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Blessington and District Forum

Blessington,
Co.Wicklow.

Mobile Number: 086 244 3640

PRIVATE & CONFIDENTIAL

Ms. Karen Vaughey,
Programme Officer,
Office of Licencing and Guidance,
Environmental Protection Agency Headquarters,
P O Box 3000,
Johnstown Castle Estate,
Co. Wexford.

17 June 2005

Dear Ms. Vaughney,

As you will be aware we arranged for Dr. Imelda Shanahan of TMS Environment Limited and Dr. Paul Johnston of Trinity College to conduct an independent scientific review of environmental data connected with an unauthorised landfill site in the ownership of Roadstone Dublin Limited located at Blessington and to advise Blessington and District Forum in relation to the proposal to develop an engineered landfill at the site.

We attach a copy of this report for your information. The report was received by the 48 Member Blessington and District Forum Body on 18 May 2005. At a meeting on Wednesday 8 June 2005 the Forum passed unanimously the following motion:

> "Based on the independent expert consultants environmental assessment report prepared by TMS Environment Limited for Blessington and District Forum in respect of Roadstone Dublin Limited landfill site at Blessington we demand that all identified and yet to be identified waste be removed forthwith from the Roadstone lands at Blessington and that the land be reinstated".

Kind regards,

Yours sincerely,

Michael Sargent
Chairman

tms environment ltd

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ENVIRONMENTAL ASSESSMENT REPORT

ROADSTONE DUBLIN LTD. LANDFILL SITES AT BLESSINGTON, CO. WICKLOW

FOR

BLESSINGTON & DISTRICT FORUM

Prepared by:

Ian Byrne
Senior Environmental Consultant

Report by TMS Environment Ltd.
Report Ref. 8236-2 Revision 1.0
12th May 2005

Approved by:

Dr. Imelda Shanahan
Technical Manager

Registration No. 217750
Directors: I Shanahan (Managing), P Wrobel, E Shanahan

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EXECUTIVE SUMMARY

A substantial illegal landfill site on lands in Blessington, Co. Wicklow, owned and operated by Roadstone Dublin Ltd. (a subsidiary of the CRH group) was investigated by Wicklow County Council in late 2002. Roadstone Dublin Ltd. were subsequently instructed by Wicklow County Council to prepare a detailed assessment of the illegal and unauthorised landfill sites and to submit a detailed risk assessment and remediation strategy proposal for the sites. Roadstone Dublin Ltd then commissioned a number of companies to investigate the environmental impact of the deposited waste on the receiving environment, to prepare a proposal to remediate the waste mass, to prepare an Environmental Impact Statement for the remediation proposals and to prepare an application to the Environmental Protection Agency for a waste licence for the development of an engineered landfill at the site in which the illegal wastes could be disposed. TMS Environment Ltd. have prepared this report to advise Blessington & District Forum on the nature and significance of the potential impacts of the unauthorised landfill sites, and to advise the Forum on the proposed remediation strategy for the site.

In order to complete a comprehensive assessment of the remediation proposal, TMS Environment Ltd. requested that all environmental monitoring information relevant to the site be submitted for review. Delays were encountered by TMS Environment Ltd. acquiring monitoring data from Wicklow County Council for the period February – October 2003.

The Scope of the Review included the Consultation Document prepared by Roadstone Dublin Ltd., the Environmental Impact Statement and the Waste Licence Application for the proposed remediation project and all monitoring data relating to the impact of the landfill on the environment.

The circumstances surrounding this Project are factually summarised as follows:

- Three separate areas of the Roadstone Dublin Ltd. site have been found to contain significant amounts of unlawfully buried waste;
- Roadstone Dublin Ltd. and Wicklow County Council have investigated the landfill areas and studied the nature and extent of potential environmental impacts;
- Roadstone Dublin Ltd. propose to remove buried waste from the landfill areas (Areas 1, 4 and 6) and bury it in a newly built engineered landfill site on the Roadstone Dublin Ltd. property.

The findings of the Review are summarised as follows.

1. A brief Consultation Document was prepared by Roadstone Dublin Ltd. and circulated to interested parties in October 2004. The document rationalised the proposed remediation plan as follows:

    - The need for remediation was seen to be driven by legislative necessity rather than out of a sense of duty.
    - The landfill site area was selected to *"Minimise the potential conflict with aggregate extraction / processing operations"*.

It is our opinion that this rationalisation is both inappropriate and unacceptable and it is not consistent with the requirements of National and International legislation.

2. The extent of landfilled waste especially in Area 6, which is very close to the Woodleigh residential development and other existing and proposed residential and amenity developments, has not been clearly delineated. In particular, the possibility that the Woodleigh properties may be built on a portion of the landfill area has not been adequately and unambiguously addressed.

3. The selection of a remediation strategy for the site only considered three alternatives in addition to the proposed strategy. The selection process was flawed for the following reasons.

   - The possible export of waste for landfilling at an existing landfill site was rejected because of the alledged unacceptable risks and the issue of Roadstone Dublin Ltd's public image.
   - No consideration was given to the possibility of developing a landfill site on a more appropriate site which meets the requirements of landfill site location guidance. This option should have been thoroughly investigated and presented as an alternative remediation option.
   - One option which only considered the capping of the existing waste masses was rejected and one of the reasons given states *"The company recognises that this in turn could have a detrimental impact on its public image and reputation..."*.

4. The Air Quality Impact Assessment of the proposed remediation plan is deficient in a number of respects as follows:

   - It has been assumed that all temporary capping systems will be 100% effective in mitigating any odours from the site, but this is an unreasonable assumption.
   - Higher odour limit values than those specified in the most relevant guidance documents have been used in the impact assessment of odours from remediation site activities, thus significantly underestimating the impact of odours from the remediation project.
   - Assumptions that dust deposition will not impact on local residential areas have been made without the support of appropriate modelling methodologies or calculations. Where prediction calculations are made in the EIS, it has been found that internationally approved methodologies have been incorrectly used and incorrect input data was used which generated artificially low output data, thus significantly underestimating potential impacts.
   - No reference is made to appropriate National Air Quality Standards in the air quality impact assessment sections.

5. The noise mitigation measures proposed state that noise barriers will reduce noise levels associated with remediation works by up to 15 dB(A) or more without providing any technical specifications or noise prediction calculations detailing how this unrealistic degree of noise reduction can be achieved.

6. No reference is made in the Waste Licence Application documentation as to how the proposed landfill will comply with BAT as required in the EPA's guidance notes for the waste sector and as required by the IPPC Directive (1999/61/EU). This is a very serious flaw and the EPA are precluded from issuing a Waste Licence if this requirement is not satisfied.

7. The risks to residential and amenity developments outside the site and potential impacts associated with landfill gas migration from the site have not been adequately addressed as follows:

   - There are a number of residential properties, including the Woodleigh development and other proposed residential and amenity developments, which are located within the generally restricted 50 meter and 250 meter development exclusion zones to the landfill site; furthermore, gardens of some residences are closer than the 10 meter limit. This is in contravention of the Department of the Environment Guidance.
   - There is no attempt made to evaluate quantitatively the potential impacts of landfill gas if nothing is done at this site, in contravention of EU Regulations on Environmental Impact Assessment.
   - Levels of methane and carbon dioxide were recorded and continue to be recorded above Department of the Environment limit values specified as unsafe for housing development in the vicinity of the Woodleigh development and other property developments in the area. There has been no competent assessment of the potential risks associated with such occurrences and no specific proposals for mitigation have been advanced.
   - The most appropriate air dispersion models were not used to provide a quantitative assessment of the dispersion of landfill gas.
   - There are concerns regarding the actual extent of the waste mass in the vicinity of Area 6 adjacent to the southern site boundary and that the extent of the impact of landfill gas has not been properly assessed.
   - It appears that landfill gas monitoring data is derived primarily from measurements which would at best underestimate the landfill gas concentrations in most of the wells. The data that has been recorded may be seriously underestimating the landfill gas concentration in some areas.
   - Landfill gas monitoring data from the passive vents installed in the vent trench which was installed between the Woodleigh properties and Area 6 continuously exceeds the acceptable levels for carbon dioxide with some exceedances also for methane.

8. In our opinion, the groundwater and surface water monitoring data presented in the EIS shows significantly elevated concentrations of many parameters relative to unpolluted groundwater and surface water. No satisfactory discussion of these data sets has been presented in the EIS.

9. The EIS makes no reference to the Groundwater Framework Directive or the requirements of this Directive and in our opinion the report is deficient in this omission.

10. Information provided by Wicklow County Council shows that water samples collected by consultants acting on their behalf were not analysed by an accredited laboratory and additional clarification on sample analysis is required from Wicklow County Council. Furthermore, so-called "independent" check-analysis was carried out by the same laboratory used by Roadstone Dublin Limited for their monitoring programme.

11. There has been no independent landfill gas monitoring reported for the site or surrounding areas.

12. The Roadstone Dublin Limited monitoring programme does not comply with the requirements of the EPA Landfill monitoring Manual (Table C.2 and Table D) and it is our opinion that an incomplete and unreliable data set has been used to formulate the remediation proposal. A significant number of parameters which could be associated with leachate from the types of wastes deposited at the site were ignored in the monitoring programme design.

13. The available monitoring data for surface water and groundwater and in the vicinity of the site clearly shows that contamination has occurred. The potential impact of this contamination has not been satisfactorily assessed. From the available data for groundwater and surface water monitoring in the vicinity of the Cookehill development site, the presence of elevated concentrations of Manganese is evident. Elevated concentrations of Manganese and Iron are known to arise as a result of anaerobic conditions where anaerobic micro organisms oxidise the element into a soluble form which may be detected in water. Anaerobic conditions may arise from leachate entering a soil mass and should be considered relevant in the context of the unauthorised landfill areas in the vicinity of the groundwater sampling location.

14. The available surface water and groundwater quality data shows significant anomalies and inexplicable data patterns all of which lead to a complete lack of confidence in the published data. The fact that the published information makes no attempt to competently interpret or explain these data sets gives rise to serious concern.

15. In view of the absence of independent monitoring data, and the unreliability of the existing data sets which were presented for review, TMS Environment Ltd recommend strongly that an independent data set should be acquired for evaluation. The entire remediation scheme was designed on the basis of interpretation of the data and since the data is unreliable, it is also possible that the proposed remediation scheme is also unreliable.

TMS Environment Ltd. have concluded from this review that we cannot support the proposed remediation strategy for the site or the Waste Licence Application for the following main reasons:

(a) the proposal to bury waste in an engineered on-site landfill has not been demonstrated to be the best option for the site;

(b) the requirements of relevant legislation on Waste Management, Integrated Pollution Prevention and Control, Landfilling, Environmental Impact Assessment, and Water Quality Management have not been satisfied;

(c) the extent of landfilled waste has not been unambiguously established;

(d) the potential risks to existing and proposed developments outside the site boundary have not been correctly evaluated;

(e) the Environmental Impact Assessment of the existing and proposed situations has been incompletely and incorrectly executed;

(f) the design of the remediation scheme was based on incomplete and unreliable data sets.

1.0 INTRODUCTION AND SCOPE

TMS Environment Ltd. were retained by Blessington & District Forum on 26th November 2004 to conduct an independent scientific review of environmental data connected with an unauthorised landfill site in the ownership of Roadstone Dublin Ltd. at lands located in Blessington, Co. Wicklow and to advise Blessington & District Forum in relation to the proposal to develop an engineered landfill at the site.

In order to ensure that a comprehensive assessment of all available monitoring data and site remediation proposals could be completed, Blessington & District Forum requested that all relevant information should be made available to TMS Environment Ltd. This information was expected to include the following:

White Young Green (WYG): Consultants for Cookehill Limited

- Groundwater monitoring data from groundwater wells in the vicinity of the Cookehill Ltd. residential development site which is located near the unauthorised landfill site.

John Barnett & Associates (JBA): Consultants for Roadstone Dublin Ltd.

