



**METRO NORTH
ORAL HEARING**

PROOF OF EVIDENCE

Brian Rouse

Soil and Geology

Wednesday 8th April 2009



Metro North Oral Hearing

Proof of Evidence

Soil

Brian Rouse

1.0 NAME, QUALIFICATIONS, ROLE IN PROJECT AND EXPERIENCE

- 1.1 My name is Brian Rouse. I am a consultant at Environmental Resources Management (ERM). I hold a degree in Environmental Geochemistry from University College Dublin (UCD).
- 1.2 The relevant chapters of the Environmental Impact Statement (EIS) were prepared either by me or under my direct supervision. I have been responsible for the desk based soil and geology assessment undertaken as part of the EIS of the Metro North project including a contamination assessment, and advising on appropriate mitigation measures. It should be noted that geotechnical and settlement assessments, which also relate to soil and geology, are presented separately by Paul Brown and Professor John Burland respectively.
- 1.3 I have over seven years experience in environmental consultation specialising in site investigation projects. I currently run the Contaminated Site Management team for ERM in Ireland with responsibility for managing subsurface investigations, soil assessments and contamination assessments.

2.0 GENERAL INTRODUCTION

- 2.1 My evidence describes and evaluates the existing soil and geological environment in the area of the proposed scheme. It also assesses the potential impacts on soil which may arise due to activities associated with the construction and operation of the proposed scheme.
- 2.2 A soil contamination assessment was also undertaken as part of the evaluation. This was based on analysis provided to ERM by RPA on sampling during the Main Ground Investigation (MGI) undertaken by Jacobs Engineering.
- 2.3 The MGI involved the installation of boreholes along the alignment. As part of the drilling process, Jacobs Engineering through their contractors sampled the soil arisings and submitted a proportion of these samples for analysis to determine the presence of contamination at each chosen location.
- 2.4 The analytical parameters required to assess the presence of contamination at the borehole locations were determined based on a review of the present and historical land uses adjacent each borehole location.

3.0 RECEIVING ENVIRONMENT

3.1 The soil baseline was developed using a range of data sources and surveys and these were:

- Review of existing soil and geological conditions as detailed by the Geological Survey of Ireland (GSI)
- Historical maps held by Ordnance survey Ireland (OSI);
- Field walkover surveys along the proposed alignment;
- Examination of the corresponding chapter for the Dublin Port Tunnel, a similar project in the vicinity of the proposed project.

3.2 The scope and methodology of the baseline assessment has been devised in consideration of the EPA document 'Developing a soil protection strategy for Ireland' (EPA, 2002).

3.3 The baseline evaluation also included a desktop study of existing available data to identify current conditions. The following describes the baseline conditions identified:

Soils

3.4 *Glacial Till (Limestone Derived Till):* A highly consolidated very stiff clay and silt matrix containing sand, gravel, cobbles and boulders.

3.5 *Glaciofluvial Sands and Gravels:* Glacial sands and gravels occur within the Dublin glacial till described above.

3.6 *Alluvial deposits:* Alluvial deposits are present along the proposed route. In particular these deposits are likely to occur along the river areas such as the Tolka River, Ward River, Sluice River and Santry River, river and estuarine areas such as the Broad Meadow River and the area adjacent Forest Little golf course. The deposits consist of soft silts and sandy clays.

3.7 *Made Ground:* Materials ranging from builders rubble to industrial, inert and municipal waste were used to fill natural depressions and areas of earth works such as quarries around the Swords, Airport and Drumcondra areas.

Made ground was also used in the reclamation of tidal flats along the River Liffey Estuary.

Bedrock Geology

- 3.8 Bedrock beneath the proposed route consists of Lower Carboniferous limestone with following main formations; the 'Calp' formation, the Tober Colleen formation, Waulsortian limestones and the Boston Hill formation. These formations are described below.
- 3.9 *Malahide (Boston Hill) Formation:* This is a fossiliferous limestone and is interbedded with thin shale beds. This formation is found in the Lissenhall area.
- 3.10 *Waulsortian Limestones:* This unit consists of massive unbedded lime-mudstones and are generally dolomitised. These limestones are found in the area around Dublin Airport.
- 3.11 *Calp (Lucan) Formation:* The Calp Formation refers to various units of basinal limestone and shale formed from carbonate sediment deposits. The Calp limestone consists of muddy limestone beds inter-bedded with calcareous shale beds.
- 3.12 *Tober Colleen Formation:* The Tober Colleen formation is the lowest Calp formation and consists of calcareous mudstone interbedded with very argillaceous micrite.

