

1 Reference  
W 0167-03  
Indaver Ireland Ltd

Sub NO (5)  
8, St Mary's Villas  
Drogheda,  
Co-Louth  
10.7.12

B.P.A.  
P.O. Box 3000  
Jobstown Cable Estate  
Co. Wexford



Dear Sir/Madam,

We wish to object to Indaver's application for permission (to an Bord Pleanála) and to the B.P.A. for licence to burn hazardous materials at Carranstown Incinerator in Co. Meath.

This Incinerator should never have been built in that location, a Regionally important Karst aquifer, the layers in North Kinstree and listed by Meath Co. Co. as having development potential to supply water to East Meath and the Dublin area, which now has to consider drawing water by pipeline from the Shannon to serve its needs. [See Meath Hydrology Map No. 14] - dark green area on map Rkd/M good dev. area

2

We, the members of "Friends of the Aquifer" considers that there was something strange if not "devious" in the changing of the vulnerability of the aquifer, from "High" vulnerability to pollution (extreme in places on the site, before part of a field was omitted) to "Medium" RKM. The Inspector said he considered the vulnerability to be "High" — as one would expect in a karst area with fissures and swallow holes as marked on the nearby CHR Cement Site Map.

Indaver in its original E.I.S. "lied" or was "economical with the truth" and said that the aquifer was **LOCALLY IMPORTANT** (as it was to local abstractors who had local wells) but the aquifer is **Regionally Important** and this Indaver knew, but choose to try to downgrade it. They also falsely claimed that there were no "areas of conservation" in the locality. Duleek Commons a fen & marshy area [Site Code 001578] is contiguous with the Incinerator Site.

An E.I.A. was never done for that development at Carranstown in spite of being reminded by the E.U. that one was required. I believe the



3 Director General of the E.P.A. said that it was only necessary for the E.P.A. to give guidance for an E.I.S. Who or what authority was meant to consider environmental issues as the planners at the time were forbidden to give consideration to environmental hazards?

The location of the Incinerator was chosen by the R.D. of Indaver purely because of the road network and the M11 motorway. The fact that Drogheda & its environs (35,000 + PPP) East Neath development south of Dundalk were situated DOWN WIND of the Incinerator emissions (to add to the emissions from the CRH Cement factory) the S.W. prevailing wind was never taken into consideration. And the N.E. area has some of the highest Cancer and Asthma rates in Ireland - but who cares? Human Health is not taken into consideration by the E.P.A. (or any planning department) when it comes to potential dangers to Health.

Now Indaver want to procure a licence to accept and burn hazardous materials

that up to now they have been exporting. Obviously Indaver have identified another profitable stream for the Co. and assumes "THAT OTHER WASTE BROKERS IN IRELAND WILL ALSO HAVE SUITABLE MATERIAL IN THEIR WASTE PORTFOLIOS"

Yours faithfully

Mary P. Burke

Secretary "Friends of the  
Aquifer Ltd"

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5  
P.S. The Inanerator should never have been built  
in that Carranstown location and should be  
decommissioned - it's an absolute abomination  
that Indaver should even consider now looking  
for a hazardous licence, increased tonnage  
and extra hours. It's the same type of  
greed for profit that brought our country  
down.

Note also that Laura Burke the Director  
General of the E.P.A since Dr Mary Kelly  
moved over to An Bord Pleanála was a  
Project Manager for Indaver Carranstown  
Inanerator. It would be impossible for  
her to be objective now, having driven  
the original project. The sure has led  
in Inaneration has already permeated  
the E.P.A - even perhaps unwittingly  
Furthermore on the first application  
to Meath Co. Co. Indaver wrongly marked the  
site application spot 1km further towards  
Duleek on a different lane leading towards  
the Commons - the only site in the locality  
with medium vulnerability - the rest of Site High  
and Extreme  
Mary P. Burke

P.P.S. Indaver made sure they got their original  
planning application in to Meath Co. Co. before  
the 2000 planning act section 257 was signed  
into law - Commencement orders - by Mr Dempsey  
(I believe) This Amendment of Waste Management  
Act provided legislation such that a.P.A.  
of Bord P. could (or might) take environmental  
pollution matters into consideration



...Questions have arisen over the timing of these projects," she said. "Many of the new projects, which

## Driver in Waterford remanded for car incident

A 22-year-old man was remanded in custody until next Thursday, when he appeared before a special sitting of Waterford District Court yesterday evening over an incident in which pedestrians in Waterford were terrified after an alleged drunk driver struck two taxis and a bollard.

A motorist drove from Spring Garden Alley to John Street at 12.20 a.m. yesterday and then refused to stop for a garda on foot patrol.

The driver then swerved violently and struck the taxis and bollard as pedestrians jumped out of his way.

The vehicle was pursued in a high-speed chase before the suspect was arrested moments later on the Cork Road, on suspicion of driving while under the influence of alcohol.

He was detained overnight at Waterford Garda station.

Yesterday evening he appeared before Judge Gerard Furlong charged with driving under the influence of alcohol, contrary to Section 49 of the Road Traffic Act.

Judge Furlong accepted the application from gardai for a remand.

the primary-care task force has earmarked for funding this year, have yet to receive their investment.

# Department of Environment resists health clause in planning reform

By Iva Picoek

A DEPARTMENT of Health proposal to replace Environmental Impact Assessments (EIAs) with Environmental Health Impact Assessments (EHIAs) is being resisted by the Department of Environment.

The recommendation is one of a number contained in a draft environmental health action plan for Ireland entitled *A Shared Vision for Quality of Life*.

In the draft plan, the Department of Health argues that health impact assessment is a way to enable more effective decision-making for improving the quality of life in the general population, and should contribute to redressing inequalities in health.

However, the Department of Environment said it could not accept the recommendation that the "system of EIA would become a system of Environmental Health Impact Assessment" because the current assessment requirements already reflect "health-related issues".

It is believed that such a change, if adopted, would result in more stringent planning legislation.

The Department of Health would neither comment specifically on the proposed change of EIAs to EHIAs nor on the Department of the Environment's resistance to the proposal.



Mr Ian Lumley of An Taisce: reforms very welcome

A spokesman said he could only comment on the draft environmental health plan in general. He said it concerned the role of the "whole of Government" in relation to health, not just the Department of Health, and that it was due for discussion among a Cabinet sub-committee in January.

He could not give a time-scale for the action plan but said that it was a "gradual on-going process" which could possibly affect planning legislation.

For example, under the proposals, if an incinerator was being planned, the human health impact would have to be taken into account, he said.

As a member of the World

...with a good quality of service of a good physiotherapy service "stand up to any scrutiny".

The physiotherapists' represent-

...the matter of ensuring that all Irish graduates have an opportunity to work at home be addressed.

Health Organisation (WHO), Ireland made a commitment to preparing a National Environmental Health Action Plan (NEHAP) in 1994. The current draft plan follows a proposal which was published by the Department of Health in 1999.

Environmental health is defined by the WHO as "those aspects of human health, including quality of life, that are determined by chemical, physical, biological, social and psycho-social factors in the environment".

The Department of Health spokesman said the proposed environmental health action plan would require all Government policies to be "health-proofed".

Mr Ian Lumley, spokesman for the environmental organisation An Taisce, said the proposed amendments to EIA legislation "would be very welcome as health is a major grey area under current legislation with both An Bord Pleanála and the EPA failing to address health issues, particularly in relation to telecommunications installations".

A Department of Environment spokeswoman said "human beings" are among the "factors" which must be considered when the "direct and indirect effects of a project" are being "identified, described and assessed" according to current EIA legislation. She also pointed out that this legisla-

tion also states that the interactions between people and other factors such as soil, water and air must be considered at present.

A further reason why the Department of Environment could not accept the proposal to amend EIAs to EHIAs, she said, was because the Environmental Protection Agency's guidelines on EIAs already deal with health and safety.

The guidelines state: "Health can be affected by a number of direct and indirect environmental pathways - air, water or soil". The evaluation of effects (for example from contaminants or irritants) on air, water and soil "is carried out by reference to known standards (usually internationally) of safety in dose, exposure or risk" and thus "provides robust and reliable health protectors for analysis relating to the environment".

"Where anxieties about human healthcare are understood to be of particular concern", the EPA guidelines continue, "the scope of EIS should ensure that observance of and reliance upon conformity with standards is adequately related to the specific health and safety topic ... of local concern."

Mr Lumley of An Taisce said that despite "the requirement to address 'human beings' in EIAs, you often just get guff from developers about the number of jobs under this section".

