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APPENDIX 6

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Fingal County Council Comhairle Contae Fhine Gall



Thursday, 02 November 2006

Ms. Gemma Larkin  
Walshestown  
Lusk  
Fingal.  
Co. Dublin

**Re: Ground Water Abstractions**

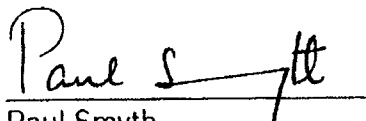
Dear Ms. Larkin

Further to your letter of the 22<sup>nd</sup> September 2006 in connection with ground water abstraction and the requirements to keep a register of ground water abstractions over 25m<sup>3</sup> per day. Firstly my apologies for the delay in replying to your due to a number of unforeseen circumstances.

I can confirm for you that we do not currently keep a register of all water abstractions in excess of 25m<sup>3</sup> per day. However we are currently putting in place the necessary procedures to set up this register. You will understand given the resource implications that I am not in a position to inform you when this register will be in place. On the other issues relating to the aquifer and the proposed landfill at the Nevitt I am informed that these issues were dealt with in detail by our Senior Engineer at the ongoing Bord Pleanála hearing.

Again my apologies for the delay in replying to you and if you have any further queries in this regard I can be contacted at 01 8906223 or by email at [paul.smyth@fingalcoco.ie](mailto:paul.smyth@fingalcoco.ie)

Yours sincerely,



Paul Smyth  
Senior Executive Officer  
Water Services Department

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APPENDIX 7

DR ANTHONY STAINES Report

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**The human health impact of the proposed landfill at the  
Nevitt, Fingal: a critique of the health assessment in the  
EIS submitted with the planning application.**

Dr. Anthony Staines,

Senior Lecturer in Epidemiology, Dept. of Public Health Medicine, University College  
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## My Background

I qualified in medicine in 1984, and after working in paediatrics for five years, I moved to train in academic epidemiology. I have a medical degree, a doctorate in epidemiology, and I am a member of the RCPI, and a fellow of the Faculty of Public Health. I am a member of the International Society for Environmental Epidemiology (ISEE), the premier professional organisation in this field.

I have worked on issues in environmental epidemiology since 1990, and particularly since I moved to work in the Small Area Health Statistics Unit at Imperial College. Since returning to work in Ireland in 1997, I have developed the first environmental epidemiology unit in the country.

I have worked on many environmental health projects in Ireland including the health assessment at Askeaton, the HRB funded report on the health and environmental impact of waste disposal, the human health impact of the uranium contamination at Baltinglass, a baseline health assessment of the proposed incinerator at Ringsend, an EPA funded project on the environmental burden of disease in Ireland, a report on the assessment of the human health impact of illegal landfill sites, a report on the EIS for the proposed incinerator at Carranstown, a report on the EIS for the proposed hazardous waste incinerator at Ringaskiddy, and a report on the human health assessment in the EIS for the second runway at Dublin airport.

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## Health Impact Assessment

I believe that it is both appropriate, necessary, and arguably, required by EU legislation, to properly assess the potential health impact of the operation of large industrial facilities. By analogy with 'Environmental Impact Statement' the standard term for the suite of methods used to do this is 'Health Impact Assessment' (HIA).

- What is HIA?

A combination of methods and tools by which a policy, programme or project may be judged as to its potential effect(s) on the health of a population and the distribution of those effects within the population.
- Why use it?

To ensure that the health consequences of decisions – positive or negative – are not overlooked

To identify new opportunities to protect and to improve health across the range of policy areas.

To understand better the interactions between health and other policy areas.
- When it can be used?

In advance of a proposal being implemented (prospective assessment).

After a programme has finished or after an unplanned event has happened (retrospective assessment).

At the same time as a proposal is being implemented (concurrent assessment).
- What does it comprise?
  - 1) Screening

Involves considering the relevance to people's health of a specific policy, programme or project and how it might affect it.
  - 2) Scoping

To determine the focus and extent of the assessment
  - 3) Assessment

Rapid appraisal or a more detailed study.

### ***HIA's in practice***

What does a 'Health Impact Assessment' or HIA look like? Much depends on the scale of the development, as this largely determines the scale of the HIA required. HIA's for a housing estate, a motorway, and an airport runway, for example, would look very different.

In general terms a HIA will have three main sections. The screening report, which

justifies carrying out a HIA, will describe in general terms, the possible impacts of a proposed development on human health, and conclude either that a HIA is warranted, or not. This could take one or two weeks, and is a desk exercise.

The next section, the scoping report, applies the general issues in the screening report to the specific situation, of this specific development in the specific site. This section will develop the scale and scope of the assessment, together with stakeholders, such as planners, developers, and members of the local community. This part of the process can take anything from a few days to a few weeks, and determines the scale of the assessment phase.

The final section, the assessment report, is the most variable element of the HIA. The big division is between projects whose assessment can be done as a desk exercise, usually building on other components of the EIS, and projects which require field work with the affected communities. The former are quick, quite cheap, and suitable for many smaller developments. The latter are more complex, and take longer, typically between a few months and a year. However, for large developments with potentially complex effects, such fieldwork is required.

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## Content of the EIS

Chapter 3 of Volume 1 of the EIS submitted for the planning application is entitled 'Environmental impacts'. The first section of this is labelled 'Human Beings' and the first subsection of this is 'Public Health', and the second 'Community Impact'. The second subsection is described as a summary of a longer report, presented in Volume 3, Appendix A, 'Human Beings, Social and Community'.

### ***Critique of 'Public Health'***

#### **Summary**

This section of the EIS seems to me to be deficient. I would not regard this as an adequate or a useful contribution to an assessment of the human health impacts of the development proposed here. There is no description of the process used to produce it, but I do not see any obvious indication that any formal process for human health assessment was used.

Even the brief consideration that I have been able to give to possible health effects, in itself no substitute for a formal scoping exercise, suggests at least the following areas which could be considered :-

***Particulate emissions; Noise; Dust; Odour; Vermin; Waste transfer; Waste spills; Flooding; Ground water contamination; Drinking water contamination; Transport hazards; Transport emissions***

These are complex exposures, with many routes of exposure, many different possible effects on different segments of the population, and many different sources in plant construction, operation within parameters, and operation outside parameters.

#### **Details**

I shall review Section 3.1 'Human Beings - Public Health' in detail.

##### **3.1.1 Introduction**

I have been unable to find the document from the IPHI referred to – There is a document published in 2006, 'Health Impact Assessment Guidance' which may be what is meant. In any event there is no further reference to any kind of HIA process in the remainder of Section 3.1. There is no description of any HI process, and no indication that any has been done. I reproduce 2 pages of the IPHI document as Appendix 1.

##### **3.1.2 Methodology**

The methodology described is not a recognised HIA methodology, and is entirely inappropriate. There is no evident assessment of site-specific risk, as the assessment is extremely generic, and the 'review of the medical literature' is incomplete, contains



several serious errors, and is, in my view, inadequate.

### **3.1.3 Existing Environment**

#### **3.1.3.1 Context**

The proposed site is a densely populated rural community, close to two rapidly developing towns.

#### **3.1.3.2 Character**

This section describes the population living in the region, on the basis of extrapolation from the national census figures. No consideration at all is given to any site-specific issues. Similar conclusions would be drawn, using these methods, for any set of 118, 259 or 497 houses anywhere in the country.

Applying this principle more widely, for example, the site hydro-geological assessment could have been done by drilling test holes in the grounds of the Fingal council offices in Swords, and then asserting that 'there is no evidence that the soil in this area is any different from the national soil'. This would be evident nonsense for hydrogeology. It is equally wrong for human beings.

The next paragraph is garbled. Part of the sentence describing the remand centres has been elided. The choice of buffer zone is not backed up with any references.

#### **3.1.3.3 Significance**

#### **3.1.3.4 Sensitivity**

The conclusion drawn, namely 'there is no reason to expect the population to be more( or less) vulnerable' is based on a failure to look. This report does not even include an accurate count of the population in the affected area, perhaps an indication of the importance attached to people by the authors of this report.

#### **3.1.3.5 Literature review**

#### **3.1.3.6 Introduction**

The authors refer to a report written by myself and my colleagues in 2002. I have not been able to find a list of references in the EIS, but I note that of the references they cite (Table 1), all except 2 can be matched with our report.

<i>Reference</i>	<i>In HRB report?</i>
Dolk et al, 1998	Yes

<i>Reference</i>	<i>In HRB report?</i>
Elliot et al. 2001	Yes
Geschwind et al. 1992	Yes
Budnick et al. 1984	Yes
Croenet et al. 1997	Yes
Roberts et al. 2000	Yes
Vrijheid et al. 2002	Yes
January 2004 published in the Irish Medical Journal by Boyle et al.	No
Pukkala and Ponka 2001	No
Janerich et al. 1981	Yes
Polednak and Janerich 1989	Yes
Goldberg et al. 1995	Yes
Griffith et al. 1989	Yes
Janerich et al. 1981	Yes
Gelberg 1997	Yes
Boswell and McCunney 1995	Yes
Gelberg 1997	Yes
Elliot et al. 2001	Yes

The authors state that 'The literature has been reviewed for different health effects', but do not specify how the review was done. The fact that they only quote one paper published after 2002, and that an Irish paper which received significant media attention, does not suggest that any very significant attempt was made to review the literature.

### **3.1.3.7 Congenital malformations**

The authors describe on three studies – the Dolk et al. 1998 study, the Boyle et al 2004 study, and the Vrijheid et al. 2002 study.

They mention four others, Geschwind et al. (1992), Budnick et al. (1984), Croenet et al. 1997 and Roberts et al. 2000. If the last of these references is in fact the matching reference from our report, then it is not a study, it is a letter responding to another study. This does not suggest that much effort was put into this section of the literature review.

There are several more recent papers which should have been reviewed.

The University of Birmingham/Enviros study referred to at the bottom of page 77, but nowhere referenced that I can see, is presumably the report commissioned by DEFRA

and found at <http://www.defra.gov.uk/ENVIRONMENT/WASTE/research/health/>.

This is not additional research, rather it is a further literature review. I am disappointed by the report's acceptance of an unspecified 'minor' effect on public health, and the failure to explain what this might be.

### **3.1.3.8 Cancers**

This section has 6 paragraphs. Of these paragraphs 2,3,4 and 5 are taken verbatim, and without acknowledgement from pages 171 and 172 of our report.

There is no explanation for why these four studies were included and the other 3 we referenced were omitted. There is no reference to any of the more recent studies on this important question.

Paragraph 1 fails to note that while some of the affected houses described were indeed built on top of the Helsinki dump others were built beside it.

Paragraph 6 is a summary of paragraphs 1 to 5. Describing a risk as absolutely minimal is not sufficient – it is necessary, admittedly hard, but necessary, to produce an estimate of the size of the risk

### **3.1.3.9 Symptoms of illness**

This section has no references at all, no descriptions of any of the studies in this area, and a conclusion which I believe to be incorrect as stated. There were five studies on this issue referenced in our report.

### **3.1.3.10 Psychological health**

There is a blanket statement, entirely devoid of supporting references, that 'there is no evidence of adverse effects on mental wellbeing of those living near to landfill sites'. This is not true.

One example, among many, suffices :- 'Greenberg M et al. Hazardous waste sites, stress, and neighborhood quality in USA, The Environmentalist, 14:1994;93-105'.

### **3.1.3.11 Occupational effects**

This section contains 3 paragraphs. The first sentence of Paragraph 1, and all of paragraphs 2 and 3 are taken verbatim, and without acknowledgement from our report on pages 177 and 178.

### **3.1.3.12 Elliott et al (2001).**

This is by far the most important study on the health impact of residence near a landfill site. The authors of the EIS quite correctly devote significant space to discussing it. I shall respond to their argument paragraph by paragraph. The material from the EIS is in italics.

*The largest study carried out on the health effects of landfill sites was*

*that by Elliot et al. for the Dept of Health in the UK published in August 2001. This appeared to show small excess risk, in the region of 1% for overall congenital abnormalities but no increased risk of cancer to those living within 2 km radius of a landfill site. It also showed a higher rate of congenital abnormalities for those living near a hazardous waste site, although this is less relevant to the proposed Fingal landfill. This is consistent with results reported in the EUROHAZON study.*

The study did in fact show an increased risk for congenital anomalies and low birth weight in people living within 2 km of a landfill site. There was little evidence of any systematic difference between hazardous and non-hazardous sites, and little data to sharply distinguish these two categories.