Contamination Encountered

- 3.13 ERM have adopted UK guidance due to the absence of definitive Irish legislation regarding the assessment of land contamination and screening criteria. This assessment is based on the principles of risk assessment, where risk is determined by the combination of the probability of a hazard occurring and the magnitude of its consequences.
- 3.14 This principle is applied to land contamination through the use of the 'source-pathway-receptor' concept. The concept relies on the identification of a contaminant (source) in on or under the land at a concentration sufficient to have the potential to cause harm and also the presence of a receptor, which may suffer harm and a pathway by which the receptor may be exposed to the

contaminant. As such not all sites at which contaminants are present will require remedial action. Where all three are present, a 'pollutant linkage' can be identified. All receptors (humans, controlled waters, ecology, crops/livestock and buildings) should be considered if there is the potential for them to be adversely affected by exposure to contamination.

- 3.15 The risk based assessment of land contamination is undertaken in accordance with the 'suitable for use' approach. For the assessment ERM have undertaken a Generic Quantitative Risk Assessment (GQRA).
- 3.16 In order to assess the suitability of the analytical results provided ERM have in the first instance undertaken the assessment using the published Soil Guideline Values (SGVs) for properties from a commercial setting. Where these criteria are unavailable equivalent Generic Assessment Criteria (GAC) have been developed for contaminants of concern. The SGVs and GAC are considered to be concentrations, which represent an acceptable level of risk when assessed against a representative indicator of receptor exposure.
- 3.17 As stated previously, in order to assess the analytical results provided ERM have undertaken the assessment using the published Soil Guideline Values for properties from a commercial setting, the category the proposed Metro North scheme falls within. The analytical parameters for all samples analysed were below the assessment criteria for a commercial property setting.

4.0 POTENTIAL IMPACTS OF THE PROPOSAL

- 4.1 Temporary impacts are typically associated with the construction phase of the scheme. These impacts are typically short-term in nature and are required to facilitate the construction of the scheme. The impacts will not continue after the construction phase has been completed. Impacts of this type include those associated with activities such as excavation and disposal of soils, contaminated materials and bedrock, temporary paving or compaction of soils, temporary construction of roads, traffic management procedures and dewatering works. In some cases, only minor disturbance of soils occurs.
- 4.2 Permanent impacts are longer term impacts which are expected to persist for the lifetime of the scheme and its operation. Permanent structural impacts occur where the soil or geology has been permanently altered to allow for the

construction of the parts of the scheme e.g. sealing of surfaces by paving and also impacts associated with the installation of the railway, new traffic systems or roadways, drainage and conduit channels, car park facilities, ancillary buildings and ground settlement. Permanent operational impacts occur where the general day to day operation of the scheme impacts on soil and geology. Potential impacts of this type arise due to activities such as maintenance works (including track cleaning) and activities which could potentially lead to contamination.

5.0 REMEDIAL OR MITIGATION MEASURES

- 5.1 *Paving*: Paved areas that are not required after the construction of the project will be removed and reinstated with landscaping to compliment the surrounding land use.
- 5.2 *Compaction*: To minimise compaction hoarding and signposting will be used to clearly demarcate haulage routes and other areas being used during construction. Landscaping and restoration will be undertaken with areas reinstated to their original condition, where possible.
- 5.3 *Excavation*: Uncontaminated spoil will be reused where possible within the scheme to construct areas such as the depot, embankments, bunds and landscaping structures. Any mitigation measures associated with potential human health impacts are addressed in Volume 1, Chapter 8 (Human Health). Measures taken to reduce the potential for environmental pollution and dispersion of contaminated soil comprise capping of contaminated areas and dust suppression if necessary. The disturbance of contaminated soils will be minimised and an appropriate risk assessment will be undertaken to mitigate against environmental risks.
- 5.4 *Waste, spoil and contamination*: A waste management plan is to be developed to ensure that all construction waste is managed, stored and disposed of in an appropriate manner by appropriate contractors in accordance with all relevant waste legislation.
- 5.5 *Ground gases including radon*: An occupational monitoring programme is to be established to ensure that no adverse impacts occur as a result of the tunnel construction process due to the migration of ground gases (including

carbon dioxide, methane and radon) which may be mobilised due to the tunnel construction technique or associated dewatering activities.