At least in the U.S.A.  
Public Health & Safety are considered  
important

"All the News  
That's Fit to Print"

# The N

VOL. CL . . . . No. 51,678

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## E.P.A.'s Authority on Air Rules Wins Supreme Court's Backing

### Cost Studies Sought by Industry Groups Rejected

By LINDA GREENHOUSE

WASHINGTON, Feb. 27 — The Supreme Court today unanimously and decisively rejected an industry attack on the Clean Air Act in one of the court's most important environmental rulings in years.

In an opinion by Justice Antonin Scalia, the court ruled that in setting national air quality standards, the Environmental Protection Agency must consider only the requirements of public health and safety and may not engage in the cost-benefit analysis that a coalition of industry groups sought to import into the statute.

Further, the court held that the Environmental Protection Agency's broad standard-setting authority did not amount to an unconstitutional delegation by Congress of legislative power to an executive branch agency. This part of the opinion rejected a ruling by a federal appeals court here that was widely viewed as one of the most powerful judicial attacks since the New Deal on the legal foundations of the modern administrative state.

The decision today dealt with new standards for two pollutants — ground-level ozone, which causes smog, and fine airborne particles, commonly known as soot — that the Environmental Protection Agency issued in 1997.

The new ozone standard has been the subject of fierce dispute, imposing substantial costs on industry and pitting states against one another,

depending on whether they are "upwind" or "downwind" of sources of pollution. While upholding the agency's authority to issue the standard, the court today rejected the E.P.A.'s plan for applying it in regions of the country, chiefly major metropolitan areas, that have not yet met the previous ozone standard.

The court sent the ozone standard back to the agency for a new implementation plan, one that must take account of two provisions of the Clean Air Act that in some respects are mutually contradictory. Reconciling these two provisions, one a general provision and one specific to ozone, will not necessarily be easy, and further delays in putting the new standard into effect are highly likely. This aspect of the opinion was confusing, and led to a number of different interpretations today.

But there was no ambiguity about the extent to which the court today strengthened the Clean Air Act in general and bolstered the sometimes embattled agency that is charged with enforcing the 31-year-old statute.

In an opinion two years ago, a panel of the United States Court of Appeals for the District of Columbia Circuit startled much of official Washington and the legal world by reviving the so-called nondelegation doctrine, which the Supreme Court

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# Supreme Court Upholds E.P.A.'s Authority on Air Rules

Continued From Page A1

had used to strike down two New Deal programs in 1935 but that had fallen into great disfavor since then.

The 2-to-1 appeals court decision held that the Clean Air Act lacked an "intelligible principle" for guiding the Environmental Protection Agency's use of its regulatory power — leaving the agency theoretically free, for example, to insist on bringing down to zero the permissible level of pollutants for which there is no known safe amount. This amounted to an undue delegation of legislative authority, the court said in an opinion that raised the prospect that the statutory foundation of many federal agencies could be open to similar attack.

But the Clean Air Act "fits comfortably within the scope of discretion permitted by our precedent," Justice Scalia said today. He added: "Even in sweeping regulatory schemes we have never demanded, as the Court of Appeals did here, that statutes provide a 'determinate criterion' for saying 'how much of the regulated harm is too much.'"

Justice Scalia noted that the Supreme Court had upheld Congress's broad delegation to the Federal Communications Commission to regulate the airwaves in the "public interest" as well as similarly broad delega-

tions to the Securities and Exchange Commission, the Interstate Commerce Commission and other agencies.

He said the Clean Air Act, properly understood, did not leave the E.P.A. with limitless discretion, instead instructing the agency's administrator to set standards that "allowing an adequate margin of safety, are requisite to protect the public health." Justice Scalia quipped with approval the definition of "requisite" that Solicitor General Seth Waxman offered when the case was argued in November: "sufficient, but not more than necessary."

Mr. Waxman, who left office with the end of the Clinton administration and is now teaching at Georgetown University Law School, said of the decision today: "I can't imagine a more thoroughgoing rejection of the D.C. Circuit's little escapade."

On the current court, Justice Scalia and Chief Justice William H. Rehnquist had, in past opinions, indicated the most interest in reviving the nondelegation doctrine. It was therefore particularly interesting that the chief justice, exercising his power to assign opinions, asked Justice Scalia to write the court's opinion in today's *Whitman v. American Trucking Associations*, No. 99-1257. While joining Justice Scalia's opinion, Justice Clarence Thomas wrote a separate concurring opinion to in-

## Rejecting an industry effort to consider cost before setting rules.

Justice Scalia quipped with approval the definition of "requisite" that Solicitor General Seth Waxman offered when the case was argued in November: "sufficient, but not more than necessary."

the future nondelegation challenges and announce that he would be open to considering them. The court's treatment of the cost-benefit issue today was equally significant and decisive. In fact, the nondelegation and the cost-benefit issues were closely interrelated. The industry group challenging the standards had urged the court to read a cost-benefit requirement into the Clean Air Act in order to avoid what it said was the constitutional problem of undue delegation. The appeals court had not addressed the question because it was bound by one of its own precedents, a 1980 decision holding that the Clean Air Act barred consideration of costs at the standard-setting stage. Once again referring to the wording of the statute, Justice Scalia said that the agency's mandate when setting standards for pollutants was to "identify the maximum airborne concentration of a pollutant that the public health can tolerate, decrease

the concentration to provide an 'adequate' margin of safety, and set the standard at that level."

He continued: "Nowhere are the costs of achieving such a standard made part of that initial calculation." The Clean Air Act "unambiguously bars cost considerations" from the standard-setting process, Justice Scalia said, "and thus ends the matter for us as well as the E.P.A."

In a separate opinion on the cost-benefit issue, Justice Stephen G. Breyer, who has written favorably about using cost-benefit analysis as a regulatory tool, said that statutory ambiguity should generally be resolved as "permitting, not forbidding, this type of rational regulation." However, he said, the history and general structure of the Clean Air Act made clear that costs were not to be considered at the standard-setting stage.

Under the statute, consideration of costs comes in at the next stage, when individual states develop their plans for complying with the standards.

The challenge to the standards was led by the American Trucking Associations and the United States Chamber of Commerce. Robin Conrad, a lawyer for the chamber, said today that industry would continue to battle the standards both in court and in Congress where, she said, "we will see if we can get the magic word 'cost' put into the statute."



# 1. Introduction

The proposed development site is situated within the townland of Carranstown in County Meath (site grid reference O 064 708). It is approximately 4 km south-west of Drogheda and 2 km north-east of Duleek. The site is approximately 30 acres in area. The entrance to the site is from the R152 regional road, which skirts the eastern boundary of the site. Ribbon housing development occurs along this road. The Navan to Drogheda railway line runs just west and north of the site. A major cement factory occurs c.500 m to the north-east of the site.

The site comprises agricultural land and this is the main landuse in the surrounding areas. The agriculture in the area is generally intensive and of mixed character (mostly pasture and cereals). The soils are good quality agricultural soils and appear well drained. The general area is drained by the River Nanny, which flows through Duleek and enters the sea at Laytown. There are no streams within the site, the nearest watercourse being a small tributary stream of the Nanny c.100 m to the south of the site.

**No part of the site is covered by a conservation designation or a proposed designation, such as an Natural Heritage Area, nor is adjacent to any area with such a designation.**

The habitats and vegetation types occurring within the site and surrounding areas are described, as are the vertebrate fauna (i.e. mammals, amphibians, reptiles and birds). The likely impacts of the development on the local flora and fauna are discussed and, where necessary, mitigation measures are recommended.

The general format of this report is in accordance with guidelines recommended by the EPA (1995) *Draft Guidelines on the Information to be contained in Environmental Impact Statements*.

## 2. Survey methodology

The survey was carried out on 11th June 2000. The survey comprised a thorough examination of the entire site. The areas immediately surrounding the site were also examined (though in less detail than the site) in order to put the site in a local context and to determine whether the development would have any impact on these areas.

The survey methodology consisted of systematically walking the site area and recording plant species and vegetation types present. As most of the site comprises intensively managed land, emphasis was placed on the field hedgerow boundaries. Notes were made on bird species present within and around the site. For mammals, the main emphasis was

untrue  
stream nearby

UNTRUE

001578 512201 001580

Duleek  
Common NHA is contiguous with site

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### Further Information Requirements

The Planning Authority considers that the planning application and accompanying Environmental Impact Statement are lacking in a number of regards. You are requested to address the following:

1. The 2002 Environmental Protection Agency Guidelines on Environmental Impact Statements states that the presentation and consideration of the various alternatives investigated by the applicant is an important requirement of the Environmental Impact Assessment process. Whilst it is noted in the E.I.S. that a number of alternatives were investigated, the Planning Authority notes that no proper presentation and consideration of alternatives investigated by the applicant re siting and scale of the proposed facility within the overall landholding has been provided for in the Environmental Impact Statement. The Planning Authority considers that it has not been demonstrated in the E.I.S. what alternative locations within the site were considered in order to minimise the visual impact of the development, in particular from Dowth and Bellewstown. Furthermore, it has not been demonstrated as to why the main building on site needs to be c. 40 meters in height. You are requested to address the above. Having regard to the landscape sensitivity of the area, the Planning Authority must stress the importance of minimising the visual impact of the proposed development.