*To put this into context, the background rate of congenital abnormalities is about 2% of all births. A 1% increase even if true would give a rate of 2.02% or an excess case every 5000 births. Again this effect is related to hazardous landfill sites often with old or inadequate controls. Logic dictates that for a non-hazardous landfill with modern controls the rate of congenital abnormalities must be less and probably very much less.*

Logic may dictate many things, but evidence not idle supposition would be nice. The effect was not limited to hazardous sites, as a cursory reading of the paper would show, for example Table 4 on page 366 of the paper. The rate of all congenital anomalies in Ireland is about 2.5%. (Eurocat data 200-2001), and there are roughly 60,000 births a year, giving 1,500 affected children a year. A 2% increase in Ireland would lead to approximately 30 extra affected children.

*There was no increase in the rate of cancers overall reported in the study. One of the more statistically significant findings of the study was an apparent increase in the incidence of low and very low birth weight babies. The study showed an increase in the order of 5%. However, the study did not control for cigarette smoking which is probably the single most important factor affecting birth weight in a Western society, so the relevance of this finding is unclear.*

It is indeed true that no increased incidence of cancer was reported in this study. As the study did not include, present, or analyse any data on cancer, this is also not surprising, and perhaps not worth specifically mentioning.

On a more relevant point, the study showed, as have several other studies, that there was a substantial and consistent excess risk of low birth weight around both hazardous and non-hazardous sites. The main risk factor for low birth weight, besides being of South Asian ethnicity is poverty, for which the study did make an adjustment. It is also of interest to note that the risk of low birth weight rose when the sites opened.

*Though the study is generally well designed there are a number of*

*limitations, some of which it shares with some of the other studies outlined in this literature review. It included well designed and operated landfills as well as poorly managed landfill sites, which could skew the results, particularly given the very small level of reported excess.*

True, but not very relevant. All studies on this topic are imperfect, but waiting for a perfect study is not an option.

*While the study did attempt to allow for other factors known as confounders, it is impossible to allow for all possible confounders. Indeed they did not even attempt to control for some potentially relevant factors such as smoking and occupation. Therefore, while noteworthy the findings cannot be relied upon and need to be considered in the light of the other available literature.*

The importance of this study is that it was well designed, that it is consistent with much of the previous (and subsequent) literature, and that they did attempt to control for confounding.

### **3.1.3.13 Summary of literature on health effects of landfilling**

Given the many deficiencies in this report viewed purely as a literature review, there seems little point in further critiquing the conclusions. Conclusions can not be more credible than the material from which they are drawn!

### **3.1.4 Effect impacts relating to public health**

This section is extremely short and does not contain any recognisable attempt at impact assessment.

#### **3.1.4.1 "Do nothing" impact**

This is not credible as a serious assessment of the do-nothing state. It is far too short, confusing, far too short and badly structured.

#### **3.1.4.2 Predicted impact**

The list of potential routes of impact is incomplete. I would suggest, at least, Particulate emissions; Noise; Dust; Odour; Vermin; Waste transfer; Waste spills; Flooding; Ground water contamination; Drinking water contamination; Transport hazards; Transport emissions. I am sure that a more detailed scoping exercise would find more and make them more site-specific.

Most of the rest of this section is a re-iteration with no references whatever, of some basic toxicological principles. This is unexceptionable, but also completely unhelpful in assessing the impact of this development.

Stating that the operators of a site will obey the law, does not amount to impact assessment.

### **3.1.5 Mitigating adverse impacts**

In the absence of any site-specific assessments of impact, site specific mitigation measures have no basis. In any event no specific measures are suggested.

#### **3.1.5.1 Construction impacts and mitigation**

There are no mitigation measures suggested.

### **3.1.6 Residual impacts**

There is no evaluation of these at all, other than a blanket denial of their existence.

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## Capacity

In our HRB funded report we noted that Ireland was poorly equipped to assess, monitor, and enforce human health protection :-

### **“(a) Risk assessment**

Ireland presently has insufficient resources to carry out adequate risk assessments for proposed waste management facilities. Although the necessary skills are available, neither the personnel nor the dedicated resources have been made available. In addition, there are serious data gaps (addressed under point (c) below). These problems should be rectified urgently.

### **(b) Detection and monitoring of human health impacts**

Irish health information systems cannot support routine monitoring of the health of people living near waste sites. There is an urgent need to develop the skills and resources required to undertake health and environmental risk assessments in Ireland. This should be considered as an important development to build capacity in Ireland to protect public health in relation to potential environmental hazards. The recommendations in the Proposal for a National Environmental Health Action Plan (Government of Ireland 1999) could form a basis for this.

### **(c) Detection and monitoring of environmental impacts**

The capacity (in terms of facilities, financial and human resources, data banks, etc.) must be developed for measuring environmental damage, and changes over time in the condition of the environment around proposed waste sites and elsewhere. There is a serious deficiency of baseline environmental information in Ireland, a situation that should be remedied. The lack of baseline data makes it very hard to interpret the results of local studies, for example around a waste management site. Existing research results should be collated and interpreted as a step toward building a baseline data bank. A strategically designed monitoring programme needs to be initiated that can correct deficiencies in current ambient environmental monitoring. In addition, capacity needs to be built in environmental analysis. In particular, Irish facilities for measuring dioxins are required, and should be developed as a priority. However, the high public profile of dioxins should not distract attention from the need for improved monitoring of other potential pollutants.

### **(d) Risk communication and perception**

Qualitative studies about waste management perceptions revealed a diversity of opinion about waste management issues generally, and about the links between waste management and both human health and environmental quality. To facilitate public debate on the issues of waste management policy and effects, a systematic programme of risk communication will be necessary. This should concentrate on providing unbiased and trusted information to all participants (or stakeholders) in waste management issues. Public trust,

whether it is placed in the regulators, in compliance with the regulations or in the information provided, will be fundamental in achieving even a modicum of consensus for any future developments in waste policy in Ireland.”  
(Crowley, Staines et al. 2002).

This remains true, although some progress has been made, for example dioxin measurement facilities have been established in UCC; the National cancer registry has capacity to monitor cancer incidence in small areas; the registries of congenital anomalies, now part of the Eurocat system, have extended their coverage to more of the country; in the former Eastern Region a great deal of health data is available at small area level.

The current situation is that neither the EPA, nor the local authorities, have the capacity, to adequately monitor and police human health. Notionally this is the role of the Department of Health, however the very limited resources in the Department, are well indicated by Ireland's continuing failure to produce our (EU mandated) National Environmental Health Action Plan. The curious division between the respective roles of the planning authority and the EPA has not helped the development of such capacity in Ireland.

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## Conclusions

The material presented is primarily a literature review, significant parts of which are copied directly and without acknowledgement from my previous work. The review is incomplete, out of date, and contains a number of important errors. It could not provide a basis for any legitimate decisions about planning or waste licensing matters.

While a good review of current knowledge is a good place to start, it would represent only a small fraction of a proper health impact assessment. There is no trace of any credible attempt to estimate potential impacts, and no consideration is given to possible mitigation of these impacts.

The proposed development, in my professional opinion, requires a proper HIA along the lines proposed by the IPHI, to ensure reasonable consideration of human health issues in the planning and licensing processes.

The material provided in the EIS falls far short of any reasonable estimate of what is required.

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## Appendix 1

(Source **Health Impact Assessment Guidance - Institute of Public Health in Ireland, April 2006 pp7,8**)

### 2.7 What is involved in doing a HIA?

There are a variety of approaches to undertaking HIA but most of them follow a similar step-by-step and methodical approach as laid out in this guidance. Experience shows that the different stages laid out here sometimes overlap with each other. For example, screening and scoping are sometimes carried out as one exercise. Aspects of HIA can be adapted depending on local circumstances, resources or subject matter. Each HIA is uniquely determined by local conditions, such as:

- The status and complexity of the policy, programme or project.
- Whether the HIA is to be undertaken before, during or after decisions on the policy, programme or project are made.
- The likelihood of health impacts occurring.
- The scale and severity of the impacts.
- The resources available.
- The quality of the evidence base and availability of data.
- Locally determined health priorities and targets.

Whatever the approach, it should be rigorous, systematic and transparent.

### 2.8 When to conduct a HIA

Ideally HIA should be carried out early in the policy-making process when health considerations can still influence the decisions at stake. In deciding when to undertake a HIA, it is important both to be clear about who is making key decisions, and to identify key decision points in a given proposal for a new policy, programme or project.

The following is a classification to denote the stage at which the HIA is undertaken:

- **Prospective HIA** - A prospective HIA is carried out when a policy, programme or project is in its developmental stage and findings and recommendations can influence decision-making. This is the ideal time to carry out a HIA.
- **Concurrent HIA** - A concurrent HIA takes place while the policy, programme or project is being implemented. This might be applicable when the policy, programme or project is subject to review.
- **Retrospective HIA** - A retrospective HIA is carried out on a policy, programme or project that has already been implemented. This can be useful where something similar is being suggested for the near future and it is important to learn from the lessons of previous exercises.

## 2.9 What are the steps involved in HIA?

This section gives an overview of the stages typically involved in HIA. These steps are described in detail in Section 3.

### **Screening**

Screening quickly and systematically establishes whether a particular policy, programme or project has an impact on health and whether a HIA is appropriate or necessary.

### **Scoping**

If screening has determined that HIA is to be carried out, the next stage is then scoping. This stage produces the blueprint for the HIA, establishes a steering group and produces a work plan for the HIA.

### **Appraisal**

The appraisal stage is the main part of the HIA where health impacts are considered, evidence is gathered and recommendations are framed.

### **Statement of influence**

Once the assessment is complete a statement of influence is produced showing how the HIA has influenced both the decision-making process and outcomes.

### **Monitoring and evaluation**

This stage assesses whether the aims and objectives set at the beginning of the HIA were achieved and whether the methodology used was effective or suitable.

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APPENDIX 8

MOTT Mc DONALD Report  
15th NOVEMBER 2006

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Your ref:

Mr John Shortt  
Nevitt Lusk Action Group  
Windfield  
Nevitt  
Lusk  
Co Dublin  
Republic of Ireland

15 November 2006

Dear John

Ref.: Fingal Landfill Project

Since the oral hearing a few weeks ago, I have had the chance to review the evidence presented by RPS and Kevin Cullen at the hearing, and I have seen the letter written by the GSI to the EPA dated 24<sup>th</sup> October 2006. I have given my comments below, and I understand you may pass them to the EPA.

- (a) Kevin Cullen presented a map showing the extent of the gravel stratum directly overlying the bedrock across part of the area. You later sent me a map prepared during the hearing by RPS which shows similar information, with the addition of contours on the thickness of the gravel layer. There is little conflict between the two maps: both show that the gravel stratum is extensive, underlies much of the footprint of the proposed landfill, and is continuous i.e. it is not broken into isolated areas, although in some areas it is less than one metre thickness. I note from the borehole records that in some areas where the gravel thickness is zero, the bedrock is actually highly fractured (e.g. HR07, HR08, AGB7), implying that even where gravel is absent, hydraulic continuity is maintained by the fractured bedrock. Mr Cullen presented the map to support his opinion, which is also mine, that the area beneath and near the proposed landfill had potential for water resource development, and his evidence has not been contradicted by the RPS map. (See my comments on the GSI letter below).
- (b) The map presented by RPS showing the bedrock profile, and the geological cross sections, do not provide additional evidence in support of the proposed landfill. The geological cross sections are far too small to show the thickness of low-permeability overburden that would remain above the gravel and bedrock after construction of the landfill. RPS has still not provided any information in the EIS or subsequently to support their assertion that at least 10 m of low permeability overburden would remain after landfill excavation and construction.

The GSI letter covers a number of issues which were referred to during the oral hearing. It confirms:

- (c) The GSI's groundwater model report "is of use as a starting point for assessing the location of the groundwater divide" between the Bog of the Ring and the proposed landfill location, and recommends "that there should be additional field data collection to verify the location of the



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Mr John Shortt  
Nevitt-Lusk Action Group

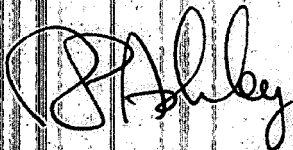
15 November 2006  
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groundwater divide". RPS therefore cannot use the GSI report as evidence for the location of the divide.