- EIS in respect of proposed remediation scheme for unauthorised landfill sites
- Waste Licence Application
- Quarterly Groundwater, Surface water, leachate and landfill gas monitoring reports

Wicklow County Council (WCC)

- Council groundwater monitoring data
- Results of parallel monitoring with JBA

2.0 BACKGROUND

Roadstone Dublin Ltd own and operate extensive aggregate extraction activities at a large site on the outskirts of Blessington, Co Wicklow. The site location and the extent of land ownership is shown in Figure 2 which is reproduced from the Roadstone Dublin Ltd Environmental Impact Statement for the proposed remediation project which is reviewed in this report.

Between December 2002 and February 2003, Wicklow County Council conducted an environmental investigation of the lands owned by Roadstone Dublin Ltd during which three unauthorised landfill areas at the site were identified. Roadstone Dublin Ltd were instructed by Wicklow County Council to submit details of an environmental risk assessment and risk management strategy and to propose remediation measures. When Roadstone Dublin Ltd and their technical advisers completed their assessments, they proposed a remediation strategy to Wicklow County Council which involved excavation and removal of the buried waste, processing of the waste and re-burial of the waste in an engineered landfill site within the site boundary. Roadstone Dublin Ltd. then

commissioned John Barnett & Associates to prepare a Waste Licence application and EIS for the proposed remediation scheme for submission to the EPA.

Lands adjoining the southeastern boundary of the Roadstone site have been developed by property developers who have built a residential development adjoining the site boundary. TMS Environment Ltd. do not have information which identifies the previous owners of this land on which the Woodleigh residential development has been built.

On a separate site south east of the Woodleigh development, planning permission has been granted to Cookehill Ltd. for further residential developments.

Planning permission has also been granted for very substantial residential, amenity and commercial developments on lands outside but close to the Roadstone Dublin Limited site boundary.

Prior to the development of this site, P.D. Lane Consulting Engineers acting on behalf of the developer, Cookehill Limited, commissioned White Young Green (formerly K.T. Cullen & Co. Ltd.) to conduct a site investigation to establish a groundwater supply well. Reports of studies undertaken at that time and more recently were made available for the purpose of this review. Planning permission was granted for the Cookehill residential development prior to the discovery of the unauthorised waste areas.

The residential units (approximately 80 No. houses and 70 No. apartments) at the Woodleigh development are located very close to the Roadstone Dublin Ltd site boundary and also very close to one of the unauthorised landfill sites. These properties are possibly even built on a section of the unauthorised landfill site, although there was insufficient information presented in the various reports reviewed to allow an unambiguous conclusion on this matter to be drawn. The properties are vulnerable to the potential risk associated with landfill gas migration from the adjoining Roadstone Dublin Ltd. site. Construction of these residences was underway but not completed in 2003 when Wicklow County Council and Roadstone Dublin Limited were investigating the unauthorised landfill sites on the Roadstone Dublin Limited site.

A number of serious concerns regarding the environmental impact that the waste material may have on local groundwater aquifers and on local surface waters were highlighted, as well as the potential harmful and dangerous impacts to which the Cookehill properties are exposed. Blessington & District Forum commissioned TMS Environment Ltd. to conduct an independent scientific review of all data relating to the remediation strategy which was proposed to Wicklow County Council and to which the various reports and studies reviewed relate. This report presents the findings of the review.

TMS Environment Ltd personnel attended a meeting of the Blessington & District Forum on Monday 20th December 2004 in order to meet members of the Forum and to advise on progress at that time. A site visit to the Roadstone Dublin Ltd. facility was completed on the same day in the company of Roadstone Dublin Ltd. personnel and their technical advisors. Much of the data (the EIS and Waste Licence Application) was only received a week before and on the day of this meeting and therefore the information available was limited and only a preliminary statement of findings was presented to the meeting.

3.0 INFORMATION RECEIVED

When TMS Environment Ltd were appointed, the first document relating to the project which was provided for review was the Consultation Document prepared by Roadstone Dublin Ltd for the purpose of providing information about their proposed remediation strategies to interested parties. This brief report described the proposed remediation strategy and identified a number of studies and reports which were required to allow a full evaluation of the proposals to be completed. TMS Environment Ltd were provided with contact details for Consultants acting for Roadstone Dublin Ltd and for Cookehill Ltd and also for the Wicklow County Council personnel dealing with the project. Blessington & District Forum advised TMS Environment Ltd that Wicklow County Council and Roadstone Dublin Ltd had been informed that we were working on their behalf and asked both parties to provide information relating to the project. Some of the information requested for review was received in December 2004, but no data was received from Wicklow County Council until April 2005. The detailed schedule of information received for review is summarised as follows.

Cookehill Ltd Data (Received December 2004)

- Groundwater quality data from PW1 (proposed supply well for Cookehill residential development) (WYG Report)
- Borehole logs and drilling reports for Production Well PW1, Observation Well OB1, Bored Well BH1 and Trial Well TW5 (WYG Report)
- Chemical and Biological Analysis data for PW1 and OB1 (WYG Report, December 2003.
- Groundwater development and source protection plan for Cookehill development (K.T Cullen Report, October 2001)
- Surface water quality data at monitoring locations SW1 (Surface water from Stream) and SW2 (Surface water from Quarry)

Roadstone Dublin Limited (Received December 2004 and March 2005)

- EIS for proposed remediation scheme for unauthorised landfill site in Blessington. (3 x 3" Lever Arch Folders & 1 x 1.5" Lever Arch Folder)
- Waste Licence Application for the proposed remediation scheme (2 x 3" Lever Arch Folders & 1 x 1.5" Lever Arch Folder)
- Groundwater and Surface water analysis data for the period February 2003 – December 2004. (90 page A3 document)
- Landfill Gas monitoring data (2004)
- Consultation Document on remediation of unauthorised landfill sites (October 2004)

NOTE
Additional reports on Environmental Risk Assessment and landfill gas modelling were received on 10th May 2005. These reports are reviewed in a separate review report.

Wicklow County Council (Received 13th April 2005 and 21st April 2005

Komex Groundwater data (March to October 2003)

- 4 groundwater wells in Area 1 opposite Old Paddocks area.
- 4 groundwater wells in Area 4 within the centre of the site.
- 6 groundwater wells in Area 6 adjacent to the Cookehill residential development.

Komex Perched Groundwater data (April to October 2003)

- 2 samples from Area 1 opposite Old Paddocks area.
- 3 samples from Area 4 within the centre of the site.
- 2 samples from Area 6 adjacent to the Cookehill residential development.

Komex Surface water data (May to October 2003)

- 3 surface water samples from Burgess Stream from Roadstone site south of Area 4, opposite Area 6 and on towards Deerpark and Ballymore Homes area south of the site.
- 1 surface water sample from Area 1 surface water pond.
- 1 surface water sample from Area 4 pond.
- 1 surface water sample from Area 6 surface water pond.

Komex private well monitoring data (October 2003)

- 4 private wells NE of Roadstone Dublin Ltd site

4.0 REVIEW OF JBA CONSULTATION DOCUMENT (OCTOBER 2004) ON REMEDIATION OF UNAUTHORISED LANDFILL SITES AT BLESSINGTON

John Barnett and Associates (JBA) prepared a Consultation Document entitled "Remediation of unauthorised Landfill sites at Blessington, Co. Wicklow" (October 2004) on behalf of Roadstone Dublin Limited which put forward the requirements for the proposed remediation works and which summarises the predicted environmental impacts associated with the proposed scheme. This consultation document was prepared in order to explain Roadstone Dublin Ltd's remediation proposals and was intended to provide information to the public and other interested parties. Roadstone Dublin Ltd published this consultation document in October 2004 and requested observations and comments by 22nd October 2004. The document was published prior to the submission of an application for a Waste Licence and accompanying EIS to the Environmental Protection Agency in December 2004.

The document may be regarded as being on the whole brief and lacking sufficient detail in a number of significant areas which constitute key areas of the remediation proposal necessary to ensure the impacts of the remediation proposals are minimised as far as is reasonably practicable; the limited information provided does not allow for absolute confidence in the techniques and works proposed. The Consultation Document provided

some information about the proposed remediation scheme, and Blessington & District Forum were allowed about 2 weeks to review the document. This very short timeframe was of course insufficient to allow Blessington & District Forum to appoint consultants and take their advice. A brief review of this Consultation Document is presented here.

Section 1-Executive Summary

Section 1.2 Public Consultation of the report states that the rationale for the application to the EPA for a Waste Licence for the proposed remediation project is driven by legislative necessity and not out of a sense of duty by Roadstone Dublin Ltd. to remediate the very significant illegal landfilling activities which occurred on its lands over an approximate 10 year period. This is surprising since this illegal and unauthorised landfilling activity had and continues to have a detrimental impact on the local receiving environment. It would seem more appropriate that the Company would be seen to express a greater sense of ownership of the problem and the significant adverse impacts which illegal and unauthorised landfilling activities have exerted and continue to exert on the environment in the vicinity of the site. In particular, the very serious potential impacts on the neighbouring residential properties at Woodleigh (adjoining Area 6) merit a more comprehensive response, particularly in respect of accepting responsibility for ensuring that any risk that these properties are exposed to is mitigated and that the owners are indemnified against any losses caused by the illegal activities.

Section 1.4 Remediation Landfill, point (iii) states as one of the criteria for selecting the remediation landfill area at the site was to *"Minimise the potential conflict with aggregate extraction / processing operations"*. This rationale is , in our opinion, highly inappropriate in that the commercial aspects of the Roadstone operations at the site should not have any influence on the selection of the most appropriate remediation proposal and the minimisation of impacts on the environment and on human health should be the only criteria considered in this case.

Section 2-Need for the proposed Remediation Scheme

The report states in *Section 2.2 Environmental Risk Assessment* that an environmental risk assessment, specifically related to water and landfill gas, was undertaken by external consultants during site investigation works. The results of the risk assessment state that there is *"no current risk to drinking water supplies"* and that *"...should a risk arise, it may be many decades before it would occur. This allows time to monitor the situation and take preventative measures / remedial actions"*. It is significant to note that no commitment is given by Roadstone Dublin Ltd. in the accompanying EIS to continue to monitor surface water or groundwater in future decades. Comment made in Section 2.7 of the EIS states that *" it is envisaged that the existing groundwater monitoring regime will remain in place up to and for an agreed period after completion of the site remediation works"* and in Appendix 6L of the EIS that *"it is proposed that the monitoring programme be wound down within 3 to 5 years, once the risks posed by the three sites have been proved to be acceptably low"*. It is our opinion that a comprehensive long term water monitoring programme must be implemented at and in the vicinity of the site which will ensure that potential long term effects on local aquifers and surface water bodies are observed at the earliest possible stage.

Section 2.2 Environmental Risk Assessment states that *"there is a potential risk to housing close to Area 6 from landfill gas"* There is no further information supplied in the report regarding the scale of risk from landfill gas, and it is even more surprising that the other documents reviewed do not provide any further information to qualify this risk. We find it astonishing that such a significant statement is not accompanied by a very detailed proposal in respect of how these risks will be monitored, managed and mitigated. The data presented appears to show that a very significant risk to property, amenity, the environment and human health and safety is likely to occur but the report does not provide any detailed proposals for ongoing monitoring, managing and mitigation of these risks.

Section 4-Remediation Scheme

Section 4-Remediation Scheme lists a number of work elements which are required to complete the remediation scheme at the site. The report states that the remediation scheme will involve the classification of potentially hazardous waste, identified by visual inspection, *in-situ* monitoring and testing. There is no information given on the methodologies or the criteria to be used to complete this critical phase of the remediation project in the report, in the accompanying EIS or in the Waste Licence Application.

In order to ensure that all hazardous material is removed from the site, a comprehensive methodology for the classification of all uncovered waste must be developed. *Attachment C2-Environmental Management Plan* of the Waste Licence Application similarly does not specify the procedures to be employed at the site to classify material other than by stating that *"Records in respect of all waste inspections/classification/testing are maintained by and are the responsibility of the environmental scientist"* although the EPA Waste Licence Application form clearly specifies in H.2 Waste Acceptance Procedures that *"Procedures for checking waste loads...These should follow the requirements of the Agency's Waste Acceptance Manual."*

Reference is also made in the report to *"A programme of soil sampling and validation testing will be established on-site"*. No details of this critical element of the remediation project are supplied in the Waste Licence Application documentation or the EIS.

