Clifton Scannell Emerson Associates

Kilkenny Northern Ring Road Extension – (Freshford Road to Castlecomer Road)

Environmental Impact Statement Volume 4: Appendices

Kilkenny County Council

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PREFACE

THIS ENVIRONMENTAL IMPACT STATEMENT CONSISTS OF THE FOLLOWING FOUR DOCUMENTS:

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VOLUME 2
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APPENDIX A

Constraints and Route Options Study

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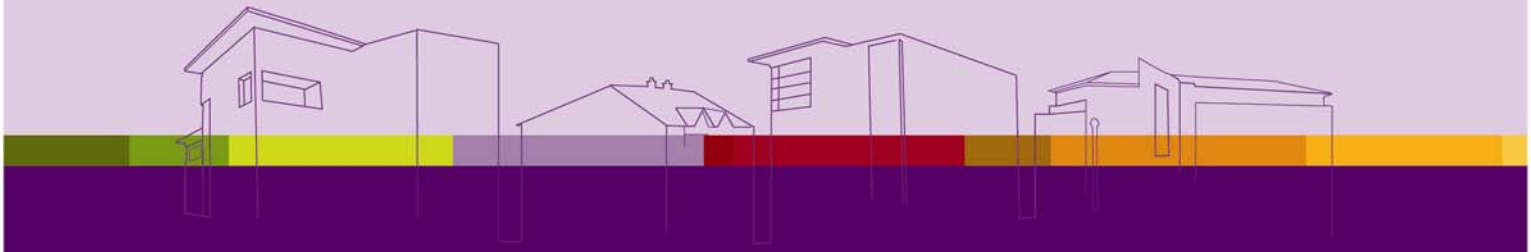

Kilkenny Northern Ring Road Extension

Constraints and Route Option Study

Kilkenny County Council

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1 Introduction

Clifton Scannell Emerson Associates have been appointed by Kilkenny County Council (KCC) to study the possible route options available for the Proposed Kilkenny Northern Ring Road Extension – Castlecomer to Freshford Road. The proposed road will connect the Castlecomer road to the Freshford Road 2.5km north of Kilkenny City Centre. Refer to drawing 07_088_030 for proposed site location.

This report is prepared in order to:

- Study the possible route options connecting the Castlecomer Road to the Freshford Road.
- To carry out a constraints study of the area covered by the Route Corridors
- Recommend an emerging Preferred Route Option in terms of engineering, economic and environment impacts.

To facilitate the route option study, Clifton Scannell Emerson Associates have carried out the following:

- A walkover survey of the area surrounding the possible road options.
- A land registry search to determine land ownership
- A planning permission search to determine potential future developments around the possible road corridors.
- Procure a specialist Archaeologist consultant to prepare a constraints study and to assess the potential impact of the possible route options.
- Procure a specialist Ecologist consultant to prepare a constraints study and to assess the potential impact of the possible route options.
- Carry out an economic assessment for each road option
- Estimate Land Take areas

2 Existing Conditions

The Kilkenny Ring Road has been completed from the Dublin Road to the Callan Road to the east and south of the City. Recently the section from the Dublin Road to the Castlecomer Road to the east of the City has been opened. The remaining section of Ring Road from the Castlecomer Road to the Callan Road would complete the loop around the City. This is outlined in the Kilkenny Development Plan 2008 – 2014. The linkage from the Castlecomer Road to the Freshford Road requires bridging over the Nore River at a single location. The proposed route would connect the recently complete Ring Road roundabout on the Castlecomer Road to the Freshford Road north of the Auteven Hospital.

3 Need for the Scheme

Kilkenny County Council has identified the proposed link between the N77 Castlecomer road and the R693 Freshford road in the Kilkenny Development Plan 2008 – 2014. The Kilkenny City and Environs Development Plan provides the land use and planning policy framework that tries to ensure that Kilkenny City and County fully play their role in achieving the objectives and targets of policy documents such as the National Spatial Strategy (NSS) and the South East Regional Planning Guidelines (RPG). The NSS defines Kilkenny City as the 'Hub' town, and the Plan therefore responds to the potential of Kilkenny City's role as a Hub town within the national and regional economies. The designation of Kilkenny City as a Hub town provides the catalyst for the City and Environs to further enhance its importance at a national and regional level which will also benefit the population of the City and County.

Currently there is a significant traffic demand crossing the River Nore from east to west to the north of Kilkenny City. This demand is currently catered for by Green's Bridge and John's Bridge leading to significant congestion at peak periods in Kilkenny City. The Northern Ring Road Extension will provide a northern link over the Nore River connecting the N77 Ring Road Extension to the Central Access Scheme, via the Freshford Road. The proposed scheme is a specific objective of the Development Plan and it will facilitate the development of Kilkenny City and Environs

in its role as a Hub town. Kilkenny County Council propose a network of road improvements to cater for the development and improvement of Kilkenny City. The Central Access Scheme is a key element of the network providing improved linkages to the west of the city. The proposed Kilkenny Northern Ring Road Extension will compliment the Central Access Scheme linking it to the existing Ring Road Extension and the N77 and N10.

The provision of the Kilkenny Northern Ring Road, extending the Ring Road from the Castlecomer Road to the Freshford Road incorporating an additional bridge crossing of the Nore River, north of Kilkenny City will cater for the existing and future traffic demand. Significant relief would be given to Green's Bridge and John's Bridge reducing congestion and traffic levels in Kilkenny City. The resultant reduction in volumes of HGV and other traffic in Kilkenny City will improve environmental amenity in the City and allow for the provision of safer City centre streetscapes. Directing large volumes of traffic inclusive of HGV's from the City Centre will reduce congestion levels on the City's streets encouraging a transport 'modal shift' by providing an environment to improve public transport, cyclist and pedestrian linkages.

The proposed link would cater for 12,480 vehicles per day in 2011, year of opening, and 23,492 vehicles per day in 2026, design year. These volumes would be removed from the City centre streets with reduced volumes on Green's bridge and John's Bridge of 17.5% and 12%, respectively.

4 Scoping of Route Options

Initial Study Area

This area was chosen based on the location of the Ring Road Extension and development along the Freshford Road, in addition to the Development Plan objectives. The initial study area identified is indicated on drawing 07_088_031 of appendix A. This area covers approximately 180 Acres all within Kilkenny County. The study area is located approximately 2 km north of Kilkenny City and bounded by the R693 – Freshford Road to the west, N77 – Castlecomer Road to the east.

Scheme Objectives

The key objectives for this scheme include:

- Reduce “by-pass” traffic from entering into Kilkenny City.
- Provide a distributor link/ring road around Kilkenny City.
- Improve safety for all road users
- Minimise impact on existing landscape
- Limit Archaeological impact
- Limit Environmental impact
- Minimise severance of land ownership

Initial Routes Considered

8 route corridor options were initially developed for consideration in this scheme, namely; Red (Route 1), Yellow (Route 2), Blue (Route 3), Cyan (Route 4), Green (Route 5), Magenta (Route 6), Orange (Route 7) and Black (Route 8) as indicated in drawing 07_088_032. All eight route corridors connect with the existing N77 Ring Road extension roundabout and traverse west to the R693, crossing the Nore River at various locations.

The major considerations taken into account in selecting these route corridors are as follows: -

- Crossing the Nore River
- Crossing Bleach Road
- New housing estate Weirview.
- Auteven Hospital
- Impact on the Candidate Special Areas of Conservation (SAC)
- Impact on the Proposed Natural Heritage Areas (NHA)
- Impact on potential Archaeological sites.
- Impacts on amenity, local residents and landholding.
- Connections with the Freshford & Castlecomer Roads
- Existing 38kv ESB O/H cables.

5 Constraints

5.1 Traffic

The proposed Kilkenny Northern Ring Road will cater for substantial traffic demand between the N77 Castlecomer Road, the N77 Kilkenny Ring Road Extension and the R693 Freshford Road. The Kilkenny City traffic model recently developed has been used as a basis to test the traffic impact of the proposed scheme. In 2007 a SATURN traffic model was developed by Malone O'Regan and Scott Wilson for Kilkenny City, the base year for this model was 2006 covering the following periods:

- Weekday AM Peak Hour (0800 – 0900hrs);
- Weekday PM Peak Hour (1700 – 1800hrs); and
- Average Saturday Peak Hour (1300 – 1600hrs).

The traffic model allowed for an assessment to be made of the impacts of a variety of development schemes in and around Kilkenny City.

The study area used for the traffic model focused on the City centre, but also included the immediate surrounding areas. Within the study area, all of the major road links and junctions were included. Detailed information on the characteristics of the traffic and the road network within the model study area was obtained which included the following:

- Road Side Interviews
- Automatic Traffic Counts
- Manual Classified Counts
- Network Inventory
- Journey Time Surveys

The information obtained for this traffic model was used to establish traffic flows for the introduction of the Northern Ring Road Extension. Traffic in the City was analysed under two different scenarios, including the Northern Ring Road Extension constructed, with and without the Central Access Scheme opened. The results of this model can be found in appendix 2.

The traffic assessment:

- Establishes year of opening 2011 and design year 2026 traffic flows on the Kilkenny City Road network based on existing count data, origin destination patterns and projected increase in travel demand due to development and population increase.
- Predicts year of opening 2011 and design year 2026 traffic demand on the proposed scheme.
- Estimates the impact on the surrounding road network and in particular key river crossings.
- Informs the need for the scheme, road cross section design, junction design, pavement design and environmental assessment.

Drawings 07_088_038 and 07_088_039 show the proposed traffic volumes (AADT, Annual Average Daily Traffic) on the key road links for 2011 and 2026 with and without the proposed scheme.

The projected traffic demand for the proposed Kilkenny Northern Ring Road is an AADT of 12,480 in year of opening 2011 and 23,492 in design year 2026.

Drawings 07_088_038 and 07_088_039 also show the projected AADT traffic volumes for 2011 and 2026 with and without the proposed scheme assuming the proposed Central Access Scheme is complete. In this scenario the projected AADT on the Kilkenny Northern Ring Road Extension is 10,538 and 17,579 for 2011 and 2026, respectively.

Based on projected traffic volumes the proposed road cross section is a wide single carriageway as defined by TA 46/97 of the National Roads Authority Design Manual for Roads and Bridges Table 2.1 which gives a year of opening economic flow range of 6,000 to 21,000 AADT. The wide single carriageway is consistent with the N77 Kilkenny Ring Road Extension recently completed.

The impact of the proposed Northern Ring Road on the Kilkenny Road Network is extremely positive, attracting additional traffic to the N77 Kilkenny Ring Road and reducing demand on City centre streets and in particular on Green's bridge, John's bridge, Central Access Scheme, Castlecomer Road, Troy's Gate, Green Street and Vicar Street. Traffic volumes on the Freshford Road are increased due to the traffic demand from the west City centre using the Freshford Road to access the Ring Road. Table 5.0 below tabulates these impacts:

Street	Do Nothing		Do Something		AADT Reduction	
	2011	2026	2011	2026	2011	2026
Castlecomer Road	9,546	11,142	8,500	9,839	1,046	1,303
Freshford Road	7,414	10,316	11,733	20,950	+4,319	+10,634
Green's Bridge	14,614	20,024	10,698	15,485	3,916	4,539
John's bridge	18,127	23,934	17,368	21,636	759	2,298
Central Access Scheme	17,226	23,416	14,118	19,676	3,108	3,740

Table 5.0 Traffic Impacts 2026

The proposed Northern Ring Road Extension will carry an average of 1.8% HGV's (Heavy Goods Vehicles) per day in 2011 and 1.26% in 2026. The projected peak hourly flows on Green's Bridge and John's bridge in the "do nothing" scenario for 2011 and 2026 are substantially above available capaCity and will lead to substantial congestion. The provision of the Northern Ring Road Extension will substantially reduce congestion on these bridges and in Kilkenny City generally and coupled with the Central Access Scheme will provide an excellent opportunity for improved quality of life, improved environmental amenity and enhance economic activity in the City.

The projected 2026 design year flows have been used to carry out capaCity checks on the N77 Ring Road Extension roundabout and the proposed roundabout on the Freshford Road. These checks have been carried out using ARCADY traffic modelling software developed by the TRL to assess queuing based on demand and geometry.

The results of the analysis show a design year 2026 demand capaCity ratio of 93% and 90% on the Castlecomer Ring Road roundabout and Freshford Road roundabouts respectively. The ARCADY junction capaCity model outputs can be found in appendix 2.

5.2 Infrastructure

The road network within the study area is comprised of one National route, the N77, one Regional Road, the R693 and one County Road. The proposed Northern Ring Road Extension will tie into the existing N77 at the recently completed Ring Road roundabout at its eastern end, the route will cross the County Road (Bleach Road) and will join into the R693 Road with a new proposed roundabout.

The Northern Ring Road Extension corridor reserved in the Draft Development Plan 2008 – 2014 skirts residentially zoned lands off the N77. The corridor shown traverses lands zoned for agricultural use and passes north of lands zoned for Agritrade, Community Facilities and Residential (Low Density) adjacent to the R693. The route is shown joining into the R693 approximately 2.5km from the centre of the City.

5.3 Ecology

An ecological constraints study has been prepared as part of an environmental assessment for the scheme. The ecological impact of each proposed route corridor option has been evaluated and compared.

The Ecological Constraints Study for the route options was prepared by Roger Goodwillie, this report can be found in Appendix 3. The following are the impacts reported in the constraints study and its mitigation recommendations. Refer to the full report in Appendix 3 for further details.

Receiving Environment

Table 5.1 shows the items of ecological interest identified in the report and its conservation evaluation rating based on criteria outlined in accordance with standard guidelines, IEEM, 2006.

Habitat Types	Classification
Improved Grassland	GA1
Treelines	WL2
Dry Meadows and Grassy Verges	GS2
Wet willow – alder – ash woodland	WN6
Reed and Large sedge swamps	FS1
Pond	FL8
Wet grassland	GS4
Tall sedges	FS1

Table 5.1 Areas of Ecological interest identified

There are two Natural Heritage Areas (NHA) identified in the study area, these are identified in drawing 07_088_033, Appendix 1. The impacts on the NHA sites are considered as a major negative and mitigation should be in place before any construction works start. Generally the habitat diversity of this area is of mixed ecological value with various species throughout. The tree lines adjacent to the old railway are of significant importance.

The study area contains a significant area designated as a candidate SAC (special area of conservation) namely the areas adjacent to the River Nore. These are shown in 07_088_033, Appendix 1. Particular interest is shown to the floodplain marshes.

Fauna

Features noted from the study are:

Fauna Type	Fauna Evidence
Otters	Evidence of otters was found on the eastern bank of the river. There is a possibility that a breeding holt could be present here.
Badgers	No signs of a set were found but there presence has been known in the area.
Bats	Suitable habitats are present in the study area in particular along the River Nore for Dambenton's but not other terrestrial species.
Whooper Swans	A small flock were present in the floodplain and also the marsh east of Bleach Road during winter 2007/8. Geese have also been seen in these areas.
Snipe	Considerable numbers habitat the field in the southeastern corner of the study area.
Fish	Salmonoid fry are present in the stream east of Bleach Road. The Nore River itself is important for a number of aquatic species.

Impact Assessment

The construction and operational phases of the proposed development will involve a number of modifications to habitats in the area. These modifications include:

- Heavy machinery movements
- Vegetation and soil removal
- Habitat destruction
- Construction of bridges and Culverts
- On-site material storage
- Increased noise and dust

These activities will incur direct and indirect impacts on the site, including:

- Removal / modification of some of the habitat recorded, including sections of hedgerows and tree lines.
- Establishment of permanent footpaths and cycle ways will lead to increased lighting, human disturbance, noise and a permanent loss of vegetation.

- On a temporary level, activities on the site will lead to certain species, such as bat, bird and mammal species avoiding the immediate construction area, with a potential for the pollution of the River Nore and of groundwater. Post construction, fauna may return to the site and with the implementation of effective mitigation, potential exists for the fauna to increase long term utilisation of the site.

Impacts & Mitigation

Impacts

The proposed project will have potential negative impacts on the ecology. The road will bisect the floodplain causing habitat loss in designated areas. Bird populations may be disturbed during winter months.

Mitigation

The least disrupted route within the study area would curve around the northern end of the double tree line as it leaves the Castlecomer Road and run as close as possible to the Auteven Hospital boundary at its western end. The ecological impacts of a new bridge over the river could largely be mitigated by construction methods and timing.

The following mitigation measures will be required during the construction stage:

- Mitigation should be in place to reduce the movement of dust associated with site works to adjacent habitats.
- All surface waters from the site and access roads should be channelled through adequately sized petrol / oil interceptors and be subject to attenuation prior to discharge.
- Culverting and rerouting of waterways should be avoided and mammal passes should be incorporated into the roadway design process, where appropriate. Nationally important waterways should be bridged leaving a minimum 3m wide natural bank passes for mammal and connectivity between habitats.

- At all times the Nore River is to be kept unobstructed. All works on or near waterways must be conducted in conjunction with NRA guidelines.
- All waste oil, empty containers and other hazardous wastes are disposed of in conjunction with the requirement of the Waste Management Act 1996.

5.4 Archaeology

The Archaeological Constraints study has been prepared as part of an environmental assessment for the scheme. This constraints study has been carried out to ascertain the potential impact of the proposed development on the archaeological and historical landscape.

The Archaeological Constraints Study for the route options was carried out by Margaret Gowen & Co. Ltd. A separate report has been produced (March 2008) detailing the archaeological and historic background surrounding the proposed development site, which can be found in Appendix 4. The study included information from the Record of Monuments and Places (RMP), the topographical files of the National Museum of Ireland, Cartographic and documentary sources for the area, Legislation, Standards and Guidelines and a Field inspection of the area.

Results of Desktop Study

There are two recorded archaeological sites contained within the assessment area. These sites are displayed in drawing 07_088_033 of appendix 1.

	Site 1	Site 2
RMP No.	KK014-064	KK014-065
Townland	Loughmerns	Loughmerns
Site Type	Enclosure Site	Enclosure Site
NGR	24999/15904	25008/15884
Distance	RMP archaeological constraint area lies partial within the assessment area	Within the assessment area
Description	Marked on 1st edition OS map as a circular enclosure but no visible traces	Marked on 1st edition OS map as a circular enclosure surrounded by trees but no visible traces

Table 4.3 Archaeological / Cultural Heritage Constraints

5.5 Hydrology

Information on the hydrology of the study area was gathered from extensive Ordinance Survey contour mapping, consultation with the Office of Public Works (OPW) and Kilkenny County Council.

The Nore River has one of the largest catchments in Ireland with significant flood planes, each holding large volumes of water during flood periods. A major contributor to the Nore River is the tributary the River Dinan, this joins the Nore approximately 4.5km north of the proposed bridge crossing. The Dinan catchment is mostly mountainous resulting in flows of high veloCity coming down the mountains into the River Nore leading to high volumes of water flowing through Kilkenny City.

The proposed route is to bridge the River Nore with a single span, allowances for the river in flood conditions are to be made. The proposed route crosses approximately 500m of a flood plane to the River Nore. Allowances for flood alleviation through the flood plane in terms of box culverts and alleviation drains are incorporated into the long section design.

5.6 Planning & Land Ownership

Each of the route corridor options was assessed in terms of their impact on local residents living or working near to the proposed route corridor. These impacts were considered under the following categories: -

- Noise and Air Environment
- Severance of land holdings
- Community Facilities
- Number of Properties within the Route Corridor
- Planning Permission Granted within the Route Corridor

Noise and Air Environment, Severance

The potential nuisance for the residents of the properties located adjacent to the proposed route corridors are the traffic noise and vibration. Air quality is also a factor affecting the environment and those properties that may be located close to the proposed road. Any route corridor that lies in close proximity to the properties could be regarded as having negative impacts on the residents and amenities.

A land ownership search was carried out for the study area and landholdings were examined for each of the 8 routes.

Impacts on Current Planning Applications

There are 12 planning applications identified in the study area, i.e. from the N77 Castlecomer Road to the R693 Freshford Road and using the weir view housing estates and the Auteven Hospital as southern boundaries. All sites are displayed in drawing 07_088_034 of Appendix 1. None of the proposed route corridor traverses near to proposed developments.

Impact on Community Facilities

Bleach Road is a walk way marked as a “Slí na Sláinte” and used by local residents and Kilkenny City visitors. The proposed Northern Ring Road Extension will require facilities for pedestrians and cyclists to pass at the point of intersection with Bleach road.

5.7 Services & Utilities

Existing public utilities information has been gathered in this report and has been utilised to identify the crossings and diversions required.

No 110kV or 220kV lines cross any of the Route options. 2 No. overhead 10kV lines cross each of the route options, these cables will require under grounding in conjunction with the ESB prior to works proceeding.

All utilities and services crossed by the proposed route option would require diversion or protection depending on the final levels.

The introduction of the Northern Ring Road Extension will provide an opertunity for the introduction of services to unserviced lands and also to extend existing services towards western lands.

6 Route Selection

6.1 Engineering Assessment

The Engineering Assessment of route corridor options is based on the latest revision of National Road Authority Design Manual for Roads and Bridges (NRA DMRB) Documents. The aim of this assessment is to ensure the conformity of the route corridor options to the latest relevant engineering design standard.

The following are the subjects considered in this assessment:

- Design Standard and Criteria
- Junctions
- Bridge Structure
- Impact on Public Utilities

Design Standard and Criteria

The design standards adopted in this scheme are based on those set out within the NRA TD 9/07 “Road Link Design”, and NRA TD 27/07 “Cross Section and Headroom”. The design speed in developing the route corridor options is 85kph, with the cross-sectional dimensions and minimum geometric parameters are given in Table 6.0 and 6.1. The proposed road cross section is shown on 07_088_035 of Appendix A.

Road Type	Lane Width (m)	Hard Shoulder (m)	Footpath (m)	Cycleway (m)	Verge (m)	Total Width (m)
Wide Single Carriageway	2x5.0	2x2.5	2.0	1.75	5.0 & 1.5	25.25

Table 6.1 Cross Section Dimensions

Design Speed (km/h)	Horizontal Alignment – Desirable Minimum Standard	Vertical Alignment – Desirable Minimum Standard		
	Desirable Min Radius with superelevation of 5%	Desirable Minimum Crest K Value	Desirable Minimum Sag K Value	Max Grad. (%)
85	510	55	26	3

Table 6.2 Geometric Parameters

The horizontal alignments for most of the route options can be achieved within desirable minimum standards and without the need for any relaxations or departures, except Route Options 1, 2 and 7 at the junction with the Castlecomer Road Roundabout. Horizontal curves with a Design speed 50Kmph have been used when these route corridors join the Castlecomer Roundabout.

Vertical alignments for all route options can be achieved within the desirable minimum standards.

Junctions

The proposed route corridors adjoin one National route, one Regional Road and one County Road. These are:

- National road (NR) – N77 Castlecomer Road. Running from north to south, connecting junction N77/N78 and Kilkenny City.
- Regional road (RR) – R693 Freshford Road. Running from north to south, connecting Freshford and Kilkenny City.
- County road (LR) – Bleach Road. Running from north to south.

Junction treatment for the intersection between the Bleach Road and all of the proposed routes was assessed geometrically. Various junction types including T-junction, roundabout and grade separated were considered. Due to the acute approach angles of route options 1 & 3 to 8 to the Bleach Road it is not possible to form a roundabout. Each of these routes therefore would pass over the Bleach Road and be joined with a T-junction for local access only. With option 2 a roundabout junction is possible.

Grade separation is not proposed due to the visual impact of a 7m embankment across a floodplain.

The junction treatments for all routes at the N77 are the same. The exiting Kilkenny Ring Road roundabout on the Castlecomer Road will be the starting point for all routes.

A roundabout junction will be adopted between R693 Freshford Road and all of the route options. The location of the roundabout will depend on the chosen option and vary from a northern location for Route 6 to a southern option for Routes 2, 4, 5, 7 & 8.

Bridges

All route options require a bridge crossing over the Nore River. Table 6.2 below shows the bridge span required on different routes and the obstacles crossed by each route.

Route Corridor	Length (m)	Obstacle
Route 1	52	Nore River
Route 2	46	Nore River
Route 3	51	Nore River
Route 4	49	Nore River
Route 5	59	Nore River
Route 6	56	Nore River
Route 7	49	Nore River
Route 8	49	Nore River

Table 6.2 Bridge Required

Each route Option crosses the River Nore at a different point and at a different angle. The bridge lengths for Route options 2, 4, 7 and 8 Crossings are the shortest as compared to the other four crossing points. Thus, the route option in the order of preference would be Routes 2, 4, 7 and 8, sharing the same preference, followed by Routes 3, 1, 5 and 6

6.2 Environmental

The following Environmental aspects are the subjects considered in this assessment:

- Ecology
- Archaeology
- Impact on Residents
- Severance of Land Holdings

Ecology – Comparison of Route Options

Each route corridor was assessed based on the habitat types along the proposed route corridor and level of impact of the proposed route options on those habitats. The habitat types for each site taken into consideration are listed below.

- West of Old Railway - Tree lines, dry meadows and grassy verges
- Bleach Road – Flowing drains and hedgerows
- Eastern Bank of River Nore – Riparian zone, mixed small trees and some herb species
- Western Bank of River Nore – Riparian zone, scrubby fringe with some trees

The potential impacts then tabulated in table 6.3 below.

Proposed Route Option	Level of Impacts based on site name	
	West of Old Railway	Bleach Road
Route 1	Moderate	Moderate
Route 2	Moderate	Moderate
Route 3	Minor	Moderate
Route 4	Minor	Moderate
Route 5	Minor	Moderate
Route 6	Minor	Minor
Route 7	Moderate	Minor
Route 8	Minor	Minor

Table 6.3 Levels of Impacts of Route Options Based on Ecological Constraints

Impact Level	Route Corridor Options							
	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
Major Negative	0	0	0	0	0	0	0	0
Moderate Negative	2	2	1	1	1	0	1	0
Minor Negative	0	0	1	1	1	2	1	2
Neutral	0	0	0	0	0	0	0	0
Order of preference	7th	7th	3rd	3rd	3rd	1st	3rd	1st

Table 6.4 Summary comparisons of route options and their impacts on ecological sites

Route options 6 and 8 have the least amount of negative impacts on the ecological conditions; they affect minimal area of the SAC along the Bleach Road, they also have minimal ecological impact on the NHA and SAC areas west of old railway. Routes 6 and 8 are preferable options. Route 8 is recommended due to the minimum length and respectively minimum area of disturbance.

Summary of Ecological Constraints Study

The site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book plant species including three rare plants in the salt meadows and the population of the hard water form of the Pearl Mussel which is limited to a 10 km stretch of the Nore, add further interest to this site.

The most favourable route based on the ecological constraints evaluation is route option 8 as it would have the least amount of negative impacts on the ecology of the area. The bridge span will provide for avoidance of impact on the riparian zone on the east and west boundaries of the Nore River.

The potential impacts of the proposed development of Route 8 is “minor” with regards to the ecology of the area.

It is important to note that further botanical and specialist mammal surveys would be required to verify the findings of the preliminary field survey and substantiate the extent of mammal activity within the proposed land take of the preferred route option.

Any mitigation measures adopted during the construction phase should be subject to ongoing monitoring during all phases of activity to determine their effectiveness.

Archaeology – Comparison of Route Options

Each route corridor was assessed based on its impacts on the Protected Structure or the site of archaeological interest. There are four levels of impacts used to identify the degree of impacts on the protected structure; they are Major Risk, Moderate Risk, Minor Risk, and Neutral. The degree of impacts is based on the proximity of the proposed development to the Protected Structure or the site of archaeological interest.
The impacts are tabulated in table 6.5 below.

Proposed Route Option	Level of Impacts based on site name		
	KK014-064	KK014-065	Other Site
Route 1	Neutral	Major	Minor
Route 2	Neutral	Major	Neutral
Route 3	Neutral	Neutral	Minor
Route 4	Neutral	Neutral	Neutral
Route 5	Neutral	Neutral	Neutral
Route 6	Neutral	Minor	Minor
Route 7	Neutral	Minor	Neutral
Route 8	Neutral	Minor	Neutral

Table 6.5 Levels of Impacts of Route Options Based on Archaeological Constraints

Proposed Route Option	Route Corridor Options				
	Major Negative	Moderate Negative	Minor Negative	Neutral	Order of preference
Route 1	1	0	1	1	8
Route 2	1	0	0	2	7
Route 3	0	0	1	2	6
Route 4	0	0	0	3	2
Route 5	0	0	0	3	1
Route 6	0	0	2	1	5
Route 7	0	0	1	2	4
Route 8	0	0	1	2	3

Table 6.6 Summary comparisons of route options based on the impacts on RMP / Protected Structure sites

The order of preference for route corridor is based on the proximity of the route corridor to the recorded archaeological site. Route options 5, 4, and 8 have the least negative impacts on the recorded archaeological site. They traverse away from most of the RMP / Protected Structure Site. Routes 1 and 2 are the less favourable routes due to their proximity to the recorded RMP site. Preferable route 8 is located within a safe distance from all known areas of archaeological interest, therefore represents minimum possibility of the impact.