2. The planning authority is of the opinion that waste for the proposed facility should in the first instance and primarily be sourced from within the north east region, in accordance with regional and national guidance on waste management.

Notwithstanding the above, the planning authority recognise the potential and sustainability of sourcing waste from neighbouring areas, in accordance with the principles of proximity and the RPG's (2004).

Having regard to the above, please indicate the location and quantities of waste, as you propose to source it. Your proposals should clearly demonstrate compliance with the north east region waste management plan and national policy guidance (ie that acceptance of waste from outside the region would not result in reasonable access being denied to waste management operators in the region, nor would such proposals prejudice the viability of proposed facilities in adjoining regions.)

The applicant is advised to liaise with the DoEHLG and the EPA, in advance of preparing their response to the further information request.

3. The Planning Authority considers that the Traffic Section of the E.I.S. should be revised to take into account the following:

- The traffic levels and access point associated with the extant Scottish and Southern Energy permission granted adjacent to the site for a 400mw electricity generating plant.

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PURPOSES ONLY**



- Traffic movement associated with staff to be employed on site during its operational phase.
  - 4. You are requested to liaise with Meath County Council Infrastructure Section to establish whether capacity is availability in the public water supply to facilitate the needs of development. **Re sourcing water supply from ground water, Meath County Council Infrastructure Section is current exploring whether the same aquifer is capable of serving the needs of the East Meath region in the short/medium term.** You are again requested to liaise with the Infrastructure Section to ensure the proposed development does not compromise the councils short/medium term strategy re water supply for East Meath. || \*
  - 5. The Planning Authority considers that the ecology section of the EIS should be revised as the language is loose and vague. From the ecology section wording, the Planning Authority cannot be sure as to precisely what is to be retained from the viewpoint of Flora and Fauna i.e. the words 'should' and 'may' occur regularly within this section. Please address
  - 6. **You are requested to submit details of a baseline assessment that should be carried out on each of the wells outlined in Table 10.2 GSI Well Search and on the surrounding industries so as to fully assess the impact of the groundwater extraction on the surrounding area.**
  - 7. **A number of procedures to be carried out are considered contrary to the basic principles of the waste management hierarchy of prevention, minimisation, reuse and recycling. These are outlined as follows:** \*
    - a.) Sections 5.7.2 and 17.7.2.1 of the EIS indicate that the output of bottom ash, (approximately 24% of the waste input by weight) can be reused. However, the EIS submits that it is not to reuse the bottom ash produced as no recovery plants for this substance exist in Ireland although such plants do exist throughout other countries within the EU. The feasibility of exporting the bottom ash for reuse has not been addressed.
    - b.) Section 5.7.2 indicates that ferrous metals shall be recovered from the process for recycling, however, the applicant has chosen not to recover non-ferrous metals from the process which could also be recycled.
- Please address.
8. If any submission resulting from the above request, alters your original proposal, requiring the submission of significant additional data, you are required to publish a notice in an approved newspaper, containing as a heading the name of the Planning Authority, marked "Further Information" or "Revised Plans", as appropriate.

SA60050

Please ensure that the format of your notice complies with Articles 35 (1)(c) of the Planning and Development Regulations 2001 (~~as your application was received~~ after 11<sup>th</sup> March 2002.

2<sup>nd</sup>  
application

You must submit an original full page of the newspaper to this office as soon as it is published.

11/3/02

2000 Planning Act Sec 257  
Amendment of Waste Management  
Act 1996 Come into Force

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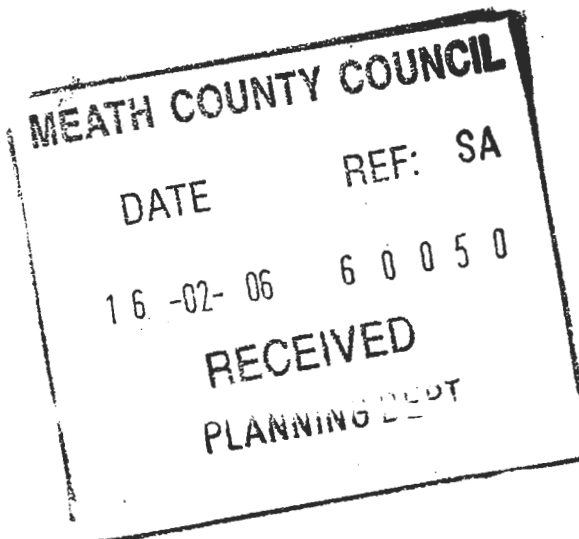


Downstairs file



28 February 2006

Planning Department  
Meath County Council  
Railway Street  
Navan  
Co. Meath



Dear Sirs:

I am enclosing Field Notes from Section 2 Appendix 6.6, which were not included in the original copies of the EIS sent to you.

Regards

Pat Kane

Pat Kane  
Communications Coordinator  
Indaver Ireland

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Why were these locations chosen for tests? - Most are not close to the proposed site at Carrasstown.



Reply to:

e-mail: [info@indaver.ie](mailto:info@indaver.ie)  
web: [www.indaver.ie](http://www.indaver.ie)

4 Haddington Terrace  
Dun Laoghaire  
Co. Dublin, Ireland

Tel +353 1 280 4534  
Fax +353 1 280 7865

Unit 11  
South Ring Business Park  
Kinsale Road, Cork, Ireland

Tel +353 21 470 4260  
Fax +353 21 470 4250

not close to 16  
proposed site

LEATH COUNTY COUNCIL

Sample Site A: Dulceek village in Ban Park REF: SA  
Grid ref: O 305233 268850 (DATE)

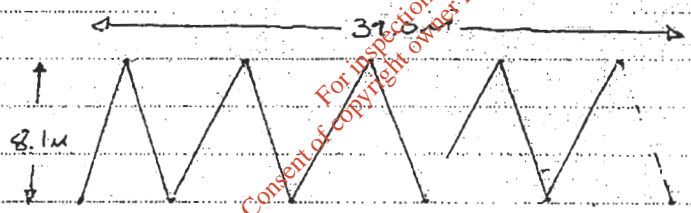
Sampling conducted by: Brian Kearns AWW  
16-02-06 6 0 0 5 0

126 samples were taken at 1m intervals  
The site is located in a large green area  
in the village. A flat surface is  
close to the road and it slopes off  
southwards to residences.

RECEIVED  
PLANNING DEPT.

Dimensions: 39.0m (length) x 8.1m (width)  
area = 315.9 m<sup>2</sup>

Samples taken from the transect which used  
the zig zag pattern sampling methodology.



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NOTES: soil was dark brown in colour slight  
clayey texture, no pebbles or stones present

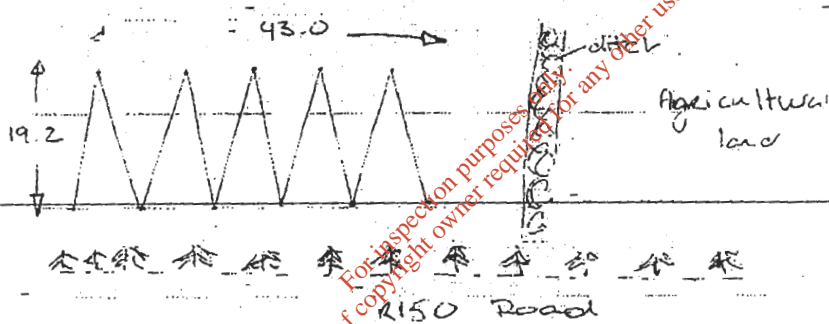
Date: 15/11/05



Example Site E. At Residential development location  
Grid ref.: C 306349, 270729 (GPS)  
Sampling conducted by: Brian Tierman (AWN)

36 samples were taken at 1m intervals. The site is located on agricultural land. The area was tilled in the last few years so on site not very compact.