6.0 PREDICTED, RESIDUAL IMPACTS AND SUMMARY

Construction

- 6.1 The following sections illustrate the potential impacts in each area during the construction phase.

MN101

- 6.2 Paving: The paved areas in Area MN101 will be constructed predominantly in areas of medium functional value so the impacts will have moderate significance. However, areas of made-ground and existing paved areas such as those along the R132 have lower functional value and the significance of impact is reduced to low and very low respectively. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases.
- 6.3 Compaction: Compacted areas in Area MN101 will be constructed in areas of medium functional value so the impacts will have moderate significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases. Areas of made-ground and existing paving such as those along the R132 have lower functional value and the significance of impact is reduced to low and very low respectively.
- 6.4 Excavation: The majority of the excavated areas are located in areas of medium functional value so the impacts will have moderate significance. However, areas of made-ground and existing paving such as those along the R132 and the Malahide Roundabout have lower functional value and the significance of impact is reduced to low and very low respectively.
- 6.5 Waste, spoil and contamination: Soil from a number of sampling locations along the route has been sampled and tested for contamination. In all cases, the current information indicates that there will not be any impact on commercial landuses in which the samples all occur because contamination

levels are all below the screening criteria for a commercial end landuse. However, soil sampling was undertaken at discrete representative locations only based on historical activities and an assessment of the potential for contamination to be encountered. Areas of soil contamination could potentially be encountered in other areas outside the areas where analysis was undertaken.

- 6.6 Ground gases including radon: The Radiological Protection Institute of Ireland (RPII) 'Radon Map of County Dublin' indicates that within the study area, the percentage of dwellings predicted to exceed the domestic radon standard is low (1- 5%) and the area is not defined as a 'high radon area'. This provides an indication that the area as a whole is not likely to be associated with a significant radon problem. Monitoring of ground gases will be carried out in the construction phase and, if necessary, mitigation measures will be put in place to adhere to all relevant H&S legislation.

MN102

- 6.7 Paving: The paved areas will be constructed predominantly in areas of medium functional value so the impacts will have moderate significance. Areas of made-ground and existing paved areas such as those along the R132 have lower functional value and the significance of impact is reduced to low and very low respectively. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases.
- 6.8 Compaction: The majority of the compacted areas are to be constructed in areas of medium functional value so the impacts will have moderate significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases. Areas of made-ground and existing paving such as those along the R132 have lower functional value and the significance of impact is reduced to low and very low respectively
- 6.9 Excavation: The majority of the excavated areas are located in areas of medium functional value so the impacts will have moderate significance. However, areas of made-ground and existing paving such as those along the

R132 have lower functional value and the significance of impact is reduced to low and very low respectively.

6.10 Waste, spoil and contamination: As MN101.

6.11 Ground gases including radon: As MN101.

MN103

6.12 Paving: The paved areas at the tunnel portal are located predominantly in areas of high functional value so the magnitude and significance of this impact is high. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases. There are also areas of natural soil, made-ground and paved areas such as areas to the north of the tunnel portal and at the halting site in this area. These have lower functional value and the significance of impact decreases to moderate, low and very low respectively

6.13 Compaction: The compacted areas at the tunnel portal will be constructed predominantly in areas of high functional value so the magnitude and significance of this impact is high. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases. There are also areas of natural soil, made-ground and paved areas such as areas to the north of the tunnel portal and at the halting site. These have lower functional value and the significance of impacts in these areas decreases to moderate, low and very low respectively.

6.14 Excavation: Excavation associated with the tunnel portal is to occur in areas of high functional value so the impact is of high significance. There are also areas of made-ground and paved areas such as the halting site in this area. These areas are of lower functional value with respect to soil and the impact is of low to very low significance. Excavation associated with the Airport stop

occurs in an area of very low functional value, so the impact is of very low significance.