- (d) The GSI considers that there is an area along the fault zone east of the proposed landfill site that would be "the most fruitful area for exploration for further groundwater supplies". It is not clear whether the GSI was aware of the extent of gravel from the fault zone and westwards beneath the proposed landfill revealed by RPS's investigations. I concur with the view of the GSI, and also consider that the extent and thickness of the gravel and fractured bedrock increase the likelihood that economically viable water resources could be obtained from the area. Such water resources would be at too great a risk of pollution if the landfill were to be constructed.
- (e) In a letter to you the GSI has declined to re-evaluate the classification of the aquifer as a locally important and moderately productive aquifer, on the basis that you presented insufficient evidence for its sustainable productivity across a wide area. However, in its letter to the EPA, it points out that the risk matrix approach employed by the GSI and EPA "are intended for use in outline planning and screening of potential development sites", and that at a particular site "the specific characteristics and risks pertaining to that site should be the decisive factors: what matters is the likelihood of groundwater contamination taking place, and the likely impact of any such contamination, given a particular landfill design and operational system". By implication, it was acceptable for RPS to rely on the GSI classification for the site selection study. However, it was incorrect to rely on it for the planning application and EIS. RPS, in the EIS and in its evidence presented to the oral hearing, repeatedly relied on the aquifer classification as its reason for not carrying out the full quantitative risk assessment implied by the GSI's statement. **In my opinion, RPS's approach therefore does not to comply with the requirements as stated by the GSI.**

I hope that these comments assist you in your discussions with the EPA.

Yours sincerely



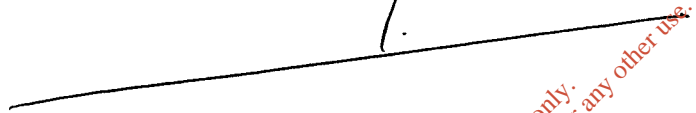
Dr Paul Ashley

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APPENDIX

9



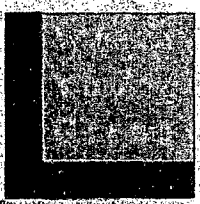
W HITE

YOUNG GREEN

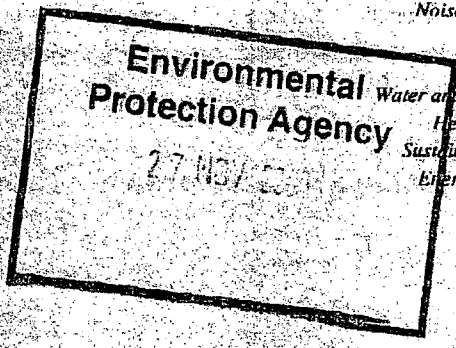
23rd NOV 2006

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Sub(63)



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Office of Licensing and Guidance,  
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Contaminated Land  
Waste Management  
Noise and Air Quality  
GIS  
Hydrology  
Water and Wastewater Services  
Health and Safety  
Sustainable Management  
Energy Management

23<sup>rd</sup> November 2006.

**Re: Waste Licence Application V0231-01 Fingal Landfill –  
Submission on Behalf of the Nevitt Lusk Action Group**

Dear Sir/Madam,

Following the recent Oral Hearing on the proposed Fingal Landfill, the following submission is being made on behalf of the Nevitt Lusk Action Group (NLAG). This submission has been compiled on the basis of data presented to An Bord Pleanála during the Oral Hearing by Fingal County Council and their team of consultants. The NLAG did not have an opportunity to review this data as part of their previous submission as it was not included in the EIS.

Items 1 and 2 below are further to data that was submitted by Fingal County Council during the hearing. Item 3 is relating to information submitted by NLAG to the inspector during the hearing following on from discussions on the source protection area of various wells downgradient of the proposed landfill facility.



White Young Green Ireland Limited, Apex Business Centre, Blackhorn Road, Sandyford Industrial Estate, Dublin 18  
Telephone: +353 1293 1200 Facsimile: +353 1293 1250 E-Mail: enviro.dublin@wyg.com



### Item 1 - Geological Cross Section A-A' and B-B'

Appendix A1.1 (of Technical Appendix H & I) of the EIS presented two geological cross sections of the site displayed on an A4 page. There are a number of issues with these cross sections which render them inadequate for assessing the suitability of the site for a landfill:

- The horizontal scale of 1:25,000 means that 1km on the ground is represented on the page by just 0.04m. Such a scale is considered inadequate for representing the complex geological and hydrogeological conditions underlying the site. A horizontal scale of 1:5,000 or 1:10,000 would be more suitable.
- A total of two cross sections representing the subsurface at a 200 hectare site is completely insufficient. Given the complexity of the subsurface a minimum of six cross sections should have been presented.
- The lines of section across the site selected for inclusion in the EIS have been poorly selected. The north-south trending Section A-A' represents the western extent of the landfill footprint. In order to have a representative north-south orientated picture of the subsurface underlying the landfill footprint, a line of section should have been along the western extent, through the centre and along the eastern extent of the footprint. Similarly, the west-east trending Section B-B' only represents the southern portion of the landfill footprint. Several lines of section should have been produced representing the northern, central and southern portions of the site in an west-east orientation.
- Therefore, WYG suggest that the cross section data presented in the original EIS is not sufficient to make an informed decision on the suitability of this site for a landfill.

On Day 5 of the Oral Hearing (Friday 20<sup>th</sup> October) hydrogeological consultant for Fingal County Council, RPS Consulting Engineers, introduced a revised cross section displayed on an A3 page. The revised version of the cross section varies significantly from the original submitted in the EIS. The revised cross section clearly shows the landfill footprint overlying gravel. This directly contradicts the assertion in the EIS (Volume 5 Technical Appendices H & I Page 15) which states:

***"Sand and gravel deposits vary across the study area with thicknesses ranging from absent to 10m. Significant gravel deposits were present beneath the glacial till to the north of the study area (13m at HR1a) and to the east (17m at HR9). These areas lie outside the landfill footprint".***

The cross sections submitted by Fingal County Council themselves renders this statement from the EIS false and incorrect. Furthermore, the inconsistencies between the cross sections highlights the inaccuracies in the assessment carried out by Fingal County Councils consultants.



## Item 2 – Bedrock Geology and Extent of Gravel Deposits Maps Introduced during the Oral Hearing

On Tuesday 24<sup>th</sup> October, Day 6 of the Oral Hearing, Fingal County Councils consultants introduced three contour maps that had not been included in the original EIS. These contour maps are as follows:

1. Proposed Fingal Landfill Extent of Gravel Deposits underlying low-permeability Superficial Deposits (overlying rockhead)
2. Proposed Fingal Landfill Bedrock Geology and Rock Level (mod) Profile
3. Proposed Fingal Landfill Clay Thickness and Landfill Cut Contours

- Figure: Proposed Fingal Landfill Extent of Gravel Deposits underlying low-permeability Superficial Deposits (overlying rockhead)

This figure clearly demonstrates that almost the full extent of the landfill footprint is underlain by gravel. Again, this directly contradicts the statement in the EIS that gravel areas "lie outside the landfill footprint".

This figure is considered to be of limited use as it displays the thickness of the gravel layer underlying the landfill footprint rather than the depth below the surface that this gravel layer occurs. A figure showing the depth below the surface to gravel would clearly show that at the location of Borehole AGB4, in the mid-west section of the footprint, gravel is recorded at just 0.7m depth below the surface. The gravel at this location is greater than 3.8m thick. The exact thickness of gravel is unknown as the borehole was finished at 4.5m below ground level (bGL) before it emerged from the gravel into clay or bedrock. Borehole ASA3, within the landfill footprint, recorded sand at 4.1m bGL while GS10, on the southern boundary of the footprint, recorded gravel at just 4.5m depth.

- Figure: Proposed Fingal Landfill Bedrock Geology and Rock Level (mod) Profile

This figure highlights the lack of site specific data that contributed to the conceptual model of the geology presented in the EIS. The lithology distribution and the position of the north-south trending fault are based on information published by the Geological Survey of Ireland. The boreholes drilled on-site have not been used to confirm the positions of the boundaries between the three limestone formations that the GSI indicates underlie the footprint. In addition, the drilling information and the geophysical surveys were not used to refine the position of the north south trending fault. Several 'possible faults' identified by the geophysical investigation were not considered in the EIS and no investigations appear to have been undertaken to confirm their presence or to establish their extent or significance.



This figure indicates that the top of the bedrock is closest to the surface in the west of the landfill footprint and again just to the north of the footprint. It is unclear whether or not this subsurface topography influences the groundwater flow pattern within the area. For example, it is unclear from the EIS if this topographic high within the bedrock acts as a groundwater divide with groundwater moving southeast on the southern side of the bedrock feature and moving northeast to the north of the bedrock feature. It is unfortunate that this information was not included in the EIS and that it was not considered in producing the groundwater contour maps.

**Item 3 – Source Protection Zones of private wells downgradient of the proposed landfill**

A previous submission on behalf of the NLAG highlighted a number of private wells downgradient of the proposed landfill facility that were not duly considered in the EIS. In particular, two wells considered at greatest risk are as follows:

User Name	Abstraction (m <sup>3</sup> /d)	Aquifer	Use
Thomas Kerrigan	1962	Bedrock	Vegetable processing plant
Thomas Moore	654	Bedrock	Vegetable processing plant

The businesses operated by Mr. Moore and Mr. Kerrigan rely on the significant quantities of good quality groundwater abstracted from their wells.

The definition of a groundwater source according to the DoELG/EPA/GSI (1999), is "a source of water supply which depends on groundwater, usually a well (dug well or borehole) or a spring, occasionally an infiltration gallery". The DoELG/EPA/GSI goes on to say that such "groundwater sources, particularly public, group scheme and industrial supplies, are of critical importance in many regions. Consequently, the objective of source protection zones is to provide protection by placing tighter controls on activities within all or part of the zone of contribution (ZOC) of the source". This definition of a source applies to Kerrigans and Moores Well, both of which are used for industrial purposes.

The aim of a source protection plan is to protect the quality of the groundwater source from potentially polluting activities in the general area and to protect the wider aquifer itself through land use management and planning. A source protection plan delineates the source protection zones to a particular source as follows:

- The inner protection zone, represented by the 100 day time of travel zone, is intended to protect the source against microbial contamination.
- The outer protection zone represents the entire zone of contribution (ZOC) to the source i.e. the entire geographical area from which the source abstracts groundwater.



The EIS did not take account of the zones of contribution to these wells. In order to demonstrate the likely extent of the zone of contribution to these wells, the source protection areas were delineated provisionally using the data available in the EIS. Although these ZOC's are not definitive and have been determined using a limited data set, they are a good representation of the area that will be contributing groundwater to these sources. They have been delineated using a recharge rate of 57mm/yr (as per EIS) and using the abstraction rates as indicated by the well owners. Kerrigans Well is reported to have an available yield of 1962m<sup>3</sup>/d and Moores Well 654m<sup>3</sup>/d. Using the recharge equation, the geographical areas required to maintain these abstractions based on 57mm/yr recharge are displayed on Figure 1 attached. The area for Kerrigans Well is some 3925351m<sup>2</sup> and some 4187894m<sup>2</sup> for Moores Well.

A zone of contribution to a source will naturally extend in an upgradient direction away from that source. Therefore, the ZOC's to both wells extend upgradient and towards the location of the proposed landfill and as such the ZOC's intersect the landfill footprint area. This is significant in that the groundwater protection responses for landfills within a source protection area are completely different to the response outside a ZOC.

It is therefore recommended that the EIS delineate the source protection areas for the wells considered to be at risk of becoming contaminated from the proposed landfill. The EIS should then be revised based on the DoELG/EPAGSI (1999) Groundwater Protection Response Matrix for Landfills to establish the suitability of the site for a landfill. This matrix is attached at the end of this submission for ease of reference. Should the response category change to either R3<sup>1</sup> or R4 then the suitability of the site for a landfill must be reconsidered.

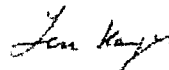
The NLAG would be grateful if the above points were considered by the Agency. The items raised above are considered of fundamental importance in assessing the suitability of this site for the proposed landfill facility.