Dimensions of sample area: 19.2 (width) x 43.0 (length).  
area = 829.6 m<sup>2</sup>



Notes soil is dark brown less moisture content due to previous agricultural practices

sandy texture and clayey in parts

Date: 15/11/08

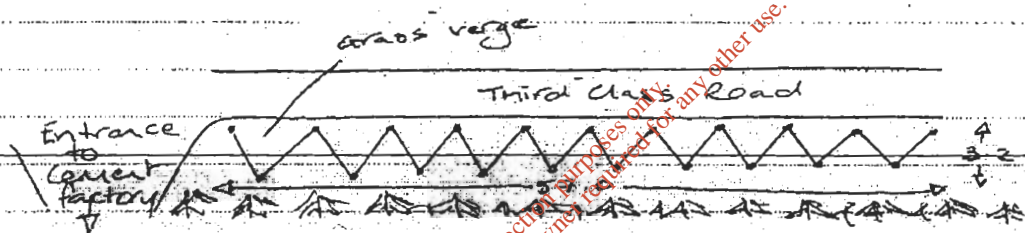
Location I: Outside Irish Cement Works, Platin.

Grid Ref: C 306969 272061 (GPS)

100 samples were taken at 1m intervals at the location. The site is located along the grass verge running along the road next to the entrance to the Irish Cement factory.

Dimensions of the area: 3.2 (width) x 57.0 (length)

Area:  $182.4 \text{ m}^2$



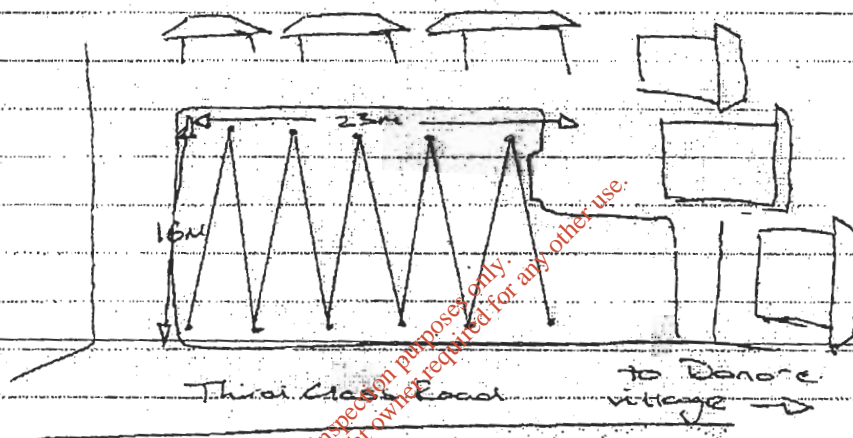
notes: Grass growing along the verge very thick, soil dark brown & colour, clayey in texture, some pebbles present. The auger could not reach the 70-80mm at some intervals due to the hard ground.

Date: 16/11/05



Location C. Residential Area, Donore Village  
Grid Ref: C 304516 272249 (GPS)

12 samples were taken at 1m intervals at the location. The site is located in the landscape area of a residential development in Donore village. The site slopes slightly towards the road.



The dimensions of the sampling area was 16.0m (width) & 23.0m (length); Area = 368m<sup>2</sup>

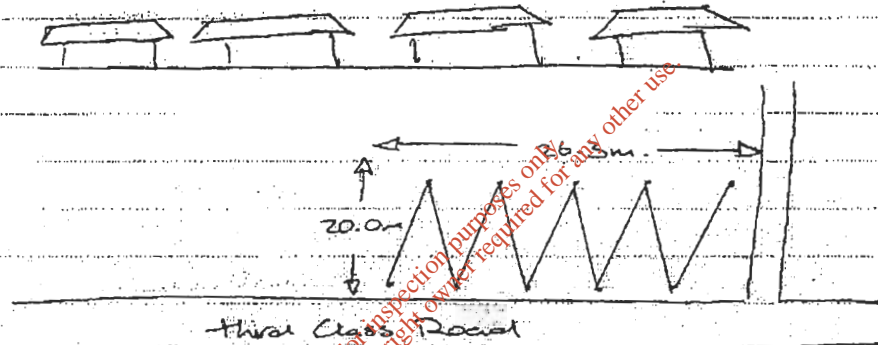
Notes: soil was light brown to brown in colour, clayey, texture and sand particles present.

Date 16/11/05

Location B: Commons, residential area, N of Duleek village.

Grid Ref: O 304679 269275

147 samples were taken at 1m intervals at the location. The site is located on a green area situated in between a row of houses and a third class road that runs from Duleek to Donore. The area is flat. The sampling area dimensions are 20.0m (width) x 26.3m (length). Area = 526.0m<sup>2</sup>



Notes: soil is dark brown in colour, clayey and sandy texture. The auger could not reach the 70-80mm at some intervals due to the hard ground.

Date: 17/11/05



fine sand or clayey sand with a T value of between 5 and 15. A reserve percolation area should also be constructed in the event of the main area malfunctioning.

- Alternatively, a sand filter could be constructed with an associated polishing filter. The advantage of this type of sand filter is that it takes up considerably less area than the trenched percolation area. The disadvantages are that a polishing filter is necessary and pumping of wastewater might be required to transfer effluent from the sand filter to the polishing filter.

### 9.4 POTENTIAL IMPACTS

The following details the potential impacts on soils and geology for both the construction and operational phases of the project.

#### 9.4.1 Construction Phase

Excavation works below the existing ground level will be required during the construction of the facility. All excavated material will be reused onsite.

Potential impacts during the construction phase would be associated with accidental spillage of potentially polluting substances including oils, paints and liquid wastes and any additional substances associated with the construction activities.

The development site is underlain by karst limestone which by its nature can pose difficulties for building foundations due to the unpredictable occurrence, extent and depth of underground cavities. The facility is located in a wide expanse of limestone strata. The development of this facility will not materially impact on the available reserves of limestone in the east Meath area.

It's the environment stupid!

#### 9.4.2 Operational Phase

The potential impacts during the operation phase would be limited to accidental spillage of potentially polluting substances including oils, paints, liquid wastes, or raw materials such as lime, caustic soda or ammonia/urea. However it should be noted that with good management practices in place it is expected that the development will not cause any impact on the soils and geology of the site.

The location of the proposed facility in close proximity to the Irish Cement quarry may give rise to concerns relating to impacts from vibration.

from blasting

[Some years ago nearby houses suffered damage & had to be demolished]

Precautionary Principle !!!

materially impact on same. Subsequent to the Agency consultation with the planning authority, the applicant also submitted additional information, which included air dispersion modelling from a 65m stack. The applicant stated that while they did not believe it necessary to increase the stack height, they had no objection to the raising of the stack height to 65m. The applicant's submission included a letter from the Irish Aviation Authority, which indicates that the increase in stack height does not alter any previous requirements relating to lighting of the structure, which is incorporated in the planning permission for the facility. The applicant's submission also included information relating to the UNESCO visit to County Meath and specifically air emission modelling which indicates that the proposed facility will not impact on the World Heritage Site Bru na Boinne.

### **Emissions Monitoring**

Emissions from the stack are to be continuously monitored for particulate, carbon monoxide (CO), ammonia (NH<sub>3</sub>), sulphur dioxide (SO<sub>2</sub>), hydrogen chloride (HCl), oxygen (O<sub>2</sub>), oxide of nitrogen (NO and NO<sub>2</sub> expressed as NO<sub>2</sub>), and volatile organic compounds (VOCs as TOC). The applicant has proposed to carry out both periodic and continuous sampling, for which analysis will take approximately 10 to 15 days, of dioxins at the stack and this is provided for in the RPD. Periodic measurements will be carried out for metals (cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V)), hydrogen fluoride (HF) and nitrous oxide (N<sub>2</sub>O). The frequency for periodic measurements is specified in *Schedule D: Monitoring*. Condition 2.18 requires the applicant to determine the size distribution (PM<sub>10</sub>, PM<sub>2.5</sub> and PM<sub>1.0</sub>) of the particulate matter in the exhaust gas emissions. Environmental monitoring is set out in *Schedule D: Monitoring*.

### **Noise & Dust**

Noise monitoring results indicate that noise levels (LA<sub>eq</sub>) at the boundary of the facility are in excess of 55dBA. The main noise impact can be attributed to passing traffic. Noise monitoring requirements from the facility are established under *Condition 8.1* and emission limits are set under *Schedule C*. Condition 7.4 provides for the control of dust emissions.

### **Odour Control**

The waste reception area (waste bunker) of the waste to energy plant will be maintained under negative pressure to prevent any odorous emissions. Odour control is not necessary at the materials recycling plant as only dry recyclable wastes will be accepted, which will be processed indoors. Condition 7.1 requires that odours do not give rise to nuisance at or adjacent to the facility.