The lack of written procedures or methodologies for identifying, classifying and handling potentially hazardous waste at the site and the obvious failure to reference the EPA Waste Characterisation guidance must be addressed prior to the commencement of any remediation operations as without comprehensive methodologies confidence in the remediation project cannot be assumed.

The report states that *"Any material which is not acceptable for disposal at the non-hazardous remediation landfill will be removed off-site to a suitably licensed hazardous waste disposal or waste recycling facility"*. No information is provided on the method of transport of waste materials from the site or on details of the use of a waste collection permitted company.

The Public Consultation Document certainly provided information about the proposed remediation scheme for the unauthorised landfill sites and did so in non-technical language where possible. However, in our opinion the amount of information presented was deficient and there was no attempt made to demonstrate that a comprehensive and rigorous evaluation of the very serious potential risks to the neighbouring properties from landfill gas migration was completed. We are especially surprised at the absence of any discussion about the possibility that the Woodleigh properties are actually built on the landfill site area. The properties in question are located very close to the current Roadstone Dublin Ltd site boundary, a boundary which we understand may have been relocated in recent years since it is reported that Roadstone Dublin Ltd sold land for property development. It is our understanding that when the Woodleigh site was being excavated for development, there was evidence of buried waste uncovered during the site excavations and yet this very serious possibility was not discussed in any of the documentation received for review. The extent of deposited waste has not, in our opinion, been unambiguously established in the published information. We are also concerned that there was no adequate review of the possible alternative remediation strategies for this site.

5.0 REVIEW OF EIS

5.1 Introduction

Roadstone Dublin Limited submitted an Environmental Impact Statement to the EPA, prepared by John Barnett & Associates, in support of an application to the EPA for a Waste Licence for the Remediation of Unauthorised Landfill sites and Development of Engineered Landfill at their Blessington site. A review of the contents of the EIS has been completed and the following observations on the contents of the EIS should be noted. It may be noted that we have serious reservations about the proposed remediation strategy and we do not accept that the best possible strategy has been selected for this site. Furthermore it is our opinion that the proposed strategy is not in conformance with EU legislation. Notwithstanding this concern, we have reviewed the EIS and present a summary of our findings in the following sections of this report.

5.2 Selection of remediation strategy

Section 1.7 of the EIS – *Alternatives Considered* details the options that Roadstone Dublin Ltd. considered to remediate the waste buried at their site. Three options in addition to the proposed remediation scheme were considered as outlined below.

Option 1 – Transfer waste from Area 6 to Area 1 and place an impermeable cap over Area 1 and Area 4

This option also provided for the long term monitoring of groundwater quality and the installation of boreholes to facilitate the passive venting of landfill gas.

This option was rejected by Roadstone Dublin Ltd. on the basis that there could be a risk of groundwater contamination and that this option would be unacceptable to local residents which could have a detrimental impact on the company's public image. *"The company recognises that this in turn could have a detrimental impact on its public image and reputation...". (Section 1.7.1 of EIS Main Report).*

TMS Environment Ltd. agree that this option was not acceptable on the basis that it does not comply with best practice and would pose an unacceptable potential threat to the receiving environment. It is however, not considered to be appropriate for Roadstone Dublin Ltd. to consider its public image in any decision made to propose the most environmentally sound remediation option for the illegal waste mass.

Option 2 - Export of waste material to a licensed landfill within a 80km radius of the site

This option was rejected by Roadstone Dublin Ltd. primarily as a result of their conclusions that there are not sufficient licensed landfill facilities within an 80km radius of the site which are in a position to accept the volume or the nature of the waste material. The option of transferring the waste to a number of smaller regional licensed facilities was also discounted on the assumption that Roadstone Dublin Ltd. would displace established users of these facilities. This option also discounted the possibility of utilising a proposed licensed facility at Ballynagran, Co. Wicklow on the assumption that as the facility is not yet operational, that there will be a delay of up to a year before it would be in a position to accept waste from the site and that the transfer of the waste would have a detrimental impact on the Wicklow Mountains Special Areas of Conservation as a result of the requirement to transport the waste by road.

The minimisation of impacts of HGV movements on the county road network generated by the export of waste material from the Roadstone Dublin Ltd. site could be facilitated by the temporary cessation of aggregate export from the Roadstone Dublin Ltd. site for the duration of remediation works. Thus the traffic movements required for waste export would replace the existing Roadstone Dublin Ltd. aggregate export HGV traffic movements, resulting in no net increase in HGV traffic.

This option may be the most expensive proposal but may also be the best environmental option and would ensure that all potential environmental impacts on the local receiving environment in the vicinity of the Roadstone Dublin Ltd. site would be minimised as a result of all material being exported to an appropriate licensed facility(s). In addition, it would ensure that residents living in the vicinity of the site would not be subject to the detrimental impacts associated with residing in close proximity to a landfill site which was not selected based on recognised guidance for landfill location but on what may be perceived as Roadstone Dublin Ltd's preference for the least expensive remediation option.

It is the opinion of TMS Environment Ltd. that Option 2 should have considered the possibility of developing a new landfill site chosen with specific regard to site selection criteria for landfill sites using recognised guidance and that it is possible that there are a number of suitable locations within an 80km radius of the site. Step 1 of the site selection process would involve the identification of a number of optimum sites and then Step 2 would involve issues such as land acquisition, site investigations, landfill design i.e. how the land can be developed into an engineered landfill facility etc.

Option 3 considered the excavation of the waste mass and the export of it to appropriate disposal facilities in other jurisdictions, specifically the UK and Germany

This option was discounted as it is inconsistent with the Proximity Principle and because the requirement to export such a large volume of waste over significant distances would not be practicable for environmental reasons. TMS Environment Ltd. agree that this option is not appropriate and does not merit additional consideration.

Selected Option to develop an engineered landfill at the Roadstone Dublin Ltd. site.

This option which was selected as the most appropriate remediation option for the site appears to have been driven primarily by commercial considerations for Roadstone Dublin Ltd. Section 1.7.1 –Summary- of the EIS states that *"the proposed remediation strategy for the unauthorised landfill sites on its lands in Blessington represents the Best Environmental Option Not Entailing Excessive Costs"*. This statement confirms the influence of economic factors in the remediation option selection process and in addition, it is noted that this statement does not refer to BAT (Best Available Techniques) which does not consider economic or cost factors associated with the utilisation of modern technology to minimise the impacts of an activity on the environment. EU legislation requires that BAT and not BATNEEC principles must be applied in the selection and development of landfill sites.

It is also noted that in Section 1.7.2, the decision made by Roadstone Dublin Ltd. to locate the proposed engineered landfill south of Area 1 was based on a number of criteria, one of which states *"the site should not conflict with established sand and gravel extraction operations or future processing / value added activities, nor should it sterilise aggregate reserves"*. This statement is further evidence of the excessive influence of economic factors on the proposed remediation strategy for the site.

The selection of an area within the Roadstone Dublin Ltd. site in which to develop an engineered landfill is not consistent with the normal criteria which are specified in recognised guidance on landfill site location selection and as such,

the selected option to develop an on-site engineered landfill does not represent the best option for remediation.

In summary, the possibility of developing a landfill site on a more appropriate site which meets the requirements of landfill site location guidance should have been thoroughly investigated and presented as an alternative remediation option. Site selection is the most critical aspect of landfill site development and provided all site selection criteria are met, it can be assumed that an engineered landfill site will have an acceptably minimum impact on the receiving environment. The selection of an area within the Roadstone Dublin Ltd. site in which to develop a landfill site does not fulfil the normally applied site selection criteria and may be considered to be the cheapest and easiest option for Roadstone Dublin Ltd.

5.3 Air Quality Impact Assessment

Contributions from the air quality consultants who prepared an odour and air quality impact assessment including an odour modelling study as part of the EIS and the Waste Licence Application, on behalf of Roadstone Dublin Ltd. have been reviewed and a number of anomalies in the consultants report have been identified as described below.

Section 2.6.5 Odour Control

This section of the EIS states that a number of measures will be employed to minimise the odour emissions from the site. However, no detail on odour sampling or monitoring is provided to assess the effectiveness of the proposed odour minimisation measures.

In order to assess effectiveness of the proposed odour minimisation methods and to quantitatively determine the odour impact that site remediation activities will have at local residential areas, it is proposed that a suitably qualified independent contractor should be employed to conduct an odour audit including odour measurements in the vicinity of local residential areas, particularly at the housing development adjacent to Area 6 during the course of waste excavation activities.

Section 7.3.3.9 Odour Annoyance Criteria

Excavation of the waste material contained in Area 6 will generate odorous emissions which will have a detrimental impact on the adjacent residential development. Given the vast quantities of degradable waste material in this area and the very close proximity of the residential units, significant odour impacts resulting in a substantial decrease in local air quality are predicted.

This section of the EIS states that a total exposure to odour at the residential development adjacent Area 6 would be 280 hours over the 8-week duration of the

waste excavation activities. This duration of exposure is derived from a 35-hour working week multiplied by 8 weeks. This assumption implies that there will be no odour emissions from Area 6 outside of the daily working hours and that the temporary capping system placed over the exposed landfill mass at the end of each day will be 100% effective in containing all odour emissions. This significant section of the impact assessment clearly underestimates the periods of odour emissions as it assumes that any temporary capping of exposed waste outside of site working hours will be fully effective. This key element of data, i.e. the period of emission, is a critical item of dispersion model input data and reliable predictions require that all critical input data is reliable. In view of the clear underestimation of the period of odour emissions from Area 6, the outputs from, and the associated conclusions of the odour modelling assessment are considered to be inaccurate and the predicted odour impacts at the residential development adjacent Area 6 will be higher than the predicted values.

This section of the EIS, in its efforts to establish and rationalise a suitable odour limit value against which the results of the dispersion modelling study can be compared, fail to make reference to the most appropriate National guidelines on the control and minimisation of odours from a landfill activity, namely the *Environmental Protection Agency's Landfill Monitoring Manual, 2nd Edition 2003* which makes further reference to *Technical Guidance Note IPPC H4-Horizontal Guidance for Odour Part 1 - Regulation and Permitting.* Instead, reference is made to the odour criteria associated with waste water treatment works and intensive pig rearing facilities which bear no direct resemblance to landfilling activities. In the report, odour limit values of 3 and 6 $Ou_E\ m^{-3}$ have been selected based on the studies conducted on unrelated activities. A more appropriate limit value of 1.0 – 1.5 $Ou_E\ m^{-3}$ should be used for the purposes of this assessment which would be consistent with *Technical Guidance Note IPPC H4.*

The high odour limit values 3 and 6 $Ou_E\ m^{-3}$ which were used in the dispersion model imply that persons will not be affected by lower concentrations of landfill odours. This assumption is based on inaccurate model input data and does not reflect a conservative approach which should have been applied as part of the remediation project given the volume and nature of the waste material and the adjacent location of residential property to Area 6.

Section 7.3.4 Dust Impacts

At the outset of section of the EIS, reference is made to two assessment criteria for dust emissions (a) health related effects related to Council Directive 1999/30/EC and (b) nuisance effects related to the German TA Luft Standard.

It is significant to note that Council Directive 1999/30/EC has been transposed into Irish Legislation as Irish Air Quality Regulations, S.I. No. 271 of 2002 and notwithstanding the fact that the limit values are identical to those specified in

Council Directive 1999/30/EC, there is no reference made in this section of the EIS to the Irish Standard.

It is stated that *"the larger dust particles will have settled from the atmosphere within the Roadstone Holding"*. This statement is considered to be highly inaccurate given that Area 6 is at the closest point, only 14m from the nearest residential area and that no supporting evidence is provided in the form of a prediction model to confirm this assumption. It is surprising that a dust model was not completed for larger airborne dust particles which will be generated by Area 6 activities and as such it may be concluded that sufficient attention has not been given to the very significant nuisance that will be caused by deposited dust arising from Area 6 activities at the adjacent residences.