Summary of Archaeological Constraints Study

Routes 1 and 2 pass through the recorded archaeological sites, all other routes avoid the sites. However, the route corridors that lie in close proximity to the recorded archaeological sites have been identified due to a potential increased risk that they might encounter unrecorded archaeological features.

Riverline environments are regarded as highly sensitive and are considered to have an intrinsically significant archaeological potential unless proved otherwise by archaeological investigation.

Any river crossing design proposals should be cognisant of the archaeological potential of both riverbanks / environs of the river and of the river bed itself. There may be a requirement for an underwater archaeological appraisal of the riverbanks and the river itself and in some locations; exploratory excavation may have to be considered.

A field inspection was carried out on the present topography and land use within the assessment area to identify any potential archaeological or historical features.

Five areas of archaeological potential have been identified, these are: River bank and environs potential, River bed potential, Milling activity, Wetland areas, Greenfield areas.

Impact on Residents

Each route corridor was assessed based on its impacts on the adjacent properties. All buildings within the 100m receptor of each route option are identified and put into 2 bands. The receptor in each band then multiplied with a rating factor, i.e. rating 2 for band 1 and rating 1 for band 2.

Route Corridor	0 - 50m (Band 1)	50 – 100m (Band 2)	Total
Route 1	0	4	4
Route 2	0	3	3
Route 3	3	1	4
Route 4	3	2	5
Route 5	3	2	5
Route 6	3	1	4
Route 7	0	4	4
Route 8	0	4	4

Table 6.7 Number of Houses Affected Within the Receptors

Comparison of Route Options

Each route corridor was assessed based on its impacts on existing parkland, amenities & local residents and land holdings. Rating will be given to each type of impact based on the level of impacts. Rating 3 is for severe impacts, 2 for moderate impacts and 1 for minor impacts. The lower cumulative rating reflects less impacts and represents the preferable route corridor.

Types of Impact	Route Corridor Options							
	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
Amenities & Local Residents	4	3	4	5	5	4	4	4
Planning Applications	0	0	0	0	0	0	0	0
Community Facilities	1	1	1	1	1	1	1	1
Total	5	4	5	6	6	5	5	5
Order of preference	2nd	1st	2nd	8th	8th	2nd	2nd	2nd

Table 6.8 Summary comparisons of route options based on the Impacts on Amenities, Local Residents and Landholding

Route options 1, 7 and 8 have the least negative impacts on local residents and amenities. Route 8 is the preferable option due to least severity of the impact to the local residents.

6.3 Economic

All the route corridors considered in this report generally traverse across a flat terrain. Earth embankments will be required along the route corridor from the N77 to the River Nore due to low ground levels through the flood plane.

Thus, a general 45m-wide road reservation is proposed for all of the route corridors. The estimated land take for each route corridor is tabulated below:

Route Option 1 (Red)	=	6.88 Hectares
Route Option 2 (Yellow)	=	6.97 Hectares
Route Option 3 (Blue)	=	6.71 Hectares
Route Option 4 (Cyan)	=	6.68 Hectares
Route Option 5 (Green)	=	6.62 Hectares
Route Option 6 (Magenta)	=	6.75 Hectares
Route Option 7 (Orange)	=	6.72 Hectares
Route Option 8 (Black)	=	6.36 Hectares

The land search results show that all route options considered traverse on approximately 100% private owned lands. The route corridor that requires less land take would be favourable compared with those that require more land take.

Cost estimates for the Northern Ring Road Extension – Castlecomer to Freshford Road for each route corridor are outlined in this section. The cost for the mainline road works and all associated costs are separated from the cost for the bridge. However, the estimated total cost in this section has excluded the land acquisition cost.

Mainline Road Works Cost Estimates

The unit costs for road works used in this chapter are based on the Road Works Unit Rate Database (Version 2 – Base date May 2007) publish by the NRA and also indicative costs from past tendering records. The cost estimates for each road option is tabulated in table 6.9 below.

Route Option	Estimated Length of Road	Mainline Road Works Cost Estimates (Excluding VAT)
Route 1 (Red)	1.53km	€ 7.485 million
Route 2 (Yellow)	1.55km	€ 7.725 million
Route 3 (Blue)	1.49km	€ 7.305 million
Route 4 (Cyan)	1.49km	€ 7.305 million
Route 5 (Green)	1.47km	€ 7.215 million
Route 6 (Magenta)	1.50km	€ 7.35 million
Route 7 (Orange)	1.49km	€ 7.305 million
Route 8 (Black)	1.48km	€ 7.26 million

Table 6.9: Summary of Mainline Road Works Cost Estimates

Bridge Works Cost Estimates

Cost estimates for the bridge crossing the Nore River are estimated at € 3,500 per square meter. The bridge construction cost for each road options are tabulated in table 6.10 below;

Route Option	Bridge Crossing Nore River Valley
Route 1 (Red)	€ 3.64 million
Route 2 (Yellow)	€ 3.22 million
Route 3 (Blue)	€ 3.57 million
Route 4 (Cyan)	€ 3.43 million
Route 5 (Green)	€ 4.13 million
Route 6 (Magenta)	€ 3.92 million
Route 7 (Orange)	€ 3.43 million
Route 8 (Black)	€ 3.43 million

Table 6.10: Summary of Bridge Works Cost Estimates

Summary of Cost Estimates

The overall cost estimated for each route option is summarised in table 6.11 below. Based on the cost estimates, Route 8 is the least expensive option.

Route Option	Estimated Mainline Works Construction Cost	Estimated Bridge Works Construction Cost	Total Estimated Cost
Route 1 (Red)	€ 7.485 million	€ 3.64 million	€ 11.125 million
Route 2 (Yellow)	€ 7.725 million	€ 3.22 million	€ 10.945 million
Route 3 (Greem)	€ 7.305 million	€ 3.57 million	€ 10.875 million
Route 4 (Cyan)	€ 7.305 million	€ 3.43 million	€ 10.735 million
Route 5 (Blue)	€ 7.215 million	€ 4.13 million	€ 11.345 million
Route 6 (Magenta)	€ 7.35 million	€ 3.92 million	€ 11.27 million
Route 7 (Orange)	€ 7.305 million	€ 3.43 million	€ 10.735 million
Route 8 (Black)	€ 7.26 million	€ 3.43 million	€ 10.69 million

Table 6.11: Summary of Cost Estimates for Each Route Option

7 Preferred Route Corridor Selection

Road Selection Matrix

Based on the assessment carried out in chapters 5 and 6 above, a road selection matrix has been established and tabulated in table 7.0 below. This table has highlighted and summarised the order of preference for each of the route option considered in every category. A rating of A to H was used to differentiate the order of preference, with rating A given to the preferable route option while rating H was given to most undesirable road option. Same ratings might be given to different route options if their orders of preference are the same.

Issue	Route Opt 1	Route Opt 2	Route Opt 3	Route Opt 4	Route Opt 5	Route Opt 6	Route Opt 7	Route Opt 8
Environmental								
Ecological Constraints	C	B	B	B	B	A	B	A
Archaeological Constraints	H	H	B	A	A	A	A	A
Amenities, Residents and Landholding	B	A	B	C	C	B	B	B
Engineering								
Design Standard and Criteria	B	B	A	A	A	A	B	A
Junctions	B	B	A	A	A	A	B	A
Bridge Crossing Nore River	B	A	D	A	C	D	A	A
Economic								
Estimated Land Take (Hectares)	6.88	6.97	6.71	6.68	6.62	6.75	6.72	6.36
Estimated Construction Cost (million)	€ 11.125	€ 10.945	€ 10.875	€ 10.735	€ 11.345	€ 11.27	€ 10.735	€ 10.69

Table 7.0: Route Selection Matrix

8 Conslusions

The following conclusions are a summary of the main points of the preceding report:

Currently there are substantial traffic volumes passing through Kilkenny City, including Heavy Goods Vehicles. Significant congestion occurs on a regular basis impacting on the quality of life and environmental amenity of the town centre. Future traffic growth will increase traffic flow on the streets, leading to further congestion over longer periods.

As an improvement solution Kilkenny County Council has identified the proposed link between the N77 Castlecomber road and the R693 Freshford road in their Kilkenny Development Plan 2008 – 2014.

The Northern Ring Road Extension will provide a northern link over the Nore River connecting the N77 Ring Road Extension to the Central Access Scheme, via the Freshford Road. The proposed scheme is a specific objective of the Development Plan and it will facilitate the development of Kilkenny City and Environs in its role as a Hub town.

The projected traffic demand for the proposed Kilkenny Northern Ring Road is an AADT of 12,480 in year of opening 2011 and 23,492 in design year 2026. The projected peak hourly flows on Green's Bridge and John's bridge in the "do nothing" scenario for 2011 and 2026 are substantially above available capaCity and will lead to substantial congestion. The provision of the Northern Ring Road Extension will substantially reduce congestion on these bridges and in Kilkenny City generally and coupled with the Central Access Scheme will provide an excellent opportunity for improved quality of life, improved environmental amenity and enhance economic activity in the City.

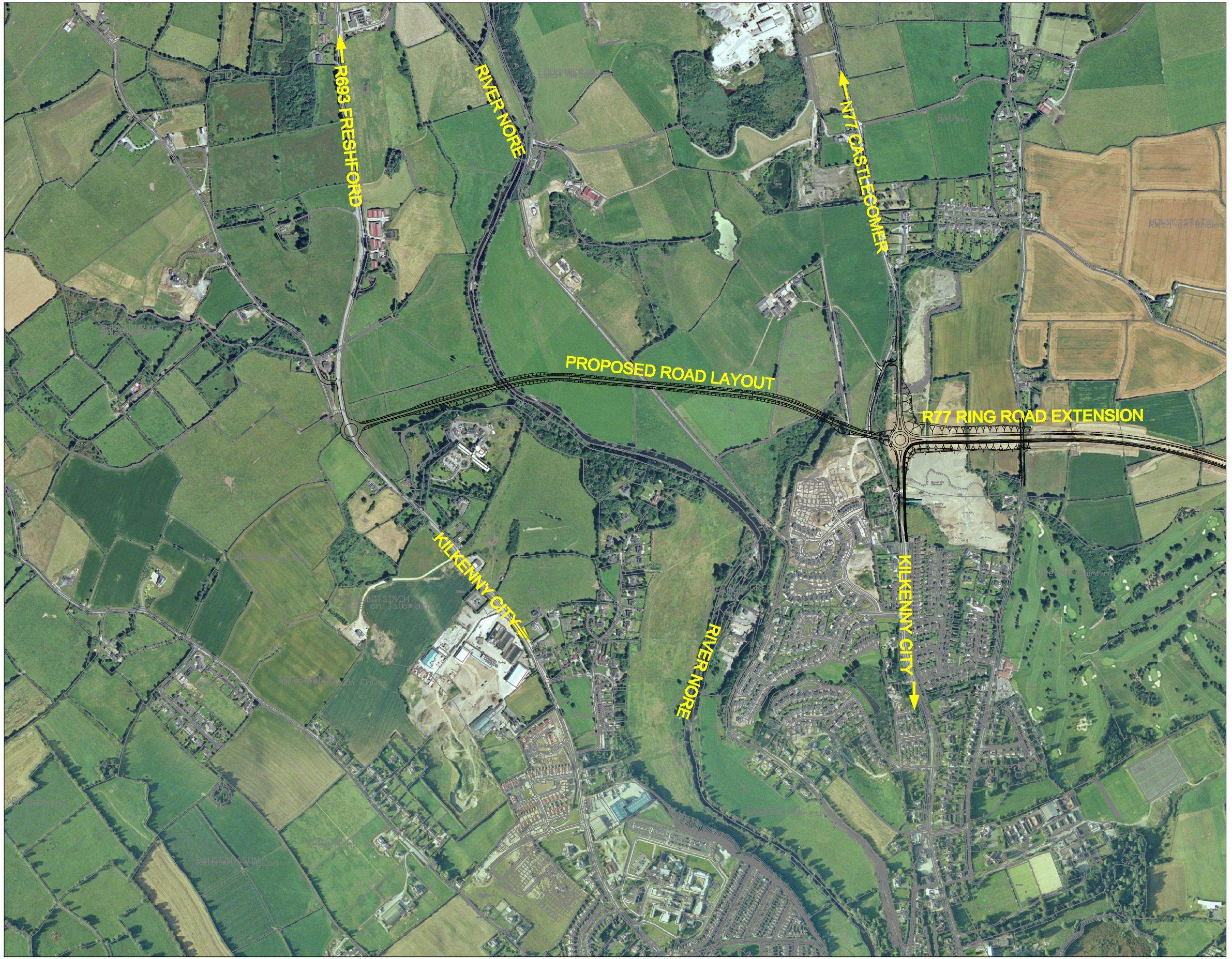
A wide single carriageway for rural all purpose roads, in accordance with the NRA Design Manual for Roads and Bridges (DMRB), has been selected following a traffic analysis.

Efforts have been made to mitigate against any adverse environmental effects, in particular in relation to water, archaeology, ecology, noise level, air quality and visual impact. Relevant specialists were engaged to report on a number of these issues, and any mitigation measures recommended have been taken into the design.

Eight different route options were investigated taking account of environmental impact, archaeological constraints, Impacts on Amenities, Residents and Landholding Assessment. Engineering assessment and cost estimation of each route have been carried out.

Route No. 8 is recommended as it is the most cost effective option with the least negative impact on the environment.

Appendix 1 Drawings



PLAN OF PROPOSED ROAD (SCALE 1:2000)

COMHAIRLE CONTAE CILL CHAINNIGH
KILKENNY COUNTY COUNCIL

N

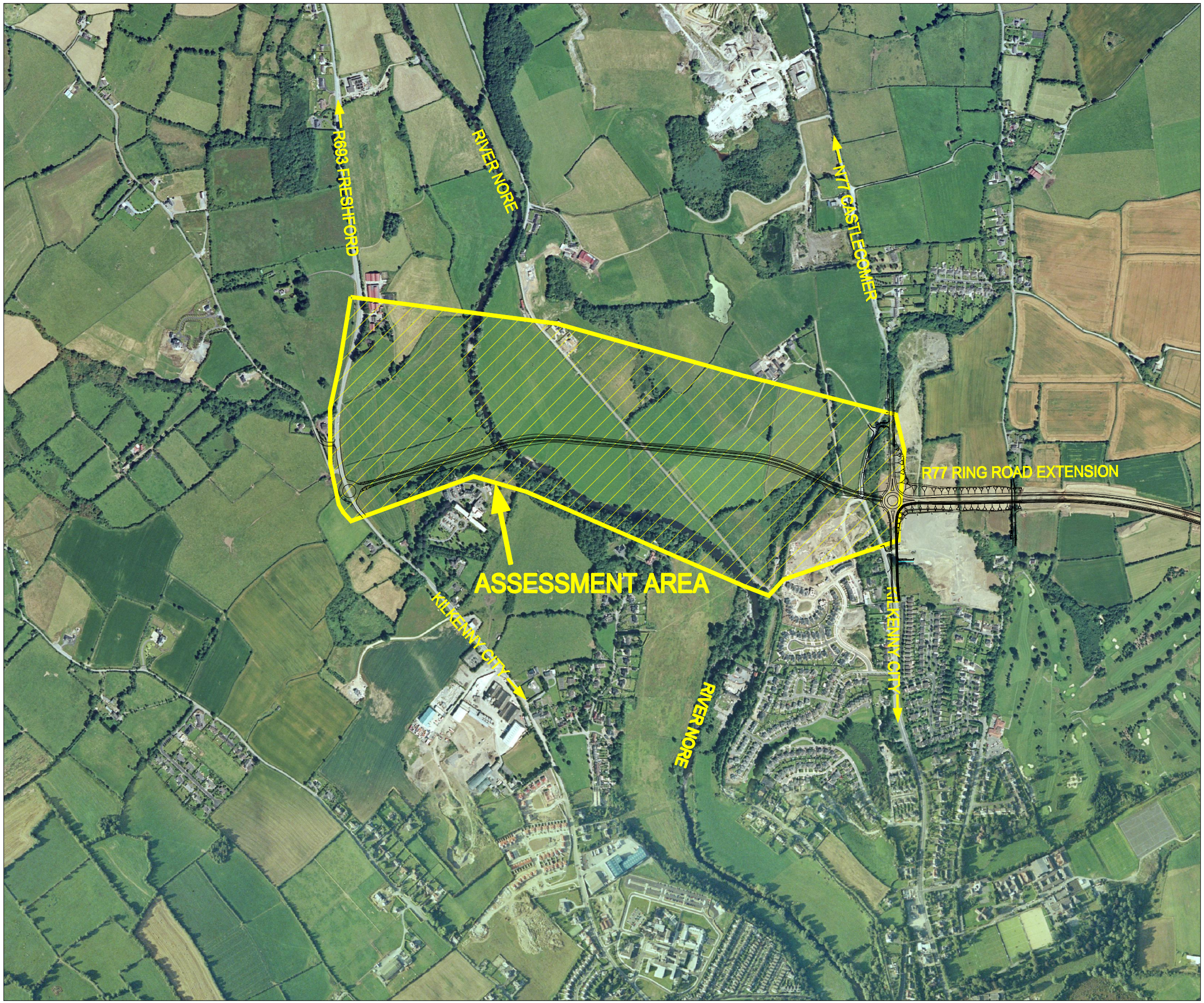
CLIFTON SCANNELL EMERSON ASSOCIATES

Drawing Status: CONSTRAINTS REPORT
Date: OCT 08
Issued By: RG

Revision	Description	Initials	Date

CLIFTON SCANNELL EMERSON ASSOCIATES
Consulting Engineers

Architect: KILKENNY COUNTY COUNCIL
Client: KILKENNY COUNTY COUNCIL
Project: THE NORTHERN RING ROAD EXTENSION
Dwg. Title: OVERALL LAYOUT
Drawn By: PW Date: OCT 08
Checked by: RG Scale: 1:2000
Dwg. No.: 07_088_030



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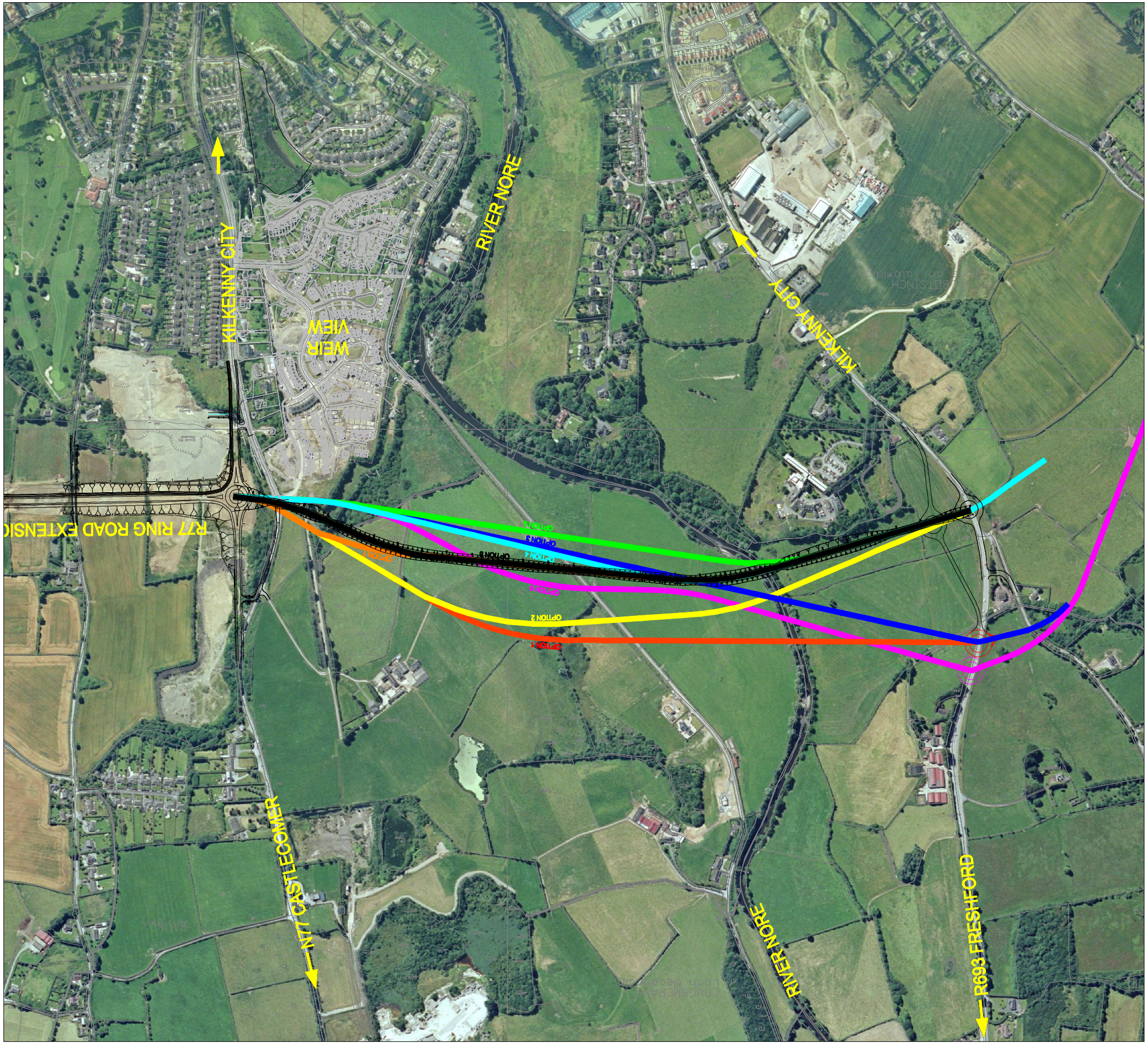
Project: THE NORTHERN RING ROAD EXTENSION
Dwg. Title: INITIAL STUDY AREA
-
Drawn By: CAB Date: OCT 08
Checked by: GE Scale: 1:2000
Dwg. No.: 07_088_031



LEGEND:

- OPTION 1
- OPTION 2
- OPTION 3
- OPTION 4
- OPTION 5
- OPTION 6
- OPTION 7
- OPTION 8

N

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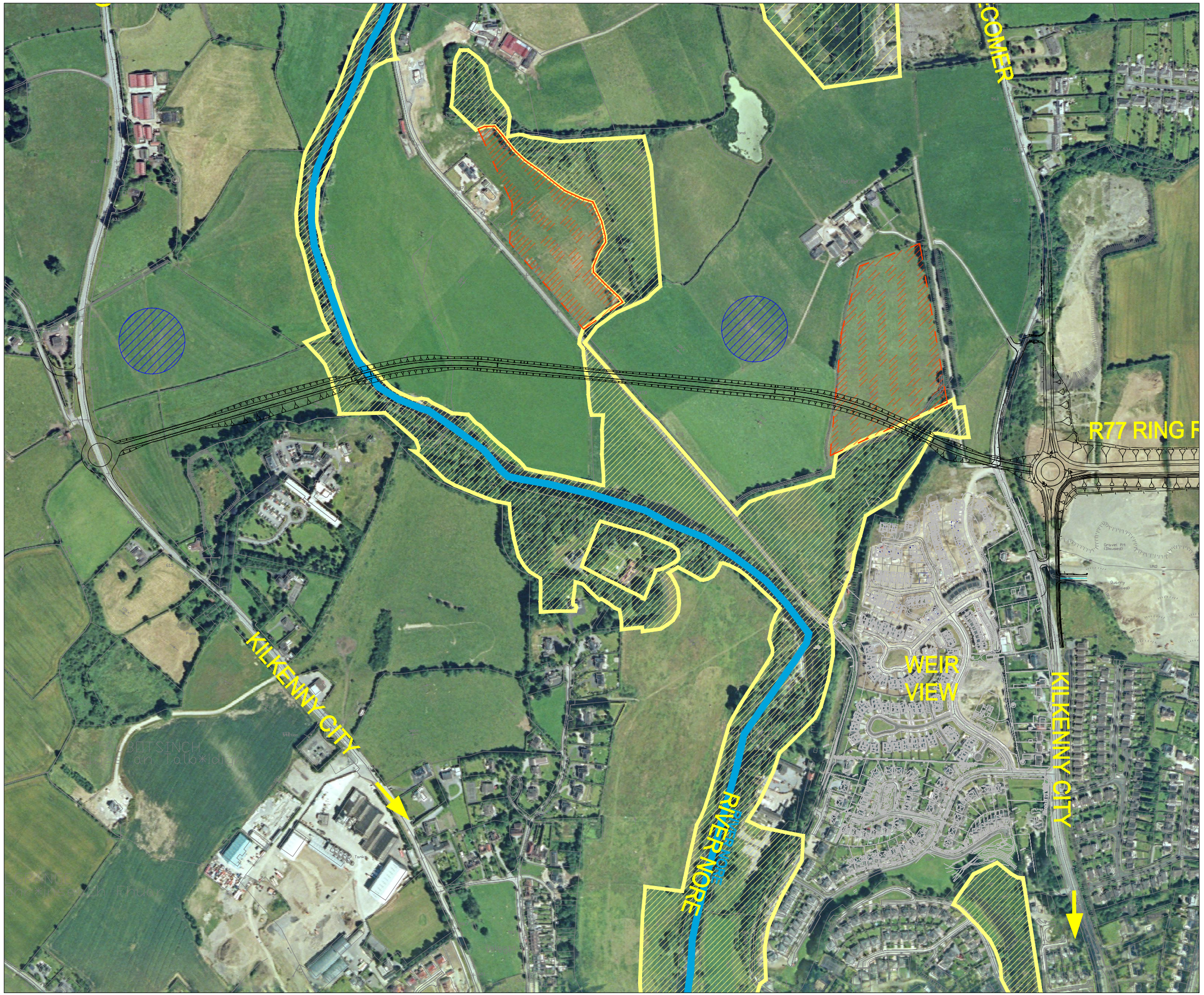
Project: THE NORTHERN RING ROAD EXTENSION
PROPOSED

Drg. Title: ROUTE OPTIONS

Drawn By: PW Date: AUG 06

Checked by: RG Scale: 1:2500

Drg. No. 07_088_032



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KILKENNY COUNTY COUNCIL

LEGEND

SPECIAL AREA OF CONSERVATION

NATURAL AREA OF CONSERVATION

POTENTIAL ARCHAEOLOGICAL SITE

N

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Drawing Status: CONSTRAINTS REPORT

Date: OCT 08

Issued By: RG

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Project: THE NORTHERN RING ROAD EXTENSION