## **5, Groundwater (GW) - Emissions, Abstraction & Monitoring**

### **Site Hydrogeology**

The applicant describes the overburden geology as consisting of silty clays (boulder clays), and states that the thickness of the boulder clays varies across the site, ranging from 5.0m towards the west of the site to greater than 20m towards the centre. Sand and gravel lenses are found throughout the boulder clays. Limestone bedrock is found beneath the overburden. The limestone bedrock constitutes a regionally important aquifer which displays both karst and fracture flow features. The groundwater within the limestone aquifer of the proposed site flows eastwards and discharges as base flow into the Nanny River by means of local tributaries of the Nanny. The applicant considers the aquifer vulnerability for this site to be moderate, but based on the varying thicknesses and type of overburden cover, I consider the aquifer vulnerability to be high. The RPD does not permit any discharges to groundwater, other than the effluent from the treatment of domestic sewage, for which the wastewater



gravel lenses are found throughout the boulder clays, and allow some water movement through the otherwise low permeability clay material.

### 2.4.3 Hydrogeology

The regional limestone bedrock constitutes a regionally important aquifer which displays both karst and fracture flow features. Groundwater within the limestone aquifer flows eastwards and either discharges directly into the Irish Sea or into the Boyne and Nanny River systems as base flow. Based on the groundwater flow direction for the proposed site, the groundwater discharges into the River Nanny by means of local tributaries of the Nanny.

Currently the limestone aquifer in the vicinity of the site is used by a large number of groundwater abstractors. Figure 2 shows the location of these abstraction points. This information was obtained from the Environmental Impact Statement entitled "Proposal for the Development of Limestone Quarry" dated 1997 and produced by Brady Shipman Martin.

Irish Cement Ltd., located to the north west of the development site, is currently de-watering the groundwater for they're quarrying activities. It is estimated that the groundwater level in the limestone aquifer has been lowered by 5.0 to 9.0 metres below its normal level in the vicinity of this site, and will remain lowered until the extraction of rock discontinues. **This dewatering has altered the natural groundwater flow within the bedrock aquifer, which currently flows towards the Platin abstraction zone.**

The till overburden on site contains groundwater, however this has moderate to low permeability thus holding little or no potential for groundwater development. **The overburden water does represent a pathway for potential localised contaminant migration.**

## 3 FIELD ACTIVITIES

Field activities for the purpose of this hydrogeological investigation were undertaken in May 2000 and consisted of the following stages:

- Soil Sampling
- Monitoring Well Installation



**Site Name : Dowth Wetland**  
**Site Code : 001861**

Located 4km east of Slane on the northern bank of the River Boyne. This site consists of an area of floodplain marsh with an associated area of deciduous woodland on steep slopes. The marsh occurs on wet alluvial soils, regularly flooded by the Boyne.

The main area of freshwater is dominated by Canary Reed-Grass with Marsh Bedstraw, Reed-Grass and Meadowsweet. Fen Bedstraw, a scarce species mainly confined to marshy areas in the midlands, is common in this vegetation. The Common reed is common as one moves north. Above the marsh there is a small area of mixed deciduous woodland Ash, Sycamore, Hazel and Lime. There is also beech, Cherry Laurel and Bird Cherry. A small herd of Red Deer graze within the site.

**Site Name : Duleek Commons**  
**Site Code : 001578.**

This NHA is 1km northwest of Duleek, occupies a level drained marsh and is associated with the floodplain of a tributary running from Thomastown marsh to the river Nanny. It is fairly dry around the periphery where Hard and Soft Rush can be found. The centre is wetter with wetland species such as Water Mint, Water Forget-me-not, large stands of Yellow Flag, Jointed Rush and bulky sedges. The rare spike-rush was recorded here in one of its very few inland locations.

**Site Name : Girley Bog.**  
**Site Code : 001580.**

This is a lowland raised bog 7km north of Athboy. It was designated an ASI in 1972 and there was no evidence of active peat growth at that time. As is normal for raised bogs Ling Heather dominates and Bog Asphodel and Deergrass are common. Bog Rosemary, the Sundrew and White Beak-sedge are also said to occur. Subsequent work has revealed that this site is in poor condition, and is one of the most easterly raised bogs in Ireland.

Site Name : Jamestown Bog.

Site Code : 001324.

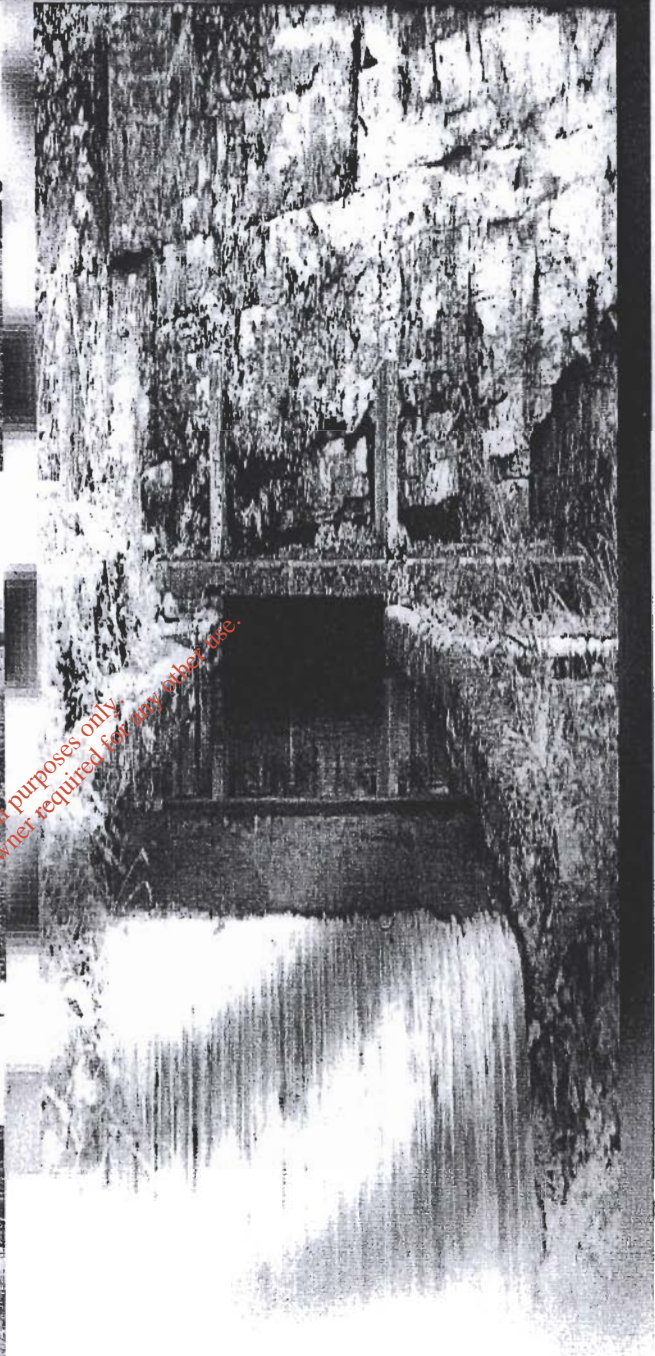
A raised bog surrounded by commercial forestry 10km west of Navan. Large tracts of the bog have suffered due to turf harvesting. The vegetation comprises a uniform cover of deep heather especially where the bog has dried out. The central area is still intact and includes species as Bog Cotton and Bog mosses. Raised bogs are under threat and this site should be protected as one of the few remaining examples of this habitat in the area.

**Site Name : Lough Naneagh**  
**Site Code : 001814.**

Located approximately 10km northeast of Castlepollard about 2km off the road to Oldcastle. The site consists of a series of small lakes (Lough Naneagh being the largest) and wetlands which lie in poorly drained hollows between drumlins and hummocks. This topography is a typical product of the ice age.

Broad bands of fen vegetation fringe the lakes and typical plants include Black Bog-Rush and Common





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# Groundwater Protection Schemes





# 1. Introduction

The primary responsibility for groundwater protection rests with any person who is carrying out an activity that poses a threat to groundwater. The protection of groundwater quality from the impact of human activities is a high priority because:

- groundwater is an important source of water for industry, agriculture and drinking water;
- groundwater moves slowly through the ground and so the impact of human activities lasts for a relatively long time;
- groundwater may be difficult to clean up, even when the source of pollution is removed;
- groundwater provides baseflow to surface water systems and accordingly its quality influences the amenity and recreational value of surface water and its potential use for water supply purposes;
- unlike surface water where flow is in defined channels, groundwater is present everywhere;
- agricultural, industrial and other human activities are posing increasing risks to groundwater quality;
- EU legislation and national regulations require that pollution must be prevented (as part of sustainable groundwater quality management).

The most practical and effective means of protecting groundwater and preventing pollution, for land-use planners and water resources managers, is through the use of groundwater protection schemes.

Since the mid 1980s, a number of local authorities – Offaly, Wexford, north Cork, Galway and Louth – have been successfully using groundwater protection schemes. These are based on a relatively simple scheme proposed by the Geological Survey of Ireland in the early 1980s and appropriate to the available hydrogeological information and planning needs of that time. Now a more comprehensive scheme, using a greater geological and hydrogeological input, is required to enable better and more defensible decision-making in land-use planning and environmental protection.