The assessment of the potential impact of the fugitive dust emissions is based on the impact of the dust deposition rates in the vicinity of the site. Particles in different size ranges are deposited at different distances from the emissions source. The US EPA has published guidelines on the deposition of dust according to particle size as shown in Table 1 below. Particles above 100 µm in size will be deposited close to the emission sources and finer particulate matter has the potential to carry beyond the site boundaries.

Remediation activities, specifically in Area 6 will generate dust emissions which will be carried off site as a result of vehicle movements and windblow across open surfaces. The impact of site activities will result in a detrimental impact on ambient air quality in the vicinity of Area 6. Consequently, the residential properties at Woodleigh (adjoining Area 6) will be adversely affected as a result of this remediation proposal.

Table 1 Fugitive dust deposition as a function of particle size [1,2]

SIZE OF PARTICLE	TRAVEL DISTANCE
> 100 µm	5 – 10 meters from source
30 – 100 µm	Within 100 metres from source "except for cases of high atmospheric turbulence"
15 – 30 µm	Transportable considerable distances downwind
< 15 µm	Likely to remain suspended

NOTES

[1] U.S. EPA, *Procedures for Conducting Air Pathway Analyses for Superfund Applications*, Vol III.

[2] U.S. EPA: *Superfund Exposure Assessment Manual*, Office of Emergency and Remedial Response, Washington D.C, April 1998.

Section 7.3.4.2 Modelling Methodology

This Section describes how the input data for the air dispersion model in which the predicted emission rates of PM_{10} from waste excavation and handling activities were derived. The section includes reference to the US EPA AP-42 dust estimation methodologies, namely *Section 13.2.4 - Aggregate Handling and Storage Piles* and *Section 13.2.2 – Unpaved Roads*.

The following discrepancies have been noted in the information contained in the EIS.

- The formula included in the EIS for determining emissions as per *Section 13.2.4 - Aggregate Handling and Storage* is incorrect in that the value by which *k* must be multiplied by is stated as being 0.0004. The actual value as contained within AP-42 Section 13.2.4 is 0.0016. This error will lead to an underestimation of the predicted emission factor (E).

- The emission factor calculation as specified in AP-42 *Section 13.2.4 - Aggregate Handling and Storage* requires the input of a value for the mean wind speed in meters per second. This value should be obtained from local or appropriate meteorological monitoring data. The value used in the EIS is 1 meter per second and is incorrect and results in a significant underestimation of the final calculated emission factor. This is further supported with reference to Section 7.2.1.5 Wind Speed of the EIS which states that the mean wind speed recorded at Casement Aerodrome between 1968 – 1996 is 5.7 meters per second and as such this long term mean value should be used in the calculation.

These very significant errors in the application of an Internationally approved emission factor methodology represent serious errors and the predicted impacts of the proposed development are therefore seriously flawed and all results of the air dispersion modelling study are considered to be inaccurate. The use of two artificially low values in the emission factor methodology together with a lack of detail as to how emission rates were derived imply that this section of the EIS was completed incorrectly and the results presented are misleading.

There is no other dispersion model input data presented in the EIS other than reference to the period of Casement Aerodrome meteorological data used. In order to further evaluate the air modelling methods used, it is necessary to acquire all model input data to assess the accuracy of the conclusions drawn from the model outputs.

Evaluation of the impact of a proposed development on air quality using dispersion modelling requires information on the actual emission rates of each pollutant, information on the local terrain, description of receptors at various heights (ed. first floor bedroom windows) as well as a ground level and the periods of emissions if non-continuous activities are assumed. In addition, the cumulative impact of all other local pollutant sources should also be considered

to establish how a proposed development could affect existing local air quality.

It is noted that there was no baseline PM_{10} monitoring data conducted in the vicinity of the Blessington area and in particular in the vicinity of the Roadstone site as part of the EIS. This significant omission of critical baseline data in the assessment of the existing air quality results in the inability to determine the cumulative impact from the predicted emissions of PM_{10} on the local receiving environment. Reference is made in Section 7.2.4.4 of the EIS to PM_{10} monitoring conducted by Wicklow County Council in Bray, Greystones and Arklow, all of which are coastal locations and which are probably not representative of local air quality in the vicinity of Blessington.

None of the above critical elements of the dispersion modelling methodology were discussed, presented or considered in Section 7.3.4 of the EIS which further supports the conclusion that the results of the air modelling study are questionable and cannot be relied upon.

Section 7.3.4.3 Dust Emission Calculations

The format of results of the air dispersion model is unclear from the presented results in Section7.3.4.3. and no information is supplied as to how the dust emission rates were calculated other than referencing the presented data of section 7.3.4.2 which has been previously discounted.

Section 7.3.4.4 Discussion of Dust Results

The first paragraph of this section of the EIS makes an incorrect reference to Section 7.3.3.2 of the EIS which has no relevance to individual source emission data. A degree of carelessness in the compilation of this section of the EIS may be attributed to this error.

The results of the dispersion model make no reference to the maximum predicted ground level concentrations of PM_{10} levels arising from waste site activities which is a fundamental aspect of any air dispersion model. Similarly, no reference is made to Irish Air Quality Standard S.I. No. 271 of 2002, the most relevant item of air quality legislation against which all model predictions should be compared in order to assess the impact of the site activities on local air quality.

These facts together with the lack of supplied information as to dispersion model inputs and outputs plus mitigation factors used result in an ambiguous conclusion to this section of the EIS.

Section 2.7.6 Landfill Gas Monitoring

This section of the EIS makes reference to the proposal to install gas vents (8

No.) in the vicinity of the proposed landfill site in Area 1. There are no proposals to monitor landfill gas in the vicinity of any private residences east of Area 1.

The Risk Assessment and Management Strategy included in Appendix 6A of the EIS states that concentrations of landfill gas being produced in Area 6 exceed Department of the Environment limit values and on occasion have exceeded the maximum explosive limit value. This constitutes an obvious risk to residences located adjacent Area 6, yet there has been no programme of regular landfill gas monitoring. One landfill gas monitoring data set has been provided by JBA which specifies the results obtained from a private residence adjacent Area 6, 28 Woodleigh on 5th November 2004. The results show that Methane and Carbon Dioxide were not present in any of the 2 internal and 2 external monitoring locations. Details on the duration of the monitoring survey or the rationale (eg. random spot check or response to complaint) for conducting the survey were not provided and as such an assessment of the zero values presented is not possible.

5.4 Noise and Vibration Impact Assessment (Section 8)

This section of the EIS deals with the existing ambient noise climate in the vicinity of the Roadstone site as well as predicting the noise impacts that site remediation and landfilling activities will have on the closest sensitive receptors to the site.

Section 8.4 Mitigation Measures

This section of the EIS states that in order to reduce the noise levels generated at Area 6 an acoustic barrier will be erected around the perimeter of the waste extraction area and that this barrier would reduce the noise levels between *"12 to 15 dB or more"*. This extremely optimistic degree of noise attenuation is assumed without providing any technical specifications, calculations or information to support this claim of very significant noise attenuation. This ambitious and unrealistic claim of noise attenuation would be extremely difficult to achieve and must not be considered realistic without evidence of the performance specification of the barrier together with design details including scaled drawings of the noise sources, receptor locations and ground elevations.

Another mitigation measure offered is *"enclosing plant and machinery where possible.."*. This is obviously an impracticable option as the three noise sources identified in Section 8.3.1 of the EIS i.e. a bulldozer, excavator and dump trucks could not be realistically enclosed as they are mobile sources.

It is also noted that in Section 8.3.1, the proposed plant listed includes a Bulldozer / Compacting Plant, Excavator and Dump Trucks. However, noise prediction calculations only considered a bulldozer, an excavator and a single dump truck and as such the predicted noise levels at Receptors A and B are underestimated and again demonstrate an inaccurate prediction of the impacts of

the remediation activities on the local receiving noise environment.

Reference is made in the EIS Attachment 2J Section 4.2 that large objects will be crushed. No detail of the plant required or the associated noise impact from this activity has been considered in the noise prediction calculations.

A further significant omission in the noise impact assessment study is the failure to address the requirement for the import of approximately 54,000 tonnes of impermeable clay liner for the base of the engineered landfill which will result in approximately 2,700 HGV movements. This significant number of vehicle movements will generate considerable additional noise levels on entering and exiting the Roadstone site and the failure to assess the potential noise impact is consistent with the underestimation of potential impacts from site activities.

5.5 "Do- nothing" impact assessment

It is a requirement of EU Environmental Impact Assessment legislation that an EIA must include an evaluation of the potential impacts of the development on the environment and that the assessment of environmental impacts must also identify and evaluate the potential impacts associated with the "do-nothing" scenario. The EIS submitted for this development does not competently identify or evaluate the potential impacts of such a scenario on the environment. In particular, the potential impact of landfill gas emissions if the waste is left in place has not been addressed and the potential impact on surface water and groundwater has not been evaluated either. This is a very serious flaw in the EIS and is clearly in breach of EU regulatory requirements.

6.0 REVIEW OF WASTE LICENCE APPLICATION

Section E.5 Noise Emissions

No noise impact information relating to the 2,700 HGV movements required to import raw material to the Roadstone site has been included in the Waste Licence application documentation.

Table E.5(i) is not included in the application documentation.

Section F Control & Monitoring

Details of the proposed mist scrubbing system as discussed in Section 7.4.1 of the EIS to minimise odours have not been supplied as specified in F.1 of the application form. There is no supporting information supplied in Attachment F1.

Section F.2 – F.9 Monitoring and Sampling Points

This section of the application requires that programmes for environmental monitoring

are to be submitted.

No detailed information relating to any environmental monitoring programme as requested is supplied in the application. Other than mentioning sections of the EIS in which the monitoring/sampling locations are identified, no detail on standard methodologies, monitoring protocols or any reference to the following relevant EPA guidance notes are specified, namely *Landfill Monitoring Manual (2003), BAT Guidance Notes for the Waste Sector Landfill Activities.*

Section H.2 Waste Acceptance Procedures

There is clear requirement for the inclusion of procedures for checking waste loads to be included in the application. This requirement has not been fulfilled in the application and there are no defined written procedures included in the EIS. Attachment H3 of the application states that proposed waste handling procedures are described in Sections 2.2, 2.4, 2.5 and 2.8 of the EIS, however the information presented in these sections are only general outlines of procedures and do not contain sufficient information as requested in the application form.

Section H.3a requires that evidence be provided to show that energy will be used efficiently. No information has been submitted in the application documentation to comply with this element of the application. This is a failure of the applicant to consider or apply BAT as necessary.

Section L Statutory Requirements

The applicant is required to demonstrate how the proposed facility will comply with BAT. In particular, there is no clear explanation of how the proposed remediation strategy is considered to be BAT.

Attachment L1 of the application makes reference to Annex IV of *Council Directive 96/61/EC on Integrated Pollution Prevention and Control* but does not make any reference to the most relevant EPA *BAT Guidance Notes for the Waste Sector: Landfill Activities.* The omission of any information to demonstrate how the proposed landfill will comply with the requirements of BAT is clearly a significant deficit in the entire waste licence application.

7.0 REVIEW OF ENVIRONMENTAL MONITORING & MODELLING DATA

7.1 Introduction

Wherever biodegradable material, including waste, is deposited in landfill sites, there is potential for leachate from the waste to enter into groundwater or surface water and cause pollution, and microbial activity generates landfill gas which may percolate through the soil and be released as dissolved gases or as vapours into the atmosphere. Both **landfill gas** and **leachate** have the potential to cause environmental pollution and other impacts, so monitoring of the effects of the

landfill site must consider monitoring of these parameters in order to reliably evaluate the potential impacts of the landfill on the environment.