Dwg. Title: CONSTRAINTS MAP

Drawn By: PW Date: AUG 08

Checked by: RG Scale: NTS

Dwg. No.: 07_088_033

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KILKENNY CITY

R77 RING RC

N77 CASTLECOMER

RIV

WEIR VIEW

KILKENNY CITY

MORE

00617

04974

97756

98964

07463 1

98933

91321

0451 9

08271

97103 9

02132

05116

98632

02174 3

07300

03152 8

05289

03301

05181

02151 3

97664

05129 5

04118 7

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40 70

07104 3

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965 3

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Date OCT 06

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Architect
-
-

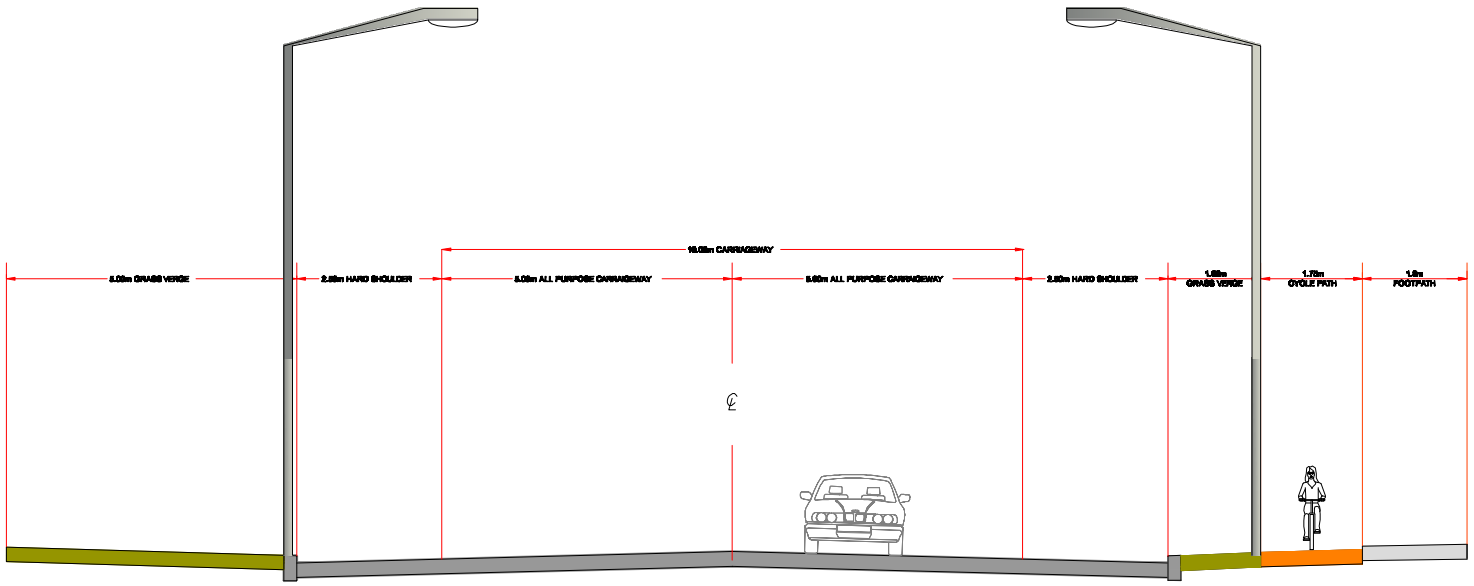
Client
Kilkenny County Council

Project
Kilkenny Relief Road
Castlecomer Rd to Freshford Rd

Dwg. Title
EXISTING PLANNING APPLICATIONS

Drawn By	PW	Date	OCT 06
Checked by	RG	Scale	NTS

Dwg. No.
07_088_034



KILKENNY NORTHERN RING ROAD EXTENSION
TYPICAL ROAD CROSS SECTION

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KILKENNY COUNTY COUNCIL

CLIFTON SCANNELL EMERSON ASSOCIATES

Drawing Status: CONSTRAINTS REPORT
Date: OCT 08
Issued By: RG

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Date: OCT 08
Checked by: RG
Scale: 1:10
Dwg. No.: 07_088_035

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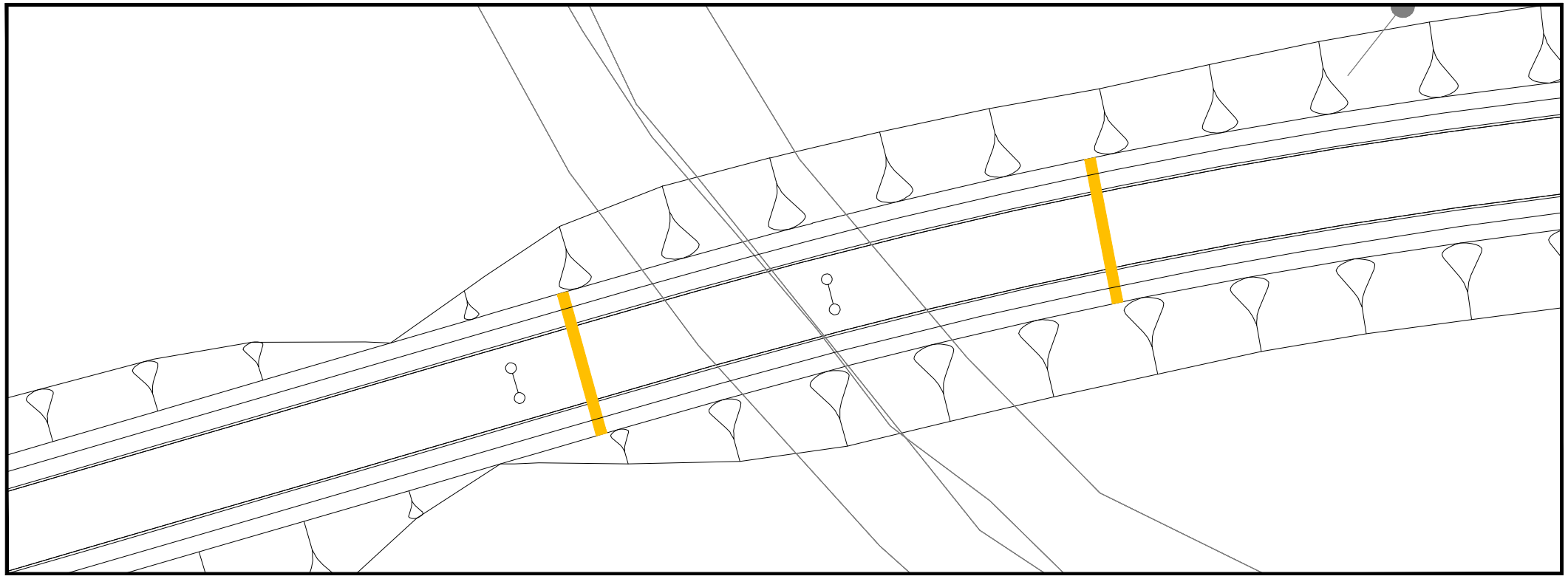
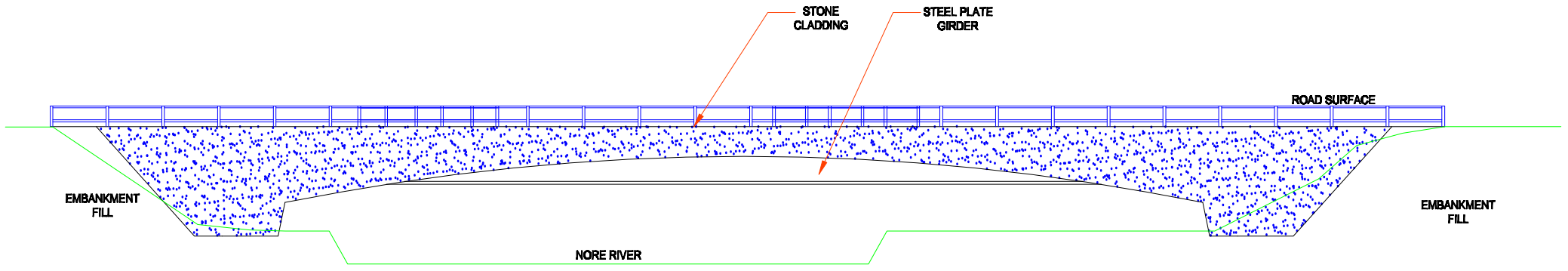


PLAN OF PROPOSED BRIDGE (SCALE 1:250)



PROPOSED BRIDGE ELEVATION (SCALE 1:100)

Drawing Status: CONSTRAINTS REPORT
Date: OCT 08
Issued By: RG

CLIFTON SCANNELL EMERSON ASSOCIATES

Revision	Description	Initials	Date

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Project: THE NORTHERN RING ROAD EXTENSION

Dwg. Title: PROPOSED BRIDGE ELEVATION

Drawn By: PW Date: OCT 08

Checked by: RG Scale: 1:100

Dwg. No. 07_088_036

Appendix 2 Traffic Information

Northern Ring Road Extension - Traffic Counts with Central Access Scheme Constructed Year of Opening 2011

2011 Do Nothing		AM Peak				PM Peak				AADT's			
Location	**Direction**	**UC1 Flow**	**UC2 Flow**	**Total**	**%HGV**	**UC1 Flow**	**UC2 Flow**	**Total**	**%HGV**	**UC1 Flow**	**UC2 Flow**	**Total**	**%HGV**
Green's Bridge	west	447.4	1.415	448.82	0.32%	730.9	5.865	736.77	0.80%				
Green's Bridge	east	537.81	23.16	560.97	4.13%	579.78	4.065	583.85	0.70%				
	2 way	**985.21**	**24.58**	**1009.79**	**4.44%**	**1310.68**	**9.93**	**1320.61**	**1.49%**	**14409**	**205**	**14614**	**1.40%**
Central Access Scheme Crossing	**west**	629.11	2.01	631.12	0.32%	818	14.44	832.44	1.73%				
Central Access Scheme Crossing	**east**	558.41	12.73	571.14	2.23%	575.72	0.055	575.78	0.01%				
	2 way	**1187.52**	**14.74**	**1202.26**	**2.55%**	**1393.72**	**14.50**	**1408.22**	**1.74%**	**17068**	**158**	**17226**	**0.92%**
John's Bridge	west	401.66	20.705	422.37	4.90%	732.68	5.17	737.85	0.70%				
John's Bridge	east	774.26	33.825	808.09	4.19%	851.62	10.185	861.81	1.18%				
	2 way	**1175.92**	**54.53**	**1230.45**	**9.09%**	**1584.30**	**15.36**	**1599.66**	**1.88%**	**17758**	**369**	**18127**	**2.04%**
ORR Crossing	west	1133.6	65.52	1199.12	5.46%	1513.38	24.355	1537.74	1.58%				
ORR Crossing	east	1088.12	58.06	1146.18	5.07%	1091.23	50.525	1141.76	4.43%				
	2 way	**2221.72**	**123.58**	**2345.30**	**10.53%**	**2604.61**	**74.88**	**2679.49**	**6.01%**	**31856**	**994**	**32849**	**3.02%**
Castlecomer Road south of new North Crossing	north	206.82	17.4	224.22	7.76%	410.94	2.975	413.92	0.72%				
Castlecomer Road south of new North Crossing	south	304.6	1.415	306.02	0.46%	422.07	10.695	432.77	2.47%				
	2 way	**511.42**	**18.82**	**530.24**	**8.22%**	**833.01**	**13.67**	**846.68**	**3.19%**	**9363**	**183**	**9546**	**1.92%**
Castlecomer Road north of new North Crossing	north	383.53	38.38	421.91	9.10%	688.06	36.265	724.33	5.01%				
Castlecomer Road north of new North Crossing	south	637.71	45.4	683.11	6.65%	709.48	40.005	749.49	5.34%				
	2 way	**1021.24**	**83.78**	**1105.02**	**15.74%**	**1397.54**	**76.27**	**1473.81**	**10.34%**	**15789**	**873**	**16663**	**5.24%**
Freshford Road south of new North Crossing	north	180.45	6.595	187.05	3.53%	373.83	2.815	376.65	0.75%				
Freshford Road south of new North Crossing	south	361.19	2.78	363.97	0.76%	165.83	11.76	177.59	6.62%				
	2 way	**541.64**	**9.38**	**551.02**	**4.29%**	**539.66**	**14.58**	**554.24**	**7.37%**	**7163**	**251**	**7414**	**3.38%**
Freshford Road north of new North Crossing	north	186	7	193.00	3.63%	381	3	384.00	0.78%				
Freshford Road north of new North Crossing	south	366	2	368.00	0.54%	171	12	183.00	6.56%				
	2 way	**552.00**	**9.00**	**561.00**	**4.17%**	**552.00**	**15.00**	**567.00**	**7.34%**	**7312**	**250**	**7563**	**3.31%**
ORR between Dublin Road & Hebron Road	north	646.21	51.15	697.36	7.33%	898.44	38.36	936.80	4.09%				
ORR between Dublin Road & Hebron Road	south	719.34	44.81	764.15	5.86%	914.55	33.285	947.84	3.51%				
	2 way	**1365.55**	**95.96**	**1461.51**	**13.20%**	**1812.99**	**71.65**	**1884.64**	**7.61%**	**21457**	**875**	**22332**	**3.92%**
ORR between Hebron Road & Johnswell Road	north	233.52	33.33	266.85	12.49%	647.08	40.095	687.18	5.83%				
ORR between Hebron Road & Johnswell Road	south	576.42	44.165	620.59	7.12%	574.17	28.815	602.99	4.78%				
	2 way	**809.94**	**77.50**	**887.44**	**19.61%**	**1221.25**	**68.91**	**1290.16**	**10.61%**	**13337**	**769**	**14106**	**5.45%**
ORR between Johnswell Road & New Orchard Road	north	174.31	20.98	195.29	10.74%	326.23	33.285	359.52	9.26%				
ORR between Johnswell Road & New Orchard Road	south	379.01	43.98	422.99	10.40%	362.96	29.075	392.04	7.42%				
	2 way	**553.32**	**64.96**	**618.28**	**21.14%**	**689.19**	**62.36**	**751.55**	**16.67%**	**8048**	**689**	**8738**	**7.89%**
ORR between New Orchard Road & Glendine Road	west	218.08	20.98	239.06	8.78%	365.61	33.285	398.90	8.34%				
ORR between New Orchard Road & Glendine Road	east	381.61	43.98	425.59	10.33%	376.57	29.31	405.88	7.22%				
	2 way	**599.69**	**64.96**	**664.65**	**19.11%**	**742.18**	**62.60**	**804.78**	**15.57%**	**8647**	**690**	**9338**	**7.39%**
ORR between Glendine Road & Castlecomer Road	west	202.17	20.98	223.15	9.40%	333.06	33.285	366.35	9.09%				
ORR between Glendine Road & Castlecomer Road	east	358.56	43.98	402.54	10.93%	343.35	29.31	372.66	7.87%				
	2 way	**560.73**	**64.96**	**625.69**	**20.33%**	**676.41**	**62.60**	**739.01**	**16.95%**	**7880**	**690**	**8571**	**8.06%**

Northern Ring Road Extension - Traffic Counts with Central Access Scheme Constructed Year of Opening 2011

2011 Do Something		AM Peak				PM Peak				AADT's			
Location	Direction	UC1 Flow	UC2 Flow	Total	%HGV	UC1 Flow	UC2 Flow	Total	%HGV	UC1 Flow	UC2 Flow	Total	%HGV
Green's Bridge	west	280.49	0.665	281.16	0.24%	431.41	5.06	436.47	1.16%				
Green's Bridge	east	441.16	18.49	459.65	4.02%	563.84	1.095	564.94	0.19%				
	2 way	**721.65**	**19.16**	**740.81**	**4.26%**	**995.25**	**6.16**	**1001.41**	**1.35%**	**10576**	**122**	**10698**	**1.14%**
Central Access Scheme Crossing	west	572.79	2.01	574.80	0.35%	700.78	14.485	715.27	2.03%				
Central Access Scheme Crossing	east	418.36	11.74	430.10	2.73%	377.02	0.04	377.06	0.01%				
	2 way	**991.15**	**13.75**	**1004.90**	**3.08%**	**1077.80**	**14.53**	**1092.33**	**2.04%**	**13976**	**142**	**14118**	**1.01%**
John's Bridge	west	390.03	23.105	413.14	5.59%	640.95	2.83	643.78	0.44%				
John's Bridge	east	760.37	23.125	783.50	2.95%	844.48	7.965	852.45	0.93%				
	2 way	**1150.40**	**46.23**	**1196.63**	**8.54%**	**1485.43**	**10.80**	**1496.23**	**1.37%**	**17076**	**292**	**17368**	**1.68%**
ORR Crossing	west	1136.21	62.595	1198.81	5.22%	1502.56	26.07	1528.63	1.71%				
ORR Crossing	east	1091.57	56.15	1147.72	4.89%	1067.4	51.56	1118.96	4.61%				
	2 way	**2227.78**	**118.75**	**2346.53**	**10.11%**	**2569.96**	**77.63**	**2647.59**	**6.31%**	**31730**	**974**	**32704**	**2.98%**
Castlecomer Road south of new North Crossing	north	198.91	3.795	202.71	1.87%	476.47	1.18	477.65	0.25%				
Castlecomer Road south of new North Crossing	south	321.11	0.37	321.48	0.12%	269.17	10.7	279.87	3.82%				
	2 way	**520.02**	**4.17**	**524.19**	**1.99%**	**745.64**	**11.88**	**757.52**	**4.07%**	**8400**	**99**	**8500**	**1.17%**
Castlecomer Road north of new North Crossing	north	384.82	37.34	422.16	8.84%	687.96	35.98	723.94	4.97%				
Castlecomer Road north of new North Crossing	south	640.62	45.495	686.12	6.63%	720.16	40.285	760.45	5.30%				
	2 way	**1025.44**	**82.84**	**1108.28**	**15.48%**	**1408.12**	**76.27**	**1484.39**	**10.27%**	**15858**	**878**	**16736**	**5.25%**
Freshford Road south of new North Crossing	north	278.95	23.28	302.23	7.70%	464.32	4.57	468.89	0.97%				
Freshford Road south of new North Crossing	south	464.12	3.055	467.18	0.65%	568.92	11.935	580.86	2.05%				
	2 way	**743.07**	**26.34**	**769.41**	**8.36%**	**1033.24**	**16.51**	**1049.75**	**3.03%**	**11441**	**293**	**11733**	**2.50%**
Freshford Road north of new North Crossing	north	184	8	192.00	4.17%	381	3	384.00	0.78%				
Freshford Road north of new North Crossing	south	363	2	365.00	0.55%	161	11	172.00	6.40%				
	2 way	**547.00**	**10.00**	**557.00**	**4.71%**	**542.00**	**14.00**	**556.00**	**7.18%**	**7243**	**241**	**7485**	**3.23%**
ORR between Dublin Road & Hebron Road	north	670.44	49.915	720.36	6.93%	951.53	40.075	991.61	4.04%				
ORR between Dublin Road & Hebron Road	south	720.55	43.045	763.60	5.64%	911.32	33.685	945.01	3.56%				
	2 way	**1390.99**	**92.96**	**1483.95**	**12.57%**	**1862.85**	**73.76**	**1936.61**	**7.61%**	**21768**	**891**	**22658**	**3.93%**
ORR between Hebron Road & Johnswell Road	north	316.11	32.765	348.88	9.39%	709.41	40.41	749.82	5.39%				
ORR between Hebron Road & Johnswell Road	south	611.42	47.34	658.76	7.19%	536.02	29.165	565.19	5.16%				
	2 way	**927.53**	**80.11**	**1007.64**	**16.58%**	**1245.43**	**69.58**	**1315.01**	**10.55%**	**14186**	**836**	**15022**	**5.56%**
ORR between Johnswell Road & New Orchard Road	north	267.25	20.415	287.67	7.10%	428.99	33.625	462.62	7.27%				
ORR between Johnswell Road & New Orchard Road	south	423.7	47.27	470.97	10.04%	344.05	29.42	373.47	7.88%				
	2 way	**690.95**	**67.69**	**758.64**	**17.13%**	**773.04**	**63.05**	**836.09**	**15.15%**	**9305**	**756**	**10061**	**7.52%**
ORR between New Orchard Road & Glendine Road	west	319.71	20.415	340.13	6.00%	456.44	33.625	490.07	6.86%				
ORR between New Orchard Road & Glendine Road	east	448.45	47.27	495.72	9.54%	381.02	29.425	410.45	7.17%				
	2 way	**768.16**	**67.69**	**835.85**	**15.54%**	**837.46**	**63.05**	**900.51**	**14.03%**	**10125**	**756**	**10881**	**6.95%**
ORR between Glendine Road & Castlecomer Road	west	303.76	20.415	324.18	6.30%	431.82	33.625	465.45	7.22%				
ORR between Glendine Road & Castlecomer Road	east	431.31	47.27	478.58	9.88%	347.94	29.425	377.37	7.80%				
	2 way	**735.07**	**67.69**	**802.76**	**16.17%**	**779.76**	**63.05**	**842.81**	**15.02%**	**9448**	**756**	**10205**	**7.41%**
New North Crossing	west	313.44	2.215	315.66	0.70%	636.41	3.385	639.80	0.53%				
New North Crossing	east	307.38	17.49	324.87	5.38%	313.03	4.4	317.43	1.39%				
	2 way	**620.82**	**19.71**	**640.53**	**6.09%**	**949.44**	**7.79**	**957.23**	**1.92%**	**10323.98**	**214.37**	**10538.35**	**2.03%**

Northern Ring Road Extension - Traffic Counts with Central Assecc Scheme NOT Constructed Year of Opening 2011

2011 Do Nothing		AM Peak				PM Peak				AADT's			
Location	Direction	UC1 Flow	UC2 Flow	Total	%HGV	UC1 Flow	UC2 Flow	Total	%HGV	UC1 Flow	UC2 Flow	Total	%HGV
Green's Bridge	west	792.38	2.445	794.83	0.31%	848.78	17.795	866.58	2.05%				
Green's Bridge	east	745.34	35.89	781.23	4.59%	807.65	2.22	809.87	0.27%				
	2 way	1537.72	38.34	1576.06	4.90%	1656.43	20.02	1676.45	2.33%	20762	315	21077	1.50%
John's Bridge	west	573.83	19.265	593.10	3.25%	982.62	4.55	987.17	0.46%				
John's Bridge	east	1010.98	27.67	1038.65	2.66%	1049.1	9.13	1058.23	0.86%				
	2 way	1584.81	46.94	1631.75	5.91%	2031.72	13.68	2045.40	1.32%	23961	326	24287	1.34%
ORR Crossing	west	1231.49	67.285	1298.78	5.18%	1685.69	16.995	1702.69	1.00%				
ORR Crossing	east	1139.78	59.2	1198.98	4.94%	1162.6	50.77	1213.37	4.18%				
	2 way	2371.27	126.49	2497.76	10.12%	2848.29	67.77	2916.06	5.18%	33955	991	34947	2.84%
Castlecomer Road south of new North Crossing	north	199.69	17.385	217.08	8.01%	419.78	1.895	421.68	0.45%				
Castlecomer Road south of new North Crossing	south	303.47	2.17	305.64	0.71%	367.27	10.63	377.90	2.81%				
	2 way	503.16	19.56	522.72	8.72%	787.05	12.53	799.58	3.26%	9123	175	9299	1.89%
Castlecomer Road north of new North Crossing	north	352	36.365	388.37	9.36%	685.59	35.18	720.77	4.88%				
Castlecomer Road north of new North Crossing	south	635.05	45.015	680.07	6.62%	648.86	37.855	686.72	5.51%				
	2 way	987.05	81.38	1068.43	15.98%	1334.45	73.04	1407.49	10.39%	15284	843	16127	5.23%
Freshford Road south of new North Crossing	north	211.98	8.605	220.59	3.90%	376.31	3.895	380.21	1.02%				
Freshford Road south of new North Crossing	south	363.85	3.165	367.02	0.86%	226.45	13.91	240.36	5.79%				
	2 way	575.83	11.77	587.60	4.76%	602.76	17.81	620.57	6.81%	7668	281	7950	3.54%
Freshford Road north of new North Crossing	north	186	7	193.00	3.63%	381	3	384.00	0.78%				
Freshford Road north of new North Crossing	south	366	2	368.00	0.54%	171	12	183.00	6.56%				
	2 way	552.00	9.00	561.00	4.17%	552.00	15.00	567.00	7.34%	7312	250	7563	3.31%
ORR between Dublin Road & Hebron Road	north	623.71	52.74	676.45	7.80%	897.95	39.63	937.58	4.23%				
ORR between Dublin Road & Hebron Road	south	688.82	44.38	733.20	6.05%	890.33	31.775	922.11	3.45%				
	2 way	1312.53	97.12	1409.65	13.85%	1788.28	71.41	1859.69	7.67%	21057	877	21934	4.00%
ORR between Hebron Road & Johnswell Road	north	212.11	31.33	243.44	12.87%	681.98	40.035	722.02	5.54%				
ORR between Hebron Road & Johnswell Road	south	582.59	42.96	625.55	6.87%	655.22	26.73	681.95	3.92%				
	2 way	794.70	74.29	868.99	19.74%	1337.20	66.77	1403.97	9.46%	13995	746	14741	5.06%
ORR between Johnswell Road & New Orchard Road	north	152.63	18.98	171.61	11.06%	336.01	33.29	369.30	9.01%				
ORR between Johnswell Road & New Orchard Road	south	383.89	42.845	426.74	10.04%	360.5	26.99	387.49	6.97%				
	2 way	536.52	61.83	598.35	21.10%	696.51	60.28	756.79	15.98%	8043	667	8709	7.65%
ORR between New Orchard Road & Glendine Road	west	196.39	18.98	215.37	8.81%	359.62	33.29	392.91	8.47%				
ORR between New Orchard Road & Glendine Road	east	386.54	42.845	429.39	9.98%	374.1	27.225	401.33	6.78%				
	2 way	582.93	61.83	644.76	18.79%	733.72	60.52	794.24	15.26%	8637	668	9304	7.17%
ORR between Glendine Road & Castlecomer Road	west	180.29	18.98	199.27	9.52%	323.22	33.29	356.51	9.34%				
ORR between Glendine Road & Castlecomer Road	east	359.55	42.845	402.40	10.65%	339.01	27.225	366.24	7.43%				
	2 way	539.84	61.83	601.67	20.17%	662.23	60.52	722.75	16.77%	7820	668	8487	7.87%

Northern Ring Road Extension - Traffic Counts with Central Assecc Scheme NOT Constructed Year of Opening 2011

2011 Do Something		AM Peak				PM Peak				AADT's			
Location	Direction	UC1 Flow	UC2 Flow	Total	%HGV	UC1 Flow	UC2 Flow	Total	%HGV	UC1 Flow	UC2 Flow	Total	%HGV
Green's Bridge	west	564.44	1.95	566.39	0.34%	764.6	17.505	782.11	2.24%				
Green's Bridge	east	633.17	29.565	662.74	4.46%	705.58	0.03	705.61	0.00%				
	2 way	1197.61	31.52	1229.13	4.81%	1470.18	17.54	1487.72	2.24%	17156	222	17378	1.28%
John's Bridge	west	514.82	21.335	536.16	3.98%	819.47	3.155	822.63	0.38%				
John's Bridge	east	897.61	20.73	918.34	2.26%	962.55	7.625	970.18	0.79%				
	2 way	1412.43	42.07	1454.50	6.24%	1782.02	10.78	1792.80	1.17%	21110	273	21383	1.28%
ORR Crossing	west	1221.05	64.77	1285.82	5.04%	1516.01	24.885	1540.90	1.61%				
ORR Crossing	east	1130.92	57.785	1188.71	4.86%	1089.75	49.81	1139.56	4.37%				
	2 way	2351.97	122.56	2474.53	9.90%	2605.76	74.70	2680.46	5.99%	32650	997	33647	2.96%
Castlecomer Road south of new North Crossing	north	200.07	3.8	203.87	1.86%	511.83	0.11	511.94	0.02%				
Castlecomer Road south of new North Crossing	south	297.82	0.725	298.55	0.24%	280.95	10.455	291.41	3.59%				
	2 way	497.89	4.53	502.42	2.11%	792.78	10.57	803.35	3.61%	8520	91	8611	1.06%
Castlecomer Road north of new North Crossing	north	379.97	36.96	416.93	8.86%	684.55	32.945	717.50	4.59%				
Castlecomer Road north of new North Crossing	south	634.99	45.395	680.39	6.67%	719.17	40.085	759.26	5.28%				
	2 way	1014.96	82.36	1097.32	15.54%	1403.72	73.03	1476.75	9.87%	15758	857	16615	5.16%
Freshford Road south of new North Crossing	north	319.22	24.365	343.59	7.09%	540.56	7.71	548.27	1.41%				
Freshford Road south of new North Crossing	south	532.49	3.16	535.65	0.59%	731.02	13.765	744.79	1.85%				
	2 way	851.71	27.53	879.24	7.68%	1271.58	21.48	1293.06	3.25%	13484	324	13808	2.35%
Freshford Road north of new North Crossing	north	184	8	192.00	4.17%	381	3	384.00	0.78%				
Freshford Road north of new North Crossing	south	363	2	365.00	0.55%	161	11	172.00	6.40%				
	2 way	547.00	10.00	557.00	4.71%	542.00	14.00	556.00	7.18%	7243	241	7485	3.23%
ORR between Dublin Road & Hebron Road	north	666.25	51.87	718.12	7.22%	952.63	38.26	990.89	3.86%				
ORR between Dublin Road & Hebron Road	south	704.79	44.245	749.04	5.91%	904.19	33.61	937.80	3.58%				
	2 way	1371.04	96.12	1467.16	13.13%	1856.82	71.87	1928.69	7.45%	21575	895	22470	3.98%
ORR between Hebron Road & Johnswell Road	north	323.77	32.3	356.07	9.07%	731.27	39.91	771.18	5.18%				
ORR between Hebron Road & Johnswell Road	south	616.14	47.535	663.68	7.16%	537.7	29.17	566.87	5.15%				
	2 way	939.91	79.84	1019.75	16.23%	1268.97	69.08	1338.05	10.32%	14507	832	15339	5.42%
ORR between Johnswell Road & New Orchard Road	north	272.83	19.95	292.78	6.81%	444.76	33.135	477.90	6.93%				
ORR between Johnswell Road & New Orchard Road	south	424.25	47.435	471.69	10.06%	338.13	29.425	367.56	8.01%				
	2 way	697.08	67.39	764.47	16.87%	782.89	62.56	845.45	14.94%	9615	752	10367	7.26%
ORR between New Orchard Road & Glendine Road	west	326.59	19.95	346.54	5.76%	551.3	33.135	584.44	5.67%				
ORR between New Orchard Road & Glendine Road	east	452.59	47.435	500.03	9.49%	414.24	29.425	443.67	6.63%				
	2 way	779.18	67.39	846.57	15.24%	965.54	62.56	1028.10	12.30%	11054	752	11806	6.37%
ORR between Glendine Road & Castlecomer Road	west	310.58	19.95	330.53	6.04%	527.26	33.135	560.40	5.91%				
ORR between Glendine Road & Castlecomer Road	east	434.49	47.435	481.93	9.84%	381.1	29.425	410.53	7.17%				
	2 way	745.07	67.39	812.46	15.88%	908.36	62.56	970.92	13.08%	10372	752	11125	6.76%
New North Crossing	west	379.51	2.22	381.73	0.58%	794.2	5.005	799.21	0.63%				
New North Crossing	east	346.13	18.195	364.33	4.99%	382.54	4.5	387.04	1.16%				
	2 way	725.64	20.42	746.06	5.58%	1176.74	9.51	1186.25	1.79%	12255	225	12480	1.80%

Appendix 3 Ecological Report

Kilkenny Ring Road

Proposed extension to Freshford Road R693

Environmental study – ecology

Report for Clifton Scannell Emerson

March 2008

Roger Goodwillie & Associates, Lavistown House, Kilkenny. Ph/Fax 056-7765145

1. INTRODUCTION

This report is written to describe and evaluate the habitats of an area between the Castlecomer (N77) and Freshford roads (R693) on the northern side of Kilkenny, through which the extension of the Ring Road is likely to go.