The level of available geological and hydrogeological information on which to base a groundwater protection scheme varies from area to area at present. Where the information is adequate, a comprehensive scheme, based on hydrogeological concepts, is achievable. As adequate geological information, particularly on subsoils, is not available for a significant proportion of the country at present, it will not be possible to produce comprehensive groundwater protection schemes for every local authority area in the short term. However, the concept and principles of a Groundwater Protection Scheme can still be used as a basis for decision-making regarding groundwater protection. Interim groundwater protection measures are recommended pending a comprehensive scheme, reflecting the precautionary principle for environmental protection.

A scheme consists of two closely interlinked components: (i) **land surface** (groundwater protection) **zones**, based on hydrogeological concepts and information particularly regarding aquifers and vulnerability; and (ii) **groundwater protection responses** for potentially polluting activities, which give guidelines on the acceptability of the activities, investigation requirements and, where appropriate, the likely planning or licensing controls.

A groundwater protection scheme enables regulatory authorities to take account of: (a) the potential risks to groundwater resources and sources; and (b) geological and hydrogeological factors, when considering the control and location of potentially polluting activities. In practice its use needs a realistic and flexible approach. The groundwater protection zone maps have limitations because they generalise (according to data availability) variable and complex geological and hydrogeological conditions. Therefore, a scheme provides a technical framework to assist in decision-making on the location and nature of developments and activities with the view to ensuring the protection of groundwater. It is not prescriptive and decisions may need to be qualified by site-specific considerations.

## 3.2 Vulnerability Categories

Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The vulnerability of groundwater depends on: (i) the time of travel of infiltrating water (and contaminants); (ii) the relative quantity of contaminants that can reach the groundwater; and (iii) the contaminant attenuation capacity of the geological materials through which the water and contaminants infiltrate. As all groundwater is hydrologically connected to the land surface, it is the effectiveness of this connection that determines the relative vulnerability to contamination. Groundwater that readily and quickly receives water (and contaminants) from the land surface is considered to be more vulnerable than groundwater that receives water (and contaminants) more slowly and in lower quantities. The travel time, attenuation capacity and quantity of contaminants are a function of the following natural geological and hydrogeological attributes of any area:

- (i) the subsoils that overlie the groundwater;
- (ii) the type of recharge - whether point or diffuse; and
- (iii) the thickness of the unsaturated zone through which the contaminant moves.

In general, little attenuation of contaminants occurs in the bedrock in Ireland because flow is almost wholly via fissures. Consequently, the subsoils (sands, gravels, glacial tills (or boulder clays), peat, lake and alluvial silts and clays), are the single most important natural feature influencing groundwater vulnerability and groundwater contamination prevention. Groundwater is most at risk where the subsoils are absent or thin and, in areas of karstic limestone, where surface streams sink underground at swallow holes. \*

The geological and hydrogeological characteristics can be examined and mapped, thereby providing a groundwater vulnerability assessment for any area or site. Four groundwater vulnerability categories are used in the scheme - **extreme (E)**, **high (H)**, **moderate (M)** and **low (L)**. The hydrogeological basis for these categories is summarised in Table 1 and further details can be obtained from the GSI. The ratings are based on pragmatic judgements, experience and available technical and scientific information. However, provided the limitations are appreciated, vulnerability assessments are essential when considering the location of potentially polluting activities. As groundwater is considered to be present everywhere in Ireland, the vulnerability concept is applied to the entire land surface. The ranking of vulnerability does not take into consideration the biologically-active soil zone, as contaminants from point sources are usually discharged below this zone, often at depths of at least 1m. However, the groundwater protection responses take account of the point of discharge for each activity.

Vulnerability maps are an important part of groundwater protection schemes and are an essential element in the decision-making on the location of potentially polluting activities. Firstly, the vulnerability rating for an area indicates, and is a measure of, the likelihood of contamination. Secondly, the vulnerability map helps to ensure that a groundwater protection scheme is not unnecessarily restrictive on human economic activity. Thirdly, the vulnerability map helps in the choice of preventative measures and enables developments, which have a significant potential to contaminate, to be located in areas of lower vulnerability.

In summary, the entire land surface is divided into four vulnerability categories - extreme (**E**), high (**H**), moderate (**M**) and low (**L**) - based on the geological and hydrogeological factors described above. This subdivision is shown on a groundwater vulnerability map. The map shows the vulnerability of the first groundwater encountered (in either sand/gravel aquifers or in bedrock) to contaminants released at depths of 1-2 m below the ground surface. Where contaminants are released at significantly different depths, there will be a need to determine groundwater vulnerability using site-specific data. The characteristics of individual contaminants are not taken into account.

## 5. Interim Measures for Groundwater Protection

### 5.1 Introduction

For a significant proportion of the country, the currently available geological and hydrogeological information is inadequate to enable a comprehensive scheme as described in the previous sections to be prepared in the short term. Until sufficient information is available for all areas, statutory authorities need an interim scheme which combines **the principles of a groundwater protection scheme with the best available hydrogeological information, to form a defensible basis for decision-making regarding groundwater protection**. In order to achieve this, interim land surface zoning and groundwater protection measures will be required.

In general, it should be possible to ascertain the aquifer category for a given locality (allowing for some uncertainty in the location of geological boundaries). However, the vulnerability rating will normally require site specific information.

Because the Interim Measures lack certain elements, particularly vulnerability maps, they will be less efficient in the evaluation of proposed developments or activities: site investigations will need to be more extensive, decision-making will be slower, and planning may be more restrictive. Authorities should aim to complete and implement a comprehensive groundwater protection scheme as soon as practicable.

### 5.2 Factors Influencing the Choice of Interim Measures

Interim Measures for the protection of groundwater should:

- (i) make the best use of the information that is readily available, (e.g. aquifer maps);
- (ii) protect the groundwater with the greater value, i.e. significant groundwater supply sources and regionally important aquifers;
- (iii) protect the most vulnerable groundwater;
- (iv) to take account of the proposed EU Framework Directive on Water.

The priorities that follow from these factors are:

- delineating source protection zones around wells and springs;
- delineating aquifer categories;
- mapping the extremely vulnerable areas, particularly on regionally important aquifers.

### 5.3 Information Needs

#### 5.3.1 Interim Source Protection Zones

To delineate protection zones around significant groundwater sources, additional information is usually needed on the following:

- water levels and groundwater gradients near the sources;
- pumping test data for wells, or flow measurements for springs;
- vulnerability maps for the zones of contribution (ZOCs).



\* Is this all the "experts" have to say about the most important Regional Aquifer in North

Keinsto  
?

\* Limestone Formation, the Dartry Limestone Formation, the Meenymore Formation and Maydown Formation. These aquifers are located in Counties Cavan and Monaghan. In the South of the North East Region there are regionally important aquifers in the Upper Carboniferous Limestone Formations.

some areas such as central Monaghan and northern Cavan which is overlain by sand or gravel. The overburden in this area has produced what is usually referred to as the North Central Drumlin Belt. The Drumlin Landscape is typically poorly drained with a stoney-grey soil cover on the better drained flanks of the drumlins. The depth of the overburden is thought to be very variable although exact depths are unknown. The type and thickness of the overburden is extremely instrumental in the vulnerability of the aquifers in the underlying bedrock.

There are other regionally important aquifers in the south of County Cavan in the Lough Sheelin area and the Mullintra Aquifer at Kingscourt. Another significant aquifer in the North East runs from Carnaross in the north of County Meath into Louth and the southern part of Monaghan. The solid geology of this aquifer consists of Calp Limestones and Shallow Water Limestones with some of the sandstones and siltstones of the Navan Beds. These formations produce reasonable yielding wells in the towns of Nobber and Kilmainhamwood.

The Local Authorities in the Region are aware of the vulnerability of natural groundwater and are implementing aquifer protection policies. The policy is based on a system of priority source protection zones related to the location of the aquifers, catchment area and abstraction points. The policy seeks to control the development within the aquifer zones in such a way as to prevent pollution and contamination of water resources.

In County Meath there is a large formation that spreads from the west of the County to the coast. This is predominantly Calp Limestones with Shallow Water Limestones. There is also a minor Upper Carboniferous aquifer along the coast in Louth to the south of Dundalk and along the coastline of the Carlingford Peninsula. In County Meath drift geology forms a sand and gravel aquifer running South West from Enfield to the north east at Navan and a small aquifer is present along the border with County Westmeath in the Athboy area.

There are also large areas of locally important aquifers in the Region which are poor aquifers and yielding very small quantities of water. They are sometimes used as water supply for single households or farms. However the capacity of the aquifer is small, the water being contained only in the uppermost few metres of rock and can therefore run dry in the summer as the water table lowers.