Leachate is a term which is used to describe any liquid percolating through the deposited wastes and emitted from or contained within the landfill site. The amount, composition and characteristics of leachate depends on a number of factors which include the types of wastes buried, rainfall and other meteorological factors, the extent of interaction with surface water and groundwater, the age of the waste and many other factors. Leachate generated in a landfill site is a potential threat to surface water and groundwater resources. Because unauthorised landfilling took place on the Roadstone Dublin Ltd site at Blessington, leachate will be generated as a result of the interaction of water (surface water, groundwater and rainfall ingress) with the buried wastes and this leachate will be released into the environment via the soils, surface water and groundwater in the vicinity of the waste. Because the water bodies move or flow, the leachate has the potential to travel significant distances off-site depending on a broad range of factors. As a result, a monitoring programme to determine the nature and extent of pollution from the landfill site must take account of the possible extent of travel of leachate from the waste into the various environmental media such as surface water and groundwater. Thus surface water and groundwater quality on the landfill site and in the areas surrounding the site must be monitored to allow this evaluation to take place. Leachate monitoring ie monitoring of the concentrated leachate from the waste should also be undertaken to allow a reliable model of the potential rate of release of the leachate from the landfill and the potential impact of such releases to be completed.

Roadstone Dublin Ltd have presented data for an environmental monitoring programme for surface water and groundwater at locations on and in the vicinity of the landfill site. This data is reviewed in order to evaluate the potential impacts of the buried waste on the surface water and groundwater environments. In addition, the reliability of the data is evaluated with particular emphasis on the possible effect of data reliability on the predicted impacts of the landfill site and the consequences of such effects for selection of the most appropriate remediation strategy for the site.

Landfill gas is also of concern since microbial degradation of waste will lead to formation of a complex mixture of flammable, toxic and asphyxiating gases. The composition of the landfill gas provides important information about the age and nature of the waste. Landfill gas can migrate from waste in any directions; lateral directions of movements are especially important when low permeability layers are encountered underlying the waste, as has been suggested in the Roadstone Dublin Ltd EIS. Gases may also dissolve in leachates, surface waters or groundwaters. Significant travel distances are common and monitoring programmes should be designed to monitor the possible extent of migration of landfill gas from buried wastes. A very limited amount of data has been provided by Roadstone Dublin Ltd and this data is reviewed below.

7.2 Landfill gas monitoring data

The main constituents of landfill gas are flammable gases (including methane), carbon dioxide, hydrogen sulphide and other inorganic and organic substances. The dangers from landfill gas are from toxic, flammable, explosive or asphyxiating constituents of the gas. The maximum permissible levels of flammable gases in landfill gas are 1% (v/v) and for carbon dioxide are 0.5% (v/v). Levels higher than these limit values represent significant threats and have led to serious adverse impacts including explosions and asphyxiation. In controlled situations, levels which exceed these concentration limits have caused authorities responsible for landfill sites to evacuate residents living within specified distances of the landfills. Because of the dangers posed by landfill gas, guidelines have been established for siting landfills and also for siting of residences close to landfill sites. Whenever landfill gases exceed or are likely to exceed the levels quoted above, housing is not permitted within 50metres of the landfill site; gardens of houses should not be allowed to extend to within 10 metres of the site (Department of the Environment: Protection of New Buildings and Occupants from Landfill Gas, 1994). There are also general restrictions on any type of development occurring within 250metres of the landfilled wastes. These Guidelines also specify construction measures which must be adopted to ensure that residential and commercial buildings are protected from ingress of landfill gas. This is of great potential concern in the case of the Roadstone Dublin Ltd Blessington site because the landfilled waste, especially that in Area 6, is situated at least as close as 16metres to the nearest residential property (Section 7 of the EIS) and there are many other existing properties on the Woodleigh development which are located within the 50metre and 250 metre exclusion zones. Other residential, community and amenity developments adjacent to the site are also located within 250m of the site boundary. These distances are of course from the site boundary which, as noted elsewhere, we are not fully satisfied represents the extent of the unauthorised landfilling activity.

The earliest significant body of published landfill gas data relating to this site was obtained by JBA acting on behalf of Roadstone Dublin Ltd in 2003, and reviewed by Mouchel Parkman in the Quantitative Risk Assessment report. The data is presented in Appendix 6A, Volume 2 of the Appendices to the Waste Licence Application. Three sets of monitoring data were presented for March, April and May 2003. Very high levels of landfill gases (notably carbon dioxide and methane) were found in all areas where waste was deposited (Areas 1, 4 and 6). Area 6 is adjacent to the new residential properties constructed at the Woodleigh development and also other residences for which planning permission has been granted; these properties were under construction at the time of the measurements. As noted in the EIS, the levels of methane and carbon dioxide found in Area 6, and also at a location outside Area 6 in the Woodleigh estate, were above the levels which the Department of the Environment have specified as unsafe for housing development. We therefore find it astonishing that the Woodleigh development was allowed to proceed.

The Mouchel Parkman Risk Assessment Report was dated August 2003 and an Addendum report that significantly modified the earlier report in respect of data interpretation and impact assessment methodology was published in December 2003. This Report (the QRA Report) clearly stated that the landfill gas emanating from Area 6 is a threat to the residential properties at Woodleigh. In evaluating the risks from landfill gas, no quantitative risk assessment or dispersion modelling was reported. The reasons cited in the QRA report were that (a) the simple calculation methodology outlined in HMIP Technical Guidance Note D1 is unsuitable and (b) the US EPA Screen 3 Method of dispersion modelling is unsuitable. We agree that both of these methods are unsuitable and in fact we are surprised that the use of the HMIP Methodology in particular was even considered since the methodology is totally unsuitable for this application. We also agree that US EPA Screen 3 methodology is not suitable but on the grounds of the simplicity and inaccuracy of the technique rather than any inherent flaw in the methodology; even though the technique is of limited accuracy, it would certainly provide useful quantitative information for the risk assessment.

It is extremely surprising that the more sophisticated approved dispersion models such as ISCST, Aermod or ADMS were not considered for the purpose of quantitatively evaluating the dispersion of landfill gases from the site. These Dispersion Models are approved by various regulatory Agencies including the Irish and US EPA, the UK EA and other authorities worldwide (although it is noted that final approval from the US EPA for the new generation dispersion model, Aermod, is awaited). Use of one of these Dispersion Models would have given a reasonable quantitative assessment of dispersion of the landfill gases released from the passive vents and also from the un-vented landfill and would have allowed a quantitative rather than a qualitative approach to risk assessment to be undertaken. It is therefore very surprising that no such assessment was considered, no reasons were given for the decision not to use these models which represent best practice in the dispersion modelling arena and **no quantitative** assessment of dispersion of landfill gas was presented in the QRA report. In our opinion, the QRA report is seriously deficient in not having considered such an assessment and we have very serious concerns about the reliability of the QRA in the absence of such a published study.

It may be noted that the GasSim Dispersion Model which was considered suitable for modelling the potential impact of landfill gas releases from the proposed engineered landfill site (Appendix 7A, Volume 3 of the Waste Licence Application) was not even mentioned in the Mouchel Parkman Quantitative Risk Assessment Report. The QRA avoided any discussion of appropriate modelling techniques for evaluating the potential impact of landfill gas releases and it is our opinion that the report is seriously deficient in this respect. It is an inescapable conclusion that the potential risks associated with the migration of landfill gas from the landfill site and more especially from Area 6 were not adequately assessed in the published QRA. The design of the remediation proposal is therefore seriously flawed since inadequate assessment data was published to support the design team.

The QRA report recommended that various mitigation measures should be undertaken. Although the QRA report was not finalised until December 2003 and therefore the recommended protective measures could not be implemented prior to that date, the Woodleigh construction project was allowed to proceed; we find it surprising that the Waste Licence Application states that the recommended mitigation measures were completed in November 2003 prior to finalising the report and this gives cause for concern. We find this astonishing and we are concerned about the safety of the development and the residents given the lack of data provided to allow any alternative conclusion to be drawn.

A further concern is that the full extent of the unauthorised landfill site may not have been uncovered in the site investigations. As noted in Section 2.0 above, the residential properties in the Woodleigh development and in other proposed residential developments adjacent to Area 6, which is one of the landfill sites, are located extremely close to the boundary of the Roadstone Dublin Ltd site; the 'boundary' of the unauthorised landfill site in Area 6 is reported by Roadstone Dublin Ltd to be very close to this site boundary but not to extend beyond it. The Woodleigh properties could be built on a section of the unauthorised landfill site, but there was insufficient information presented in the various reports reviewed to allow an unambiguous conclusion on this matter to be drawn. Even if the extent of the unauthorised landfilling activity has been correctly delineated, the risks from landfill gas migration have not been properly assessed and the guidelines on location of residential properties have not been followed. Since the residential development was allowed to proceed, it is even more important that a reliable Quantitative Risk Assessment is completed in order to ensure that there is no threat to the residents of these properties from landfill gas migration from the site. For the reasons noted above, it is our opinion that a reliable quantitative risk assessment has not been completed and published to date.

Finally, we are concerned about the measurements of landfill gas since we could not find any details of the construction of the wells which are used for the landfill gas monitoring which prove that they were properly constructed for landfill gas monitoring. The Groundwater wells were constructed for monitoring groundwater and the drilling logs clearly show that the method of construction would be unsuitable for measuring landfill gases – the accompanying text does not provide any additional information to demonstrate that the appropriate construction techniques were employed. Drilling Logs for only two of the wells (GW6/5A and GW6/6A, drilled in June 2003) state that a gas monitoring valve was installed – there are no references to gas sampling valves on any of the other well or borehole Drilling Logs. It therefore appears based on the information presented that the landfill gas monitoring data is derived primarily from measurements which would at best underestimate the landfill gas concentrations in most of the wells. The data that has been recorded may be seriously underestimating the landfill gas concentration in some areas.

Notwithstanding our concern that the landfill gas levels are underestimated, data presented by Roadstone Dublin Ltd on 20th December 2004 but not included in the EIS shows that the levels of methane and carbon dioxide in all areas and

especially in Area 6 continue to exceed the acceptable limits. The close proximity to the site boundary near A6 of the housing development at Woodleigh and other developments in this area is of concern in respect of these emissions.

Landfill gas monitoring data from the passive vents installed in the vent trench which was installed between the Woodleigh properties and Area 6 continuously exceeds the acceptable levels for carbon dioxide with some exceedances also for methane. Landfill gas monitoring data from the landfill mass areas regularly shows concentrations of methane and carbon dioxide which exceed the permissible levels.

7.3 Leachate monitoring data

There appears to be a complete absence of any concentrated leachate monitoring data in the EIS and Waste licence application. This is astonishing because such data is an essential requirement for the Quantitative Risk Assessment and Modelling study undertaken by Mouchel Parkman. There is data presented in the EIS and Waste Licence Application for both perched groundwater and groundwater samples collected within the waste landfill areas (Areas 1, 4 and 6); the EIS states that the perched groundwater quality data (referred to by TMS Environment Ltd. as leachate) is indicative of the waste deposited in each Area. It is not entirely clear from the reports that the perched groundwater data represents the most concentrated leachate quality since this was not discussed in the EIS and Waste Licence Application. We have some concerns that the data reported may not represent the most concentrated leachate quality at the site. Notwithstanding this reservation, we discuss the data that was presented and the implications for the QRA in this section.

The Leachate quality data (represented by perched groundwater data) was acquired in 2003 and acquisition of data has continued. The Roadstone Dublin Ltd EIS and Waste Licence Application presents data for boreholes installed in Areas 1, 4 and 6 which are stated to be perched groundwater monitoring boreholes – these are taken in this review to represent leachate monitoring wells, although reservations are noted above. The data was acquired by JBA acting on behalf of Roadstone Dublin Ltd and elevated concentrations of many pollutants were found in the perched groundwater / leachate in all areas. The QRA report took the highest measured concentrations from each area and modelled the possible impact of releases on nearby receptors. The QRA Report found that there was a risk of groundwater pollution from the landfill site areas in respect of several substances including fluoride, lead, sulphide, strontium, phosphorous, ammonia, barium, nitrite, and aliphatic and aromatic organics. The report also found that there was a risk of serious contamination of groundwater at a distance of only 100m from the Area 6 landfill site. This distance extends beyond many areas where residential developments have already been built or for which planning permission has been granted.