It is derived from fieldwork carried out in March 2008 but making use of some existing knowledge of the area. Habitats are classified with the Heritage Council publication (Fossitt 2000) and further described by listing their main plant species. Plants are given their Latin name at first mention but this is dropped later for trees and shrubs that are well known. A few species, significant for their rarity or indicator value, are marked with an asterisk and described in the evaluation section. The route is covered from east to west and may be followed on the aerial photograph..

Although the survey was done early in the season there was enough evidence to determine vegetation quality even if not to find all species.

2. STUDY AREA

2.1 Vegetation & Flora

The strip of ground between the present Castlecomer Road and the old railway embankment consists of a narrow field of improved agricultural grassland (GA1 in Fossitt 2000) and, to the south, some recent building works. The embankment now carries a farm access and its hedges are clipped and rather uniform. Ash *Fraxinus excelsior*, hawthorn *Crataegus monogyna* and sycamore *Acer pseudoplatanus* grow as small trees with some common gorse *Ulex europaeus*, blackthorn *Prunus spinosa* and wild rose *Rosa canina* and herbaceous plants such as glaucous sedge *Carex flacca*, cinquefoil *Potentilla reptans* and false brome *Brachypodium sylvaticum*. Disturbance of sandy material on the western side has provided a site for ragwort Senecio jacobaea, perforate St John's wort *Hypericum perforatum* and the hawkweed ox-tongue **Picris hieracioides*

West of the railway is low-lying land, in part the floodplain of the Nore. The southern end of this floods regularly and terminates at the base of a slope edged by two treelines (WL2). The slope itself is now rough grass (dry meadows and grassy verges GS2) of cocksfoot *Dactylis glomerata*, false oat *Arrhenatherum elatius* and bush vetch *Vicia sepium* with marginal invasion by brambles *Rubus fruticosus*, blackthorn and a little hazel *Corylus avellana*. Meadow vetchling *Lathyrus pratensis* and hedge St John's wort *Hypericum maculatum* also occur. Ash is the main tree species but there is an occasional oak *Quercus robur* and beech *Fagus sylvestris*. Both hedges contain typical species such as lords-and-ladies *Arum maculatum*, wood avens *Geum urbanum*, honeysuckle *Lonicera periclymenum*, garlic mustard *Alliaria petiolata* and early violet *Viola reichenbachiana*.

The wet ground at the base of the slope supports wet willow-alder-ash woodland WN6 which consists of grey willow *Salix cinerea* with a little osier *S.viminalis* and white willow *S.alba* and guelder rose *Viburnum opulus*. The ground in the wettest places is largely bare but elsewhere contains

Filipendula ulmaria	meadowsweet
Valeriana officinalis	marsh valerian
Angelica sylvestris	wild angelica
Urtica dioica	nettle
Iris pseudacorus	yellow flag
Carex acutiformis	lesser pond sedge
C.otrubae	fox sedge
Rorippa nasturtium-aquaticum	watercress
Caltha palustris	marsh marigold
Epilobium hirsutum	great willowherb

In more open places tufted vetch Vicia cracca, field stitchwort *Stellaria graminea*, reed grass *Phalaris arundinacea* and locally common reed *Phragmites australis* and greater pond sedge *Carex riparia* come into the picture (patches of reed and large sedge swamps FS1) while there is an old drain through the wood lined by alder *Alnus glutinosa*. A rise near it brings some hazel, goat willow *Salix caprea* and bramble as well as wood anemone *Anemone nemorosa*, wood avens *Geum urbanum* and much celandine *Ranunculus ficaria*.

At the eastern end there is a small pond (FL8) filled by the floating liverwort **Riccia fluitans*, the duckweeds *Lemna trisulca* and *L.minor* and some bur reed *Sparganium erectum*, bottle sedge *Carex rostrata*, water mint *Mentha aquatica* and bulrush *Typha latifolia*. A gravel slope of hard rush *Juncus inflexus*, small sedges *Carex panicea*, *C.flacca* and red clover *Trifolium pratense* runs down to a drain coming from under the railway with more pond sedge *Carex riparia* and marsh bedstraw *Galium palustre*.

The main triangular field is now a mosaic of wet grassland (GS4) and tall sedges (FS1). Mowing in 2007 has produced a sward containing reed grass *Phalaris arundinacea*, pond sedge *Carex riparia*, sweet grass *Glyceria fluitans* and creeping bent *Agrostis stolonifera* with some creeping buttercup Ranunculus repens and meadowsweet *Filipendula ulmaria* as well as the rushes *Juncus inflexus* and *J.effusus*. Crow garlic *Allium vineale* was formerly present in this field and may survive. The ground drops off along the southern edge where water lies the longest. Water horsetail *Equisetum fluviatile*, reed grass *Phalaris arundinacea*, sweet grass *Glyceria fluitans*, lesser pond sedge *Carex acutiformis*, marsh bedstraw *Galium palustre* and yellow flag Iris pseudacorus are dominant here and there is a considerable amount of great water dock **Rumex hydrolapathum*, yellow loosestrife **Lysimachia vulgaris* and marsh marigold *Caltha palustris*.

The Bleach Road is bordered by a flowing drain at this point which has been cleaned out recently onto the field. There is therefore a strip of fool's watercress *Apium nodiflorum*, curled dock *Rumex crispus* and broad-leaved dock *R.obtusifolius* there. Water starwort *Callitriche stagnalis* survives in the water itself.

Northwards there are several fields of improved grassland (GA1) based on ryegrass and treated intensively. A group of small ash trees survive on one drain side but it is only at the northwest corner of this area that habitat interest returns in the form of a floodplain marsh. Again this is a tall sedge stand (FS1) consisting of greater pond sedge *Carex riparia* and reed grass *Phalaris arundinacea*, overhung at the edges by willows and alder. Other plants include

Urtica dioica	nettle
Cardamine pratensis	lady's smock
Lythrum salicaria	purple loosestrife
Filipendula ulmaria	meadowsweet
Valeriana officinalis	marsh valerian
Senecio aquaticus	marsh ragwort
Persicaria amphibia	amphibious bistort
Equisetum fluviatile	water horsetail
**Rumex hydrolapathum*	great water dock
Myosotis scorpioides	water forget-me-not
Ranunculus repens	creeping buttercup
Galium palustre	marsh bedstraw

Garden angelica **Angelica archangelica*, remote sedge *Carex remota* and marsh marigold *Caltha palustris* grow occasionally on stumps, banks or other rises.

The Bleach Road is lined by hedges of varied composition. The western side formerly had a line of tall English elms *Ulmus procera* and after being killed by disease these have re-sprouted to give the main body to the hedge. The elm is mixed with ash, grey willow *Salix cinerea*, alder, hawthorn, blackthorn, beech, privet *Ligustrum vulgare* and guelder rose *Viburnum opulus*. The base (and road) is flooded in most winters and adds meadowsweet *Filipendula ulmaria*, sweet grass *Glyceria fluitans*, false fox sedge *Carex otrubae* and creeping jenny **Lysimachia nummularia* (centred on old tree stumps), with some soft rush *Juncus effusus*, reed grass *Phalaris arundinacea* and celandine *Ranunculus ficaria*. Shield fern *Polystichum setiferum* and cow parsley *Anthriscus sylvestris* survive on higher places.

The fields on the western side of the road are of improved grassland (GA1). The northern, larger section was reseeded in 2000 and is fairly pure ryegrass. The southern part retains more variety in the grasses with some Yorkshire fog *Holcus lanatus*, meadow foxtail *Alopecurus pratensis*, creeping bent *Agrostis stolonifera* and meadowgrass *Poa trivialis*. A spring and channel in the northern part has been recently piped and is now represented by a hollow where there is some reed grass *Phalaris arundinacea* and sweet grass *Glyceria fluitans* as well as much scutch *Elytrigia repens*, creeping buttercup *Ranunculus repens* and docks *Rumex* spp. Cultivation has extended to within 2-3m of the riverbank but this narrow fringe allows some additional species into the turf such as creeping thistle *Cirsium arvense*, hogweed *Heracleum sphondylium*, cocksfoot *Dactylis glomerata* and a little crow garlic *Allium vineale*.

The riverbank is low (1m or so) on the eastern side with small trees of ash, alder and willows *Salix cinerea, S.fragilis, S.alba* creating an open line. Animals graze between them keeping the bank open and allowing some herb species to grow, for example

Anthriscus sylvestris	cow parsley
Ranunculus ficaria	celandine
Scrophularia auriculata	water figwort
Urtica dioica	nettle
Aegopodium podagraria	ground elder
**Rorippa sylvestris*	creeping yellowcress

The western bank is higher (4-5m) and fenced off from animals so has an intact, scrubby fringe including bramble, gorse *Ulex europaeus*, blackthorn, privet, elder and a little guelder rose with trees growing above it. On this side English elm *Ulmus procera*, white willow *Salix alba* and sycamore are noticeable and the herbs include false brome *Brachypodium sylvaticum* and lords-and-ladies *Arum maculatum*. A small patch of gorse scrub also covers the valley side below Auteven adding hard rush *Juncus inflexus*, primrose *Primula vulgaris* and barren strawberry *Potentilla sterilis*. These species recur in the boundary treeline of the hospital which forms the edge of the study area. Tall ash stand over hawthorn and there is a typical hedge flora including ground ivy *Glechoma hederacea*, wood avens *Geum urbanum*, garlic mustard *Alliaria petiolata* and a little wood melick grass **Melica uniflora*.

The fields between the river and the Freshford road are intensively managed for the most part with broad-leaved dock *Rumex obtusifolius*, chickweed *Stellaria media* and scutch *Elytrigia repens* showing the high nutrient status. Locally in the northern section under fences or on slopes there is a more varied vegetation with yarrow *Achillea millefolium* and daisy *Bellis perennis* but only on the present roadside verge does this include significant diversity. Knapweed *Centaurea nigra*, crested dogstail *Cynosurus cristatus*, red fescue *Festuca rubra*, glaucous sedge *Carex flacca* and bulbous buttercup *Ranunculus bulbosus* grow here amid much moss *Rhytidiadelphus squarrosus*.

Tree groups in the north-western corner are planted and include sycamore, ash and elm. They grow above clumps of brambles with goosegrass *Galium aparine*, celandine *Ranunculus ficaria*, cow parsley *Anthriscus sylvestris* and nettle *Urtica dioica* the common ground flora. Sweet violet *Viola odorata* occurs in the most southern group which is on a small stream.

2.2 Fauna

A walkover survey does not give a complete picture of the vertebrate fauna of an area because species move around to a considerable extent as well as changing during the year. Features noted in the area however are:

Otter. Clear evidence of otters was seen on the eastern bank of the river while sufficient cover exists on the western side for the animals to rest up. A breeding holt could occur here but better habitat exists to the south.

Badger. No sign of a sett was found in the study area but the animals are resident in the woodland at Talbots Inch so probably make some use of the grassland between the river and Freshford Road.

Bats. Suitable habitat exists along the river for Daubenton's bat as well as several other, more terrestrial species. These are likely to be based in woodland at Talbot's Inch but feed in the marginal trees on the river and around Auteven. Additional animals may make use of the treelines in the SE corner of the area.

*Whooper swan. A small flock (10-15) was centred on the floodplain in winter 2007-8, using both the open field west of Bleach Road and also the marsh on the eastern side. There were also a group of geese (probably greylag J.Conroy, pers.comm) seen for a short time during flooded conditions.

Snipe. Considerable numbers (20) remained in the triangular field at the SE corner of the study area in April and a few are likely to nest there. There were also three put up from the floodplain marsh to the north.

A sparrow hawk was seen following the western bank of the river and probably nests in the woodland north of Talbots Inch.

Yellowhammers nest in the hedge along the Bleach Road.

Salmonid fry were using the cleaned out stream on the eastern side of the Bleach Road beside the triangular field.

Fish species. The Nore is important for a number of aquatic species, salmon, lampreys and freshwater crayfish which are included in the EU Habitats Directive and National legislation. See Site Synopsis (below).

3. EVALUATION

The study area contains significant ecological interest and parts have already been designated in the River Barrow and River Nore candidate SAC (Code No 2165) and in the Dunmore pNHA (Code No 1859) – which are shown in the map following. The floodplain marshes are particularly good, both that in the fields close to the northern edge and the triangular field at the SE corner. These have a diverse flora with several unusual species (water dock *Rumex hydrolapathum*, pond sedge *Carex riparia*, yellow loosestrife *Lysimachia vulgaris*). In addition they include an area of wet woodland which is relatively uncommon. The presence of nesting yellowhammer and snipe is another feature of this area, as both are declining. The yellowhammer is on the Red list of Irish birds (Lynas *et al*. 2007) while the snipe is included in the Amber list.

Other notable plant species are the two long standing introductions ox-tongue *Picris hieracioides* and angelica *Angelica archangelica*. These are very local in Ireland but have long been known around Kilkenny. The liverwort *Riccia fluitans* is rare in Ireland but has been seen in Kilkenny before. Wood melick *Melica uniflora* is likewise uncommon, occurring in about five other places in the county. The distribution of creeping jenny Lysimachia nummularia and yellowcress Rorippa sylvestris in Kilkenny is centred on the Nore valley.

The fields west of the Bleach Road have no interest from a botanical viewpoint but are important locally for whooper swan and occasionally for geese. They form the major site for the swan close to town though it does range along the valley to Threecastles, Ballyraggett etc. Whooper swans do not occur in Kilkenny in every year (Crowe *et al* 2005). They are listed in the EU Birds Directive as Annex I species for which special protection measures are required.

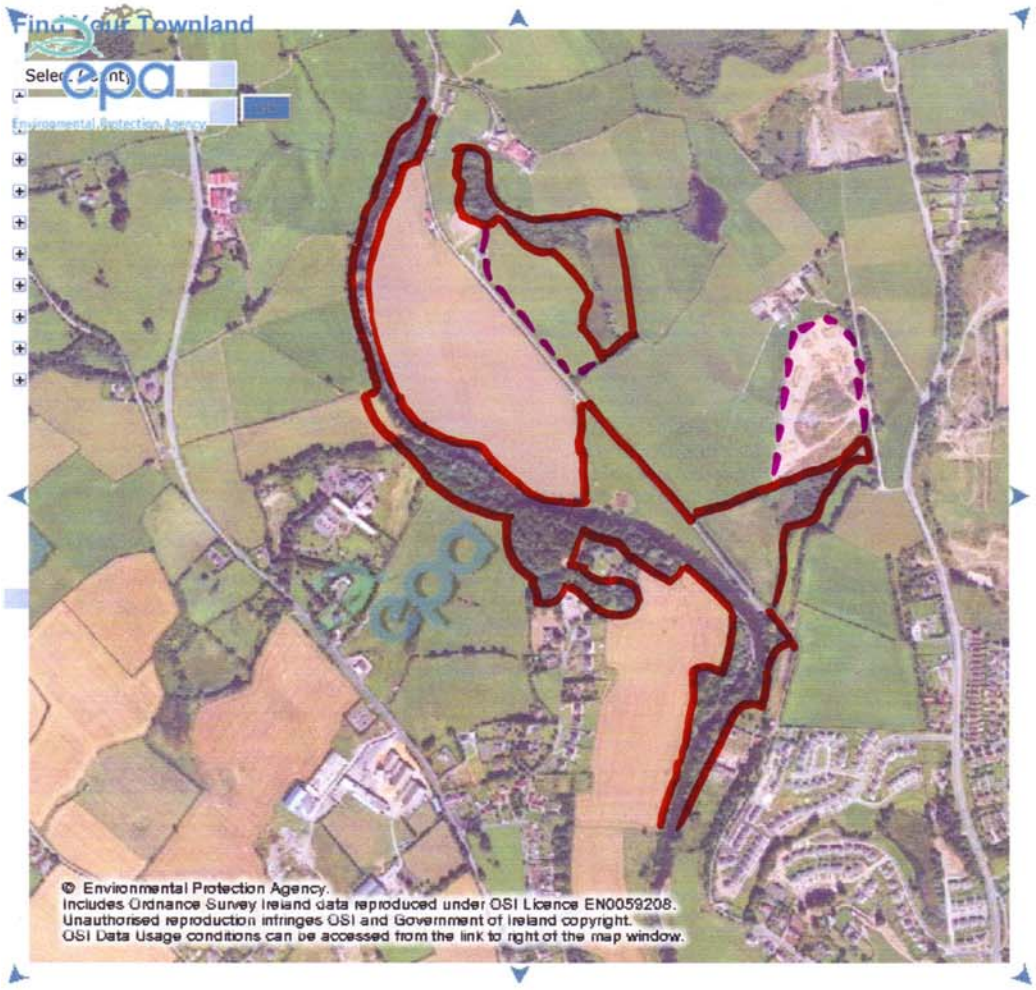
The Nore river has inherent value as a fishery and habitat for several aquatic species which are rare in Europe.

4. POTENTIAL IMPACTS & MITIGATION

Running a road though this area will have definite negative impacts on ecology by dividing a floodplain in two and causing habitat loss in designated areas. It is likely to lead to the loss of one species of interest (*Riccia fluitans*) and to the reduction of several others (yellowhammer, whooper swan). It may also disrupt flooding patterns and cause disturbance to bird populations, particularly in winter. This would arise from the new embankment reducing visibility, and from traffic, both vehicular and pedestrian.

The ecological impacts of a new bridge over the river could largely be mitigated by construction methods and timing.

The least disruptive route within the study area would curve around the northern end of the double treeline as it leaves the Castlecomer Road and run as close as possible to the Auteven boundary at the western end.



Candidate SAC boundary (2008)

Proposed NHA boundary (not revised since 2000)

SITE SYNOPSIS

SITE NAME: RIVER BARROW AND RIVER NORE

SITE CODE: 002162

This site consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The site passes through eight counties – Offaly, Kildare, Laois, Carlow, Kilkenny, Tipperary, Wexford and Waterford. Major towns along the edge of the site include Mountmellick, Portarlington, Monasterevin, Stradbally, Athy, Carlow, Leighlinbridge, Graiguenamanagh, New Ross, Inistioge, Thomastown, Callan, Bennettsbridge, Kilkenny and Durrow. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King's Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones. The Nore, for a large part of its course, traverses limestone plains and then Old Red Sandstone for a short stretch below Thomastown. Before joining the Barrow it runs over intrusive rocks poor in silica. The upper reaches of the Barrow also runs through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, like the Nore runs over intrusive rocks poor in silica. Waterford Harbour is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore.

The site is a candidate SAC selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, *Vertigo moulinsiana* and the plant Killarney Fern.

Good examples of Alluvial Forest are seen at Rathsnagadan, Murphy's of the River, in Abbeyleix estate and along other shorter stretches of both the tidal and freshwater elements of the site. Typical species seen include Almond Willow (*Salix triandra*), White Willow (*S. alba*), Grey Willow (*S. cinerea*), Crack Willow (*S. fragilis*), Osier (*S. viminalis*), with Iris (*Iris pseudacorus*), Hemlock Water-dropwort (*Oenanthe crocata*), Angelica (*Angelica sylvestris*), Thin-spiked Wood-sedge (*Carex strigosa*), Pendulous Sedge (*C. pendula*), Meadowsweet (*Filipendula ulmaria*), Valerian (*Valeriana officinalis*) and the Red Data Book species Nettle-leaved Bellflower (*Campanula trachelium*). Three rare invertebrates have been recorded in this habitat at Murphy's of the River. These are: *Neoascia obliqua* (Diptera: Syrphidae), *Tetanocera freyi* (Diptera: Sciomyzidae) and *Dictya umbrarum* (Diptera: Sciomyzidae).

A good example of petrifying springs with tufa formations occurs at Dysart Wood along the Nore. This is a rare habitat in Ireland and one listed with priority status on Annex I of the EU Habitats Directive. These hard water springs are characterised by lime encrustations, often associated with small waterfalls. A rich bryophyte flora is typical of the habitat and two diagnostic species, *Cratoneuron commutatum* var. *commutatum* and *Eucladium verticillatum*, have been recorded.

The best examples of old Oak woodlands are seen in the ancient Park Hill woodland in the estate at Abbeyleix; at Kyleadohir, on the Delour, Forest Wood House, Kylecorragh and Brownstown Woods on the Nore; and at Cloghristic Wood, Drummond Wood and Borris Demesne on the Barrow, though other patches occur throughout the site. Abbeyleix Woods is a large tract of mixed deciduous woodland which is one of the only remaining true ancient woodlands in Ireland. Historical records show that Park Hill has been continuously wooded since the sixteenth century and has the most complete written record of any woodland in the country. It supports a variety of woodland habitats and an exceptional diversity of species including 22 native trees, 44 bryophytes and 92 lichens. It also contains eight indicator species of ancient woodlands. Park Hill is also the site of two rare plants, Nettle-leaved Bellflower and the moss *Leucodon sciuroides*. It has a typical bird fauna including Jay, Long-eared Owl and Raven. A rare invertebrate, *Mitostoma chrysomelas*, occurs in Abbeyleix and only two other sites in the country. Two flies *Chrysogaster virescens* and *Hybomitra muhlfeldi* also occur. The rare Myxomycete fungus, *Licea minima* has been recorded from woodland at Abbeyleix.

Oak woodland covers parts of the valley side south of Woodstock and is well developed at Brownsford where the Nore takes several sharp bends. The steep valley side is covered by Oak (*Quercus* spp.), Holly (*Ilex aquifolium*), Hazel (*Corylus avellana*) and Birch (*Betula pubescens*) with some Beech (*Fagus sylvatica*) and Ash (*Fraxinus excelsior*). All the trees are regenerating through a cover of Bramble (*Rubus fruticosus* agg.), Foxglove (*Digitalis purpurea*) Wood Rush (*Luzula sylvatica*) and Broad Buckler-fern (*Dryopteris dilatata*).

On the steeply sloping banks of the River Nore about 5 km west of New Ross, in County Kilkenny, Kylecorragh Woods form a prominent feature in the landscape. This is an excellent example of a relatively undisturbed, relict Oak woodland with a very good tree canopy. The wood is quite damp and there is a rich and varied ground flora. At Brownstown a small, mature Oak-dominant woodland occurs on a steep slope. There is younger woodland to the north and east of it. Regeneration throughout is evident. The understorey is similar to the woods at Brownsford. The ground flora of this woodland is developed on acidic, brown earth type soil and comprises a thick carpet of Bilberry (*Vaccinium myrtillus*), Heather (*Calluna vulgaris*), Hard Fern (*Blechnum spicant*), Cow-wheat (*Melampyrum* spp.) and Bracken (*Pteridium aquilinum*).

Borris Demesne contains a very good example of a semi-natural broad-leaved woodland in very good condition. There is quite a high degree of natural re-generation of Oak and Ash through the woodland. At the northern end of the estate Oak species predominate. Drummond Wood, also on the Barrow, consists of three blocks of deciduous woods situated on steep slopes above the river. The deciduous trees are mostly Oak species. The woods have a well established understorey of Holly (*Ilex aquifolium*), and the herb

layer is varied, with Brambles abundant. Whitebeam (*Sorbus devoniensis*) has also been recorded.

Eutrophic tall herb vegetation occurs in association with the various areas of alluvial forest and elsewhere where the flood-plain of the river is intact. Characteristic species of the habitat include Meadowsweet (*Filipendula ulmaria*), Purple Loosestrife (*Lythrum salicaria*), Marsh Ragwort (*Senecio aquaticus*), Ground Ivy (*Glechoma hederacea*) and Hedge Bindweed (*Calystegia sepium*). Indian Balsam (*Impatiens glandulifera*), an introduced and invasive species, is abundant in places.

Floating River Vegetation is well represented in the Barrow and in the many tributaries of the site. In the Barrow the species found include Water Starworts (*Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), Bulbous Rush (*Juncus bulbosus*), Milfoil (*Myriophyllum* spp.), *Potamogeton* x *nitens*, Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (*P. pectinatus*), Perfoliated Pondweed (*P. perfoliatus*) and Crowfoots (*Ranunculus* spp.). The water quality of the Barrow has improved since the vegetation survey was carried out (EPA, 1996).

Dry Heath at the site occurs in pockets along the steep valley sides of the rivers especially in the Barrow Valley and along the Barrow tributaries where they occur in the foothills of the Blackstairs Mountains. The dry heath vegetation along the slopes of the river bank consists of Bracken (*Pteridium aquilinum*) and Gorse (*Ulex europaeus*) species with patches of acidic grassland vegetation. Additional typical species include Heath Bedstraw (*Galium saxatile*), Foxglove (*Digitalis purpurea*), Common Sorrel (*Rumex acetosa*) and Bent Grass (*Agrostis stolonifera*). On the steep slopes above New Ross the Red Data Book species Greater Broomrape (*Orobanche rapum-genistae*) has been recorded. Where rocky outcrops are shown on the maps Bilberry (*Vaccinium myrtillus*) and Wood Rush (*Luzula sylvatica*) are present. At Ballyhack a small area of dry heath is interspersed with patches of lowland dry grassland. These support a number of Clover species including the legally protected Clustered Clover (*Trifolium glomeratum*) - a species known from only one other site in Ireland. This grassland community is especially well developed on the west side of the mud-capped walls by the road. On the east of the cliffs a group of rock-dwelling species occur, i.e. English Stonecrop (*Sedum anglicum*), Sheep's-bit (*Jasione montana*) and Wild Madder (*Rubia peregrina*). These rocks also support good lichen and moss assemblages with *Ramalina subfarinacea* and *Hedwigia ciliata*.

Dry Heath at the site generally grades into wet woodland or wet swamp vegetation lower down the slopes on the river bank. Close to the Blackstairs Mountains, in the foothills associated with the Aughnabrisky, Aughavaud and Mountain Rivers there are small patches of wet heath dominated by Purple Moor-grass (*Molinia caerulea*) with Heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Carnation Sedge (*Carex panicea*) and Bell Heather (*Erica cinerea*).