Yours sincerely,

**White Young Green Environmental (Ireland) Ltd.**



**Karen-Lee Ibbotson**  
**Principal Hydrogeologist**



**Teri Hayes**  
**Director**



## Attachments:

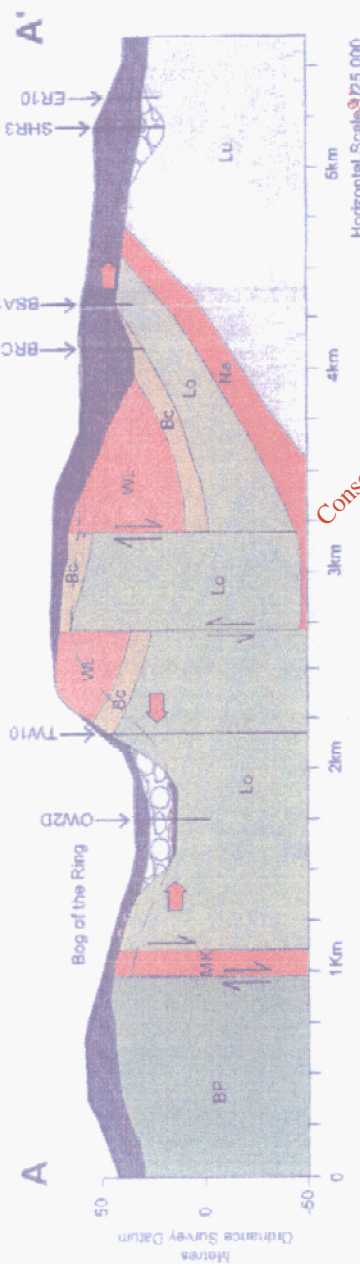
Data submitted by Fingal County Council during Oral Hearing

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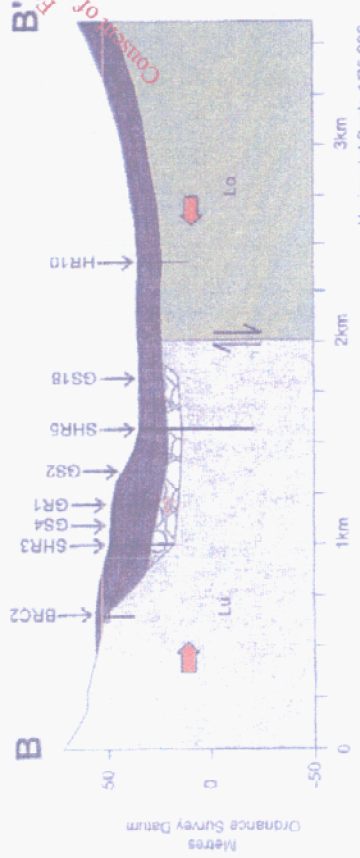


**NOTES**

- This study is the property of RPS Consulting Engineers. It is to be used for the purposes specified and not for any other purpose without the prior written consent of RPS Consulting Engineers.
- All data shall refer to Ordnance Survey datum, Mean Sea Level as published by RPS.
- All RPS SCALE, site specific documents apply.
- Revised ESD (2013) Geology of South West 1:50,000.



**GEOLOGICAL CROSS SECTION A-A'**



**GEOLOGICAL CROSS SECTION B-B'**

**LEGEND**

	Walshestown		Clay
	Malinckard		Gravel
	Loughshinny		Fault Throw
	Naul		Direction of Groundwater Flow
	Lucan		Groundwater Table/ Piezometric Surface (Bedrock)
	Mudbank Limestone		
	Belcamp		

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Rev	Date	Description / Item	By	App
001	12/11/2013	Issue for approval	WJ	WJ
002	12/11/2013	Revised for approval	WJ	WJ
003	12/11/2013	Final for approval	WJ	WJ

Fingal County Council  
Consulting Engineers

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E: info@rps.ie / www.rps.ie

**RPS Consulting Engineers**

**FINGAL LANDFILL PROJECT**

**GEOLOGICAL CROSS SECTIONS A-A' & B-B'**

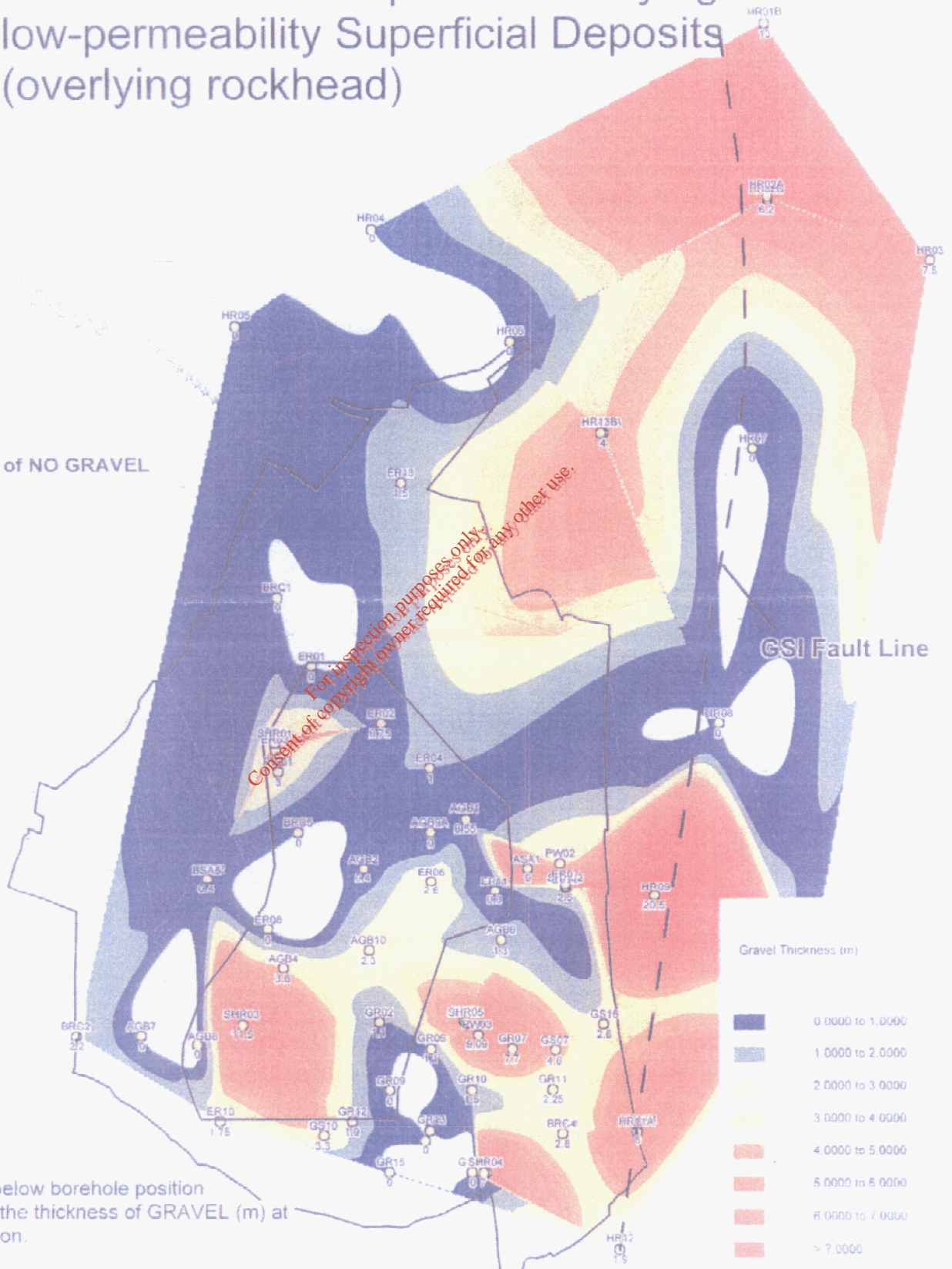
Drawn By:	WJ	Checked By:	WJ
Scale:	1:1000	Approved By:	WJ
Version:	1.0	Project No.:	10000000000000000000
Issue:	1.0	Page No.:	1

# Proposed Fingal Landfill

## Extent of Gravel Deposits underlying low-permeability Superficial Deposits (overlying rockhead)



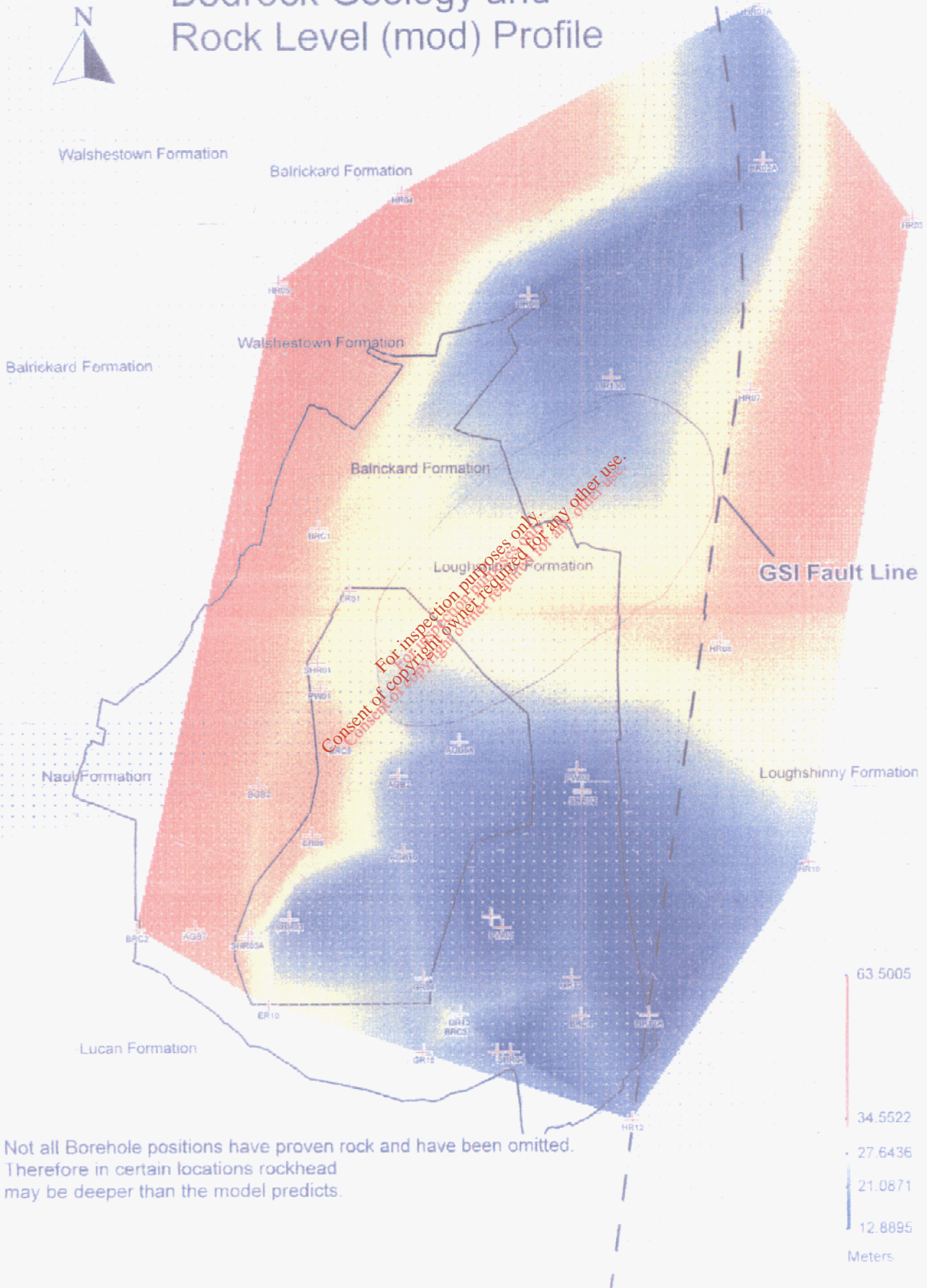
Areas of NO GRAVEL



Number below borehole position  
Indicates the thickness of GRAVEL (m) at  
that location.

Not all boreholes will have reached the base of the  
GRAVEL due to refusal.

# Proposed Fingal Landfill Bedrock Geology and Rock Level (mod) Profile



Not all Borehole positions have proven rock and have been omitted.  
Therefore in certain locations rockhead  
may be deeper than the model predicts.