The QRA purported to take the highest measured leachate concentrations and model the possible extent of contamination from these levels and a risk was predicted at a distance of only 100m from the site. It is therefore very significant that the data should be reliable – if the data is unreliable, and especially if the levels are underestimating the composition of the leachate, then the predictions of the QRA model are also unreliable. A separate discussion on the reliability of the data acquired is presented in Section 7.5 below, and an assessment of the reliability of the QRA predictions is also presented in that Section.

One additional concern about the reliability of the Quantitative Risk Assessment is that no significant sensitivity analysis was completed with respect to the levels of contaminants present in the leachate. The QRA took the highest measured values from the JBA data set but no consideration was given to the fact that alternative data sets from Wicklow County Council showed that Alcontrol consistently underestimate the concentrations of various contaminants; furthermore it would be normal practice to consider the uncertainty of measurements and sampling variabilities in the model input data and sensitivity analysis for higher than measured concentrations of critical parameters would be a normal feature of studies of this type. The failure to complete a robust and rigorous sensitivity analysis significantly reduces our confidence in the findings of the QRA.

7.4 Roadstone Dublin Ltd Water Quality Monitoring data

The earliest records of groundwater and surface water monitoring at the site which are detailed in the EIS refer to measurements completed in 2002 (on-site groundwater) and 1999 (surface water, on-site and off-site). In Section 6 of the EIS for the proposed remediation project, it is stated that the first available groundwater monitoring data in the vicinity of Area 4, one of the landfill areas, was obtained in 2002. Data for other wells (GW4/2 and GW6/4) which were also constructed in May 2002 is also presented from 2002 onwards. The data showed that elevated concentrations of several parameters were found. The EIS refers to concentration levels above screening levels and elevated concentration levels for the following wells and areas:

- West of Area 6, BH1 to BH6; elevated iron, manganese and aluminium;
- Around Area 1, fluoride, sulphide, ammonia, nitrite, lead, Diesel Range Organics, PAH, and 2-ethyl hexyl phthalate were above screening levels and chloride, potassium, nitrate, barium and manganese were all elevated;
- Around Area 4, cyanide, phosphorous, nitrate, ammonia, aluminium, nickel, iron, manganese, barium, strontium, arsenic, DRO, PAH and lead above screening levels; chloride, potassium, calcium carbonate were all elevated;
- Around Area 6, cyanide, phosphorous, nitrate, ammonia, aluminium, nickel, iron, manganese, barium, strontium, arsenic, boron, selenium, zinc, phenol, total petroleum hydrocarbons, mineral oil, DRO, PAH, aromatic compounds and chlorinated compounds, and lead above screening levels; chloride, potassium, calcium, magnesium, sulphate were all elevated;
- Other boreholes on the site and on the site perimeter showed concentrations

of various substances above permissible levels.

It was noted that the concentrations determined were erratic and variable but no explanation was offered for this or for the lack of any definite trends in the analysis results. It was also noted that the same substances which were found in the perched groundwater and leachate samples were also found in groundwater, generally at lower levels.

We find it most surprising that the EIS reports data only from 2002 for groundwater quality. A series of six monitoring wells was installed in November 1996 at locations on the site which appear to be very close to the illegal landfill areas (Appendix 5A of the EIS). There is no further reference to these monitoring wells, the purpose of installation or details of any groundwater or soil monitoring data from these locations.

Surface water and groundwater monitoring has been undertaken at regular intervals by JBA, consultants for Roadstone Dublin Ltd. As noted below, the monitoring data does not include all of the parameters which the EPA Landfill Monitoring Manual recommends should be included in such a programme. The data gaps are significant because the parameters are some of those which would reasonably be expected to be present in the leachate and which would also pose significant environmental risks on release.

The available water quality data (surface water and groundwater) shows significant anomalies with very high levels of pollutants detected in one Quarterly monitoring Event and levels below detection limits in the following event. This is an exceptionally difficult pattern to explain, especially for so-called deep groundwater monitoring wells and it is our opinion that at least some of the data sets may be inaccurate. Similar trends have been observed for a number of parameters which suggest that the data may be unreliable.

Other inexplicable data patterns are also observed e.g. levels of chromium below detection limit for three quarterly events, a very high result, and then levels back to below detection limit again. Other patterns of unreliable results include inconsistent ratios of COD to TOC, inconsistent ratios of COD or TOC to levels of PAH's and other organic substances, incomplete ionic balances, and inexplicable results for some parameters in what is supposed to be groundwater. No satisfactory explanation of any of the anomalies was presented in either the EIS or the Waste Licence Application.

In our opinion, the groundwater and surface water monitoring data presented in the EIS and reviewed here shows significantly elevated concentrations of many parameters relative to unpolluted groundwater and surface water. Furthermore, many of the pollutants are present at levels considerably higher than the relevant water quality standards. The comparison of monitoring data with so-called screening levels which are the **maximum permissible levels** only considers the maximum acceptable level of pollutants in the water body. It is our opinion that the assessment should also clearly identify the normal unpolluted background

levels and that the results obtained should be benchmarked against that standard. In our opinion, the report is flawed in not including this assessment. This section of the EIS makes no reference to the Groundwater Framework Directive or the requirements of this Directive and in our opinion the report is deficient in this omission.

7.5 Wicklow County Council Water Quality Monitoring data

TMS Environment Ltd contacted representatives of Wicklow County Council on numerous occasions between November 2004 and April 2005 to obtain monitoring data collected on behalf of the County Council at the Roadstone Dublin Ltd Blessington site. Data was eventually received on 13th April 2005, and this data is reviewed here.

The information provided by Wicklow County Council was contained in a series of spreadsheets with very little information about the type of sampling strategies, the analysis laboratories, the sampling personnel and some of the information was confusing in the absence of an explanation as to the origin of the data. We therefore contacted Wicklow County Council again to request clarification which was received on 21st April 2005.

The analytical parameters tested in the monitoring programme were the same as some of those tested by Roadstone Dublin Ltd. However, as noted in Section 7.7 below, the test programme does not include all of the parameters specified in the EPA Landfill Monitoring Manual (2nd Edition). In our opinion an incomplete and unreliable data set has been used to formulate the remediation proposal.

The data was identified as being prepared by Komex, consultants for Wicklow County Council. The analytical laboratory used by Komex was identified as CMA (Centre for Microscopy and Analysis, Trinity College Dublin). This laboratory is not an accredited laboratory to ISO17025 and we find the selection of this laboratory surprising in view of the sensitivity and significance of the project. Furthermore, we understand that CMA did not have in 2003 all of the equipment and personnel needed to complete all of the analysis reported and attributed to them. Further clarification of this detail is required in respect of what laboratory actually completed the analysis on behalf of Wicklow County Council. No further analysis laboratories were identified other than Alcontrol Dublin who completed some additional analysis on duplicate or split samples with CMA. For some of the data sets, three separate results were presented for samples collected on the same day – these were identified as duplicate analyses by CMA and a separate analysis by AlControl Dublin. Again, we find the selection of AlControl Dublin surprising since it is our understanding that AlControl Dublin were subcontracting significant volumes of analysis to a sister laboratory in the UK during 2003 and to date. Furthermore, it is incomprehensible why Komex would choose AlControl, the laboratory working for JBA on behalf of Roadstone Dublin Ltd, as a check laboratory rather than an independent laboratory.

Finally, Wicklow County Council advised us that none of the samples analysed by Komex and laboratories acting for them were split samples with JBA. It is therefore not possible to draw completely reliable conclusions about the comparability of either data set since the samples were not split. The absence of actual split samples from the monitoring programme is surprising as we would have expected any company carrying out independent monitoring to include split samples for cross-checking the reliability of the programme.

The Wicklow County Council / Komex data consisted of a number of rounds of sampling and analysis of surface water, perched groundwater and groundwater. Wicklow County Council advised TMS Environment Ltd that no independent landfill gas monitoring was completed by either the Council or their consultants. An assessment of the data included the comparison of analytical data from split samples between Komex, CMA and Alcontrol which shows that for a number of samples there are very significant variations between Alcontrol and Komex analytical results for split samples. The principal parameters which show repeated significant variations include:

- Suspended Solids,
- Iron,
- Manganese,
- Zinc,
- Magnesium,
- Boron and
- Total Organic Carbon.

Variations in analytical data are of concern if the variation falls outside acceptable precision limits and if the variations are persistently unacceptable. In this project, the variations are especially significant in view of the sensitivity of the project and the purpose for which the data is required. As noted above, the Quantitative Assessment of Risk from both the existing landfill sites and the proposed remediation scheme are based on models constructed with input data from the monitoring programmes. Unreliable data sets will therefore lead to inaccurate predictions and an unreliable remediation proposal. It is also of concern that AlControl, who completed all of the Roadstone Dublin Ltd analyses, were shown in the limited exercise reported in the Wicklow County Council data to persistently underestimate the concentrations of some analytical parameters and to grossly overestimate other data relative to the results reported by CMA. A review of the data received from Wicklow County Council is presented below, together with some limited comparisons with the Roadstone Dublin Ltd monitoring data.

Komex Perched Groundwater data

As noted above, perched groundwater is taken to represent the leachate from the waste although this may underestimate the strength of the leachate. Data sets were presented from two separate boreholes in each of the three waste areas, and monitoring was completed twice in April and October 2003. For two wells

(BH4/12, 15/04/2003 and BH6/10, 01/10/2003) Alcontrol carried out duplicate analysis, and for a single sample (BH6/10, 01/10/2003) CMA carried out their own duplicate analysis of the sample. The data showed variations of up to 1700% for some parameters, with closer agreement for a small number of parameters. Typical variations are in the region of 70 – 80%.

A sample taken on 01/10/2003 and analysed by Komex, CMA and Alcontrol shows the following. The analytical results for all parameters for the Alcontrol and the CMA data sets are identical which was attributed by Wicklow County Council to a typographical error; no replacement data has been provided to date. In addition, there are also a number of analytical results (COD, Cyanide, Total Phosphorus, Ortho-Phosphate, Total Oxidised Nitrogen, Mercury, Barium and Benzene) included in the Komex data set which are also identical to the reported Alcontrol and CMA data sets which is most unlikely. This latter anomaly has been attributed to a typographical error but no replacement data has been received to date. In summary, the analytical test results for this particular round of perched groundwater sampling is considered to be unreliable.

The results of the analysis of a sample collected from BH1/11 on 15/04/2003 and analysed by CMA was compared with the results fro a sample collected on the same date and reported by JBA in the EIS for the development. It is unclear whether this was a split sample or if the samples were collected at different times. A summary of the comparison is as follows, with the Komex result presented first and then the JBA result:

- COD 258mg/L versus 18 mg/l;
- Suspended solids 40 mg/l versus 7144mg/l;
- Chloride 25mg/l versus 6 mg/l;
- Boron < 0.5 versus 400µg/l;
- Manganese 986.6 versus 473µg/l;
- Zinc 36.46 versus 15µg/l;
- TOC 52 versus 7 mg/l

The results show the same general trend noted above ie the JBA results (obtained by Alcontrol) are consistently lower than the Komex results (analysed byCMA). Similar data comparisons for other samples show variations of up to a factor of 100 (excluding suspended solids for which much greater variations were observed). Such broad variations do not lend confidence to the reliability of the data.

Komex Groundwater data

Data sets were presented from groundwater wells in each of the three waste areas, and monitoring was completed on various occasions between April and October 2003. For four wells (GW1/1, 29/09/2003, GW4/2, 30/09/2003, GW1/3, 2/10/2003 and GW6/2, 2/10/2003) Alcontrol carried out duplicate analysis, and for a single sample (GW1/1, 29/09/2003) CMA carried out their own duplicate

analysis of the sample. The data showed variations of up to 10,000% for some parameters, with closer agreement for a small number of parameters. Typical variations are in the region of 100 – 300%. Alcontrol results were generally lower than those obtained by CMA, with the notable exception of suspended solids. It may also be noted that not all of the parameters tested by CMA were repeated by Alcontrol.