Saltmeadows occur at the southern section of the site in old meadows where the embankment has been breached, along the tidal stretches of in-flowing rivers below Stokestown House, in a narrow band on the channel side of Common Reed (*Phragmites*) beds and in narrow fragmented strips along the open shoreline. In the larger areas of salt meadow, notably at Carrickcloney, Ballinlaw Ferry and Rochestown on the west bank; Fisherstown, Alderton and Great Island to Dunbrody on the east bank,

the Atlantic and Mediterranean sub types are generally intermixed. At the upper edge of the salt meadow in the narrow ecotonal areas bordering the grasslands where there is significant percolation of salt water, the legally protected species Borrer's Saltmarsh-grass (*Puccinellia fasciculata*) and Meadow Barley (*Hordeum secalinum*) (Flora Protection Order, 1987) are found. The very rare Divided Sedge (*Carex divisa*) is also found. Sea Rush (*Juncus maritimus*) is also present. Other plants recorded and associated with salt meadows include Sea Aster (*Aster tripolium*), Sea Thrift (*Armeria maritima*), Sea Couch (*Elymus pycnanthus*), Spear-leaved Orache (*Atriplex prostrata*), Lesser Sea-spurrey (*Spergularia marina*), Sea Arrowgrass (*Triglochin maritima*) and Sea Plantain (*Plantago maritima*).

Salicornia and other annuals colonising mud and sand are found in the creeks of the saltmarshes and at the seaward edges of them. The habitat also occurs in small amounts on some stretches of the shore free of stones.

The estuary and the other Habitats Directive Annex I habitats within it form a large component of the site. Extensive areas of intertidal flats, comprised of substrates ranging from fine, silty mud to coarse sand with pebbles/stones are present. Good quality intertidal sand and mudflats have developed on a linear shelf on the western side of Waterford Harbour, extending for over 6 km from north to south between Passage East and Creadaun Head, and in places are over 1 km wide. The sediments are mostly firm sands, though grade into muddy sands towards the upper shore. They have a typical macro-invertebrate fauna, characterised by polychaetes and bivalves. Common species include *Arenicola marina, Nephtys hombergii, Scoloplos armiger, Lanice conchilega* and *Cerastoderma edule*.

The western shore of the harbour is generally stony and backed by low cliffs of glacial drift. At Woodstown there is a sandy beach, now much influenced by recreation pressure and erosion. Behind it a lagoonal marsh has been impounded which runs westwards from Gaultiere Lodge along the course of a slow stream. An extensive reedbed occurs here. At the edges is a tall fen dominated by sedges (*Carex* spp.), Meadowsweet, Willowherb (*Epilobium* spp.) and rushes (*Juncus* spp.). Wet woodland also occurs. This area supports populations of typical waterbirds including Mallard, Snipe, Sedge Warbler and Water Rail.

The dunes which fringe the strand at Duncannon are dominated by Marram grass (*Ammophila arenaria*) towards the sea. Other species present include Wild Sage (*Salvia verbenaca*), a rare Red Data Book species. The rocks around Duncannon ford have a rich flora of seaweeds typical of a moderately exposed shore and the cliffs themselves support a number of coastal species on ledges, including Thrift (*Armeria maritima*), Rock Samphire (*Crithmum maritimum*) and Buck's-horn Plantain (*Plantago coronopus*).

Other habitats which occur throughout the site include wet grassland, marsh, reed swamp, improved grassland, arable land, quarries, coniferous plantations, deciduous woodland, scrub and ponds.

Seventeen Red Data Book plant species have been recorded within the site, most in the recent past. These are Killarney Fern (*Trichomanes speciosum*), Divided Sedge (*Carex divisa*), Clustered Clover (*Trifolium glomeratum*), Basil Thyme (*Acinos arvensis*),

Hemp nettle (*Galeopsis angustifolia*), Borrer's Saltmarsh Grass (*Puccinellia fasiculata*), Meadow Barley (*Hordeum secalinum*), Opposite-leaved Pondweed (*Groenlandia densa*), Autumn Crocus (*Colchicum autumnale*), Wild Sage (*Salvia verbenaca*), Nettle-leaved Bellflower (*Campanula trachelium*), Saw-wort (*Serratula tinctoria*), Bird Cherry (*Prunus padus*), Blue Fleabane (*Erigeron acer*), Fly Orchid (*Ophrys insectifera*), Broomrape (*Orobanche hederae*) and Greater Broomrape (*Orobanche rapum-genistae*). Of these the first nine are protected under the Flora Protection Order 1999. Divided Sedge (*Carex divisa*) was thought to be extinct but has been found in a few locations in the site since 1990. In addition plants which do not have a very wide distribution in the country are found in the site including Thin-spiked Wood-sedge (*Carex strigosa*), Field Garlic (*Allium oleraceum*) and Summer Snowflake (*Leucojum aestivum*). Six rare lichens, indicators of ancient woodland, are found including *Lobaria laetevirens* and *L. pulmonaria*. The rare moss *Leucodon sciuroides* also occurs.

The site is very important for the presence of a number of EU Habitats Directive Annex II animal species including Freshwater Pearl Mussel (*Margaritifera margaritifera* and *M. m. durrovensis*), Freshwater Crayfish (*Austropotamobius pallipes*), Salmon (*Salmo salar*), Twaite Shad (*Alosa fallax fallax*), three Lamprey species - Sea (*Petromyzon marinus*), Brook (*Lampetra planeri*) and River (*Lampetra fluviatilis*), the marsh snail *Vertigo moulinsiana* and Otter (*Lutra lutra*). This is the only site in the world for the hard water form of the Pearl Mussel *M. m. durrovensis* and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning.

The site supports many other important animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (*Myotis daubentoni*), Badger (*Meles meles*), Irish Hare (*Lepus timidus hibernicus*) and Frog (*Rana temporaria*). The rare Red Data Book fish species Smelt (*Osmerus eperlanus*) occurs in estuarine stretches of the site. In addition to the Freshwater Pearl Mussel, the site also supports two other freshwater Mussel species, *Anodonta anatina* and *A. cygnea*.

The site is of ornithological importance for a number of E.U. Birds Directive Annex I species including Greenland White-fronted Goose, Whooper Swan, Bewick's Swan, Bar-tailed Godwit, Peregrine and Kingfisher. Nationally important numbers of Golden Plover and Bar-tailed Godwit are found during the winter. Wintering flocks of migratory birds are seen in Shanahoe Marsh and the Curragh and Goul Marsh, both in Co. Laois and also along the Barrow Estuary in Waterford Harbour. There is also an extensive autumnal roosting site in the reedbeds of the Barrow Estuary used by Swallows before they leave the country.

Landuse at the site consists mainly of agricultural activities – many intensive, principally grazing and silage production. Slurry is spread over much of this area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of the salmonid river and to the populations of Habitats Directive Annex II animal species within the site. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs. Fishing is a main tourist attraction along stretches of the main rivers and their

tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. There is net fishing in the estuary and a mussel bed also. Other recreational activities such as boating, golfing and walking, particularly along the Barrow towpath are also popular. There is a golf course on the banks of the Nore at Mount Juliet and GAA pitches on the banks at Inistioge and Thomastown. There are active and disused sand and gravel pits throughout the site. Several industrial developments, which discharge into the river, border the site. New Ross is an important shipping port. Shipping to and from Waterford and Belview ports also passes through the estuary.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, overgrazing within the woodland areas, and invasion by non-native species, for example Cherry Laurel and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above. Good quality is dependent on controlling fertilisation of the grasslands, particularly along the Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods which can damage the many Annex II species present. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book plant species including three rare plants in the salt meadows and the population of the hard water form of the Pearl Mussel which is limited to a 10 km stretch of the Nore, add further interest to this site.

16.1.03

Appendix 4 Archaeological Report

Archaeological Appraisal

Proposed Kilkenny Ring Road Extension
From N77 Castlecomer Road to R693 Freshford Road
Co. Kilkenny

By
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Job No. 08031

For
Clifton Scannell Emerson Associates

28th March 2008

Illustrations

Figures

Plates

Appendices

1 Introduction

1.1 This archaeological appraisal has been prepared for Clifton Scannell Emerson Associates. It assesses the potential archaeological significance of lands proposed for the Kilkenny Ring Road Extension from the N77 Castlecomer Road to the R693 Freshford Road, County Kilkenny.

1.2 Using the existing archaeological sources, the report, through a desk study and field inspection, identifies sites and areas of potential significant archaeological importance and potential within the assessment area identified for the scheme.

1.3 The assessment area lies on the north side of Kilkenny City. It extends west from the N77 Castlecomer Road, crossing the River Nore, to the R693 Freshford Road in the east, encompassing parts of the townlands of Baun, Dunmore, Loughmerans, Talbotsinch, Troyswood, Glendine, Raheenagun and Coolgrange. The assessment area is shown on Figures 1-5.

1.4 Two recorded archaeological sites lie within, or partially within, the assessment area: enclosure sites KK014-064 and KK014-065 in Loughmerans townland (Figure 1). No visible trace of either site could be identified during field inspection or examination of aerial photography and their exact locations could not be confirmed. There is significant potential that these associated sites or associated features may survive beneath the surface within the constraints areas indicated by the Record of Monuments and Places (RMP) or their vicinity.

1.5 A number specific areas of archaeological potential were also identified: the River Nore and environs; wetland areas in fields 10, 11, 12 and 15; and a mound in field 5 (Figure 5).

2 Report Methodology

2.1 *Records of Monuments and Places*

The primary source of information for the archaeological and cultural heritage of the study area is the Record of Monuments and Places (RMP) maintained by Department of the Environment, Heritage and Local Government (DoEHLG). The Sites and Monuments Record (SMR), as revised in the light of fieldwork, formed the basis for the establishment of the statutory RMP pursuant to Section 12 of the National Monuments (Amendment) Act, 1994 (See Appendix 1). The RMP documents known upstanding archaeological monuments, their original location (in cases of destroyed monuments) and the position of possible sites identified as cropmarks on vertical aerial photographs. It is based on a comprehensive range of published and publicly available documentary and cartographic sources.

The information held in the RMP files is read in conjunction with constraint maps, published at reduced six-inch scale, on which recorded sites are clearly marked. Maps for the RMP sheet relevant to the present scheme are Sheets 014 and 019 for Kilkenny (KK) (Figure 1).

2.2 *Topographical files of the National Museum of Ireland*

The topographical files of the National Museum of Ireland (NMI) identify recorded stray finds that have been donated to the state in accordance with national monuments legislation (See Appendix 1) and are now held in the museum's archive. The files, provenanced to townland, sometimes include reports on excavations undertaken by NMI archaeologists.

2.3 *Cartographic and documentary sources*

Literary and documentary references, including excavation bulletins and historic maps were consulted in order to predict the likelihood of potential archaeological remains surviving on site and to clarify the study area of the proposed development. The maps consulted in this appraisal include the Records of Monuments and Places Map, the Down Survey Map of 1656 and the Ordnance Survey Maps for the area (Sheets 14 and 19 County Kilkenny) including the 1st edition of 1839-40, the 2nd edition of 1899-1902 and the revised edition of 1945-6.

Previous excavations carried out in the vicinity of the area under study were also consulted. Additional published and unpublished documentary and literary references consulted are listed at the end of the report.

2.4 *Legislation, Standards and Guidelines*

The following legislation, standards and guidelines were consulted and considered for the purpose of this assessment:

- National Monuments Acts, 1930-2004
- European Convention Concerning the Protection of the Archaeological Heritage of Europe, 'Valetta Convention' (ratified by Ireland in 1992)
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, Department of Arts, Heritage, Gaeltacht and Islands
- Council of Europe Convention of the Protection of the Archaeological Heritage of Europe, 'Granada Convention' (ratified by Ireland in 1997)
- Code of Practice between the National Roads Authority and The Minister for Arts, Heritage, Gaeltacht and the Islands, 2000
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA
- NRA Guidelines for Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes, 2006

2.5 *Field Inspection*

A field inspection of the proposed development took place on February 28th and 29th 2008. Its aim was to assess present topography and land use within the study area. It also sought to identify potential low-visibility archaeological features, and to assess the impact of the proposed development on recorded archaeological sites.

3 Archaeological Background

3.1 *Prehistoric Activity*

There is no known or recorded evidence for prehistoric activity within the assessment area, although excavations in advance of the N77 ring road extension from the Dublin Road to the Castlecomer Road in 2003 revealed an Early Bronze Age funerary pit in Garrincreen townland.

3.2 *Early Medieval Period (c.500AD-1100AD)*

The majority of the recorded monuments located within and in the environs of the assessment area are enclosures, with one ringfort (KK019-006) and a crannóg (KK014-063), signifying early medieval settlement activity in this area (c.AD400–1150).

Ringforts are by far the most common archaeological monuments in the country. They are characterised as a circular area defined by banks and external ditches and excavation often reveals the remains of dwelling houses within their interior. The banks are generally constructed of earth except in stony areas where they may be of stone. Those with earthen banks are sometimes referred to as ‘raths’ while those with stone banks are known as ‘cashels’. Most ringforts are enclosed by a single bank (a ‘univallate’ ringfort) but it is also quite common for them to have two sets of banks (‘bivallate’) or even three (‘trivallate’). Ringforts are usually situated on gentle slopes with good views of the surrounding countryside and although they tend to have a dispersed distribution in the landscape, they are occasionally found in pairs.

Another common feature of the early medieval landscape is the crannóg, an artificial or natural island used for settlement during this and earlier prehistoric periods. A crannóg (KK014-063) is located in Loughmerans townland, in an area of bog to the north of the assessment area.

Five enclosures or enclosure sites are recorded within and in the vicinity of the assessment area (KK014-064 & -065, KK019-008, -011 & -010). The term ‘enclosure’ is applied to monuments that cannot be classified more accurately without archaeological assessment but that were identified as enclosures during fieldwork or through the study of aerial photography or other sources. When investigated further through archaeological assessment, enclosures often prove to be highly denuded ringforts, former church sites, or

some other prehistoric archaeological site type. They can also prove to be of no archaeological significance, as is the case with the enclosure site KK019-010 (See below Section 4.2).

3.3 *Medieval Period (c.1100AD-1600AD)*

Following the initial Anglo-Norman incursions in Ireland in the late 12th century Richard 'Strongbow' de Clare was created Lord of Leinster by the King of England. As lord, Strongbow began to grant territory to his favourites in exchange for military service (knight service). These grants of land were expressed in terms of knights' fees, with payment due from each tenant-in-chief to their lord who was ultimately accountable to the King of England. The granting of lands, and knight's fees, continued under Strongbow's successor, the Earl Marshal, beginning in the 1190's and also through their descendants. The lands they held were those of the Irish who often lived alongside the new tenants, sometimes in opposition but at times in alliance with this Anglo-Norman landed gentry. Theobald Troye, is listed as one of the tenants paying knight's fees assigned in dower to Gilbert de Clare's widow in 1314/15, and was undoubtedly associated with Troyswood House and townland at the northwestern extent of the assessment area.

There is clear evidence that the strong Anglo-Norman presence in Kilkenny City extended into the lands north of the city itself. Orpen refers to 'Locmadran' (1920, 93) and states that 'here in 1307 there were a bretage (a wooden fortification associated with a motte and bailey), grange, stable, sheepfold on posts, in bad condition and ruinous. The earthworks of the bretage, easily discernable, look from the neighbouring railway like a motte, but may be more properly classed as a promontory fort, fully forty feet high, jutting out into the dried up lake. It has a roughly triangular space, twenty-three paces by thirteen on top, cut off by a wide ditch from a rectangular bailey.' The author also makes a note in the text of having visited the site and identified the bretage (Orpen, 1920, 93).

The influence of the medieval religious houses is also evident in this area, with townland names such as Coolgrange, Friarsinch and Bishopsfurze suggesting that much of this land was owned or farmed by the church.

4 Review of Recent Excavations and Archaeological Assessments

4.1 A search of the Excavations Bulletins (2002-2004) and of www.excavations.ie yielded no results for the townlands of Dunmore, Loughmerans, Talbotsinch, Troyswood, Oldpark, Raheenagun and Coolgrange.

4.2 Centre-line testing was carried out in advance of the N77 ring road extension from the Dublin Road to the Castlecomer Road, along the proposed route of the extension in Baun, Bonnetsrath, Neworchard, Garrincreen, Blanchfieldsland and Leggetsrath West townlands (Licence No. 03E1719). A trench was excavated along the centre-line of the proposed route with alternate lateral offsets every 15–25m. All trenches were mechanically excavated to subsoil.

4.3 The testing identified two previously unknown archaeological sites: a ringfort in Blanchfieldsland and an Early Bronze Age funerary pit in Garrincreen.

4.4 Subsequent excavation at the Blachfieldsland site uncovered a bivallate ringfort situated on a small gravel hillock. The large deep-cut features survived, such as the inner and outer ditches, slot-trenches and a single large pit. The gravel nature of the site, natural erosion and agricultural practices did not allow for the finer, more subtle, features to survive on the hill, such as occupation layers and shallow cuts. Downslope from the site was a deep accumulation of hill-wash that afforded protection to many of the features associated with the peripheral activity. These included two corn-drying kilns, a scatter of post-holes, stake-holes, pits and a complex of linear field boundaries. (Anne-Marie Lennon, for ACS Ltd, Licence No.04661; Bennett 2004:0868).

4.5 Excavation of the funerary pit in Garrincreen revealed the remains of two coil-built Early Bronze Age funerary vessels were recovered from the upper pit fills. Vessel 1 consisted of 23 sherds from an urn probably of vase type, c. 0.23m in maximum external diameter at the rim. Vessel 2 consisted of three sherds from a bipartite vase food vessel. Both of the vessels were decorated. (Anne-Marie Lennon, for ACS Ltd, Licence No.04659; Bennett 2004:0878).

4.6 The programme of testing also identified and recorded a number of apparently isolated features (hearths and pits) within Bonnetsrath, Neworchard and Garrincreen townlands. The two pits in Garrincreen were located close to the Early Bronze Age funerary pit and

contained a combined weight of 70g in charred seed remains, as well as charcoal and hazelnut fragments and a possible saddle quern fragment (Bennett 2003, 1018).

4.7 Site specific archaeological testing was undertaken in Baun townland at the site of an enclosure listed in the RMP (KK019-010) in advance of the N77 ring road extension from the Dublin Road to the Castlecomer Road (Robert O'Hara for ACS Ltd, Licence No. 03E1720). A total of fifteen test-trenches were excavated at the site. No evidence of an enclosure was revealed in any of the trenches and the site was deemed to be of no archaeological significance (Bennett 2003, 984).

5 Townland Names and Townland Boundaries

5.1 *Townland Names*

Townland names are an invaluable source of information not only on the topography, land ownership, and land use within the landscape, but also on its history, the archaeological monuments and the folklore. Where a monument has been forgotten or destroyed, a placename may still refer to it, and may therefore indicate the possibility that remains may survive below the ground surface.

Townland names were recorded by the Ordnance Survey surveyors in the 1830s and 1840s, when the entire country was mapped for the first time. The mapmakers, soldiers and antiquarians who collected the placenames and local history varied in their interests and abilities. While most placenames were anglicised or translated relatively accurately, some were corrupted virtually beyond recognition.

The placenames found within the assessment area are a mixture of Irish and English names referring to topography, archaeological sites and land use. They also provide a good picture of the influences of the strong Anglo-Norman and English presence at Kilkenny.

Baun (and the English 'bawn') is an anglicisation of the Irish *bán*, which translates as white and can represent a grassy field or a cow-keep. Another placename referring to the topography is **Glendine**, *gleann doimhín*, meaning 'deep glen' (O'Kelly 1969a, 24). While the second half of the placename **Loughmerans**, *Loch Méadhrán* meaning 'Mearan's Lough', must refer to a now dried up lake.

The Irish for **Coolgrange** is '*Cúl gráinsíghe*', meaning 'hill of the grange' or 'hill of the granary'. A grange was originally an area of land some miles away from an urban-based monastery where in mediæval times food was grown for the monastery. The suffix 'grange' in Coolgrange suggests that these lands were a part of a monastic farm, as is known to be the case with other lands in this area. Baun townland, for example, is listed in the civil survey of the 1650's as being in the possession of Jerpoint Abbey, which records '*two messuages forty acres of arable, forty of pasture and wood with appurtenances in Baun, annual value besides apprise 540*' (O'Donovan, II, 263). The

townland is designated 'churchland' on the accompanying Down Survey map of 1656 (Figure 2).

Dunmore may be an anglicisation of the Irish *Dún Mór*, meaning 'big fort' and O'Kelly notes that the townland was anciently called *Baile Muicín* or 'Muicín's Homestead' (1969a, 35). It is, however, marked on Sir William Pettit's map of 1686 as *Domhnachmore* or *Donoghmore*, meaning 'Great Church', suggesting an ecclesiastical association for the townland (O'Donovan, I, 38). According to O'Kelly, the old parish church in the townland was called *Domhnach Mór na Trionóide Naomtha* meaning 'great church of the Holy Trinity' (1969a, 35). Another reference to an archaeological monument is contained in **Raheenagun**, where the prefix 'raheen' derives from the Irish *Rathín* meaning 'little fort'. O'Kelly (1969a, 24) names this as 'Ráithín na gcon', little rath of the hounds.

Troyswood records the strong Anglo-Norman presence in the area and refers to Theobald Troye, one of the tenants paying knight's fees assigned in dower to Gilbert de Clare's widow, listed in 1314/15 (*http://www.rootsweb.com/~irlkik/history/knights_fees.htm*). The townland was formed from the union of two ancient districts (Donore and Farranbroc) in 1454 when the Troy family came into possession of these lands. Donore or *Dún Uabhar*, meaning 'proud fort', remained in the possession of the Black Abbey firars until 1540 (O'Kelly 1969b, 25). Given the presence of a ringfort at the northern end of the present townland, the district of Donore is likely to have occupied this area. Farranbroc derives from the Irish *fearann broc* or 'badger land'.

Talbotsinch might also refer to this period in Kilkenny's history, recording the presence of another Anglo-Norman family, the Talbots. The suffix '-inch', from the Irish *inse* which can mean 'water-meadow', might refer to the topography in this area close to the river.

5.2 *Townland boundaries*

Townlands are land divisions that form a unique feature in the Irish landscape, their origins can be of great antiquity and many are of pre-Norman date. They existed well before the establishment of parishes or counties. Townland boundaries can take the form of natural boundaries or routeways as well as artificially constructed earthen banks and ditch divisions. They are predominantly formed of substantial boundaries which are usually distinguishable from standard field division boundaries. There are 62,000

townlands in Ireland, grouped into civil parishes, then counties and finally provinces. The assessment area contains, from west to east, the following townland boundaries:

- Burntfurze and Talbotsinch;
- Talbotsinch and Troyswood;
- Troyswood and Loughmerans;
- Loughmerans and Dunmore;
- Dunmore and Baun.

6 Record of Monuments and Places sites and stray finds in the vicinity of the proposed development area

6.1 *RMP sites located within the study area*

There are two recorded archaeological sites contained within the assessment area:

RMP No: KK014-064 **Townland:** Loughmerans

Site Type: Enclosure site **NGR:** 24999/15904

Distance: RMP archaeological constraint area lies partially within the assessment area.

Description: Marked on 1st edition OS map as a circular enclosure. Situated on the east margin of the Nore valley, with the flat valley floor to the west. This is rolling glacial terrain consisting of many small north-south ridges and hillocks (lateral morraines). Land rises gently to east. Good views in all directions from top of ridges and hillocks. The area consists of mostly reclaimed or cultivated grassland. This site is situated on the eastern edge of one of these small ridges. There is no visible trace. Field has been reclaimed. There is a reference to a rath in Loughmerans (possible KK014-065?) that has been levelled, possibly 25 yards diameter based on 'marks on the ground' (Doyle 1981, source NMI Topographical Files).

RMP No: KK014-065 **Townland:** Loughmerans

Site Type: Enclosure site **NGR:** 25008/15884

Distance: Within the assessment area

Description: Marked on 1st edition OS map as a circular enclosure surrounded by mature trees. General situation as for KK019-064. The site is located on southeast end of a northwest/southeast ridge or hillock in a reclaimed field. There is no visible trace and the owner remembers the small wood and banks known locally as a 'rath'.

While a third recorded archaeological site lies partially within the assessment area as shown on the RMP map (figure 1), this was investigated during archaeological testing in advance of the construction of a section of the ringroad on the east side of the N77 road and was found to be non-archaeological in nature:

RMP No: KK019-010 **Townland:** Baun

Site Type: Enclosure site **NGR:** 25055/15865

Distance: Within the assessment area

Description: Marked on 1st edition OS map as a circular enclosure. This site was excavated in advance of the N77 Ringroad extension in 2003 by Robert O'Hara (Licence No.03E1720, testing). No archaeological material was found at the site of this hilltop enclosure. A letter from Martin Reid (National Monuments Section, DoEHLG) in file: O'Hara recommended that the original identification was erroneous and the site should be struck from the RMP (seconded by M. Reid).

See also Appendix 2 for recorded archaeological sites located within 1km of the assessment area.

6.2 *Topographical Files: Museum of Archaeology & History, National Museum of Ireland*

A search of the topographical files yielded no record of stray finds from the townlands of Baun, Dunmore, Loughmerans, Talbotsinch, Troyswood, Glendine, Raheenagun and Coolgrange.

7 Cartographic Analysis

7.1 *Down Survey Map 1656 (Figure 2)*

This map names many of the townlands forming the assessment area, although sometimes in a slightly different form: *Talbots Inch*, *Glaydorine* (Glendine), *Lough medrume* (Loughmerans), *Troyes wood*, *Bonninsrath* (Bonnetsrath) and *Could Grange* (Coolgrange). Coolgrange is indicated as 'church land', Glendine (*and Ardnemury*) belong to the Corporation of Kilkenny and Loughmerans, as with much of the lands are marked as a possession of the Ormond family. The River Nore flows through the lands and south to Kilkenny City. An area of land on the east and west banks of the river between Talbotsinch, Troyswood and Loughmerans is marked as '*bog and shrubby*'. A castle is depicted on the western bank of the river, in Talbotsinch. No further information can be gleaned from this early map.

7.2 *First edition Ordnance Survey Map Sheets 14 & 19, County Kilkenny, 1839 (Figure 3)*

This represents the first accurate mapping of the study area, which is predominantly agricultural lands bisected by the River Nore. On the west bank, most of the fields form part of the estate belonging to Richmond House, with the remainder forming small agricultural fields. The estate grounds contain courtyard buildings near the main house, kitchen gardens / orchards and tree planting. A lime kiln is depicted in a field to the south of the house. An entrance avenue leads east from the main road coming from Kilkenny to the south. The westernmost portion of the assessment area encompasses part of the estate grounds associated with a large unnamed house. This estate lies on the west side of the main Kilkenny road.

Several very large fields occupy the west bank, between the river and a secondary road. This road leads from 'Bleach Mills' and 'Bleach Green' in Dunmore townland to the south, to 'Dunmore Woollen Manufactory' to the north. The main road north from Kilkenny on this side of the river runs through the easternmost side of the assessment area. Several small structures are depicted on the map along the secondary and main road.

Three recorded enclosures are depicted on this map, two of which are shown as earthworks (KK014-065 & KK014-064). The third recorded enclosure (KK019-010) is

shown as a tree-ring. As this enclosure was revealed in testing to be non-archaeological, it is likely to be a landscaping feature.

7.3 ***Second Ordnance Survey Map Sheets 14 &19, County Kilkenny, 1900 (Figure 4)***

Richmond House has been demolished and only the courtyard buildings survive. The house to the west is now named Troyswood House and its grounds and gardens appear to have been extended. The Great Southern and Western Railway now runs south/north through the easternmost end of the assessment area. Recorded enclosures KK019-010 and KK014-064 are no longer depicted. The lands on the eastern bank is marked as liable to floods.

7.4 ***Revised Ordnance Survey Map Sheet 24 County Kilkenny 1945-6 (As in Figure 1)***

The lands on the west bank of the river are now being used to house a hospital, with Auteven Hospital lying on the southern edge of the assessment area. Auteven House and grounds have been constructed close to the west river bank. Electricity lines are shown criss-crossing the assessment area. A circular-shaped structure is shown in the eastern portion of the plot formerly occupied by Richmond House.

8 Field Inspection

8.1 A field inspection of the proposed development site was undertaken by two archaeologists in mostly bright and dry conditions on the 28th February 2008 and overcast conditions on the 29th of February 2008.

The purpose of a field survey was to assess the present topography and land use within the assessment area, to identify any potential low-visibility archaeological and/or historical features that might be subject to direct or indirect impacts as a result of the proposed road alignment and also to assess the archaeological potential of the landscape.