**Preliminary Source Protection Zones for Kerrigans and  
Moore's Well**

**and**

**Groundwater Protection Response Matrix for Landfills**

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**WASTE**  
WATER  
CONSULTANTS

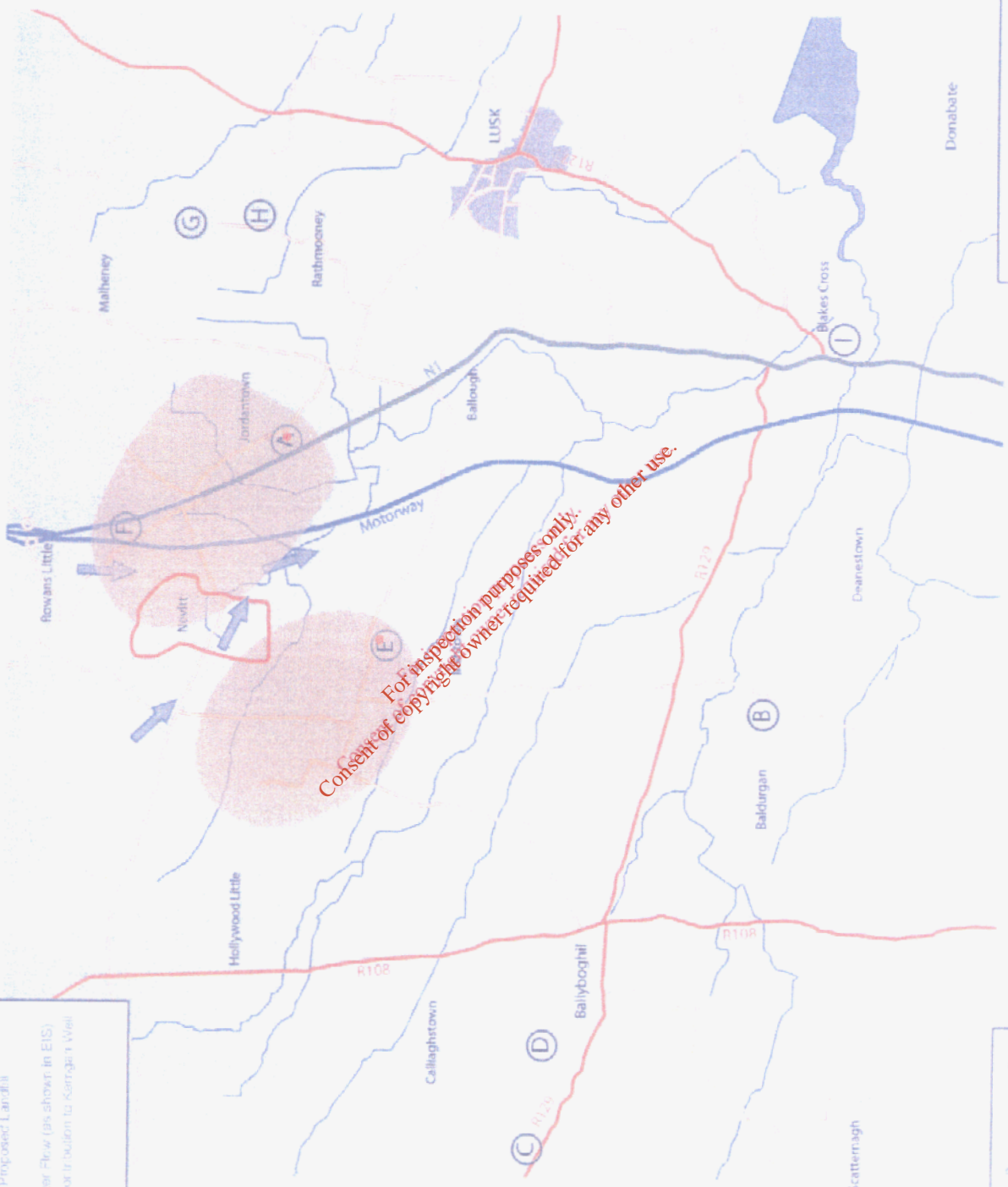
Fingal Landfill EIS - NLAG  
Preliminary Well Survey

Figure No. 1

Job No. CE1538E Date Nov. 2006  
Finished By: KLT

**LEGEND**

- Approximate outline of Proposed Landfill Well Locations
- Direction of Groundwater Flow (as shown in EIS)
- Preliminary Zones of Contention for Serravallo Well (E) & McGee Well (A)



NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken

# Groundwater Protection Responses for Landfills – Summary

## Response Matrix for Landfills

VULNERABILITY RATING	SOURCE PROTECTION AREA		RESOURCE PROTECTION Aquifer Category					
			Regionally Important (R)		Locally Important (L)		Poor Aquifers (P)	
	Inner	Outer	Rk	Rf/Rg	Lm/Lg	Li	Pl	Pu
Extreme (E)	R4	R4	R4	R4	R3 <sup>2</sup>	R2 <sup>2</sup>	R2 <sup>2</sup>	R2 <sup>1</sup>
High (H)	R4	R4	R4	R4	R3 <sup>1</sup>	R2 <sup>1</sup>	R2 <sup>1</sup>	R1
Moderate (M)	R4	R4	R4	R3 <sup>1</sup>	R2 <sup>2</sup>	R2 <sup>1</sup>	R2 <sup>1</sup>	R1
Low (L)	R4	R3 <sup>1</sup>	R3 <sup>1</sup>	R3 <sup>1</sup>	R1	R1	R1	R1

In all cases standards prescribed in the *EPA Landfill Site Design Manual (EPA,1999)* or conditions of a waste licence will apply.

- R1** Acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence.
- R2<sup>1</sup>** Acceptable subject to guidance outlined in the EPA Landfill Design Manual or conditions of a waste licence.
- Special attention should be given to checking for the presence of high permeability zones. If such zones are present then the landfill should only be allowed if it can be proven that the risk of leachate movement to these zones is insignificant. Special attention must be given to existing wells down-gradient of the site and to the projected future development of the aquifer.
- R2<sup>2</sup>** Acceptable subject to guidance outlined in the EPA Landfill Design Manual or conditions of a waste licence.
- Special attention should be given to checking for the presence of high permeability zones. If such zones are present then the landfill should only be allowed if it can be proven that the risk of leachate movement to these zones is insignificant. Special attention must be given to existing wells down-gradient of the site and to the projected future development of the aquifer.
  - Groundwater control measures such as cut-off walls or interceptor drains may be necessary to control high water table or the head of leachate may be required to be maintained at a level lower than the water table depending on site conditions.
- R3<sup>1</sup>** Not generally acceptable, unless it can be shown that:
- the groundwater in the aquifer is confined; or
  - there will be no significant impact on the groundwater; and
  - it is not practicable to find a site in a lower risk area.
- R3<sup>2</sup>** Not generally acceptable, unless it can be shown that:
- there is a minimum consistent thickness of 3 metres of low permeability subsoil present;
  - there will be no significant impact on the groundwater; and
  - it is not practicable to find a site in a lower risk area.
- R4** Not acceptable.
- This guidance is for the siting of landfills for non-hazardous wastes.
  - New landfills should not generally be developed on regionally important aquifers
  - The siting, design, operation and monitoring of landfills must comply with the guidelines outlined in the EPA's Landfill manuals except where facilities hold a waste licence issued by the EPA.
  - It is recommended that all landfills be located in, or as near as possible to, the zone in the bottom right hand corner of the matrix.
  - Special attention should be given to checking for the presence of more permeable zones, such as faults, particularly in fractured bedrock.

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APPENDIX 10

Kevin Callan Report

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November 7<sup>th</sup> 2006



W0231-01  
 Sub 48

Licensing Unit,  
 Office of Licensing & Guidance,  
 Environmental Protection Agency,  
 Johnstown Castle Estate,  
 County Wexford

Sliding Rock,  
 Blackglen Road,  
 Sandyford,  
 Dublin 18.

7-11-2006

**Re: Waste Licence Application W 0231-01 Fingal Landfill**

**Objection By: Kevin Cullen**

Dear Sirs,

A review of Geological and Hydrogeological Sections (Vol. 5) of the EIS accompanying the above licence application indicates that there are a number of significant omissions and inaccuracies in the published document.

These inaccuracies and omissions can only be properly addressed through the publication of a revised EIS.

I am confident that a revised EIS will clearly demonstrate the proposed Nevitt landfill will compromise a significant groundwater resource that could be readily developed in association with the nearby Jordanstown reservoir located just 1 km to the east of the development site.

I am equally confident that a revised EIS will demonstrate that the proposed Nevitt landfill is an unsustainable development and would, if allowed to proceed, prevent future generations using the groundwater resources now proven to exist at the Nevitt site.

In these circumstances the proposed landfill at Nevitt should not be allowed to proceed.

The inaccuracies and omissions identified in the Geological and Hydrogeological Sections (Vol. 5) of the EIS are generally as follows.

### **Section 3.2 .1 Bedrock Geology**

#### **i) Absence of Local Bedrock Geological Map**

The Applicant has chosen to rely completely on the Geological Survey of Ireland (GSI) map of the region, Geology of Meath Sheet 13 and published in 1999 at a scale of 1:50,000, as the basis for the geological and hydrogeological interpretation of the collected data sets at the development site.

Figure 4, which is a reproduction of part of the GSI Sheet 13 is presented in the EIS as describing the bedrock geology for the Nevitt site. No other geological map for the Nevitt site is included in the EIS.

Figure 4 is an enlargement of the original GSI published map. The enlargement of the GSI map to a scale of 1:25,000 is misleading as it might suggest that additional geological data has been used to enhance the original GSI boundaries and fault lines.

In fact, none of the geological information gathered from the 102 boreholes completed during the Nevitt project have been used to update the geology of this part of Fingal or the development site.

This omission is important as the Memoir accompanying Sheet 13 announces that the Sheet 13 is;

*'constructed from information recorded at surface outcrops and from boreholes and geophysical information where available.'*

However, on page 5 of the Memoir the GSI cautions about relying on the map in areas of thick overburden;

*'Using structural measurements such as strike and dip of bedding, position of fold axes and faults, geologists have extrapolated from exposed into unexposed ground. Uncertainty grows with increasing distance between outcrops, and where rock outcrops are few and far between, for example in areas of thick Quaternary glacial deposits, the map is an intelligent guess.'*

The development site and the Applicants study area are both characterised by thick overburden. The exact bedrock geology of the development site and surrounds can only therefore be provided through the interpretation of borehole and geophysical information.

The Applicant completed over 100 boreholes at and around the development site together with numerous geophysical surveys. The information gathered from these boreholes and geophysical surveys should have been used to enhance the geological picture or 'intelligent guess' provided on Sheet 13 for the development site.

The Applicant should have presented in the EIS a geological map based on the recent drilling results of the bedrock geology of the development site at a scale of 1:10,000.

**Conclusion:** A revised EIS should be published with a detailed geological map at a scale of 1:10,000.

#### ii) Absence of Detail Cross Sections

No detailed geological cross sections are included in the EIS. The cross sections presented in Appendix A1 are regional in nature, inaccurate and do not portray the geological conditions actually found at the development site.

Section A-A' does not pass through the landfill footprint as suggested in Appendix A1.1. As shown in Figure 4 of the EIS Section A-A' passes mostly to the west of the footprint.

The Loughshinny Formation is shown as only 10m thick on Section A-A' while to the north and east of the development site it is shown as being many 100's of metres thick. No such thinning of the Loughshinny Formation is indicated on the GSI Sheet 13.

Detailed and site specific geological cross sections through the development site should have been included in the EIS.

**Conclusion:** A revised EIS should be published with a series of north-south and east west cross sections through the landfill footprint with a horizontal scale of 1:10,000.

### Section 3.2.2 Study Area Bedrock Geology

#### i) Bedrock Lithologies

The EIS states that the 'Lithologies encountered were limestones, siltstones and mudstones inferred to be of the Balrickard, Loughshinny, Lucan, Naul and Walshestown Formations.'

This Loughshinny, Naul and Lucan Formations are defined on both lithological and biostratigraphic grounds. Prior to the publication of Sheet 13 by the GSI, the monotonous dark coloured and lithologically similar limestone and shales found in north Dublin and neighbouring County Meath were grouped together within a single bedrock unit referred to as the Calp Limestone unit. Advances in biostratigraphy in the mid 1990's using conodonts and foraminifers allowed the Calp Limestone unit to be subdivided into a number of identifiable formations with specific ages within the Dinantian biozone.