Area 1 GW1/1

A sample taken on 29/09/2003 and analysed by Komex, CMA and Alcontrol shows the following. Alcontrol analytical results when compared to CMA (and duplicate) analytical results show very significant variations for a number of parameters:

- Suspended solids (697 mg/l versus <10 mg/l and <10 mg/l respectively),
- Boron (<0.05 µg/l versus 5.15 µg/l and 4.52 µg/l respectively),
- Iron (15 mg/l versus 0.74 mg/l and 0.75 mg/l respectively),
- Magnesium (697 mg/l versus <10 mg/l and <10 mg/l respectively),
- Lead (<5 µg/l versus 87.38 µg/l and 72.73 µg/l respectively),
- Manganese (4µg/l versus 354.3 µg/l and 395.3 µg/l respectively)
- Zinc (9 µg/l versus 187.5 µg/l and 159.1 µg/l respectively).

Area 1 GW1/3

A sample taken on 02/10/2003 and analysed by Komex and Alcontrol show very significant variations for a number of parameters:

- Suspended solids (680 mg/l versus <10 mg/l respectively),
- Iron (22 mg/l versus 0.36 mg/l respectively),
- Manganese (4 µg/l versus 247.6 µg/l respectively) and
- Zinc (<5µg/l versus 48.36 µg/l respectively).

Area 4 GW4/1

A sample taken on 14/05/2003 and analysed by Komex and Alcontrol shows very significant variations for a number of parameters:

- Iron (18 mg/l versus 0.41 mg/l respectively),
- Manganese (4 µg /l versus 34.82 µg /l respectively) and
- Zinc (<5 µg /l versus 30.53 µg /l respectively).

Area 6 GW6/2

A sample taken on 02/10/2003 and analysed by Komex and Alcontrol shows very significant variations for a number of parameters:

- Suspended solids (505 mg/l versus <10 mg/l respectively),
- Chloride (<1 mg/l versus 13 mg/l respectively),

- Alkalinity (90 mg/l versus 307 mg/l respectively),
- Boron (<0.05 µg/l versus 6.97 µg/l respectively),
- Manganese (4 µg/l versus 45.74 µg/l respectively),
- Zinc (< 5 µg/l versus 43.36 µg/l respectively) and
- TOC (< 2 mg/l versus 24 mg/l respectively).

Area 6 GW6/2

A sample taken on 03/04/2003 and analysed by Komex and Alcontrol shows very significant variations for Suspended solids (622 mg/l versus 10 mg/l respectively).

Area 6 GW6/3

A sample taken on 08/05/2003 and analysed by Komex and Alcontrol shows very significant variations for the following parameters:

- Manganese (4 µg/l versus 934.5 µg/l respectively) and
- Zinc (<5 µg/l versus 42.93 µg/l respectively).

Area 6 GW6/3

A sample taken on 07/08/2003 and analysed by Komex and CMA shows very significant variations as follows:

- pH (6.19 versus 7.19 respectively),
- Electrical Conductivity (3.3 µS/cm versus 560 µS/cm respectively),
- Suspended Solids (<10 mg/l versus 40 mg/l respectively),
- Alkalinity (2 mg/l versus 272 mg/l respectively),
- Magnesium (<0.02 mg/l versus 17.88 mg/l respectively),
- Manganese (<0.5 µg/l versus 126.2 µg/l respectively) and
- Sodium (0.28mg/l versus 9.68 mg/l respectively).

Komex Surface water data

The information supplied included analytical test results from Komex as well as the test results of a duplicate sample from Alcontrol laboratories. A sample taken on 02/10/2003 and analysed by Alcontrol and Komex, respectively shows very significant variations for a number of parameters:

Total Alkalinity (470 mg/l versus 270 mg/l respectively)
Chloride (< 1mg/L versus 11mg/L, respectively)
Boron (<0.05 µg/l versus 8.13 µg/l respectively)
Iron (15 mg/l versus 0.18 mg/l respectively)
Manganese (3 µg/l versus 21.1 µg/l respectively)
Zinc (<5 µg/l versus 36.56 µg/l respectively)
TOC (3 mg/l versus 36 mg/l respectively)

Komex private well monitoring data

Komex also undertook sampling of water from 4 private wells located northeast of the landfill site. These wells are located up-gradient of the landfill site and the significance of the analysis data is therefore viewed in this context. It would be reasonable to expect that if adverse impacts were to occur they should occur down gradient of the site and the data would be more meaningful; if it was acquired for wells down-gradient of the landfill sites.

In conclusion, it is significant to note that all samples analysed by Komex and Alcontrol (10 samples) show significant variations in the reported analytical values for a number of parameters for all samples. In general, Alcontrol analysis results were lower analysis results than the Komex/CMA data. No PAH analysis was undertaken, which is surprising given the relatively high results obtained by Roadstone Dublin Ltd.

7.6 Cookehill Ltd Water Quality Monitoring data

Cookehill Limited have received planning permission to developed a housing scheme near the southeastern boundary of the unauthorised landfill at Roadstone Dublin Ltd.'s lands in Blessington Co. Wicklow. (Figure 6.1 abstracted from Roadstone Dublin Ltd EIS). Prior to the development of the site, PD Lane Consulting Engineers to Cookehill Ltd., commissioned a water supply study from a local groundwater source. The study was completed by KT Cullen Ltd (October 2001) and the conclusions drawn include a statement of the high vulnerability of the aquifer in which pumping well BH2 was located. This well was subsequently abandoned following the development of the Blessington Inner Relief Road and a second well (PW1A) was drilled 20m from the road in the vicinity of the Cookehill development site.

White Young Green (formerly KT Cullen) were commissioned in October 2003 to conduct a pumping test for the replacement well (PW1A) and the results of the pump test indicate an estimated yield of 350m^3/day; the quality of the water is indicated as being good based on chemical and bacteriological testing with no exceedances of the Drinking Water Regulations 2000 (S.I. 439 of 2000) recorded. Subsequent test results for PW1A conducted on 22/11/04, 11/11/04 (PAH analysis only), 16/11/04 and 25/11/04 do not report any exceedances of S.I. 439 of 2000.

Observation well OB1 which is located in proximity to Well PW1A was also sampled for chemical and bacteriological analysis in October 2003 and the results show that *E.Coli* and *Faecal Streptococci* bacteria were present in the water sample. The OB1 sample was also reported to have elevated concentrations of aluminium (6.84 mg/l), iron (3.73mg/l) and manganese (1.9mg/l) relative to Drinking Water Regulations 2000 (S.I. 439 of 2000) limit values. It was reported that external sources of contamination may be the cause of these elevated

parameters.

The direction of the flow of groundwater in the area in which the unauthorised landfill areas within the Roadstone Dublin Ltd site are located is generally towards the monitoring well in which the elevated metal concentrations were recorded. This conclusion is further clarified with reference to Figure 2 of the White Young Green report (December 2003) which illustrates the locations of groundwater wells BH1 and OB1, the direction of groundwater flow and the location of the Cookehill site relative to the Roadstone Dublin Ltd. site; this drawing is presented in Appendix 6Aof the EIS and in Figure 3 of this report.

Additional groundwater monitoring data for BH1, BH2, BH3, BH4 and TW5 sampled on 04/06/2002, 03/09/2002 and on 30/09/2002 was also reviewed and an exceedance of S.I.439 MAC for Nitrate, 0.84 mg/l (MAC 0.5 mg/l) was reported from BH1 on the sample taken on 04/06/2002.

Surface water monitoring data from 3 separate sample periods, 04/06/2002, 03/09/2002 and 30/09/2002, is also available for two monitoring locations, SW1 (Surface water from Stream) and SW2 (Surface water from Quarry). Exceedances of Manganese, 0.09 mg/l on 04/06/2002 and 03/09/2002 from SW1 and 0.1 mg/l on 03/09/2002 from SW2 are reported.

Surface water monitoring data from a single sample period 06/03/2001 is also available for two monitoring locations identified as Spring and Stream. Exceedances of the MAC for Manganese, 0.11 mg/l is observed from the results for the Spring sample.

From the available data for groundwater and surface water monitoring in the vicinity of the Cookehill development site, the presence of elevated concentrations of Manganese is evident. Elevated concentrations of Manganese and Iron are known to arise as a result of anaerobic conditions where anaerobic micro organisms oxidise the element into a soluble form which may be detected in water. Anaerobic conditions may arise from leachate entering a soil mass and should be considered relevant in the context of the unauthorised landfill areas in the vicinity of the groundwater sampling location.

7.7 Independent monitoring data

On 23rd February 2005, TMS Environment Ltd submitted a preliminary report to Blessington & District Forum outlining the findings of the data review conducted on their behalf. Our conclusions at that time, and as noted in this more comprehensive report, were that there are a number of significant anomalies contained within the received data sets for groundwater, leachate and surface water monitoring. At that time, we had received water quality monitoring data compiled by John Barnett & Associates (the consultants acting for Roadstone Dublin Ltd) which relate to quarterly monitoring conducted at various intervals between 2003 and Quarter #4 of 2004. We had not received the results of

monitoring conducted by Wicklow County Council, despite numerous requests, and our correspondence with the County Council led us to believe that no independent monitoring had been undertaken. We had received no recent data for landfill gas monitoring in the gas monitoring wells but some data was received for the landfill gas vent pipes, and no reliable data for off-site landfill gas monitoring had been received.

Our review of monitoring data demonstrated, in our opinion, that a number of the reported analytical results are questionable and therefore unreliable, and other data is extremely difficult to interpret in the context of the broader data sets provided. Furthermore, there are analyses which have never been undertaken which in our opinion should be completed in order to conduct a reliable assessment. In order for TMS Environment Ltd. to accurately evaluate the actual impact that the landfill site has on the receiving environment, and to allow us to advise Blessington & District Forum on the issues relating to this site, we proposed to complete independent monitoring at the site. The purpose of this monitoring is as follows:

- To acquire a complete data set of relevant monitoring data from an independent organisation;
- To acquire data which would allow us to rationalize anomalous data presented in the Roadstone Dublin Ltd Consultants reports;
- To acquire data on substances and parameters which are relevant to the assessments but which have not been reported previously;
- To acquire landfill gas data from off-site as well as on-site locations so that an evaluation of current risks from landfill gas may be completed;
- To allow a reliable evaluation of the Roadstone Dublin Ltd proposals for remediation.

We prepared a Work Programme which was designed to allow us to complete a reliable assessment of groundwater, surface water, leachate and landfill gas at the established monitoring locations at and in the vicinity of the site. Following the completion of the proposed independent monitoring programme, all monitoring results would then be used to reliably assess the impacts on the receiving environment in the vicinity of the subject site. In particular, it was intended that the independent study should rationalize the significant number of anomalies in the data presented by the Roadstone Dublin Ltd Consultants. The expected outcome of this monitoring and investigation programme would be a definitive evaluation of the potential impacts of the Roadstone Dublin Ltd proposal and advice on whether the B&DF should support or oppose the proposed remediation scheme.

In the preliminary report, we concluded that there are too many anomalies in the information publicly presented in the EIS and the Waste Licence Application to allow us to support the Waste Licence Application as it stands. Our particular concerns included the following.

1. There was no reliable landfill gas data although a report from Parkman in 2003 stated that levels were high enough to present a risk to the houses located near Area #6. It was therefore not possible to form any opinion on whether the proposed remediation scheme is acceptable in terms of the safety and environmental hazards which local residents, and their properties, would be exposed to. Furthermore, the reliability of the Quantitative Risk Assessment was questioned by both the absence of reliable data and by the failure to use recognised methodologies for evaluation of dispersion of landfill gas.

2. The available water quality data (surface water and groundwater) showed significant anomalies with very high levels of pollutants detected in one Quarterly monitoring Event and levels below detection limits in the following event. This is an exceptionally difficult pattern to explain and it is our opinion that one or more of the data sets may be inaccurate. Similar trends were observed for a number of parameters which suggest that the data may be unreliable. Other patterns of unreliable results include inconsistent ratios of COD or TOC to levels of PAHS and other organic substances, incomplete ionic balances, and inexplicable results for some parameters in what is supposed to be groundwater.