**Overburden Geology:** The overburden of the Region is a uniform glacial till which varies in

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The N3 is also scheduled for major improvements with the M3 Clonee to Kells PPP Scheme, which will commence later this year and involve the construction of a 50km stretch of motorway/dual carriageway, and 11km of single carriageway. The scheme also involves construction of a further 24km of link road and the widening/realignment of other roads. The Virginia Bypass is also undergoing development.

National Secondary Routes in the Region include the N51 from Drogheda to Navan meeting the N52 at Delvin which then passes through Kells and Ardee and terminates in Dundalk. The N54 runs from Monaghan to Clones and meets the N3 at Butler's Bridge, while the N87 goes through Belturbet to Swanlinbar. Finally, the N55 runs from Cavan to Athlone through the South West of the Region. The N51 and N52 are also expected to be improved.

**Regional Roads:** There are numerous regional roads in the Region including the R180 through Monaghan, the R154, which runs through Cavan and Meath, and the R165 which runs through both Cavan and Louth.

**Ports and Airports:** Transportation by sea is also relevant in the area. The Region has three rapidly growing Ports in County Louth at Dundalk, Drogheda and Greenore. In addition to the Dublin-Belfast rail line there is also a freight line from Navan to Kingscourt. While there is no airport in the Region there is an airport close by in Enniskillen in County Fermanagh which is close to the northern part of the Region while Dublin Airport is very accessible to the southern part of the Region.

## 8.6 GEOLOGY & HYDROGEOLOGY

The geology of the North East is a continuation of the Southern Upland Fault in Scotland which runs from Scotland to the coast of County Down in Northern Ireland and further South West to Carlingford and Monaghan ending in County Longford. This section of the Fault is known as the Longford-Down Inlier. The bedrock is Ordovician and Silurian sandstones and consists of siltstones and shales with small pockets of tuffs and lavas.

The Carlingford Mountains are granitic igneous intrusions that were formed during the Tertiary

period. These give way westwards into the drumlin area of Monaghan. These drumlins were formed in the Quaternary period and are glacial features. The densely packed till resulted in land that is difficult to drain and hence the numerous lakes in this section of the country. Monaghan geology consists of a series of sandstone, shale and siltstone formations which are similar to those of the southern upland fault and are carried on to the north and east as far as the southern uplands of Scotland.

The North West of the Region is again dominated by drumlins and lakes. However in the extreme north west the rocks are Carboniferous in origin consisting of limestones which become the higher ground on the Cavan/Fermanagh boarder. Further south in the centre of Cavan the geology is predominantly Ordovician and Silurian dominated by Greywackes and Shales.

To the East, County Louth is comprised predominantly of rock from the Ordovician and Silurian periods. There is a small pocket of Upper Carboniferous Limestone in the North of the County which conforms with the coastal limestones around the Cooley or Carlingford Mountains.

The South of the Region in County Meath is comprised of limestones again from the Upper Carboniferous period which underlie the fertile plains surrounding Navan and the River Boyne. In the Northern part of this County there is a zone of movement with a series of faulting associated with the Longford-Down inlier. This zone contains older rocks of the Devonian, with some limestones. There are also significant lead and zinc deposits from the Lower Carboniferous in the Navan area.

Overall the geology of the North East Region shows some variation ranging from the Devonian to the Tertiary in age and comprising a number of valuable deposits. The variation in geology has resulted in a number of topographical features which are great assets to the Region, the Lakes of Cavan and the Mountains in Carlingford are valuable tourist attractions and as such, key economic features. While the presence of the lead and zinc deposits are also of key economic importance.

**Hydrogeology:** The most significant aquifers in the North of the Region are the Ballysteen

1<sup>st</sup> Application

Alpha Engineering  
Services  
Site Investigation

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- 1.0 INTRODUCTION
- 2.0 SITE INVESTIGATION
  - 2.1 Introduction
  - 2.2 Statigraphy
- 3.0 RECOMMENDATIONS
  - 3.1 Foundations
  - 3.2 Slabs
  - 3.3 Groundwater
- 4.0 FURTHER SITE INVESTIGATION

Drawing A228 - 02 – Site Investigation Locations

Appendix A – Trial Pit Logs

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## 1.0 INTRODUCTION

Alpha Engineering Services (AES) have been requested by Project Management Ltd. to carry out a site investigation at a green field site in Platin, Co. Meath. The total area investigated is approximately 45 acres, which is subdivided into 6 fields.

The site investigation was carried out on the 22<sup>nd</sup> January 2000 and consisted of excavating fifteen trial pits. This report details the findings of the site investigation along with making a number of geotechnical recommendations.

The trial pits were excavated on the 24<sup>th</sup> January 2000 using a 13 tonne excavator and were logged by a geotechnical engineer from Alpha Engineering Services.

## 2.0 SITE INVESTIGATION

### 2.1 Introduction

15 No. trial pits were excavated on the site at the locations indicated on Drawing No. A228-02. All ground stratas revealed in the trial pits were classified in accordance with BS 5930 "British Standard Code of Practice for Site Investigation". The trial pit logs are represented in Appendix A.

The site is bounded to the north by a railway embankment, to the west by a small side road and the south by the R152 road.

A gas pipe is located through the centre of the site. In order to avoid the pipe, trial pits were not excavated within 25m of the pipeline.

Topographical levels on the site were noted to vary from approximately 34 mOD in the north west corner of the site to 43 mOD in the south east corner of the site. Topographical low points of 32 mOD were noted in the centre and the south east corner of the site.

## 2.2 Site Stratigraphy

The trial pits were examined by a Geotechnical Engineer from AES. The stratigraphy varied across the site but generally consisted of topsoil overlaying brown boulder clay on a clayey gravel layer which was in turn underlain by a black boulder clay. Bedrock was noted to be carboniferous limestone. In both the gravel and clay layers large boulders up to 600mm in diameter were noted. A summary of the stratigraphy is presented in Table 1 below.

STRATUM	Depth (m bgl)
TOPSOIL	0 – 0.4
Soft to firm brown silty CLAY with cobbles.	0.4 – 1.0
Firm to hard brown silty CLAY with cobbles and large boulders (Brown boulder clay).	0.4 – 4.0
Medium dense to dense sandy GRAVEL approximately 7m in depth with local sand lenses	0.4 – 5.0
Hard black silty CLAY cobbles and large boulders (Black boulder clay)	2.5 – 4.0

Table1 – Summary of Ground Stratigraphy Revealed by the Site Investigation

## 2.3 Brown Boulder Clay

In TP No.'s 1, 2, 5, 6, 7, 8, 9 & 12 a soft to firm brown silty clay was noted to a maximum depth of 0.9 m bgl, directly under the topsoil.

The brown boulder clays which underlay the upper soft to firm layer were noted as being firm to stiff silty gravelly low plasticity clays, with a high cobble and boulder content. The undrained shear strength of the clay was estimated to be in the order of 50kPa to 100kPa.

In TP 8 a soft clay layer was noted between 1.5mbgl and 2.6mbgl. The material was of low strength while significant side collapsing of the sides of

the pit and ground water seepage were noted. In TP 14 adjacent to TP 8 a similar soft sandy clay was noted to extend from 2.4 to 4.4 mbgl however collapsing was not as significant and ground water ingress was not noted.

In TP 11 a soft clay with large boulder clay was noted to extend from 2.0 to 2.7 mbgl.

#### 2.4 Gravel

Gravel layers were noted to underlay the brown boulder clay layer in all trial pits excluding TP No.'s 1, 2, 4, 10 & 11.

The gravels were generally noted as a competent medium dense to dense sandy clayey gravels with large boulders. Intermittent localised sand lenses typically in the order of 100 – 200mm were also noted. In TP 15 2m of loose sand was noted from 1.5m bgl.

The gravels were generally noted to be dry and stable with only moderate localised seepage occurring in some trial pits (TP 16). However, it is noted that trial pits were generally not left over for a significant length of time, typically in the order of 15 – 20 minutes.

TP 13 was left open for five hours and significant ground water seepage was noted, localised failure of side slopes had occurred.

#### 2.5 Black Boulder Clay

The black boulder clay stratum was noted in trial pits No.'s 1, 2, 5, 6, 8 & 15.

The black clay layer was noted to be a hard silty gravelly clay with cobbles and large boulders.

As with the brown clay it was described as a low plasticity clay while the undrained strength is estimated to be in the order of 75kPa to 150kPa.

#### 2.6 Bedrock



Refusal was noted at shallow depth in trial pit No. 4 and No. 10 at 2.6 and 2.2m bgl respectively. From a visual inspection the refusal was attributed to the presence of limestone bedrock (rather than large boulders).