6.15 Waste, spoil and contamination: As MN101

6.16 Ground gases including radon: As MN101

MN104

6.17 Paving: The paved areas will be constructed predominantly in areas of medium functional value so the impacts will have moderate significance. There are two areas of high functional value, a section of the hedgerows along the access road to the DOE test centre and an area around Santry Lodge. The track will cross through these areas and is likely to be paved. This impact will have high significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases. There are also areas of made-ground and existing paved areas such as those along the M50 and R108. These have lower functional values and the significance of impact is reduced to low and very low respectively

6.18 Compaction: The compacted areas will be constructed in areas of medium functional value so the impacts will have moderate significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases. There are two areas of high functional value, a section of the hedgerows along the access road to the DOE test centre and an area around Santry Lodge. The track will cross through this area and compaction will occur. This impact will have high significance. There are also areas of made-ground and existing paved areas such as those along the M50 and R108. These areas are of lower functional values and therefore the significance of impact is reduced to low and very low respectively.

6.19 Excavation: Excavation of soil will occur at the tunnel boring launch site, the tunnel portal, cuttings and the cut and cover section at R108. The magnitude of the impact associated with this activity (i.e. excavating an area during construction) is high as soil disturbance has a high impact on soil function.

The excavated area will be constructed in an area of medium functional value so the impacts will have moderate significance.

6.20 Waste, spoil and contamination: As MN101

6.21 Ground gases including radon: As MN101

MN105

6.22 Paving: Area MN105 consists of cut and cover sections which are paved. There will also be some paved areas associated with the construction compounds. The paved areas will be constructed predominantly in areas of low to very low functional value so the impacts are of low to very low significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases.

6.23 Compaction: Compacted areas will occur during the construction of the cut and cover tunnel and stops in Area MN105. The compacted areas are to be constructed in areas of low to very low functional value so the impacts are of low to very low significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases.

6.24 Excavation: Excavation of soil will occur as part of the cut and cover method of construction. The magnitude of the impact associated with this activity (i.e. excavating an area during construction) is high as soil disturbance has a high impact on soil function. The excavated area is to be constructed in areas of low to very low functional value so the impacts are of low to very low significance.

6.25 Waste, spoil and contamination: As MN101

6.26 Ground gases including radon: As MN101

MN106

6.27 Paving: Area MN106 consists of cut and cover sections, the tunnel boring launch site (Albert College Park), underground stops and tunnelled sections through areas of existing paving. Some areas will also be paved to provide

for construction compounds, access points to stops and ventilation shaft. The paved areas will be constructed predominantly in areas that are already paved and which are therefore of low to very low functional value so the impacts are of low to very low significance. However, areas of natural soil at Albert College Park and the Griffith Avenue Stop have a moderate functional value and the significance of impact is increased to moderate.

- 6.28 Compaction: Compacted areas will occur during the construction of the cut and cover tunnel and the tunnel boring launch site in Albert College Park, Griffith stop and access routes, the ventilation shaft and Drumcondra stop in Area MN106. The compacted areas are to be constructed in areas of moderate functional value so the impacts are of moderate significance. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases.
- 6.29 Excavation: Excavation of soil will occur during the construction of the cut and cover tunnel and the tunnel boring launch site in Albert College Park, Griffith stop and access routes, the ventilation shaft and Drumcondra stop in Area MN106. The magnitude of the impact associated with this activity (i.e. excavating an area during construction) is high as soil disturbance has a high impact on soil function. The excavated area will be constructed in an area of moderate functional value so the impacts are of moderate significance.
- 6.30 Waste, spoil and contamination: As MN101
- 6.31 Ground gases including radon: As MN101

MN107

- 6.32 Paving: Area MN107 consists of tunnelled sections and stops in existing hardstanding paved areas. Some paved areas will also be created for construction compounds and access points to stops. The paved areas will be constructed predominantly in areas that are already paved and which are therefore of low to very low functional value so the impacts are of low to very

low significance. The impact on these areas is therefore deemed to be of low significance.

6.33 Compaction: Compacted areas will occur at the construction compounds. The compacted areas are to be constructed in areas of low to very low functional value so the impacts will be low to very low. When the mitigation measures are taken into consideration, the magnitude and significance of this impact remains the same but the footprint of the area impacted upon decreases.

6.34 Excavation: Excavation of soil will occur at the construction compounds and stops. The magnitude of the impact associated with this activity (i.e. excavating an area during construction) is high as soil disturbance has a high impact on soil function. The excavated area will be constructed in an area of low to very low functional value so the impacts will be moderate to low.