In view of the absence of independent monitoring data, and the unreliability of the existing data sets which were presented for review, TMS Environment Ltd recommended strongly that an independent data set should be acquired for evaluation. The entire remediation scheme was designed on the basis of interpretation of the data and, as noted above, since the data is unreliable, it is also possible that the proposed remediation scheme is also unreliable. A detailed Work Programme was therefore submitted to Roadstone Dublin Ltd who had previously indicated their willingness to support independent monitoring by Blessington & District Forum and their representatives. Roadstone Dublin Ltd responded on 13th March 2005 stating that they saw no need for the independent monitoring and refusing to support the programme.

Roadstone Dublin Ltd further stated in their response to Blessington & District Forum that their monitoring programme complies with Table C.2 of the EPA Landfill Monitoring Manual (2nd Edition). This is factually incorrect. Table C.2 of the EPA Landfill Monitoring Manual (Note 7) refers to Table D.2 as specifying the organic substances which should be monitored and further states that monitoring of surface water should also include the parameters regulated in the Water Quality (Dangerous Substances) Regulations; SI No 12 of 2001. These requirements have not been satisfied by any of the monitoring programmes referred to previously or in this review and we reiterate our opinion that an incomplete and unreliable data set has been used to formulate the remediation proposal.

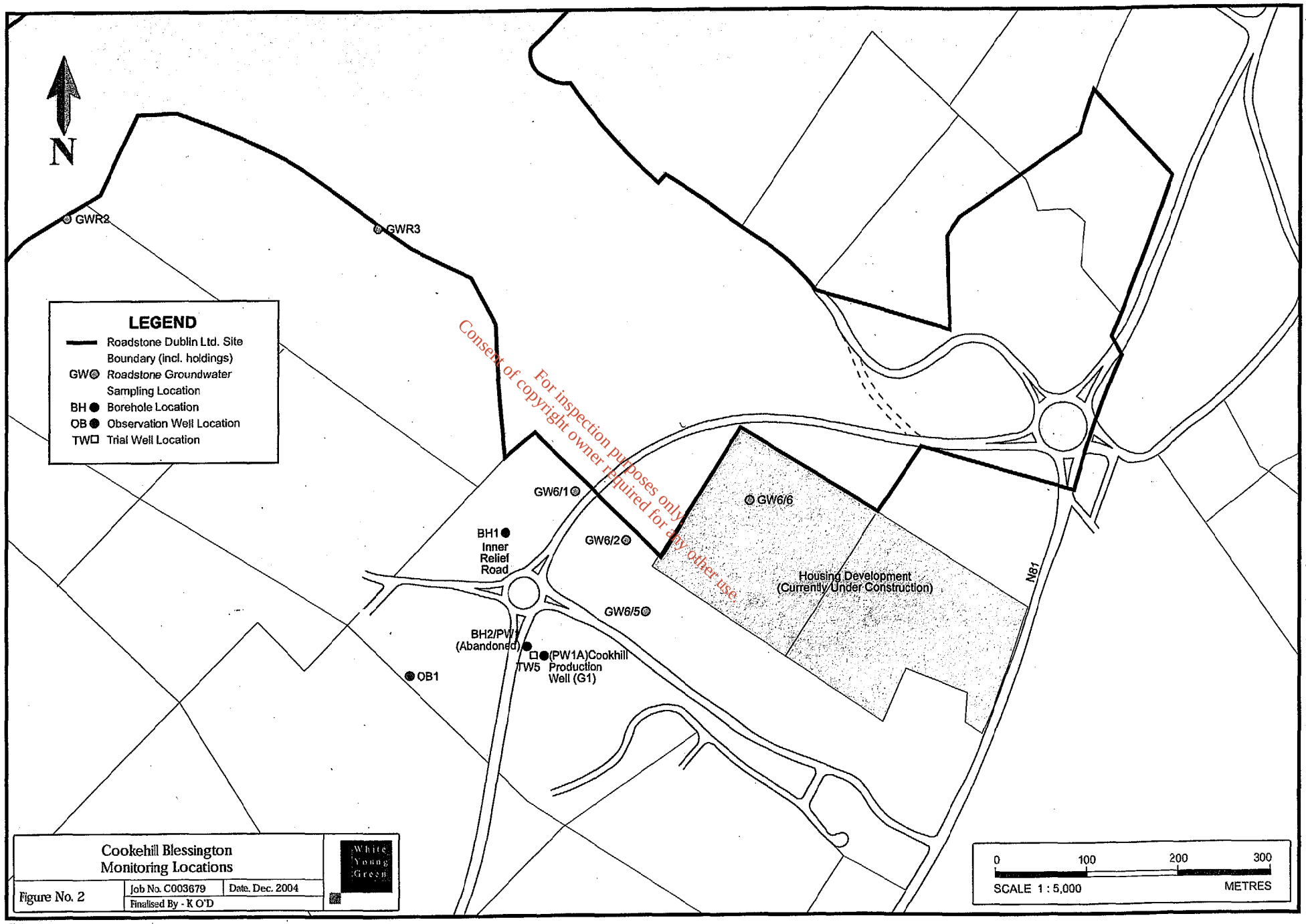
It is disappointing that Roadstone Dublin Ltd have refused to support an independent monitoring programme at the site. Roadstone Dublin Ltd believed

that Wicklow County Council had undertaken independent monitoring at the site but as we have clearly shown in this review, the monitoring completed by Wicklow County Council raises far more questions than answers and does not add to our confidence in the data on which the remediation proposals are based. While it may be understandable that Roadstone Dublin Ltd, part of one of Europe's largest and most profitable Corporations, should seek to maximize shareholder funds by minimizing expenditure on environmental monitoring and indeed on the entire remediation scheme, we are concerned that monetary considerations should not be the driving force behind this remediation project.

- We have raised serious concerns about the reliability of the data published by Roadstone Dublin Ltd and by Wicklow County Council, particularly in respect of the substances not included in the monitoring programme but also in respect of anomalous data sets presented for review. The entire Quantitative Risk Assessment and the remediation proposal are founded on the monitoring data sets and the predictions made using the data sets, and unreliable data sets will lead to unreliable impact predictions and an unreliable remediation strategy. If Roadstone Dublin Ltd are unwilling to fund an independent monitoring programme to be undertaken by TMS Environment Ltd as consultants to Blessington & District Forum, then we are quite happy to accept an independent monitoring data set from an agreed Third Party provided the design / content of the monitoring programme is also agreed in advance of completion of such a study.

8.0 CONCLUSIONS

This report has presented a review of available information relating to the environmental impact of the unauthorized landfill sites at Roadstone Dublin Ltd's lands in Blessington, Co. Wicklow and the potential environmental impacts of the proposed remediation scheme. The report highlights a number of concerns about the methodologies adopted by Roadstone Dublin Ltd and their technical advisers in their assessment of environmental impacts associated with the unauthorized landfill sites at their facility. These concerns are especially significant in the context that unreliable data and assumptions were used to formulate the proposed remediation plan for the site, and the reliability of the proposal must therefore be questioned. In our opinion, the assessment of risks to adjoining properties and especially to the properties closest to Area 6, which is one of the landfill areas, has not been demonstrably and unambiguously rigorous. It is also possible that information pertinent to such risk assessments may have been suppressed and therefore not published for independent review. The proposed remediation scheme appears to have been selected primarily for the purpose of minimizing costs and effort for Roadstone Dublin Ltd rather than for the purpose of achieving the best possible environmental outcome for this essential remediation project. It is also of concern that no reliable independent monitoring data has been acquired by Wicklow County Council who are responsible for regulating this activity.



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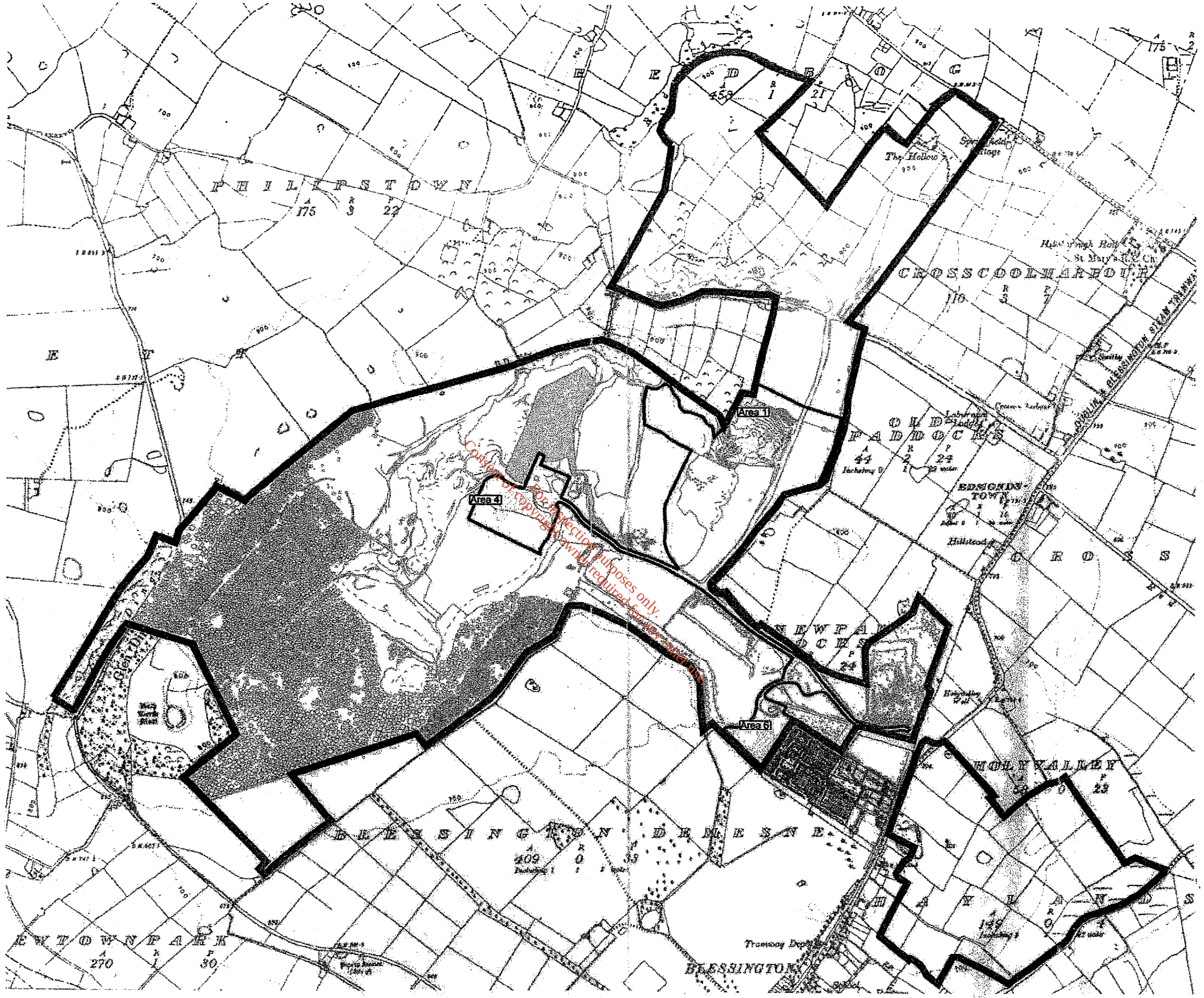

roadstone

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TALLAGHT
DUBLIN 24

JBA

JOHN BARNETT & ASSOCIATES
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14

Legend

- Land Ownership (c. 267ha)
- Application Area (c. 27.6ha)
- Unauthorised Landfill Sites

Rev.	Date	By	Description
0	Dec 03	SMD/PM	

Site:	Lands at Blessington, Co. Wicklow	
Project:	Remediation of Unauthorised Landfill Sites	
Title:	Application Area/Applicants Land Holding	
Drawn: PMC	Scale: 1:12,500	**FIGURE 2**
Job. No: 2901/10	Date: Dec 2004	

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COUNTY DUBLIN

Rev.	Date	By	Description

Site:	Lands at Blessington, Co. Wicklow	
Project:	Remediation of Unauthorised Landfill Sites	
Title:	Surface Water and Groundwater Monitoring Locations	
Drawn: PM	Scale: 1:12500	**FIGURE 6.1**
Job. No: 2901/10	Date: Dec 2004	