The Loughshinny Formation is of Brigantian age while the Naul and Lucan Formations are of Chadian to Asbian age.

As the Loughshinny Formation is very similar lithologically to the older Lucan and Naul Formations it is necessary to carry out biostratigraphic studies to establish the presence and exact distribution of each of these components of the Dinantian biozone.

The exact distribution of the various formations needs to be completed as there appears to be poor correlation between the published Sheet 13 and some of the bedrock descriptions given in the EIS. For instance, boreholes SHR1, SHR2 and ER9 all return thick successions of mudstone while supposedly being collared in the Loughshinny, Naul and Lucan Formations respectively as per the GSI Sheet 13. Also, borehole BRC1 is shown on Section AA (see Appendix A1.1 of Volume 5) as being located in the Balrickard Formation which consists of sandstones. However, the log for borehole BRC1 records only limestone.

No biostratigraphic studies appear to have been carried out during the detailed site investigations. This work would have enhanced the geological picture published by the GSI without the benefit of this wealth of geological information.

In the absence of this information, the geological picture presented in Sheet 13 provides the most recent picture of the distribution of the various formations found in the Nevitt area.

Figure 4 of Volume 5 of the Applicant's EIS indicates how the landfill footprint is reportedly partly underlain by the Loughshinny Formation, which is the geological unit supplying the Bog of the Ring well field.

While the Sheet 13 'intelligent guess' shows the Loughshinny Formation underlying only the northern part of the footprint the exact situation remains uncertain. In fact, in the absence of the major displacement of the Loughshinny Formation proposed by the GSI the whole of the landfill footprint could be underlain by the Loughshinny Formation.

**Conclusion:** A revised EIS should be published with a map at a scale of 1:10,000 showing the distribution of the bedrock Formations derived from an analysis of the cores collected during the Nevitt drilling programme.

## ii) Bedrock Structure

No attempt was made in the EIS to establish the distribution of faults beneath the development site rather the EIS relies wholly on the structural picture presented in regional Sheet 13 which, as stated above, was constructed without the benefit of borehole data in the Nevitt area.

Nor has the Applicant presented in the EIS a detailed interpretation of the collected geological data for the development site by way contoured plans of the bedrock surface.

The accompanying Figure 1 shows that a deep north – south trending trough or buried channel is present in the bedrock surface within and beyond the Applicant's study area.

This buried channel feature is also highlighted by the depth to bedrock contours shown in Map 2b of the Final Geophysical Report provided in the supporting documents to Volume 5. In fact the base of the trough is given as close to sea level below the southern part of the landfill footprint.

This bedrock trough or buried channel feature is generally coincident with the postulated major north south fault shown by the GSI Sheet 13 as traversing this part of north county Dublin. The bedrock depression probably reflects a weakening or weathering of the bedrock here as a result of the structural deformation associated with the faulting.

The N-S trending bedrock depression is likely to be primarily structurally related as bedding strike is east west in this region generally.

The accompanying Figure 1 also shows how the trace of this postulated structural break is associated with a very broad fault zone which extends beneath the landfill foot print. The exact location of the GSI fault remains uncertain as it might define either the eastern or western edge of the bedrock escarpment or be located in the intervening graben like feature.

For example, at borehole SHR3 in the west of the landfill footprint there is at least a 15m change in the elevation of the bedrock surface between this borehole and the nearby borehole SHR3a which is located approximately only c.60m away.

However, the fault zone presented in the accompanying Figure 1 is more likely to be composed of numerous fault like features and which together account for the structural displacement of the Loughshinny Formation described on the GSI's Sheet 13.

The Loughshinny Formation at the Bog of the Ring well field is similarly in close proximity to a major fault feature as shown on Sheet 13 as indicated on the Applicant's section A-A' in Appendix A1.1 of Volume 5. It is postulated that the productivity of the Loughshinny Formation at the Bog of the Ring is related to the structural deformation that would be associated with the near by fault.

A similar increase in the groundwater productivity in the Loughshinny Formation could reasonably be anticipated at Nevitt due to the proximity of the major N-S fault feature.

**Conclusion:** A revised EIS should be published with a map at a scale of 1:10,000 showing the contours of the bedrock surface together with the proposed fault lines and Formation boundaries.



### Section 3.3.2 Study Area Quaternary Geology

The EIS fails to describe the presence of the major sand and gravel deposit that extends from the Bog of the Ring well field south wards to beyond the Nevitt site.

The accompanying Figure 2 indicates the likely extent of this sand and gravel deposit at Nevitt as derived from the borehole logs presented with the EIS. It is obvious from the accompanying Figure 2 that this unit is continuous, very thick in places and open in extent both to the north and south.

Figure 2 shows how the deep bedrock valley outlined on the accompanying Figure 1 is infilled with sands and gravels and which predate the deposition of the overlying glacial till deposits. Figure 2 also indicates that much of the landfill footprint is underlain by the sand & gravel deposit.

The sand and gravel deposits found at Nevitt are a continuation of similar sand and gravels found further north at the Bog of the Ring. The full extent of the sand and gravel deposit remains to be established as the northern and southern ends remain open. The sand and gravel deposits found at the Bog of the Ring well field are understood to be an integral part of the groundwater system that supplies the production wells.

The gravel deposits found at Nevitt and the Bog of the Ring also constitute an important groundwater resource in their right. For example, a trial well (TW9) completed by Dublin Co. Co. in these gravels was test pumped at a rate of 1,200 m<sup>3</sup>/day in 1993. TW 9 is located between Nevitt and the Bog of the Ring well field. Similarly, the pumping test conducted by the Applicant at borehole ASA2 in the gravels yielded 623m<sup>3</sup>/day with a screen length only over half the aquifer thickness at that location.

It would be expected that the sand and gravel deposits at Nevitt would play a similar bedrock transmissivity enhancing role as the sand and gravel deposits do in the Bog of the Ring abstraction and which is noted on page 34 of Voume 5 of the EIS.

**Conclusion:** A revised EIS should be published with a map at a scale of 1:10,000 showing the distribution of the extensive sand and gravel deposit found at Nevitt.

### Section 3.4.4

The EIS selectively quotes from the ERBD Final Characterisation Report to suggest that the bedrock aquifer found at Nevitt is being over abstracted. The EIS fails to present or analyse the data on which the ERBD findings were based and fails to reflect the actual artesian and flowing conditions reported from wells drilled during the Nevitt project.

1. The ERBD report for Fingal indicates that no water bodies are under hydrological pressure.
2. There are no EPA monitoring wells in the groundwater body on which to support the over abstraction scenario.
3. The EIS reports artesian and flowing conditions in the vicinity of the Nevitt site.
4. The EIS notes that the Bog of the Ring abstraction has no impact whatever on groundwater levels in the nearby Nevitt area

There is no factual evidence whatever and none is presented in either the ERBD report or the EIS to suggest that the bedrock aquifer found in north Fingal is being over abstracted.

In fact all the available evidence indicates the opposite picture which is that the aquifer is full up and overflowing.

**Conclusion:** A revised EIS should be published without the suggestion that the Nevitt bedrock aquifer is being over abstracted.

### **Section 3.5.2 Groundwater levels, flow direction and recharge.**

The EIS fails to relate the groundwater flow pattern to the distribution of faulting in the underlying bedrock. In particular, the EIS fails to identify areas of increased permeability beneath the landfill footprint as indicated by the groundwater flow pattern.

The accompanying Figure 3 superimposes the fault zones derived from the analysis of depth to bedrock presented in the accompanying Figure 2.

It is clear that the fault zone is seen to impart a major control on the bedrock groundwater flow patterns presented in the EIS by the Applicant in Appendix A5 of Volume 5. Note also the dramatic change in the groundwater gradient in the south west of the planned footprint area which coincides with the western edge of the fault zone.

Clearly, the proposed fault zone represents an area of increased permeability as demonstrated by the preferential flow of groundwater in the bedrock and along this zone.

Note how the fault zone is acting as a regional conduit for groundwater movement. The fault zone collects groundwater from both the east and west and then channels the groundwater to flow both to the north and south of borehole HS13b.

**Conclusion:** A revised EIS should be published with a map at a scale of 1:10,000 showing the distribution of zones of high permeability at Nevitt and an analysis of how these zones control the groundwater flow patterns beneath the landfill footprint.

### **Section 3.5.2.2 Groundwater Recharge**

The EIS uses hydrographs collected from a number of monitoring wells to suggest that the recharge to the bedrock aquifer is low. This conclusion is incorrect as the analysis in the EIS fails to take account of the position of the groundwater levels in relation to the top of the aquifer at each of the monitoring wells.

In fact, groundwater levels quickly rise to the top of the aquifer where and when the aquifer is capable of accepting recharge after which time any additional infiltration is rejected.

Rejected recharge has been an accepted characteristic feature of Irish aquifers for the past 20 years.

For example, in the monitoring borehole BRC2 the hydrograph shows the groundwater level falling below the top of the aquifer which is at 51.65mOD in May 2005. In this situation the aquifer is unconfined and can readily accept recharge when it is available and which it does after October 2005. The groundwater level quickly responds to recharge until it again reaches the top of the aquifer at 51.65mOD. After this time any additional recharge is rejected until the groundwater level again falls below the top of the aquifer.

The picture is different in most of the other monitoring wells as the aquifer remains confined and artesian during the entire monitoring period.

The aquifers, i.e. both the bedrock and the overlying sand and gravel deposit at Nevitt are generally full up and incapable of accepting additional recharge. This is evident from Table 1 below which shows that in all of these monitoring boreholes the aquifers are confined and artesian. Any additional recharge could only be accommodated at these locations through an expansion of the aquifer.

Borehole No.	Aquifer Type	Top of Aquifer mOD	Groundwater Level mOD	Aquifer Condition
BRC5	Bedrock	34.89	>40	Artesian
ER3	Bedrock	26.2	>50	Artesian
HR1A	Bedrock	17.7	>30	Artesian
HR4	Bedrock	54.47	>60	Artesian
SHR2	Bedrock	14.97	>29	Artesian
HR1B	Gravel	32.4	>30	Artesian
ASA2	Gravel	22.7	>29	Artesian

Table 1. Aquifer conditions at monitoring borehole sites.

**Conclusion:** A revised EIS should be published with a corrected analysis of the groundwater patterns displayed on the monitoring well hydrographs and without the suggestion that recharge to the aquifer is low.

### Section 3.5.3 Aquifer Characteristics

The EIS incorrectly projects the transmissivity values determined from the shallow pumping wells completed at Nevitt to the entire bedrock column and suggests that based on these results that the bedrock aquifer at Nevitt is less productive than at nearby Bog of the Ring.

Such a projection is not possible as the Nevitt limestone aquifer is fracture controlled.

A suggestion that the output from a shallow well in a fracture controlled aquifer will establish the yield from the whole rock column is incorrect. Experience indicates that wells in the order of 90 to 120m deep are required to test most shallow aquifers and that well yields will be greater where the bedrock is preferentially fractured in the proximity of fault zones. The test pumping wells at Nevitt were drilled to only c.35m.

Also, maintaining a long screen section ensures that the well can accept inflows over the entire saturated rock column and minimises well loss in the pumping well. The screen lengths used at Nevitt were between 4 and 9m long compared to over 35m at the Bog of the Ring wells.

Applying the permeability values derived at the Nevitt data over the same screen lengths used at the Bog of the Ring clearly indicates that the transmissivity values of the limestones at Nevitt are

Development Site	Depth (m)	Screen Length (m)	Permeability m/d	Transmissivity (m <sup>2</sup> /d)
PW1	36.4	4	3-4	117-156*
PW2	31.5	9	7.3-8.4	284-327*
PW3	34.9	9	1.1-4.2	39-180*
<b>Bog of the Ring</b>				
PW2	c.80	36	3.9-4.2	139-152**
PW3	c.50	39	3.6-3.8	141-149**
PW5	c.80	43	3.1	133**

within the range found at the Bog of the Ring well field.

The Applicant's interpretation suggests that the transmissivity of the bedrock at Nevitt was up to 10 times lower than that found at the Bog of the Ring. As demonstrated in Table 2 below the extension of the transmissivity measured by the Applicant over the limited screen lengths used at Nevitt to the longer rock sections used at the Bog of the Ring allows for a more balanced comparison of the transmissivity data sets collected at Nevitt and the Bog of the Ring.