The field inspection is described on a townland by townland basis within the assessment area from west to east. Each field was assigned a number and the descriptions should be read in conjunction with the aerial photography (Figure 5).

The topography of the landscape through which the route passes is predominantly undulating, good pasture land. The grass was short in all pasture fields, with good surface visibility. Many of the original field boundaries have been removed and in some cases have been replaced with electric or post and wire fencing. Where they survive they comprise, for the most part, recently cut hedgerow. Rock outcropping was visible in some fields and the occasional presence of former quarry pits was also noted.

8.2 ***Burntfurze and Talbotsinch townlands***

The eastern edge of number of fields and a garden on the west side of the R693 road are included in the assessment area. Within Talbotsinch townland to the south, a small pasture field rises steeply from the roadside. An area of rough scrub and a memorial roadside marker (date 1972; Plate 1) occupy a triangular area at the roadside to the north of the field. Scrub has been partly cleared to provide access to the memorial. Within Burntfurze townland to the north, a very large undulating pasture field occupies the southern half of the former demesne lands associated with Troyswood House to the northwest (Plate 2; Figures 3 & 4). A stream flows along the western boundary of the field, through a wide overgrown ditch.

8.3 ***Troyswood and Talbotsinch townlands***

A large portion of the assessment area between the R693 road and the River Nore forms part of the lands associated with Richmond House, as depicted on the first edition OS map (1839) (Figure 3). Some of the demesne features, such as a folly, are extant and are now incorporated into a modern farm complex. Fields 1-7 within the assessment area still form a part of the farm and all lie within Troyswood townland.

The topography is generally undulating pastureland, with the farm house and outbuildings situated on a ridge of higher ground at the roadside that drops steeply east to the river and gently south to a stream (field 1; Figure 5). A laneway forms the south and east boundaries of field 1, as depicted on the first edition OS map (Figure 3). There are good views from northeast to southeast, over the river valley (Plates 3 & 4). Field 2 drops steeply from the laneway along its western boundary, levelling out in its eastern half towards the river bank. The steep slope is pitted and uneven in places, possibly as a result of quarrying (Plate 5). A shallow stream flows along the southern field boundary of field 2. The channel is narrow and the banks well-maintained, with no overgrowth (Plate 6). Field 4 is level well-drained pasture with the river forming its eastern boundary. Although in close proximity to both a river and stream, there was no waterlogging. A water-filled ditch runs along the western boundary to join the stream to the south.

Field 3 is a large triangular-shaped field, level along the river bank and rising to form a natural ridge to the west (Plate 7). Two circular features identified on the aerial photography in field 3 appear to be formed by a former quarry pit and natural dips or undulations in the field. The level ground at the river bank continues at the eastern end of field 6, comprising rough pasture, rising steeply from the bank and levelling out to the west. A stream flows in a wide shallow channel along the northern boundary. The stream continues along the northern boundary of the adjacent field 7, a large field of rough pasture (Plate 8). Field 7 has a slightly undulating ground surface, rising up to the west and south from the centre. A stream is depicted flowing through field 7 on the first edition OS map (Figure 3) but is absent from later editions. It is likely that the stream was diverted to its present course along the boundary between field 5 and fields 6 and 7.

Field 5 is a very large pasture field bounded by the R693 road to the west, the stream to the south and the laneway to the north (Plate 10). It is subdivided by electric fencing and a slightly raised grassed path running north/south. The field is slightly undulating but otherwise relatively level pasture. A mound was identified in the approximate location of

a lime kiln marked on the first edition OS map (Plate 9), on the east side of the present electric fence that subdivides the field.

The Troyswood / Talbotsinch townland boundary runs along the south side of field 6 and the east side of field 7. The boundary is formed by a stream, lined with trees on the rising slope to Auteven Hospital and its grounds. The assessment area includes a narrow strip of land contained within Talbotsinch townland. This strip of land runs to the rear (north) of the hospital where it is largely obscured by scrub and overgrowth. It continues east, forming part of a woodland along the river bank, with rough pasture at the eastern end.

8.4 *Loughmerans townland, west of local road*

Fields 8 and 9 are bounded by the River Nore to the west and a local road to the east (Figure 5). The river is approximately 10m wide and relatively fast moving, with water levels almost to the top of the banks at the time of the inspection. Both are level and under pasture, lying within the floodplain of the river. The river banks are lined with mature trees of varying size, but are otherwise clear of vegetation overgrowth. The ground is slightly waterlogged in places but otherwise appears well drained. A stream flowing into the river acts as a boundary between the two fields, with the smaller field 8 to the south. There was no surface trace of a circular feature identified on aerial photography at the south end of field 8 close to the river bank. All of the original field boundaries in field 9 have been removed to create a very large field occupying most of the land between the river and the road. A pipe has been laid through the field from the river, probably to service farm buildings immediately north of the assessment area in field 9 (Plate 12).

8.5 *Loughmerans townland, east of local road*

Field 10, on the east side of the local road, is bounded by a stream to the north and east. A wide band of marshy ground occupies the west bank of the stream, while a copse of trees extends north and west along the stream. The field is relatively large, subdivided by post and wire fencing, and slopes down only slightly from the northwest and at the east to the stream (Plate 13). The northwest end of the field is occupied by two houses and the field to the north and east of the houses has been newly seeded with grass.

Field 11 encompasses a large area of undulating pastureland, subdivided by electric fencing and a path to a large farm complex, bounded by the local road to the southwest (Figure 5; formerly Dunmore House as shown on the historic OS mapping, Figures 3 & 4). The ground is level to the southwest and south, with waterlogging evident along the roadside boundary. A ridge of high ground runs northwest / southeast through the field, continuing northwest into field 15 (Plate 16). Two recorded archaeological sites occupy this ridge of high ground: enclosure site KK014-065 in field 11 and enclosure site KK014-064 in field 15 (Figures 1, 3 & 5). Both enclosures are depicted on the first edition OS map (1839); this places the enclosure in field 15 immediately outside the assessment area to the north (Figure 3). No visible surface trace of either site was identified during field inspection. There are good views in all directions from the ridge, which would have been a prominent feature in the landscape, and the two sites were inter-visible (Plates 14 & 15). Neither location could be confirmed during field inspection. The ground at the base of the ridge in field 15 is flat and marshy, bounded to the west by the stream noted in field 10. The stream feeds into a large pond to the north of the ridge, outside the assessment area.

A stream also flows along the boundary between field 11 and field 13 to the east. Apart from a small section at the base of the ridge which is tree-lined, the stream has been mostly cleared of vegetation along its banks. The stream flows to the townland boundary between Loughmerans and Dunmore, which runs along the south side of field 13 and west into the River Nore. This boundary is heavily tree-lined, with an overgrowth of gorse and scrub. Field 13 is relatively flat, rising gently to the southeast corner. An old railway embankment, now in use as a laneway, bounds the field to the east. Pasture fields on the east side of the railway embankment have been partially impacted by the existing section of ringroad and a new housing development. No record of archaeological investigations that may have been undertaken in advance of the housing development were available at the time of this assessment (the *Excavations Bulletin* is at present only available up to and including 2004). Field 14 is level pasture, bisected by the stream flowing from the Loughmerans and Dunmore townland boundary via a culvert in the railway embankment (Plate 17). The boundary between fields 14 and 16 to the northeast comprises an access road to Dunmore House and farm via an underpass in the railway embankment (Plate 18). Field 16 is relatively level pasture within the assessment area, bounded by a wide verge of rough grass at the roadside.

8.6 ***Dunmore townland***

Field 12 is a small, flat waterlogged field. An area of marshy ground was noted in the approximate location of a feature identified on aerial photography (Plate 19). The stream flowing along the Loughmerans and Dunmore townland boundary continues along the eastern boundary of field 12. A stagnant water-filled ditch runs along the southwestern field boundary. The ground rises sharply beyond the eastern boundary to a recent housing development.

9 Summary and Conclusions

9.1 *General Archaeological Background*

Although the known archaeological record points to this as a well-established settlement area during the early medieval and later periods, it is highly likely that the river has long been the focus of settlement and activity, acting as a major conduit for trade and communications from the prehistoric period onwards. Water travel was often safer and more expedient than moving by road, making such an artery a valuable resource, particularly for the movement of goods, especially heavy items such as stone or timber (Doran 2004, 61). Human activity during the prehistoric period was confirmed in the wider area during excavations in advance of the N77 ring road extension from the Dublin Road to the Castlecomer Road in 2003, in the form of an Early Bronze Age funerary pit revealed in Garrincreen townland

9.2 *Known Record of Monuments and Places Sites (RMP sites)*

Two recorded archaeological sites lie within, or partially within, the assessment area: enclosure sites KK014-064 and KK014-065 in Loughmerans townland. No visible trace of either site could be identified during field inspection or by an examination of aerial photography and their exact locations could not be confirmed.

Given the morphology shown on the first edition OS mapping, it is likely that these two enclosure sites were ringforts or raths (Figure 3). Ringforts were not simple isolated homesteads and should be considered within their contemporary settlement landscape, which would have consisted of unenclosed settlements, farms and fields, route-ways and natural resources. Although these elements have left no obvious trace in the area, the potential for revealing these features has been demonstrated on other road schemes, where archaeological excavation and geophysical survey has revealed annexes and complex field systems associated with early medieval enclosure sites. Souterrains are also found in association with ringforts and, by their nature, can go undetected for long periods of time and are often discovered by accident when heavy machinery causes them to collapse. Fields 11 and 15 are considered to be of archaeological potential (Figure 5). There is significant potential that associated sites or features may survive beneath the surface within the vicinity of the recorded sites.

9.3 ***Areas of archaeological potential***

- *Riverine Environment*

The River Nore and its environs are regarded as highly sensitive and are considered to have an intrinsically significant archaeological potential unless proved otherwise by archaeological investigation. The River Nore is an important waterway, providing a routeway between the open sea and inland. Its importance is attested to by the number of recorded monuments in its vicinity, it has attracted a great deal of human activity through the ages. Any river crossing design proposals should be cognisant of the archaeological potential of both the river banks/ environs of the river and of the river bed itself:

- *River bank and environs potential*

It is possible, particularly in riverside greenfield areas, which are prone to fewer disturbances than arable areas that subsurface prehistoric or later settlement activity may come to light. Fields 3, 4, 6, 8 and 9 are considered to be of archaeological potential (Figure 5).

- *River bed potential*

There is a significant potential that any work that takes place within the River Nore itself will reveal riverine archaeological deposits or features such as former bridge crossings, fording points, weirs, fish traps and stray finds etc.

- *Milling activity*

The cartographic sources indicate that there was a thriving milling industry in this area, along the banks of the River Nore, with woollen and bleach mills located at the very southeastern extent of the assessment area in Dunmore townland. The historic maps depict mill buildings powered by a system of mill races, and a bleach green on the east bank of the River Nore. ‘Dunmore Woollen Manufactory’ is depicted to the north of the assessment area and is connected to the mills and bleach green by a road running along the east bank of the river, through the assessment area. There is the potential that features or structures associated with the milling industry may survive subsurface, particularly along the east bank of the river.

- *Wetland Areas*

  Wetland or boggy areas are considered to be of high archaeological potential were noted particularly in fields 10, 11, 12 and 15, often in proximity to streams. Wetland and bogs provide unusually good preservation conditions for organic materials, such as wood, leather, textiles and human remains. A number of streams flow through the assessment area to the river. This topography and the proximity of streams as a water source is typical of the locations in which *fulachta fiadh* (or burnt mounds) are found. The presence of burnt mounds or *fulachta fiadh* is often indicative of Bronze Age seasonal communal activity in river valleys and boggy ground. While the mound identified in field 5 is likely to be associated with a lime kiln depicted on the first edition OS map, it is also possible that this represents a burnt mound.

- *Greenfield Areas*

  The assessment area is predominantly greenfield, agricultural lands. As agricultural development tends to obscure surviving subsurface archaeology there is a high potential that archaeological features or finds survive beneath the surface. There is a potential that previously unknown subsurface archaeological features and finds will be uncovered in any previously undisturbed greenfield areas within the assessment area. This potential is supported by the recorded archaeological sites located both within and in the vicinity of the assessment area, which attest to the importance of the area for settlement since at least the early medieval period.

9.4 ***Recommendations***

9.4.1 All recorded archaeological monuments are protected under National Legislation (Appendix 1) and avoidance of all recorded sites is the preferred policy of the Department of the Environment Heritage and Local Government (DoEHLG). This must therefore form the focus of continuing study during the design of the road realignment. If development is planned to occur in the vicinity of the two recorded archaeological sites located within the assessment area, archaeological investigations will have to take place to establish the location, extent and nature of the sites and any associated features. Investigation may take the form of geophysical survey or archaeological test excavation.

9.4.2 Geophysical survey has proven to be effective on other road and infrastructural schemes in identifying and locating the nature and extent of below-ground archaeological sites and remains. This is a non-invasive method of examining the below ground archaeological potential without disturbing the surface of the fields. The benefits of availing of this technique are that it can cover a large amount of ground rapidly and provide definition on the nature, extent and often plan layout of below ground sites.

Given the presence of two recorded archaeological sites and the significant archaeological potential of the area, it is recommended that geophysical survey be carried out throughout the assessment area. This will assist in the selection of a route alignment with the least impact on archaeological heritage. This work should be carried out under licence to the National Monuments Section of the Department of Environment, Heritage and Local Government.

9.4.3 Given the significant potential for discovery of previously unknown sites or features within the assessment area, it is recommended that a programme of blanket linear archaeological test excavation be undertaken once a route has been defined. The purpose of this blanket testing strategy is to determine the location, date, nature and extent of any previously unknown archaeological sites, features or deposits and to resolve, where possible, all archaeological heritage issues prior to the main construction contract phase of development.

Blanket testing is carried out by a mechanical digger which under the supervision of an archaeologist, digs a trench along the centre line of the entire route with a number of offsets, usually placed at intervals of 15-20m. In areas of known archaeological potential the distance between the offsets can be decreased. Depending on the nature of the terrain different arrangements of trenches can be approved to optimise investigation within the proposed route alignment. Local conditions such as wetland or access difficulties may mean deviation from this strategy necessitating a slightly different pattern or layout of investigation trenches. This methodology will be consistent with that used to investigate the Dublin Road to Castlecomer Road section of the N77 ring road extension in 2003 (see above Section 4.2) and is in accordance with NRA guidelines.

All works should be carried out with reference to the NRA guidelines under licence to the National Monuments Section and the National Museum of Ireland. The exact strategy to

be employed should be agreed with the NRA Archaeologist (if appropriate) and the National Monuments Section of the Department of Environment, Heritage and Local Government.

9.4.4 A licensed archaeologist will ultimately be required to monitor all groundworks and/or topsoil stripping during both the site preparatory and construction stages of development. Monitoring will be carried out under licence from the Department of the Environment, Heritage and Local Government, and will ensure the full recognition of, and the proper excavation and recording of all archaeological soils, features, finds and deposits which may be disturbed below the ground surface.

9.4.5 It is also recommended that an underwater archaeological appraisal be undertaken once a preferred river crossing has been identified. This should take the form of a dive and metal detection survey of the river banks and the river itself and in some locations, exploratory excavation may have to be considered. Such an assessment would be carried out under licence to and in consultation with the Underwater Unit of the Department of the Environment, Heritage and Local Government and National Museum of Ireland.

9.4.6 The developer's attention is drawn to the National Monuments Legislation 1937-2004 (Appendix 1), which states in the event of the discovery of archaeological finds or remains, the Department of Environment, Heritage and Local Government should be notified immediately. The developer should make provision to allow for and to fund the archaeological works that may be needed on the site if any remains are noted during the site preparation phase of development.

All recommendations regarding the site will be subject to discussion with and approval from the Planning Authority and the National Monuments Section of the Department of Environment, Heritage and Local Government.

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Appendix 1

National Monuments Legislation

All archaeological sites have the full protection of the national monuments legislation (Principal Act 1930; Amendments 1954, 1987, 1994 and 2004).

In the 1987 Amendment of Section 2 of the Principal Act (1930), the definition of a national monument is specified as:

any artificial or partly artificial building, structure or erection or group of such buildings, structures or erections,

> any artificial cave, stone or natural product, whether forming part of the ground, that has been artificially carved, sculptured or worked upon or which (where it does not form part of the place where it is) appears to have been purposely put or arranged in position,
>
> any, or any part of any, prehistoric or ancient
>
> (i) tomb, grave or burial deposit, or
>
> (ii) ritual, industrial or habitation site,
>
> and
>
> any place comprising the remains or traces of any such building, structure or erection, any cave, stone or natural product or any such tomb, grave, burial deposit or ritual, industrial or habitation site...

Under Section 14 of the Principal Act (1930):

> It shall be unlawful...
>
> to demolish or remove wholly or in part or to disfigure, deface, alter, or in any manner injure or interfere with any such national monument without or otherwise than in accordance with the consent hereinafter mentioned (a licence issued by the Office of Public Works National Monuments Branch),
>
> or
>
> to excavate, dig, plough or otherwise disturb the ground within, around, or in the proximity to any such national monument without or otherwise than in accordance...

Under Amendment to Section 23 of the Principal Act (1930),

> A person who finds an archaeological object shall, within four days after the finding, make a report of it to a member of the Garda Síochána...or the Director of the National Museum...

The latter is of relevance to any finds made during a watching brief.

In the 1994 Amendment of Section 12 of the Principal Act (1930), all of the sites and 'places' recorded by the Sites and Monuments Record of the Office of Public Works are provided with a new status in law. This new status provides a level of protection to the listed sites that is

equivalent to that accorded to 'registered' sites [Section 8(1), National Monuments Amendment Act 1954] as follows:

> The Commissioners shall establish and maintain a record of monuments and places where they believe there are monuments and the record shall be comprised of a list of monuments and such places and a map or maps showing each monument and such place in respect of each county in the State.
>
> The Commissioners shall cause to be exhibited in a prescribed manner in each county the list and map or maps of the county drawn up and publish in a prescribed manner information about when and where the lists and maps may be consulted.
>
> *In addition, when the owner or occupier (not being the Commissioners) of a monument or place which has been recorded, or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Commissioners and shall not, except in the case of urgent necessity and with the consent of the Commissioners, commence the work for a period of two months after having given the notice.*

The National Monuments Amendment Act 2004

The National Monuments Amendment Act enacted in 2004 provides clarification in relation to the division of responsibilities between the Minister of Environment, Heritage and Local Government, Finance and Arts, Sports and Tourism together with the Commissioners of Public Works. The Minister of Environment, Heritage and Local Government will issue directions relating to archaeological works and will be advised by the National Monuments Section and the National Museum of Ireland. The Act gives discretion to the Minister of Environment, Heritage and Local Government to grant consent or issue directions in relation to road developments (Section 49 and 51) approved by An Bord Pleanála and/or in relation to the discovery of National Monuments

14A. (1) The consent of the Minister under section 14 of this Act and any further consent or licence under any other provision of the National Monuments Acts 1930 to 2004 shall not be required where the works involved are connected with an approved road development.

(2) Any works of an archaeological nature that are carried out in respect of an approved road development shall be carried out in accordance with the directions of the Minister, which

directions shall be issued following consultation by the minister with the Director of the National Museum of Ireland.

Subsection 14A (4) Where a national monument has been discovered to which subsection (3) of this section relates, then
(a) the road authority carrying out the road development shall report the discovery to the Minister

(b) subject to subsection (7) of this section, and pending any directions by the minister under paragraph (d) of this subsection, no works which would interfere with the monument shall be carried out, except works urgently required to secure its preservation carried out in accordance with such measures as may be specified by the Minister

The Minister will consult with the Director of the National Museum of Ireland for a period not longer than 14 days before issuing further directions in relation to the national monument.

The Minister will not be restricted to archaeological considerations alone, but will also consider the wider public interest.

Appendix 2 - The Record of Monuments and Places (RMP)

The RMP was established under Section 12 of the National Monuments Act, 1994. It holds the name, location and brief descriptions of historical monuments or archaeological complexes throughout the country, at the discretion of the Minister. This provides legal protection for all monuments listed and mapped under Section 12 of the 1994 Amendment Act. The record consists of a list of monuments and places and a map showing each monument and place in respect of each county in the State. Two months notice must be given to the Minister for the Environment, Heritage and Local Government of any proposed works affecting a monument, place or archaeological area included in the Record of Monuments and Places or the Register of Historical Monuments (Section 5, National Monuments Amendment Act 1987).

There are four sites within c. 1km of the assessment area as follows:

RMP No: KK019-011 **Townland:** Glendine

Site Type: Enclosure **NGR:** 250690/ 158280

Distance: c.220m southeast of assessment area

Description: Marked on 1st edition OS map. No file description. Doyle 1981: 'Part of the rath in Glendine is removed. It is on the brow of a steep hill. Its entrance, which faced south, is approached from level ground at the top of a steep hill. Measures 30 yards across its centre. Situated c.1/4 mile from the rath in Loughmeran.'

RMP No: KK019-063 **Townland:** Loughmerans

Site Type: Crannóg **NGR:**

Distance: c.420m southeast of assessment area

Description: OPW 1986: Bordered by dykes of River Nore to west, quarries to south where ground rises sharply, modern concrete works to east. Situated in an almost impassable field of 'red bog'. A low man-made platform, c.25m diameter, rising c.1m above the surrounding bog. No visible traces of habitation remains. Definitely not a natural feature.

OPW 1987: Situated in very low-lying bog, the bed of an old lake. Low hills to north, south and east and fairly low-level land of Nore valley to west. Not possible to visit the site as it was too wet and marshy. Visible from the edge of the bog as a low circular grassy mound. Possibly a crannóg or natural island. Farmer says it has always been explained as the spoil from old drainage schemes.

RMP No: KK019-006 **Townland:** Raheenagun

Site Type: Ringfort **NGR:** 248760/ 157660

Distance: c.850m southwest of assessment area

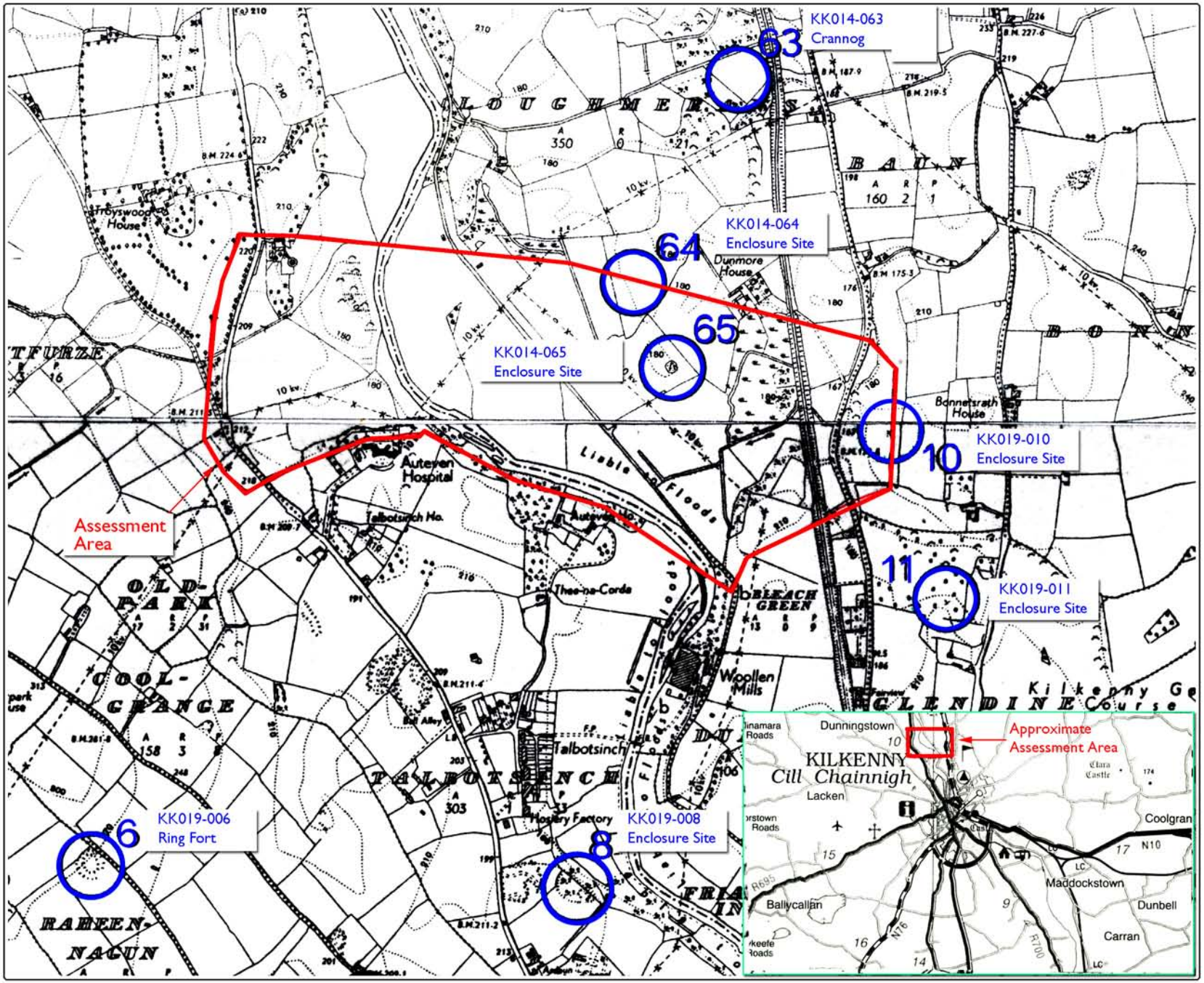
Description: Marked on 1st edition OS map and 1945-6 edition. O'Kelly (1969, 24) names this as 'Ráithín na gcon', little rath of the hounds, and describes it as a small partly demolished rath at 210 feet. No file description.

RMP No: KK019-008 **Townland:** Talbotsinch

Site Type: Enclosure **NGR:** 249850/ 157630

Distance: c.670m south of assessment area

Description: Marked on 1st edition OS map and 1945-6 edition. No file description.