### 3.0 RECOMMENDATIONS

#### 3.1 Excavation

Excavations of subsoils, to the depth investigated by the trial pits, will not require any extraordinary means. Use of conventional excavation plant will be sufficient. However, the presence of large boulders (diameter greater than 0.5m) could make excavation more difficult and slower than would be normally expected in such materials. Also, the preparation of formations may prove more difficult because of the presence of the boulders.

The trial pits were generally noted to be stable. However, when TP 5 was left open for five hours localised collapsing was noted. In TP No.'s 8 and 14 immediate collapsing was noted during excavation. It should be assumed, therefore, that excavations will require temporary support or the side slopes to be graded at a safe angle. Typical side slopes in the clayey subsoils encountered during the excavation would be 1.0 vertical to 1.5 horizontal for temporary slopes and 1.0 vertical to 2.0 horizontal for permanent slopes. Any gravel encountered should be graded at 1.0 vertical to 2.0 horizontal in the temporary and permanent condition.

It is noted that the depth to bedrock is suspected to be shallow in a number of places across the site (TP 4 and TP 10). Therefore if deep excavations are required (for drainage pipes or localised lift pits etc.) it is recommended that the depth and integrity of the rock is proven by rotary coring.

#### 3.2 Foundations

Given the variation in the upper layers of the brown clays noted in Section 2 the preferable foundation option is pad foundations bearing 1.5 onto the brown boulder clay stratum. It is noted that in some trial pits (TP 9 and TP 15), given the shallow depths of the gravel stratum, foundations will be required to be founded on the same. The gravels typically are dense enough to provide adequate bearing capacity for shallow foundations. However, if the

site layout means that building will be founded on both strata (gravels and clays), pads should be designed such as to prevent differential settlement occurring.

A net allowable bearing pressure for sizing foundations would be 200kPa based on a steel frame building while for concrete buildings a bearing of 150kPa should be used.

In TP 3 a localised soft spot was noted between 2.0 and 2.7m bgl. It is recommended, therefore, that some contingency is allowed for extending structural pads deeper than such soft spots using leanmix. Foundation formations should be inspected by suitably qualified engineers to detect such layers. It is also recommended that further investigation (Dynamic Loads or similar) are carried out to confirm that such soft spots do not exist in other areas of the site. The probes should also be carried out in the location of Trial Pit 15, to confirm the extent and density of the sand stratum noted, to confirm the above bearing pressure are acceptable in this stratum.

In the area of TP 8 and TP 14 given the presence of low quality clays and sand, a suitable formation level for foundations would be in the order of 4m bgl making pad foundations impracticable. Pile foundations would most likely be the most cost effective and technically suitable solution.

Typically, allowable working of various driven piles are provided below:

<u>Pile size (mm x mm)</u>	<u>Design Load Capacity (kN)</u>
350 sq.	1300
300 sq.	900
250 sq.	600

It is recommended more detail site investigation is carried out in the area to confirm the ground conditions.

The brown and black clay layers would be very susceptible to moisture and will degrade if over exposed to water. Therefore all excavations should be kept as dry as possible and all formations blinded immediately when excavated.

### 3.3 Slabs

All topsoil and subsoil layers should be removed in the areas of all slabs and carparks.

The upper soft to firm clay layer is most likely not competent enough to support ground bearing slabs and trafficed areas. CBR tests should be carried out to confirm the consistency of these upper clay layers and if a capping layer/geotextile can be employed to avoid removing these layers. A contingency should be allowed for the removal and backfilling of soft spots.

The underlying firm brown boulder clay will be more than competent to support ground bearing slabs and trafficed areas.

It is noted that the upper soft to firm clays would be susceptible to temporary construction traffic and therefore sufficiently deep haul roads should be employed to prevent the permanent formation to be disturbed.

### 3.4 Groundwater

Groundwater was generally encountered in small quantities. However in TP No. 8 significant seepage was noted. Therefore any excavations in this area will mostly require de-watering methods (pumps etc.) to control groundwater.

### 3.5 Earthworks

From a visual inspection of the gravels and clays on site, it is estimated that reuse of excavated subsoils as fill under flexibly finished trafficed areas would be acceptable if finished floor/carpark levels result in significant cut and fill volumes.







However given the cost implication of overestimating the strengths of subsoils for reuse, it is recommended that detail classification tests are carried out if this is anticipated.






The upper soft to firm clay would only be suitable for reuse in soft landscape areas.



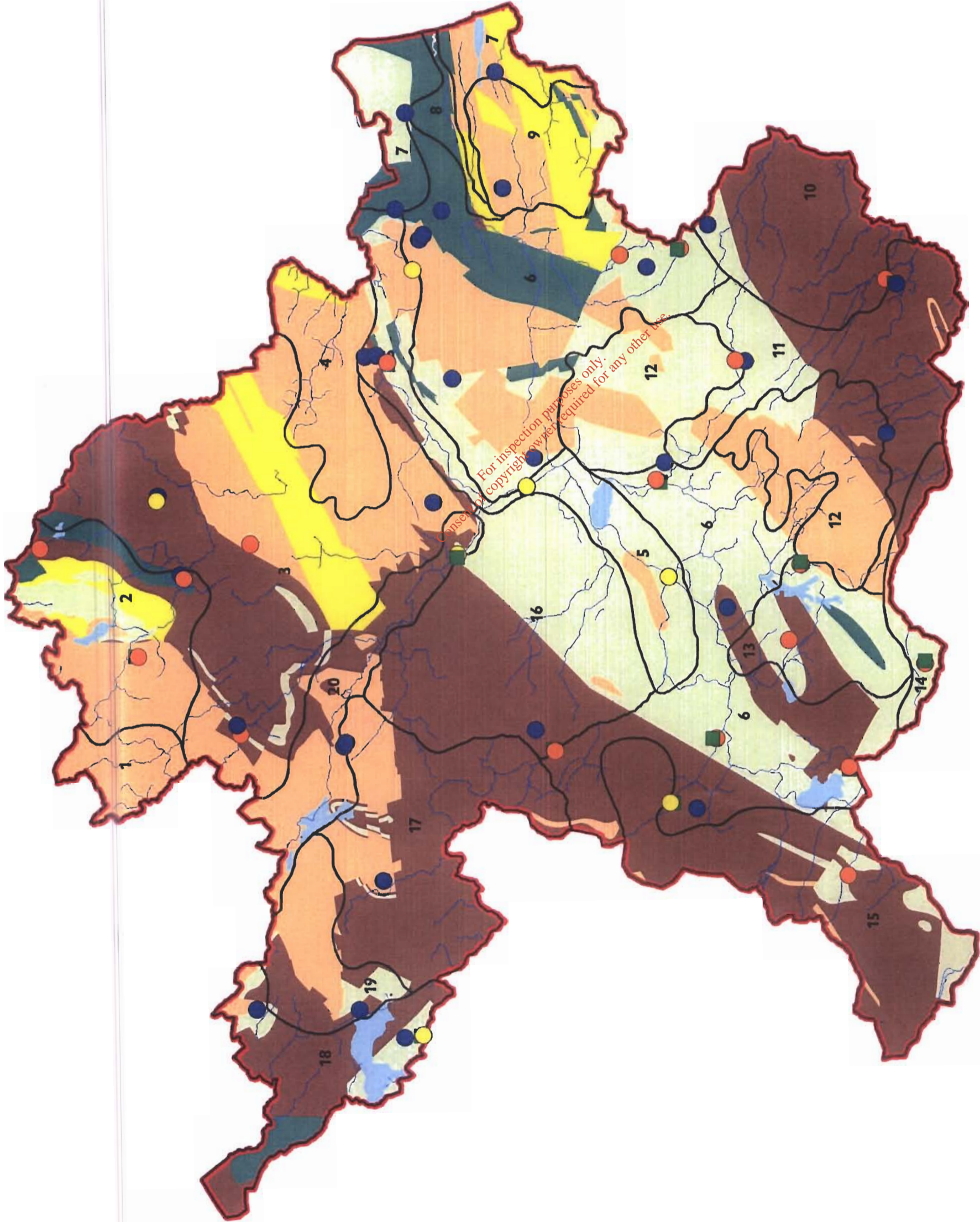
**KEY**

**Aquifer Classification**

-  Lg/H : Sand and Gravel
-  Ll/E : Moderately productive only in local zones
-  Lm/M : Generally Moderately productive
-  P/E : Generally unproductive except for local zones
-  Pu/E : Generally unproductive
-  Rkd/M : Good development potential

-  Water Intake Works
-  Reservoir
-  Water Treatment Works
-  Borehole
-  River and Canal

 Landscape Character Boundary



map 14: hydrology