6.35 Waste, spoil and contamination: As MN101

6.36 Ground gases including radon: As MN101

Operation

6.37 The following sections illustrate the potential impacts in each area during the operational phase.

6.38 Maintenance: Maintenance work is likely to be undertaken in the depot area and along the track. There is the potential for contaminating materials (such as oils and lubricants) to impact on the soil outside of paved areas. The magnitude of impact associated with a spill of hazardous materials during maintenance/repair work is high because of the potential for soil contamination to occur. However, when the mitigation measures are taken into account, the significance of an impact is low to very low.

6.39 Ground gases including radon: In the operational phase it is assumed that the construction of tunnel lining and the ventilation systems are sufficient to mitigate any potential accumulation of radon or other ground gases including methane and carbon dioxide. This will be appraised during the detail design. This appraisal will include consideration of not just the main tunnel structure

but also any side tunnels, refuges or other confined spaces where ventilation rates may not be the same as in the main tunnel.

7.0 RESPONSE TO SUBMISSIONS

7.1 The following represents the main concerns raised in the submissions that related to soil and geology with responses.

Settlement

7.2 This topic is being specifically dealt with by Professor John Burland's evidence.

Suitability of geology for tunnelling

7.3 This topic is being dealt with in tunnel design and tunnel construction briefs of evidence.

Radon

7.4 The Radiological Protection Institute of Ireland (RPII) has produced a 'Radon Map of County Dublin' which was compiled based on monitoring results from a number of sample houses within the county. The map illustrates 10km grid squares within the county and provides an estimate of the percentage of dwellings within each 10km area which are predicted to exceed the domestic radon standard of 200 Bq/m³ of radiation.

7.5 The geology of the study area is described in Chapter 17 (Baseline Soils and Geology). As detailed in this chapter, the study area is dominated by limestones and shales which would allow the transmission of radon to occur if a significant source of radon existed. However, the RPII database indicates that within the study area, the percentage of dwellings predicted to exceed the domestic radon standard is low (1- 5%) and the area is not defined as a

‘high radon area’. This provides an indication that the area as a whole is not likely to be associated with a significant radon problem.

- 7.6 It is noted the RPII assessment does not take into consideration exposure pathways that may be created due to any underground works such as the construction of tunnels or underpasses. In recognition of this fact, an occupational monitoring programme is to ensure that no adverse impacts occur as a result of the tunnel construction process due to the migration of ground gases (including carbon dioxide, methane and radon) which may be mobilised due to the tunnel construction technique or associated dewatering activities. The RPII has issued separate guidance in respect underground working entitled ‘Radon in Underground Workplaces - Guidance Notes for Employers’ (2007) and in this guidance an occupational exposure standard of 400 Bq/m³ has been set. If radon levels in the underground sections of the scheme exceed this threshold during construction, appropriate remedial measures (as prescribed by the RPII) will be undertaken by the contractor to ensure that no negative impact on the surrounding environment occurs.

Spoil disposal

- 7.7 Where possible spoil generated in the construction process will be reused in the scheme for a number of purposes such as construction of the depot, embankments, levelling of topography, landscaping and other mitigation measures.
- 7.8 Where reuse is not possible, spoil will be recycled, if possible, in projects such as landfill capping and quarry restoration. The exact timing of these external reuse projects will be dependant on their overlap with the construction of the proposed scheme.
- 7.9 Where reuse is not possible, the spoil will be disposed of in a manner that is in accordance with all relevant legislation. Impacts associated with the transport of spoil are addressed in Ian Byrne’s evidence.
- 7.10 A waste management plan is to be developed in accordance with the Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG, 2006) as part of the

construction environmental management plan to ensure that all construction waste is managed, stored and disposed of in an appropriate manner by appropriate contractors in accordance with all relevant waste legislation. A spoil strategy is to be developed by the contractor to ensure that spoil and any potential contamination is dealt with in an appropriate manner in accordance with all relevant legislation.

8.0 RAILWAY ORDER CHANGES

- 8.1 Since the publication of the EIS the RPA has made a number of changes to the Railway Order further to discussion and agreement with third parties. I have considered all of these and they are noted in my evidence and I can confirm that in general the Railway Order changes will result in no change to the residual impacts.

9.0 OVERALL CONCLUSION

- 9.1 Overall Metro North will have a significant impact at a local level through compaction and paving of natural soils, however, these impacts are not significant at a regional and national level and will be minimised.

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