Margaret Gowen & Co Ltd
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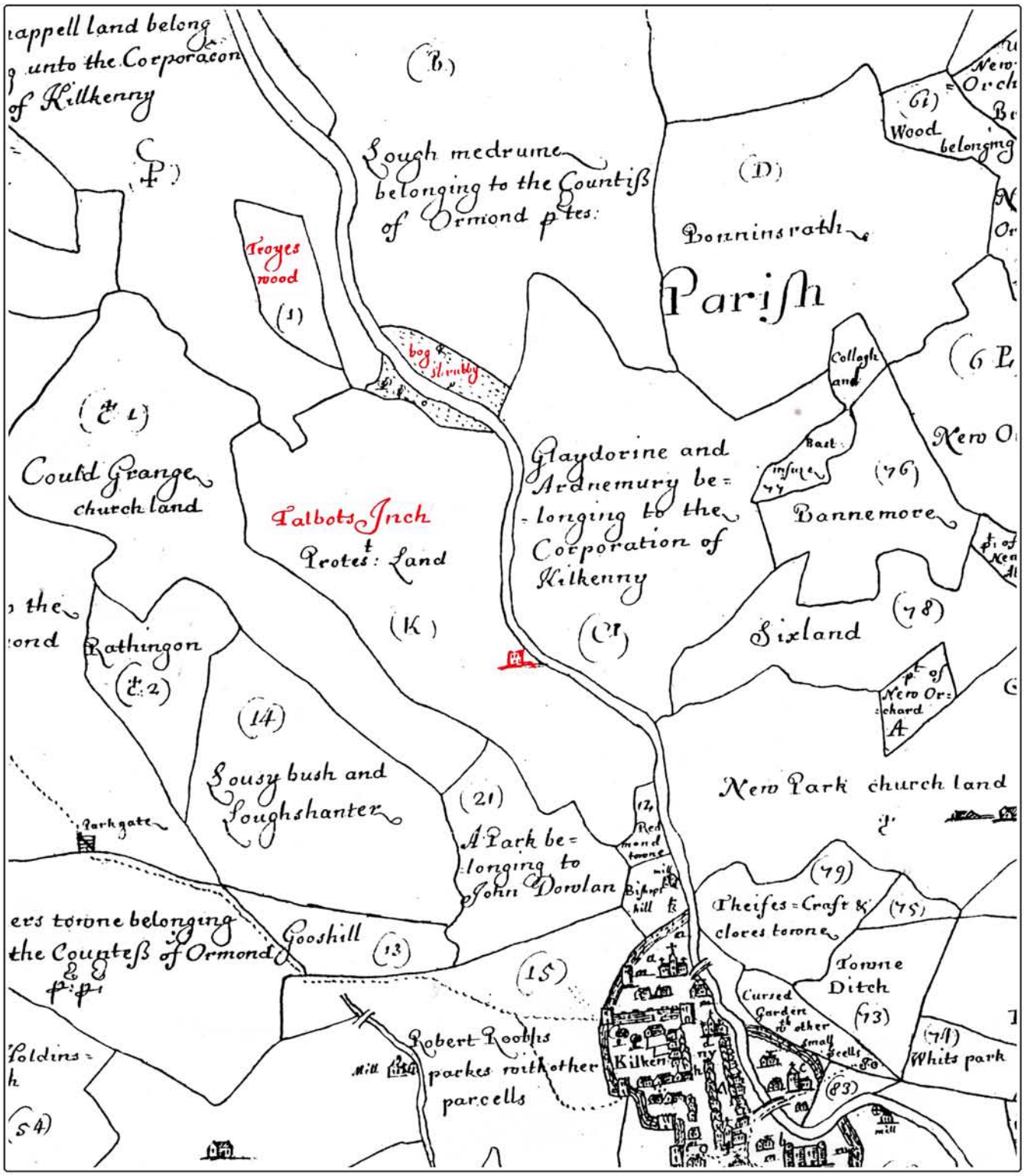
Job	N77 Kilkenny Ring Road Extension, Co. Kilkenny
Ref.	08031-R1
Date	18.03.08
Client	Clifton Scannell Emerson
Scale	Not applicable
Fig. 1	RMP site location map



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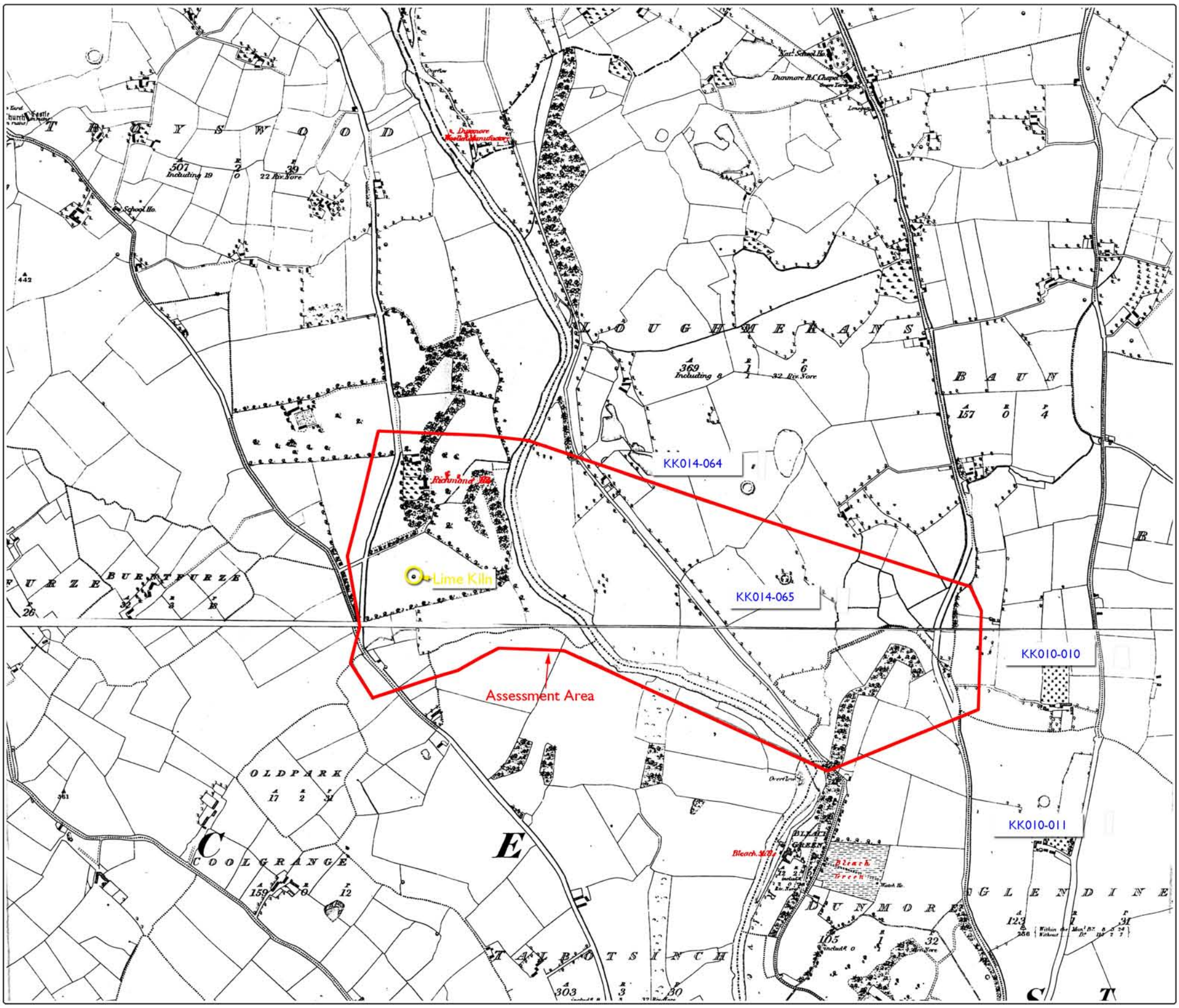
Job	N77 Kilkenny Ring Road Extension, Co. Kilkenny
Ref.	08031-R1
Date	18.03.08
Client	Clifton Scannell Emerson
Scale	Not applicable
Fig. 2	Down Survey, 1656



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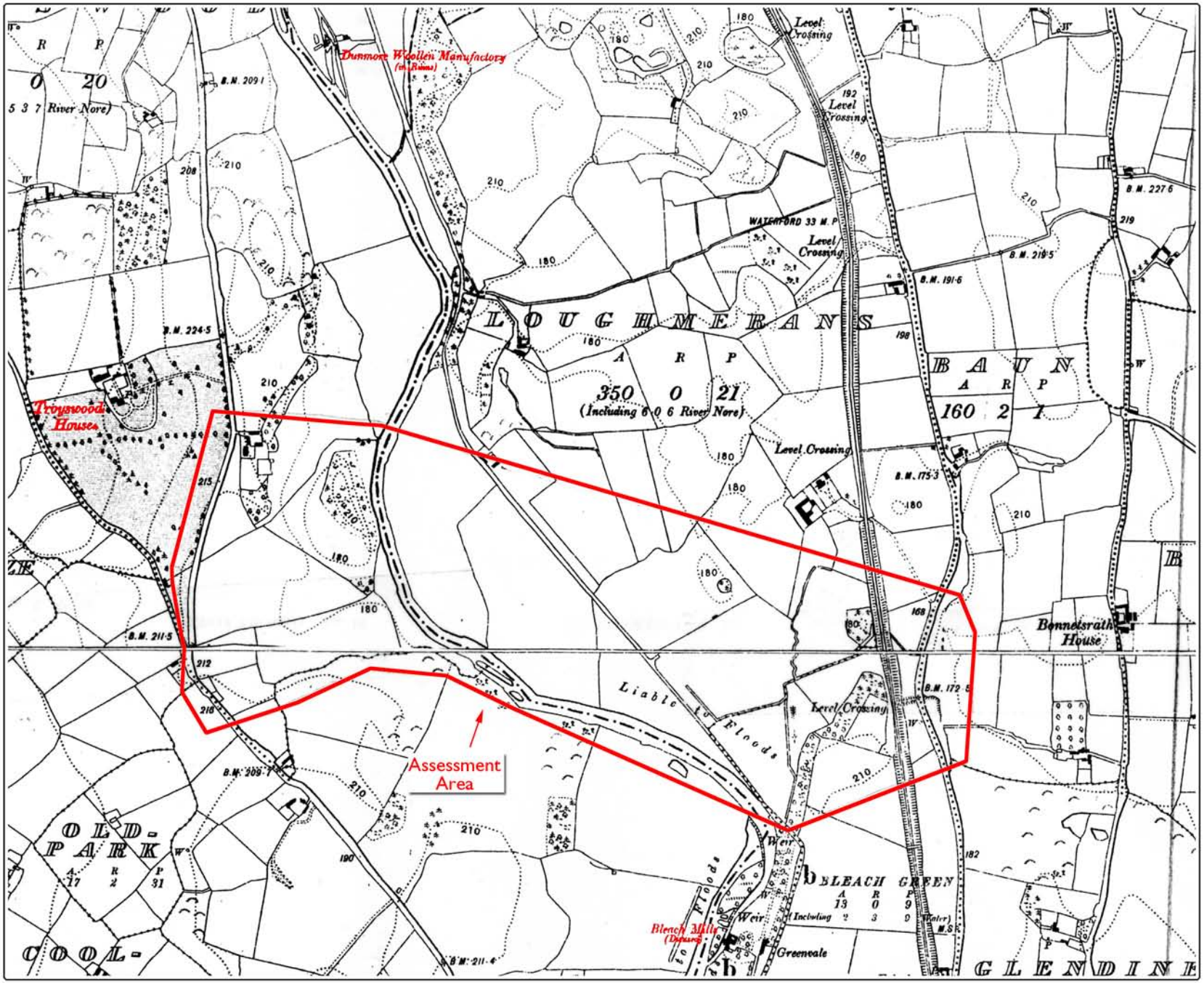
Ref.	08031-R1
Date	18.03.08
Client	Clifton Scannell Emerson
Scale	Not applicable
Fig. 3	1st ed OS map, 1839



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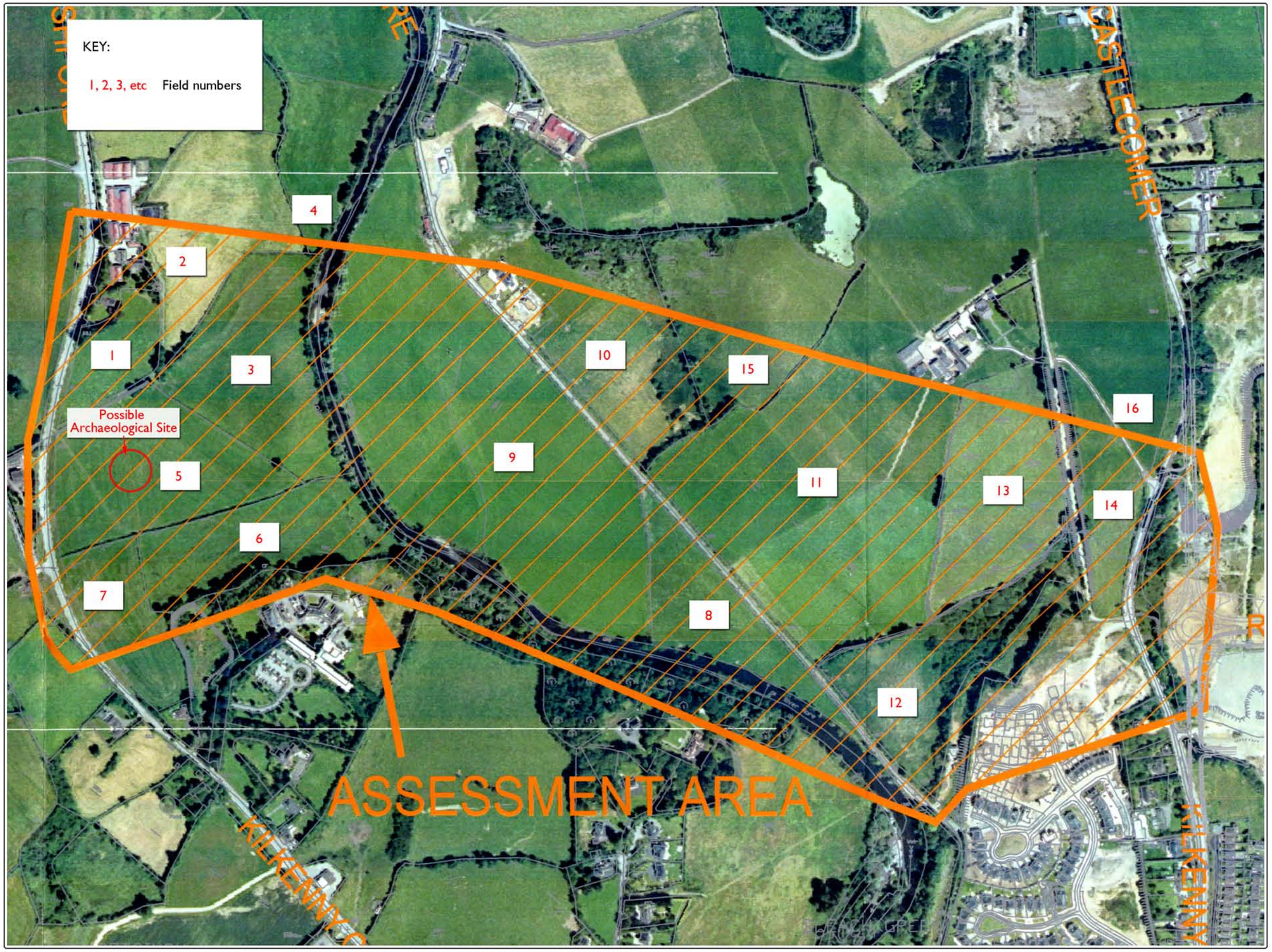
Job	N77 Kilkenny Ring Road Extension, Co. Kilkenny
Ref.	08031-R1
Date	18.03.08
Client	Clifton Scannell Emerson
Scale	Not applicable
Fig. 4	2nd ed OS map, 1900



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Job	N77 Kilkenny Ring Road Extension, Co. Kilkenny
Ref.	08031-R1
Date	18.03.08
Client	Clifton Scannell Emerson
Scale	Not applicable
Fig. 5	Aerial photography showing assessment area and field numbers

Plate 1 Memorial marker on west side of R693 road, facing west

Plate 2 View south from lands associated with Troyswood House

Plate 3 View NE from laneway around farm

Plate 4 View ENE from laneway over fields 2, 3 & 4

Plate 5 View upslope (west) in field 2, to folly and farmhouse on ridge

Plate 6 Stream flowing along south boundary of field 2

Plate 7 View over river from ridge in field 3

Plate 8 View west over fields 6 and 7

Plate 9 View of mound in field 5 from northwest

Plate 10 View east over assessment area, across river valley, from field 5

Plate 11 South end of field 8, facing SE

Plate 12 Field 9 facing north, showing gravel laid over pipe trench

Plate 13 Field 10 facing south

Plate 14 View north over assessment area from RMP site KK014-065

Plate 15 View SE over fields 11 & 13 from RMP site KK014-065

Plate 16 View of natural ridge in fields 11 and 15, from north to east

Plate 17 Field 14 facing south, showing new residential development

Plate 18 Field 14 facing NNW, showing access road

Plate 19 Field 12 facing NE

APPENDIX B

An Bord Pleanála Letter

An Bord Pleanála

Inspector's Report

Development

Description:	Assessment pursuant to Section 50 (i)(c) of the Roads Act 1993 as to whether or not an EIS is required for the Kilkenny Ring Road Extension.
Address:	Lands between Castlecomer (at the roundabout from N77 ring road extensions) to a new proposed roundabout on the R693 (Kilkenny to Freshford Road) approximately 2.5 kilometres north of Kilkenny City.

Planning Application

Planning Authority:	Kilkenny County Council.
Planning Authority Reg. Ref.:	N/A
Applicant:	Kilkenny County Council.
Type of Application:	Section 50 (1)(c) of the Roads Act 1993.
Date of Site Inspection:	23rd April 2012.
Inspector:	**Paul Caprani**

1.0 INTRODUCTION

Under the provisions of Section 50 (1)(c) of the Road Act 1993, Kilkenny County Council is seeking a direction from the An Board Pleanala as to whether or not an extension to the Ring Road to the north of Kilkenny City would be likely to have a significant effect on the environment and thus require the preparation of an EIS.

2.0 THE PROPOSED SCHEME

As the new ring road extension is currently at a preliminary stage no detailed design drawings are submitted with this application. However, a number of aerial photographs depicting the preferred alignment are submitted as part of the "Kilkenny Northern Ring Road Extension – Constraints and Route Option Study" contained on file. A total of eight routes were investigated (see Drawing No. 07-088-032 with the preferred route (indicated as black on the drawing referred to) linking the existing roundabout at the intersection of the N77 ring road extension with the N77 Castlecomer National Secondary Route to a new roundabout approximately 1.5 kilometres to the west on the R693 Kilkenny to Freshford Regional Route. The design standard adopted in the scheme is based on the NRA TD9/07 "Road Link Design" and the NRA TD27/07 "Cross-Section and Headroom". The design speed for the route corridor is 85 kmph and the alignment is to comprise of two 5 metre wide single lane carriageways with 2.5 metre hard shoulders on either side together with a two metre wide public footpath and 1.7 metre wide cycleway. The total width of the alignment including verges will be 25.25 metres. The alignment will involve crossing the Nore River and also a local county road referred to as the 'Bleach Road' which runs in a north-south direction to the east of the Nore River. Junction treatment for the intersection between the new road and the Bleach Road has yet to be determined, however at this stage it is not proposed to incorporate any grade separation between the two roadways. A new roundabout junction will be incorporated at the intersection of the new link road and the R693 – Freshford Road. The bridge span required over the Nore is 49 metres in length under the preferred option (Option 8). It is estimated that the proposed link would cater for 12,480 vehicles per day in 2011 (the intended year of opening) and 23,492 per day in the design year of 2026. The reassignment of the above trips from Kilkenny City Centre to the outer ring road would result in reduced congestion at Green's Bridge and John's Bridge in Kilkenny City Centre.

3.0 RECEIVING ENVIRONMENT

Running from east to west, the preferred alignment will traverse, for the most part, Improved Agricultural Grassland (based on Fossit's Classification 2002). Approximately 100 metres west of the junction between the Castlecomer Road and the N77 ring road, the route will traverse the northern apex of a triangular field which incorporates mature hedgerows before traversing a large area of

improved agricultural grassland to the east of the Bleach Road. The route will also traverse a tree lined private access road to a farm house, which was previously a railway alignment. The area between the Bleach Road and the River Nore likewise comprises of approved agricultural grassland. The River Nore forms part of the River Barrow and Nore SAC (site code 002162),and SPA (site code 004233) a designated Natura 2000 site. The route also traverses to designated pNHA sites (referred on the NPWS website as the Dunmore Complex pNHA). There is riparian woodland along the banks of the River Nore. This woodland area expands on the western side of the riverbank to the immediate south of the alignment. The agricultural lands to the west of the River Nore between the river and the Freshford Road, are cultivated for tillage purposes. There are no dwellinghouses in the immediate vicinity (ie contiguous to) of the proposed alignment. A recently constructed housing development 'Weir View' is located to the south of the alignment, to the immediate south-west of the N77 ring road/Castlecomer roundabout. This development was recently completed and there appears to be a number on unsold/unoccupied dwellings within the estate. There are a number of one-off dwellinghouses and agricultural farmsteads particularly along the Bleach Road to the north of the site. The closest dwellinghouse along the Bleach Road is approximately 220 metres from the proposed alignment. The Auteven Hospital, a small private hospital is located to the west of the Nore and to the immediate south of the western section of the proposed alignment. Access to this hospital is currently provided off the Freshford Road.

4.0 KILKENNY COUNTY COUNCIL SUBMISSION

A submission from Kilkenny County Council under Section 50 (1) (c) of the Road Act 1993 was received on the 6th March 2012. The submission notes that following the completion of the constraints and route option study, it was concluded that the preferred route identified has the potential for significant environmental effects during the construction and operation phases of the proposed scheme. Thus the Planning Authority is seeking a written Direction from the Board as to whether or not an EIS should be prepared in accordance with statutory requirements. The proposed scheme does not exceed any of the threshold criteria specified within Article 8 of the Roads Regulations (SI 119 of 1994).

Notwithstanding the fact that the proposed development is sub-threshold, taking into account the provisions of Section 50 of the Roads Act 1993, together with Article 27 of the European Community (EIA Amendment) Regulations 1999, it was concluded that there would be significant environmental effects associated with this scheme. These include: -

- The size and cumulative effects associated with the scheme.
- The location of the proposed development in environmentally sensitive areas.
- The characteristics of the proposed impact in terms of the extent, magnitude and probability and duration of the impacts.

Following this process, it was concluded that the proposed northern ring road extension has the potential to have significant environmental impacts, particularly in terms of: -

- Ecology.
- Cultural and heritage impacts.
- Hydrogeological impacts.
- Potential impacts on human beings.

Also submitted was a copy of the Kilkenny Northern Ring Road Extension – Constraints and Route Option Study. The more salient points contained in this study as they relate to the application before the Board, are summarised below. The report outlines the need for the scheme and evaluates each of the initial route options considered under various constraints, including: -

- **Traffic**

  In terms of traffic it is argued that the impact of the proposed northern ring road on the Kilkenny Road Network is extremely positive, reducing demand and therefore congestion in the city centre. The impact in terms of AADT reduction on city centre traffic is set out in Table 5 of the report.

- **Ecology**

  It is noted that there are two natural heritage areas identified in the studied area and these are identified in Drawing No. 07-088-033. The impacts on the NHA are considered as a major negative and mitigation measures should be put in place before any construction works start. It is noted that the treelines adjacent to old railway line are of significant importance. The study area also contains a significant area designated as a candidate SAC (Special Area of Conservation) namely the areas adjacent to the River Nore. This area is shown in Drawing No. 07-088-033. In terms of fauna, evidence of otters was found in the area. There are also suitable habitats for bats, whooper swans, snipes and salmonids fry.

  The proposed modifications resulting from the new road would include vegetation and soil removal, habitat destruction, heavy machinery movements, construction of bridges and culverts, increased noise and dirt and on-site material storage. Mitigation measures for ecology are set out.

- **Archaeology and Archaeological Constraints Study**

  An Archaeology and Archaeological Constraints Study was carried out and this is separately contained in Appendix 4 of the document. It is noted that there are two recorded archaeological sites contained within the assessment area, these are described as “enclosure sites” in the report.

- **Hydrology**

  It is noted that the River Nore has one of the largest catchments in Ireland with significant floodplain areas holding large volumes of water during flood periods. It is proposed to construct a bridge over the River Nore with a single span and the proposed design will incorporate allowances for natural flooding occurrences.

- **Planning Issues**

  It is acknowledged that the proposed alignment could offer a potential nuisance for residents of properties located adjacent to the route in terms of traffic noise and vibration. Air quality is also a factor affecting the environment, particularly for those properties located in close distance to the road. The Bleach Road is also used by local residents as a 'Slí na Slainte' route and therefore has some amenity value.

- **Service and Utilities**

  Two 10 kV lines cross the varous route options and these cables require undergrounding in conjunction with the ESB prior to works proceeding.

The report goes onto evaluate each of the eight route options in the context of the constraints highlighted above.

Based on the assessment it was considered that Route No. 8 was deemed to be the most cost effective option with the least negative impact on the environment.

5.0 LEGISLATIVE PROVISIONS

The proposed route alignment, despite being 1.5 kilometres in length nevertheless falls short of the threshold for a mandatory EIS. Article 8 of SI 119 of 1994 requires a mandatory EIS for a road scheme of four lanes or more in excess of 500 metres in length or the construction of a new bridge or tunnel in excess of 100 metres in length. As the current proposal relates to a two-way single carriageway, it falls below the threshold and therefore constitutes a sub-threshold development.

Section 50 (1)(c) provides that where it appears to the Roads Authority that a proposed road development would be likely to have significant effects on the environment, it shall inform the Board that if the Board concurs, the Roads Authority shall prepare an EIS. The Roads Act 1993 was further amended under Article 14 of the European Communities (Environmental Impact Assessment) (Amendment) Regulations 1999 (SI 93/1999) where a proposed public road or an improvement to an existing road would be located on:

(i) A Special Area of Conservation.

(ii) A site notified in accordance with Regulation 4 of the European Communities (Natural Habitat) Regulations 1997.
(iii) An area classified pursuant to Paragraph 1 and 2 of Article 4 of Council Directive No. 79/409 (EEC) (Birds Directive).
(iv) A site where consultation has been initiated in accordance with Article 5 of Council Directive 92 (43/EEC) (Habitats Directive).
(v) A site designated under the Wildlife Act 1976,

the Roads Authority shall inform the Board of the proposal and if the Board concurs, the Roads Authority shall prepare an EIS.

In terms of appropriate assessment, the Board in determining whether or not an Appropriate Assessment (AA) or a Natura Impact Statement (NIS) should be undertaken and prepared, regard should be had to the DoEHLG Guidelines of 2009 entitled "Appropriate Assessment of Plans and Projects in Ireland – Guidelines for Planning Authorities". These guidelines advises that all plans and projects which may not be directly connected to or for the management of a Natura 2000 site, nevertheless must be assessed for its potential significant effects which may affect the integrity of a European site before any decision is made to allow the plan or project to proceed. Each plan or project must also be assessed for its possible effects in combination with other plans and projects. This process is designated "Appropriate Assessment" and arises from obligations imposed under Article 6 (3) and 6 (4) of the Habitats Directive (92/43/EEC).

The development under consideration traverses the River Nore candidate SAC (Site Code 002162). The site is also located in close proximity and in one instance traverses the proposed NHA boundary. In this regard the provisions of Section 50 (1)(c) and (d) of the Roads Act 1993 as amended would apply.

Whether or not the proposed development is likely to have a significant effect on the environment is assessed in more detail below.

6.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

Ecological Impact

It is clear from the ecological report contained in Appendix 3 of the Constraints and Route Option Study that the proposal could have a significant impact on terrestrial flora and fauna. The receiving ecology of the area is detailed in this report. It concludes that the study area contains significant ecological interest. The floodplain marshes are noted as being particularly good with a diverse flora including several unusual species. The area also includes an area of wet woodland which is also deemed to be generally uncommon in the context of the wider area. It is noted that the Nore River has an inherent value as a fishery and hosts several aquatic species which are rare in Europe. The more important species listed include salmon, lampreys and freshwater crayfish. Salmonid fry were also observed in the river.

In terms of terrestrial fauna clear evidence of otters was recorded on the eastern bank of the river. Other species recorded in the area include the whooper swan, snipe, sparrow hawk and yellow hammer. The report concludes that *"running a road through this area will have a definite negative impact on the ecology by dividing a floodplain in two and causing habitat loss in designated areas. It is likely to lead to the loss of one species of interest (riccia fluitans) and to the reduction of several others (yellow hammer and whooper swan). It may also disrupt flooding patterns and cause disturbance to bird populations, particularly in winter"*. It is clear therefore that the receiving environment is ecologically sensitive and that the construction and operation phases would give rise to significant ecological impact. While the report notes that the ecological impacts of a new bridge over the river could be largely mitigated by construction methods and timing, further investigation is required in my view as to the detailed adverse impacts which may arise and the mitigation measures which would be required in order to potentially address these adverse impacts.

The Board should also have regard to the fact that the River Nore and contiguous lands along the riverbank are also designated as a candidate SAC. The conservation objectives for this SAC as set out seek to maintain the favourable status of a number of species referred to in the ecological report. The conservation objectives include maintaining and restoring the following species which appear to be located in the assessment area.

- The freshwater white-clawed crayfish.
- The brook, sea and river lamprey.
- The otter.
- The Atlantic salmon.
- Alluvial forests.

It is clear therefore that the proposed development has the potential to have significant affects on a European site.

Although not referred to specifically in the constraints and route option study, it appears that the River Nore is also designated as a SPA (site code 004233). The potential impact on birds, including bird strikes at the proposed bridge should be evaluated in any assessment. While reference is made to two Natural Heritage Areas located within the study area (and which may be traversed by the proposed alignment), it appears that these two areas are proposed Natural Heritage Areas and accordingly to the NPWS website there appears to be no detailed site synopsis for the proposed natural heritage areas. Further information will required to be obtained in relation to both the SPA and the pNHA identified in the site assessment area.

Archaeology

Two archaeological sites have been identified in the study area. A more detailed archaeological assessment was carried out in relation to the study area and this assessment is contained in Appendix 4 of the Constraints and Route Option Study. The archaeological assessment notes that the area is well-

established settlement area during the early and later medieval periods, particularly along the river. It is suggested that there are a number of areas of archaeological potential including the riverbed, milling activity associated along the riverbank and the wetland and bogland areas together with the improved agricultural grassland area which makes up most of the receiving environment surrounding the proposed alignment. The report suggests that further archaeological investigations including geophysical surveys would be required throughout the assessment area. This information should be researched and submitted as part of an EIA undertaking.