\* New Screen Length = 39m, \*\* Screen Length as reported by GSI.

Table 2. Re-calculation of transmissivity values at Nevitt.

The shallow and partially completed wells completed by the Applicant have a combined yield of 1,550m<sup>3</sup>/day.

Deepening the bedrock wells at PW 1 and PW 2 to the same depth as those completed at the Bog of the Ring well field and extending the well screen in the gravel well ASA2 over the full thickness of the gravel aquifer would probably double the output from these well sites.

By adding a further well into the gravel aquifer at the SHR3 site in the south west of the landfill footprint where 11m of gravel was recorded would likely provide a further 1,000m<sup>3</sup>/day.

The output from four production wells at PW1, PW2, ASA3 and SHR3 at the Nevitt site would equal that available from the four production well sites in the Bog of the Ring well field.

The combined yield from the Nevitt and Bog of the Ring well fields could be readily increased by the installation of additional boreholes along the deep, fault controlled trough that connects the two areas. For example at the site of TW9 were the trial well recorded a yield of in excess of 1,000m<sup>3</sup>/day.

**Conclusion:** A revised EIS should be published limiting the transmissivity values determined at Nevitt to the shallow bedrock at the test sites.

### Section 3.6 Conceptual Model.

The Conceptual Model does not reflect the geological picture determined by the boreholes or cross section B-B' and presented in the accompanying Figures 1, 2 and 3.

In particular the Conceptual Model does not include for ;

- the continuous gravel horizon shown on Section B-B',
- the layer of saturated gravel or weathered rock reported in the majority of resistivity cross sections accompanying the EIS
- the significant variations in the bedrock surface shown on Section B-B'

The Conceptual Model describes the overburden as a *non-aquifer* which is not consistent with the saturated gravel horizon shown on Section B-B'.

The Conceptual describes the gravels present in the model as *discontinuous*. This is not consistent with the picture presented in Section B-B' nor with the resistivity sections

**Conclusion:** A revised EIS should be published with a Conceptual Model that properly reflects the geological and hydrogeological conditions present at the Nevitt site.


### Section 5.2 Risk assessment

The risk assessment presented in the EIS is founded on an incomplete and inaccurate conceptual model as detailed above.

**Conclusion:** A revised EIS should be published with a Risk Assessment based on a conceptual model that properly describes the geological and hydrogeological conditions present at the Nevitt site.

Thank you for your attention.

Yours Sincerely,



EurGeol Kevin Cullen P.Geo.

### Accompanying Figures;

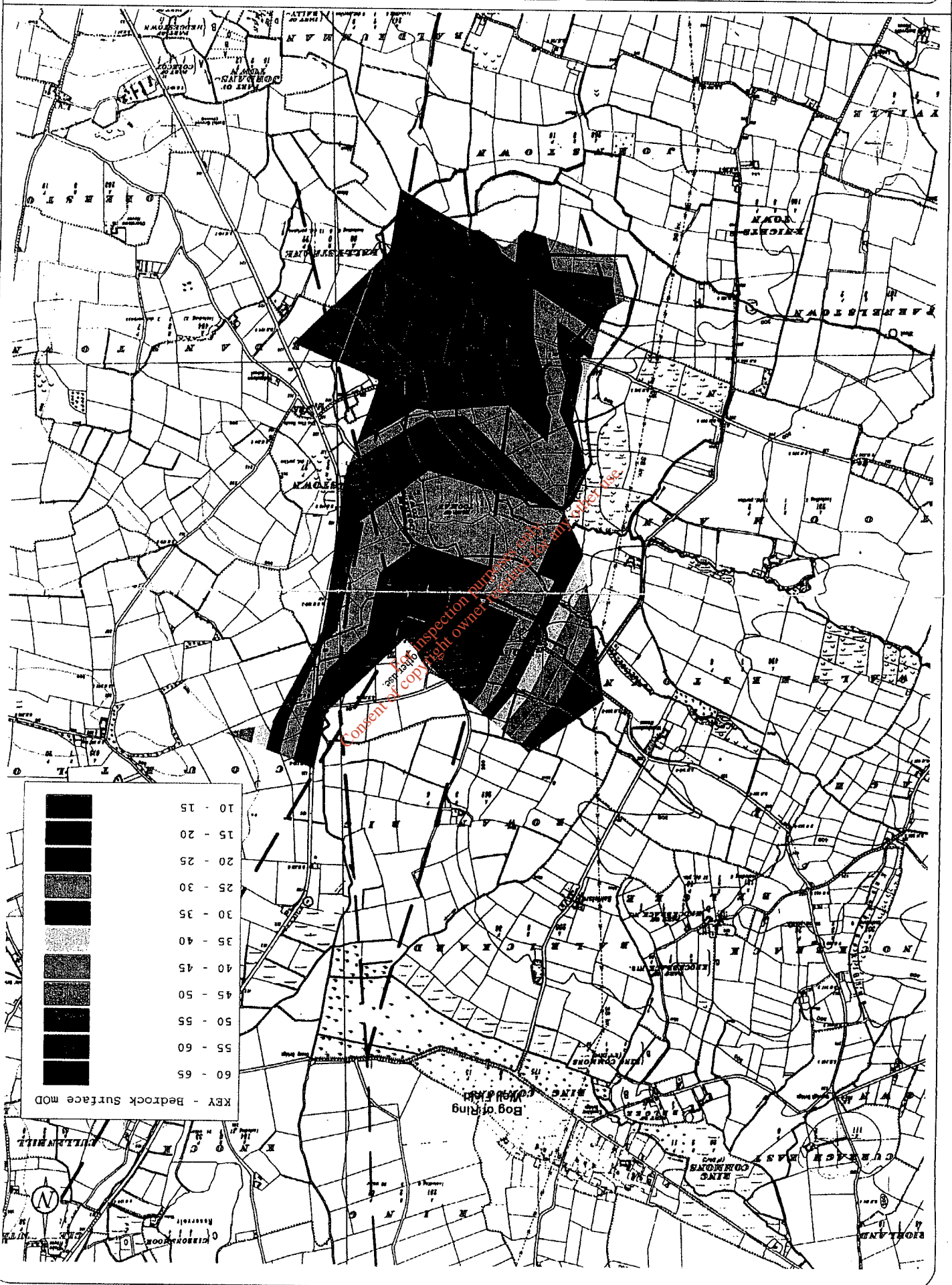
- Figure 1      Bedrock Surface and Possible Fault zone
- Figure 2      Possible Extent of Buried Sand & Gravel Deposit
- Figure 3      Groundwater Contours – Bedrock – 17<sup>th</sup> January 2006

Job No. --	Date: Sept 2006
Drawn: --	Scale: Not to Scale
Title: Approximate Bedrock Surface & Possible Fault Zone	
Site: Nevitt Landfill & Bog of the Ring Wall Field	

Legend

- : Possible Extent of Fault Zone
- : Line of GSI Fault
- : Landfill Footprint
- : Outline of Study Area B

Note  
 Drawing is for diagrammatic purposes only.  
 No measurements to be taken from the drawing.



KEY - Bedrock surface MOD

[Solid Black]	10 - 15
[Dark Grey]	15 - 20
[Medium Grey]	20 - 25
[Light Grey]	25 - 30
[Dotted Grey]	30 - 35
[Cross-hatched Grey]	35 - 40
[Diagonal Lines Grey]	40 - 45
[Horizontal Lines Grey]	45 - 50
[Vertical Lines Grey]	50 - 55
[Stippled Grey]	55 - 60
[Dotted Grey]	60 - 65

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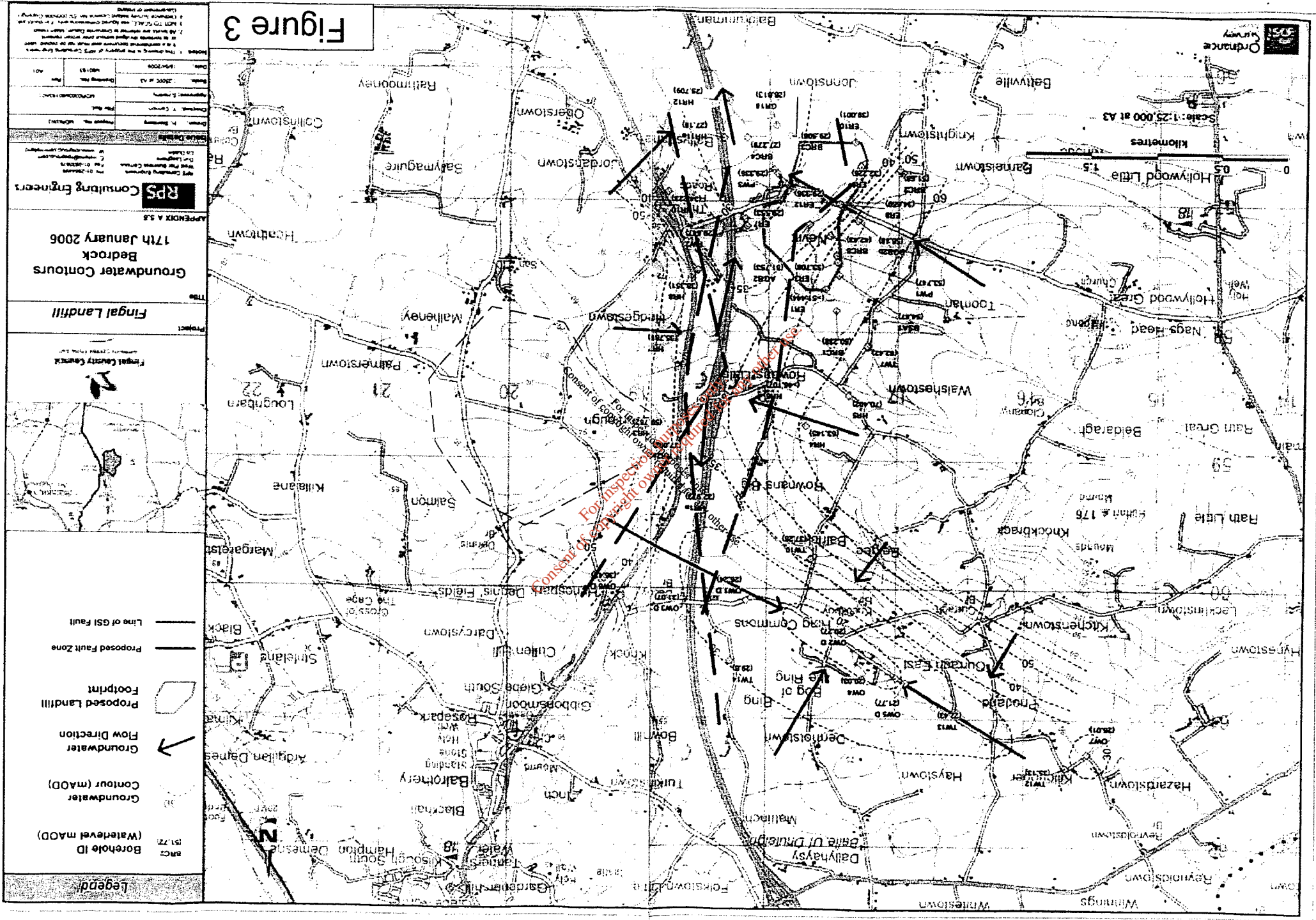
Job No. --	Date: Sept 2006
Drawn: --	Scale: Not to Scale
Title: Possible Extent of Buried Sand & Gravel Deposit	
Site: Nevill Landfill & Bog of the Ring Well Field	

Legend

- : Extent of Buried Sand & Gravel Deposit
- : Proposed Fault Zone
- : GSI Fault
- : Landfill Footprint
- : Outline of Study Area B

Note:  
Drawing is for diagrammatic purposes only.  
No measurements to be taken from the drawing.







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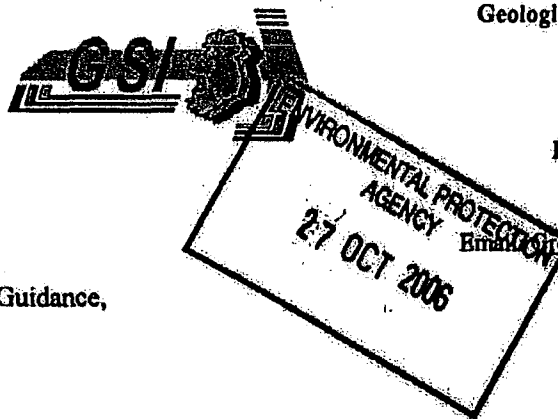
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Tor an Bhacaigh  
Bóthar Haddington  
Baile Átha Cliath 4

Geological Survey of Ireland  
Beggars Bush  
Haddington Road  
Dublin 4  
Tel. +353 1 6782000  
Direct +353 1 6782780  
Fax. +353 1 6782569  
<http://www.gsi.ie>  
Email: [groundwaterinfo@gsi.ie](mailto:groundwaterinfo@gsi.ie)

Dr. Ian Marnane,  
Inspector,  
Licensing Unit, Office of Licensing and Guidance,  
EPA,  
PO Box 3000,  
Johnstown Castle Estate,  
Co. Wexford



24<sup>th</sup> October 2006

Re: Waste License Application Ref. No. W0231-01, Fingal Landfill

Dear Dr. Marnane,

Thank you for your letter dated 23<sup>rd</sup> August 2006, requesting clarification on a number of specific points. As we discussed by phone subsequently, the GSI awaited further information from you prior to responding to your letter. I received further information from you via email on 3<sup>rd</sup> October 2006 and by post on 4<sup>th</sup> October 2006. This letter confines itself to answering the questions posed in your letter of 23<sup>rd</sup> August 2006, but refers to documents received by the GSI at a later date. EPA text is indicated by italics. The underlined portion of the text is my emphasis.

The Agency is requesting assistance from the GSI on a number of points related to the site of the proposed development and the information contained in the application, as follows:

- *The EIS document completed by RPS reports a groundwater divide to the north of the Nevitt site (at the approximate location of Rowans Little), as referenced in Appendix H, Section 3.5.2.1 of the EIS. This is also supported by Appendix A5 (groundwater contour maps) of the same document. Section 3.5.2.1 states that GSI includes this divide in the model completed as part of the 'Bog of the Ring Groundwater Protection Zones' study. Can GSI please comment on the reported divide and the basis for its inclusion in the model, and also supply a copy of the referenced report (and any other relevant reports in relation to the subject area).*

In describing the conceptual model used to generate the numerical model, the GSI's report comments that "Along the southernmost part of this boundary, the groundwater divide is in a low-relief area. The location of the groundwater divide is presumed to coincide with the surface water catchment divide. It is defined on this basis and with few data, and therefore its exact location is uncertain." (Bog of the Ring Groundwater Protection Zones, page 30.) The groundwater divide is also described on page 14 of the document.

The groundwater divide was identified by the GSI using hydrogeological principles. A groundwater "high" that groundwater flows away from, and across which no groundwater flows, was inferred from water level and other data. The data used by the GSI for its delineation were:

- Trial wells drilled in 1990's by K.T. Cullen & Co.: TW6, TW7
- Production well drilled in summer 2000: PW1
- Water level data provided by RPS from their preliminary site investigations at the Toomin site. Water level data are from Spring 2004.
- Stream rising at GR: 318243, 257841.
- Streams flowing southwards of the inferred groundwater divide.

Contd/...



Department of Communications, Marine and Natural Resources

Roinn Cumarsáide, Mara agus Acmhainní Náúúrtha

A copy of the report, Bog of the Ring Groundwater Protection Zones, is enclosed.

- *A report prepared by Mott McDonald consultants on behalf of the Nevitt Lusk Action Group includes a review of the 'Bog of the Ring Groundwater Protection Zones' study completed by GSI in 2005 and suggests that the study should not be relied upon as an indicator on the issue of whether the Nevitt site falls within the zone of contribution of the Bog of the Ring wellfield, as the model developed by the GSI makes the assumption that the Nevitt site area is outside of the zone of contribution. Can the GSI provide a comment of the utility of their study in assessing the potential as to whether the Nevitt site falls within the zone of contribution of the Bog of the Ring wellfield.*

The GSI's groundwater model was constructed for the purpose of understanding and evaluating the distribution of recharge to the groundwater system that the Bog of the Ring wellfield draws water from, the distribution of the aquifer transmissivities in the groundwater system, and to help define the extent of the Zone of Contribution (ZOC) and 100-day time of travel for the four production wells.

The GSI's report is of use as a starting point for assessing the location of the groundwater divide. However, the report also recommended that there should be field data collection to verify the location of the groundwater divide. "Due to the general complexity of Ireland's hydrogeology and limitations in data availability, uncertainty is an inherent element in drawing boundaries (see Section 3.5 in DoELG/EPA/GSI, 1999). The hydrogeology of the Bog of the Ring area is exceptionally complex. Therefore, drawing boundaries, particularly in the high transmissivity zones, is difficult and some uncertainty is inevitable. Detailed drilling and monitoring in these areas would be required before precise boundaries could be delineated." (Bog of the Ring Groundwater Protection Zones, page 39.)

- *The Mott McDonald report also indicates that there is potential for development of a new groundwater resource from the Loughshinny Formation to the east and northeast of the Nevitt site (see Section 4 of the Mott McDonald report). Can the GSI comment on the potential yields from a wellfield in this area? Is development of this area for public supply considered a viable option based on available information?*

For the following reasons, in the GSI's opinion, the most fruitful area for exploration for further groundwater supplies would be south of Decoy Bridge along a zone that is roughly parallel to the M1:

- Geological mapping indicates a fault zone within the Carboniferous Limestones in this location.
- There is evidence of high aquifer transmissivities along the fault zone both north and south of Nevitt.
- There is evidence of gravel deposits overlying the bedrock aquifer along the fault zone. Gravel deposits could provide additional transmissivity within the groundwater system, and also groundwater storage.
- *An additional report from James Bourke hydro-geological consultant suggests that 90% of the water supply to the Bog of the Ring is derived from the proposed landfill area. Can you comment on the above statement.*

Based on evidence that the GSI had available to it at the time of the study, we concluded that no groundwater was coming from beneath the landfill footprint at current pumping rates. The southern margin of the Zone of Contribution to the boreholes was defined using the natural groundwater divide (whose presence was determined from groundwater level data) and the projected southwards migration of the groundwater divide under pumping conditions (estimated using model predictions and trigonometric projections).

- *The EIS completed by RPS consultants indicates a potential variation in the extent of the zone of contribution to the Bog of the Ring wellfield in the event of an increase in the abstraction rate to 5,000 m<sup>3</sup>/d (see Section 3.4.4 of Appendix H of the EIS document). This is quoted from the GSI report on the 'Bog of the Ring Groundwater Protection Zones'. Can the GSI comment on the capacity of the aquifer to provide/sustain this abstraction rate and if possible provide a plot of the likely changes to the zone of contribution from that previously detailed in Map 5 of the GSI 'Bog of the Ring Groundwater Protection Zones' study.*

The report (Bog of the Ring Groundwater Protection Zones, page 35) records that, for an increase in pumping rate to 5,000 m<sup>3</sup>/d, numerical modelling indicates "the boundary of the zone is predicted to migrate westwards by approximately 200 m in the Hazardstown area and approximately 40 m southwards in the Rowans Little-Hedgestown area." The predicted southwards migration of the ZOC by a further 40m for an abstraction rate of 5,000 m<sup>3</sup>/d was estimated in the same way as described above (i.e. projection using trigonometry of drawdown at numerical model boundary onto contoured piezometric map). Note that, due to model discretisation (cell size) and uncertainty inherent in the model parameters, there is uncertainty in the magnitude of the predicted lateral movement of the ZOC under pumping conditions.

Because of the thick, low permeability subsoil covering much of the aquifer, recharge is limited, and it is likely to be this that that will put a limit on the abstraction from the Bog of the Ring wellfield.

A copy of the TES report ("Groundwater Monitoring of Bog of the Ring - Final Hydrogeological Assessment Report, October 2006") was received by the GSI on 12<sup>th</sup> October 2006. It suggests on pages 90 and 95 that the sustainable yield is approximately 4,000 m<sup>3</sup>/d +/- 15%.

- *Can the GSI confirm the classification of the landfill site area under the groundwater protection response matrix for landfills as R1, based on a 'low' vulnerability rating and an aquifer category of 'Locally Important and generally moderately productive (Lm)'. The classification scheme is as per the 'Groundwater Protection Schemes' (DELG/EPA/GSI, 1999). See extent of site area in attached Figure B.2.1 and B.2.2 in Licence Application document on enclosed CD, the proposed licence area is outlined in red.*

The GSI undertook a major review of aquifer classifications across Ireland in 2002-2004, which includes the area in North County Dublin. We examined carefully the data available to us at the time and arrived at the current aquifer classifications using considerable experience, knowledge and assessment of many data nationally according to a clear set of criteria.

The aquifer category of the Dinantian Upper Impure Limestones rock unit group in this area (which, in this area, includes the Loughshinny Formation, Naul Formation, Lucan Formation) is classified by the GSI as Lm - a Locally important bedrock aquifer which is Generally Moderately Productive.

Groundwater vulnerability over the northern part of the proposed landfill footprint is mapped by the GSI as 'Low'. Therefore, in this area, the Groundwater Protection Zone is Lm/L. According to the Groundwater Protection Responses matrix for Landfills (DHELG/EPA/GSI, 1999), the response category is R1. The vulnerability in the southern part of the proposed landfill footprint was not mapped by the GSI.

The Groundwater Protection Responses, which combine the factors of aquifer category and groundwater vulnerability, are intended for use in outline planning and screening of potential development sites. In deciding on the suitability or otherwise of a particular site, the specific characteristics and risks pertaining to that site should be the decisive factors: what matters is the likelihood of groundwater contamination taking place, and the likely impact of any such contamination, given a particular landfill design and operational system.

Contd/...

4/

I hope that foregoing answers satisfactorily the questions that you raised. If you need any further clarification, please don't hesitate to contact me.

Yours sincerely,



**Natalya Hunter Williams**  
**Project Hydrogeologist**  
**Groundwater Section**

Encs.

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APPENDIX 12.

E MAIL Correspondence DA 760

30<sup>th</sup> NOV. 2006 from G. Power

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**Shortt, John**

---

**From:** Lazeral [lazeral@indigo.ie]  
**Sent:** 30 November 2006 10:19  
**To:** Shortt, John  
**Subject:** Fw: Aquifer and gravel maps for Annsbrook, 2nd most preferred site from site selection study.

Original Message -----

**From:** Gilbert Power  
**To:** Lazeral  
**Sent:** 30 November 2006 09:46  
**Subject:** RE: Aquifer and gravel maps for Annsbrook, 2nd most preferred site from site selection study.

Con

Thought you would enjoy this! The aquifer map they keep talking about - is this the GSI one?

Gilbert

-----Original Message-----

**From:** Lazeral [mailto:lazeral@indigo.ie]  
**Sent:** 30 November 2006 09:29  
**To:** Gilbert Power  
**Subject:** Aquifer and gravel maps for Annsbrook, 2nd most preferred site from site selection study.

Dear gilbert,

Could you please provide me with A1 size aquifer and gravel maps for the Annsbrook site, (as soon as possible please)

Thank you  
Shay Lunney

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Version: 7.1.409 / Virus Database: 268.15.2/559 - Release Date: 30-11-06

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**Shortt, John**

---

**From:** Lazeral [lazeral@indigo.ie]  
**Sent:** 30 November 2006 10:19  
**To:** Shortt, John  
**Subject:** Fw: Aquifer and gravel maps for Annsbrook, 2nd most preferred site from site selection study.

----- Original Message -----

**From:** Gilbert Power  
**To:** Lazeral  
**Sent:** 30 November 2006 09:49  
**Subject:** RE: Aquifer and gravel maps for Annsbrook, 2nd most preferred site from site selection study.

Shay

Ignore and delete last e-mail - obviously not sent to you! I will reply as soon as possible.

Regards,

Gilbert Power

-----Original Message-----

**From:** Lazeral [mailto:lazeral@indigo.ie]  
**Sent:** 30 November 2006 09:29  
**To:** Gilbert Power  
**Subject:** Aquifer and gravel maps for Annsbrook, 2nd most preferred site from site selection study.

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Thank you  
Shay Lunney

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