Socio - economic Impacts

The proposal seeks to extend an existing ring road to the north of Kilkenny City. This, according to the constraint study, will redirect significant volumes of traffic away from Kilkenny City and would result in almost 12,500 vehicles using the new alignment on the date of opening and this figure would increase to almost 23,500 vehicles in the design year of 2026. This could have significant implications on surrounding residential amenity in terms of noise, nuisance, community severance and economic severance (dividing landholdings etc.). The amenity impact could be quite considerable in this instance having regard to the close proximity of the proposed alignment to both dwellings in the recently completed 'Weir View' residential development but perhaps more importantly the close proximity of the alignment to the Auteven Hospital which is located to the immediate south of the western end of the proposed alignment. Obviously hospitals are particularly sensitive receptors in terms of noise, during construction and operation and also, albeit perhaps to a lesser extent air pollution.

The resulting volumes of traffic which will be discharged onto the R693 regional route (Kilkenny-Freshford Road) should also be evaluated as the additional traffic could likewise have significant adverse impacts on residential amenity along this road. Potential impacts on tourist/amenity/community activities in the surrounding area such as walking routes should also be considered in more detail. I note that the Constraints Study makes reference to a "Slí na Slainte" which is located along the Bleach Road which will be intersected by the proposed alignment.

Another important socioeconomic impact relates to the potential visual impact arising from the scheme particularly from the bridge which will incorporate a span of nearly 50 metres in length across the River Nore. Section 6.1.4 of the Development Plan states that it is the policy of the Council to promote the natural amenity potential for the River Nore in order to facilitate the development of amenity, recreational, ecological and tourism benefits for the City and region generally. It notes that the River Nore has the considerable potential to be used as a recreational asset for the City, the County and the region as a whole. Policy RTA13 seeks to protect and improve access to the River Nore without compromising the quality and setting of the river.

The photographs attached indicate the aesthetic qualities in and around the banks of the river. Any proposed bridge would need to take cognisance of the

visual amenities of the area in any design approach. This would need to be explored further in my view with the use of photomontages and a proper landscape assessment which should form part of any Environmental Impact Statement. The lands to the immediate south of the alignment to the west of the River Nore are zoned for recreation, amenity and open space. The visual impact could therefore be a material consideration in evaluating the proposal. (The lands to the immediate south of the alignment to the east of the River Nore appear to be located outside the boundary of the Kilkenny City and Environs Development Plan 2008-2014).

In conclusion I note that the constraints report concludes that "any route corridor that lies in close proximity to properties could be regarded as having negative impacts on residents and amenities". This suggests that further investigations are required in this area.

Air and Climate

The potential impact in terms of air pollution is unlikely to be material having regard to the overall air quality status for Kilkenny and its environs. Kilkenny is located in air quality Zone C (major towns outside Dublin and Cork). The latest available measurements of Ozone, nitrogen dioxide, PM_{10} and sulphur dioxide are carried out at Civil Lodge, Kilkenny. Currently according to the EPA website the air quality in this area is very good. Having regard to the nature of the receiving environment and the levels of traffic proposed to be diverted to this area it is unlikely that the proposed development will have any significant or profound impacts on air quality which would result in any air quality standards being breached. Notwithstanding this conclusion it would not be unreasonable in my view that any EIA carried out would demonstrate in more detail that air quality standards would not breached as a result of the proposed development particularly having regard to the close proximity of the hospital.

Geology, Hydrogeology and Soils

Detailed bedrock subsoil investigations including geophysical investigation may be required to be undertaken both in terms of laying the road foundations and also assessing the foundations for any bridge span over the River Nore. Any excavations in this regard could potentially impact on the water table particularly in terms of dewatering and potential consequences on source protection areas, water supplies or zones of contributions to wells etc. Detailed investigations in relation to potential sources of pollutions, pathways and potential receptors including any wells or wetlands in the area should be assessed particularly at construction stage.

Hydrology

Further hydrological investigations are likely to be required having regard to the statement in the Constraints and Route Options Study which indicates that the proposed route crosses approximately 500 metres of floodplain. The River Nore has a significant catchment area, holding large volumes of water during flood periods. It is also noted in the above report that the River Dinan, which

joins the Nore approximately 4.5 kilometres to the north of the proposed bridge crossing, runs for the most part through an upland area which can result in significant high velocity flows which could further exacerbate the flooding potential. The construction of a road and bridge traversing the floodplain could have significant implications for the flood dynamics and floodplain displacement. A more detailed analysis of the bridge design, flood characteristics and flood frequency events are therefore a necessary requirement in my view.

As the current application is being assessed under Section 50 of the Roads Act 1993 as amended and Article 14 of SI 93/1999, it would be useful and appropriate in my view to have regard to the criteria specified under article 27 of SI No. 93 of 1999 as amended, in further assessing the potential for likely impacts on the environment.

In terms of the characteristics of the proposed development, it should be noted that while the proposed road will not entail the construction of four lanes, it will involve an alignment with a total length of c.1.5 kilometres. This is three times the threshold in terms of length of carriageway for which an EIS is mandatory. The proposed development therefore in its own right can be regarded as a substantial development notwithstanding the fact that it does not comprise of three lanes of carriageway. The proposal could give rise to cumulative effects, as it will constitute an extension to an existing ring road which already accommodates large volumes of traffic around the peripheral ring road of Kilkenny City.

With regard to the location of the development, I have already alluded to the fact that the proposal traverses and therefore could significantly affect an area classified as a SAC and SPA to which Directives 92/43/EEC and 79/409/EC apply. The alignment is also located in proximity to areas designated as a pNHA. Furthermore it traverses a landscape which may be of historical, cultural and archaeological significance. These two issues are specifically referred to under Section 2(e) and 2(h) of Schedule 7.

In terms of the characteristics of the potential impacts, it could be reasonably argued that the extent of the impact will be significant in that the proposed alignment traverses an area in excess of 1500 metres. The magnitude of complexity of the impact could also be significant having regard to the potential receptors in terms of ecology, archaeology, hydrology, visual impact and other socioeconomic impacts. Furthermore the probability of the impact is high having regard to the nature of the works to be carried out and the impact is likely to be permanent and irreversible (subject to any mitigation measures set out in an EIS).

Appropriate Assessment

If the Board conclude that an EIS is not warranted in this instance, I would recommend that the Board consider requesting that an Appropriate Assessment be carried out and that at the very least an NIS be submitted, as the proposal, for reasons already outlined in my report, has the potential to affect a European

Site namely the River Barrow and River Nore SAC and SPA (site codes 002162 and 004233 respectively). It should be noted that this was not what was specifically applied for under the current application, the Board under its statutory powers request the applicant to submit this information.

Conclusion

In conclusion therefore and having particular regard to the information submitted with the application in particular the information contained in the 'Kilkenny Northern Ring Road Extension – Constraints and Route Option Study' together with my site inspection, I would consider that given the size and scale of the development and the nature of the receiving environment it is considered that the proposal is likely to have significant impacts on the environment and therefore an Environmental Impact Assessment should be carried out and an Environmental Impact Statement should be prepared in respect of the proposed road development.

7.0 RECOMMENDATION

I therefore recommend that the Board directs the Roads Authority, Kilkenny County Council under Section 50(i)(b) of the Roads Act 1993 to prepare an Environmental Impact Statement in respect of the road development which is the subject of the current application.

REASONS AND CONSIDERATIONS

Having considered the submissions made to the Board, the report and recommendation of the person appointed by the Board to make a report and recommendation on the matter and having regard to:

(a) The Guidance contained within the Department of the Environment, Heritage and Local Government document entitled "Environmental Impact Assessment (EIA) Guidance for consent Authorities regarding sub- threshold Development" (2003)

(b) The nature and scale of the proposed road development which includes the construction of a bridge over the River Nore.

(c) The environmental sensitivity of the receiving environment in the vicinity of the alignment including the proximity of the River Nore SAC (site code 002162) and SPA (site code 004233) and the Dunmore Complex proposed Natural Heritage area (site code 001859).

(d) The information contained in the document submitted with the application entitled "Kilkenny Northern Ring Road Extension – Constraints and Route Option Study".

It is considered that the proposed Ring Road Extension is likely to have significant impacts on the environment, and therefore an environmental impact assessment (and the submission of an environmental impact statement) for the proposed development will be required.

_____

Paul Caprani,
Senior Planning Inspector.

8th May, 2012.
Cr / rk

APPENDIX C

Relevant Stakeholder Responses

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

16th July 2013

Our Ref: **G Pre00190/2013**

Roger Goodwillie,
Lavistown House,
Kilkenny

Re: **Natura Impact Statement for an extension of the Kilkenny Ring Road.**

A Chara,

I refer to your recent correspondence. Outlined below are the nature conservation observations of the Department of Arts, Heritage and the Gaeltacht with respect to the above.

This project has the potential to impact on water quality both at construction and operation stages. It also has the potential to introduce alien invasive species at construction stage. It is essential that all mitigation measures outlined are implemented.

The applicant should refer to the various circular letters issued by the National Parks and Wildlife Service of this Department, which can be found at:
http://www.npws.ie/planning/appropriateassessment/ .

In particular, Circular Letter PD 2/07 and NPWS 1/07 on the use of compliance conditions is relevant. In order to allow for a complete assessment it is essential that any mitigation measures detailed in the NIS form part of a construction management plan, which must be implemented by the successful contractor at construction phase. This should be detailed in the NIS and the EIS/planning application.

You should also note that, apart from appropriate assessment, if there are impacts on protected species and their habitats, resting or breeding places as a result of this proposed development that licenses may be required under the Wildlife Acts or derogations under the Habitats Regulations. In particular, bats and otters are strictly protected under annex IV of the Habitats Directive and a copy of Circular Letter NPWS 2/07 entitled "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences*" can be found on our web site at:
http://www.npws.ie/media/npws/publications/circulars/media,6686,en.pdf.

In addition licenses will be required if there are any impacts on other protected species or their resting or breeding places, such as on protected plants, badger setts or birds nests. Hedgerows should be maintained where possible. Where trees or hedges have to be removed there should be suitable planting of native species in mitigation. Where possible hedges and trees should not be

removed during the nesting season (i.e. March 1st to August 31st). Birds nests can only be intentionally destroyed under licence issued under the Wildlife Acts of 1976 and 2000. In order to apply for any such licenses or derogations as mentioned above a detailed survey should be submitted to NPWS, which should have been carried out by appropriately qualified person/s.

Kindly forward any further information to the following address:

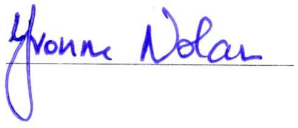
The Manager,
Development Applications Unit,
Department of Arts, Heritage and the Gaeltacht,
Newtown Road,
Wexford

Alternatively, documentation associated with the above can be referred electronically to the DAU at the following address:

manager.dau@ahg.gov.ie

Finally, the above observations and recommendations are based on the papers submitted to this Department on a pre-planning basis and are made without prejudice to any observations the Minister may make in the context of any consultation arising on foot of any development application referred to the Minister, by the planning authority, in his role as statutory consultee under the Planning and Development Act 2000, as amended.

Is mise le meas,



Yvonne Nolan,
Development Applications Unit
Tel: (053) 911 7382

From: Maire Buckley [mailto:M.Buckley@epa.ie]
Sent: 13 February 2013 15:22
To: Pat Groves
Subject: RE: EPA - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Pat,

Thanks for your email.

In relation to EIS scoping you are advised to refer to the Agency's guidance notes on EIS at the following link:
http://www.epa.ie/downloads/advice/ea/guidelines/
It is noted that based on the information provided, the proposed development does not appear to be a licensable activity under the Environmental Protection Agency Act, 1992, as amended, and the Waste Management Act, 1996, as amended. Therefore, please be advised that the Agency has no further observations in regard to the proposed development at this time.
Thanks and regards,
Máire
Máire Buckley
Programme Officer
Environmental Licensing Programme
m.buckley@epa.ie
www.epa.ie

From: Sophie Preteseille [mailto:Sophie.Preteseille@gsi.ie]
Sent: 12 February 2013 11:18
To: Pat Groves
Subject: RE: Geological Survey of Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report

GSI Ref: 13/23

Re Scoping comments for Kilkenny Northern Ring Road EIS report

Dear Pat,

In relation to the scoping exercise for the Kilkenny Northern Ring Road, The Geological Survey of Ireland (GSI) comments will be as follow:

Preparation of the EIS report

All relevant datasets for the "Soils and Geology" and "Hydrogeology" chapters of the EIS are available on GSI website at http://www.gsi.ie/mapping (bedrock, subsoils, geotechnical, boreholes, groundwater vulnerability, aquifers, karst, wells.).

Geological Heritage

The only input from GSI at this stage will be on geological heritage for the "Soils and Geology" chapter, as the data is not available through any

of our mapviewers so far.

The audit of County Geological Sites (CGS) for Kilkenny was carried out in 2007 and updated in 2012 (mainly with road cuttings linked to the M9 works). The 2007 Report and shapefile are available on GSI website at: http://www.gsi.ie/Programmes/Heritage+and+Planning/County+Geological+Sites+Audits/Kilkenny.htm

There are no geological sites of interest, either recommended for CGS or NHA designation in the vicinity of the proposed N77 Northern Ring Road extension.

For information, the closest sites of interest within a 5km radius lie at about 4.5km from the proposed development and are unlikely to be affected by the works. These sites are:

- Three castle quarry to the north west
- Ballyfoyle channels to the north east
- Archersgrove quarry to the south east

Site descriptions are available at the above mentioned link.

Other comments

Other completed county audits of geological heritage sites for other projects you might be dealing with are available at: http://www.gsi.ie/Programmes/Heritage+and+Planning/County+Geological+Sites+Audits/. Please note that the completion of audits is very much in progress, so please continue to either contact me or my colleague Sarah Gatley (sarah.gatley@gsi.ie) for information on geological heritage sites and discussion of possible mitigation measures when applicable.

GSI would much appreciate a copy of reports detailing any site investigations carried out. The data would be added to GSI's national database of site investigation boreholes feeding into the geotechnical viewer, implemented to provide a better service to the civil engineering sector. Data can be sent to Beatriz Mozo at GSI's address or at beatriz.mozo@gsi.ie , 01-678 2795.

As GSI's karst dataset is far from comprehensive due to important data gaps, GSI would welcome complementary data collected during this EIA; data which would be added to the national database. If you wish to contribute data, please contact Caoimhe Hickey for details (caoimhe.hickey@gsi.ie, 01-678 2811).

GSI would also request notification of ground excavations, etc. undertaken that might provide good geological exposures for our examination. This would allow recording, fossil or rock sample collecting and gathering of new data in order to enhance our understanding of the area.

At a later stage, should any significant bedrock cuttings be created, we would ask that they be designed to remain visible as rock exposure rather than covered with soil and vegetated, in accordance with safety guidelines

and engineering constraints.

I hope you'll find these comments useful, and if the GSI can be of further help, please contact me.

Kind regards
Sophie

Sophie Préteseille
Geologist
Heritage and Planning Programme

Geological Survey of Ireland
Beggars Bush
Haddington Road
Dublin 4
T. 01-678 2741
Website: www.gsi.ie
Events Diary: http://www.gsi.ie/Events+Diary/
GSI Newsletter: http://www.gsi.ie/Newsletters/Home.htm
Geological Heritage Audits:
http://www.gsi.ie/Programmes/Heritage+and+Planning/County+Geological+Sites+Audits/

From: Alison Harvey [mailto:aharvey@heritagecouncil.ie]
Sent: 15 February 2013 17:00
To: Pat Groves
Subject: RE: The Heritage Council - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Hello Pat
Many thanks for your email. Please could you get in touch again when the EIA has been undertaken and we/the Heritage Council will endeavour to review the EIS.
Kind regards
Alison

From: Pat Groves [mailto:Pat.Groves@awnconsulting.com]
Sent: 07 February 2013 09:19
To: Alison Harvey
Subject: The Heritage Council - Re Scoping comments for Kilkenny Northern Ring Road EIS report

FAO: Alison Harvey
The Heritage Council

Dear Alison,

AWN Consulting Ltd. has been commissioned by Kilkenny County Council to prepare the Soils & Geology and Hydrogeology chapters for an Environmental Impact Statement for Kilkenny Northern Ring Road Extension road project which is the new ring road extension for Kilkenny City. The preferred route links the existing roundabout at the intersection of the N77 ring road extension with the N77 Castlecomer National Secondary Route to a new roundabout approximately 1.5 kilometres to the west on the R693 Kilkenny to Freshford Regional Route. The alignment will involve crossing the River Nore and also a local county road referred to as the 'Bleach Road' which runs in a north-south direction to the east of the River Nore. The total width of the alignment including verges will be 25.25 metres.

A plan of the proposed road including cross sections is enclosed herein (as 2 separate sheets) depicting the preferred alignment. Please note that the ring road extension is currently at a preliminary stage and as a result no detailed design drawings are available.

For the purpose of compiling this EIS, we would be very grateful for any comments and direction from The Heritage Council as per EIA Scoping Requirements.
Please do not hesitate to contact the undersigned should you require any additional information.

Regards,

PAT A. GROVES
Hydrogeologist

AWN Consulting Ltd.,
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Republic of Ireland.

Mobile: +353 (0) 87 6383782
Office: +353 (0)1 847 4220
Facsimile: +353 (0)1 847 4257
E-mail: pat.groves@awnconsulting.com
Website: www.awnconsulting.com

From: Pat Groves
Sent: 27 February 2013 21:28
To: Dominica Baird
Subject: FW: Inland Fisheries Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report
Importance: High

Hi Dominica,

Attached the response from Inland Fisheries Ireland re Kilkenny RR, if you wish to forward to Caroline.
Quite comprehensive really.

Regards,

Pat

PAT A. GROVES
Hydrogeologist

AWN Consulting	**e:** pat.groves@awnconsulting.com
The Tecpro Building	**m:** +353.87.638.3782
IDA Business and Techology Park	**t:** +353.1.847.4220
Clonshaugh	**f:** +353.1.847.4257
Dublin 17	**w:** www.awnconsulting.com

From: Patrick Kilfeather [mailto:pkilfeather@fisheriesireland.ie]
Sent: 27 February 2013 17:17
To: Pat Groves
Subject: RE: Inland Fisheries Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Mr. Pat A. Groves,
AWN Consulting Ltd.

Dear Pat,

Thank you for your emails dated 7th and 10th inst. and attachments.

As you will be aware, the main channel of the River Nore is a formally designated salmonid water under S.I. 293 of 1988. The reach at the proposed crossing location is a good trout and salmon rod fishery and much of it is wadeable in low flow conditions. While the waters might best be described as primarily comprising a glide and pools, there are areas in the reach concerned where spawning of both trout and salmon has been observed. And so at the proposed crossing site, the main channel primarily comprises a zone of passage, a holding area and a spawning/nursery area for salmonids.

While the proposed bridge (based on the drawings supplied) appears to be a clear span structure and thus is in accordance with our requirements, the proposed installation of flood carrying culverts (again based on the drawings supplied) within the embankment which will be required on the Bleach Road side of the bridge is a matter which needs detailed consideration. If the carrying capacity of the flood plain is reduced, and based on a preliminary assessment of the drawings supplied this appears to be the case, such embankment and culverts may lead to those intensively farmed lands along the Bleach Road being flooded for longer than is currently the case. This could result in increased erosion and nutrient losses to waters. The area subjected to flooding may also increase consequent on the embankment installation. Your clients are advised to consider a

bridge structure spanning not only the main channel of the Nore, but also the flood plain between the main channel and the Bleach Road. Additionally, if flood relief culverts within the embankment are provided, these must be self-emptying so as to ensure no fish or aquatic life become trapped during falling water levels post a flood event.

Hereunder is guidance as to our requirements for works at and adjacent to waters. For ease of reference, I have highlighted particular items which are directly relevant to the proposed works.

RIVER AND STREAM PERMANENT CROSSING STRUCTURES.

Structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage. Design and choice of structure should be based on its technical and economic feasibility to pass fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over-wintering areas, provision in certain areas of angling and commercial fishing access including boat access and prevention of erosion and sedimentation.

Culverts are the most frequently used river/stream crossing structures and are associated with some of the most common fish passage problems. The culverting of long stretches of fisheries water is extremely undesirable and can result in significant loss of valuable habitat. In the case of crossing structures over fishery waters, the preferred position is for clear span structures (bridges), so as not to interfere in any way with the bed or bank of the watercourses in question.

Bridge foundations should be designed and positioned at least 2.5 metres from the river bank so as not to impact on the riparian habitat .

Generally, bridges and bottomless culverts are the best option for maintaining natural stream channel characteristics and have the least impact on habitat. However, because of design and load bearing considerations, bottomless culverts may not always be suitable for installation particularly on narrow river channels, as foundations may encroach on the channel itself and possibly result in future scouring or erosion.

Taking account of recent advances and investigations in the area of climate change and flood studies, designs should be such as to verifiably have carrying capacity for a 1 in 100 year fluvial flood flow whilst maintaining a minimum freeboard of 300 mm.

The Office of Public Works (OPW) is the lead agency for flood risk management in the Republic of Ireland. Design and capacity of structures must also be in accordance with their requirements. IFI strongly recommends that contact be made with OPW at the earliest stage in the planning and design process. (www.opw.ie)

Clear span designs maintain channel profile, do not alter gradients, readily pass sediment and debris and provide unrestricted passage for all size classes of fish by retaining the natural stream bed and gradient. Water velocity is not changed and they can be designed to maintain the normal stream width. Foundations should be positioned at least 2.5 metres from waters.

Embedded box and pipe culverts are less preferable to bridges and bottomless culverts. Embedded culverts must maintain the natural channel gradient, width and substrate configuration. They should be buried to a minimum of 500 mm. below the stream bed at the natural gradient. Box and pipe culverts must be sized to maintain the natural stream channel width. The gradient should not exceed 3%. The availability of suitably sized material (depending on hydraulic conditions) to initiate "simulation" of the stream bed is the most preferable approach to establish fish and faunal passage through culverts.

Culverts should be positioned where the watercourse is straightest and aligned with its bed.

In the case of bridges and bottomless culverts, structures should be designed and installed so as to:

- Allow for the maintenance of channel profile and existing gradient.
- Be capable of passing such debris as might arise during flood flow conditions.
- Ensure adequate light penetration to minimise loss in primary productivity.
- Not result in damage to the riparian habitat or necessitate construction within 2.5 metres of waters.
- Provide at locations specified by IFI, angling access and/or access for commercial fishing purposes.

IFI is prepared in certain circumstances to consider proposals for the installation of box or pipe culverts on fisheries waters. These may be installed subject to structures being sized so as to meet the requirements above in terms of channel profile, gradient, flood debris capacity, light, access and:

- Be positioned such that both the upstream and downstream invert shall be 500 mm. below the upstream and downstream river bed invert levels respectively.
- Never exceed a slope of 5%, in which circumstances baffles generally are required, and preferably not exceed a slope of 3%.
- As baffles can reduce the hydraulic efficiency of culverts, appropriate capacity provision must be included in the overall design.
- In the case of box culverts on angling waters, be 3 meters in height.

Pipe culverts are not generally considered acceptable on fisheries waters. They are normally only appropriate for use on minor watercourses and drainage ditches where these can be demonstrated as not being significant in terms of fisheries habitat

Bank protection works are often required upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs. In carrying out bank protection works, it is essential that large enough boulders are selected and strategically positioned, to ensure they cannot be undercut. Normally this entails part burying boulders up to one third of their depth below stream bed level and securing them into their final position. In areas of high water energy, to ensure stability, boulders size should be a minimum of 0.5 ton. To facilitate revegetation, each course of boulders laid should be back filled with a layer of top soil. Selection of boulders in terms of shape to facilitate their placement and stability is a major consideration. Irregularly shaped boulders are very difficult to work with in terms of building multiple stable courses. The height to which rock armour is built must take account not only of the riparian zone requiring protection, but also in certain circumstances of the need to protect e.g. kingfisher and sand martin habitat. In many instances, one or two layers of armour will be sufficient to protect and stabilise the toe of embankments while allowing nesting.

Gabions are not a preferred option when it comes to bank protection. They can easily be vandalised and once the mesh is cut or broken, baskets can collapse. Gabion baskets can be unsightly and it is difficult to successfully establish and maintain vegetation on side walls. Gabion baskets are normally only acceptable at locations where due to access constraints it is not possible to install rock armour.

CONSTRUCTION IMPACTS.

Uncured concrete can kill fish, plant life and macroinvertebrates by altering the pH of the water . Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life.

Discharge of silt-laden waters to fisheries streams is of particular concern. Silt can clog fish spawning beds and juvenile fish species are particularly sensitive. Plant and macroinvertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat. It is important to incorporate best practices into construction methods to minimise discharges of silt/suspended solids to waters.

Discharges of fuels and oils can be directly toxic to aquatic life and at sub lethal levels lead to tainting of fish tissues, rendering fish inedible. Oil films on water can seriously interfere with the diffusion of oxygen from the atmosphere into waters and in extreme cases result in oxygen depletion.

IFI require that:

- When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete.
- No direct discharges be made to waters where there is potential for cement or residues in discharges.
- Designated impermeable cement washout areas must be provided.
- The pH of any and all discharges made from and during construction works shall be in the range 6.0 - 9.0 units and not alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units.
- Silt traps/settlement ponds or other forms of containment and treatment shall be constructed at locations that will intercept run-off to streams. Traps shall not be constructed immediately adjacent to natural watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact. Alternatively, imported materials such as terram, straw bales, coarse to fine gravel should be used either separately or in combination as appropriate to remove suspended matter from discharges.
- The level of suspended solids in any discharges to fisheries waters as a consequence of construction works shall not exceed 25 mg/l, nor result in the deposition of silts on gravels or any element of the aquatic flora or fauna.
- All oils and fuels shall be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular attention shall be paid to gradient and ground conditions which could increase the risk of discharge to waters.
- Temporary oil interceptor facilities shall be installed and maintained where site works involve the discharge of drainage water to receiving rivers and streams.
- There shall be no visible oil film in any discharges from construction works to waters.
- That all containment and treatment facilities are regularly inspected and maintained.
- Waterproofing and other chemical treatment to structures in close proximity to waters shall be applied by hand.
- Hydroseeding shall not be carried out in close proximity to water. These areas shall be seeded by hand.

ANGLING AND COMMERCIAL FISHING ACCESS .

In circumstances where crossings of important angling waters are concerned, it will often be necessary to provide for angling access to and from stretches of water during the construction phase of projects. It is important to note that fishing rights are property rights and that it is a legal right for anglers to access fisheries. Additionally, certain

commercial fishing activities may have entry and access requirements. In such site specific circumstances, IFI will issue project and location specific requirements

IFI require:

- In the case of permanent crossing structures on waters recognised as of angling importance, that a minimum walkway through or under the structure 1.5 meters in width and 2.5 meters in height be provided. The walkway shall be self-draining and have a non-slip finish.
- In the case of a bridge spanning a specific salmon angling site, up to 7 meters clearance above water level and in the case of trout angling, up to 4 metres clearance to allow casting.

TEMPORARY CROSSING STRUCTURES ON WATERS .

All watercourses which have to be traversed during construction projects should be effectively bridged prior to commencement of works. There is sometimes a serious misconception that in installing temporary crossing structures, the only issue is keeping water flowing from above a temporary crossing to below it. Design and choice of temporary crossing structures must provide for passage of fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over wintering areas, as well as preventing erosion and sedimentation. In certain circumstances, access for angling or commercial fishing purposes may also be required .

No temporary crossing on any watercourse shall be installed without the approval of IFI as regards sizing, location, duration and timing .

The preferred option is for clear span 'bridge type' structures on fisheries waters.

The crossing of watercourses at natural fords is not permitted because of the amount of uncontrolled sedimentation that can be generated.

The creation of fords on streams and rivers through the introduction of stone is prohibited.

Where circumstances such as space or access difficulties preclude use of clear span structures, temporary crossings structures shall:

- Comprise one or more metal or concrete pipes, prefabricated culverts or such other material as IFI may permit of minimum diameter 900 mm. Pipes or culverts may be vertically stacked.
- Be laid in such manner as to maintain the existing stream profile.
- Ensure no significant alteration in current speed or hydraulic characteristics, in particular not result in scouring, deposition or erosion upstream or downstream the temporary crossing location.
- Have capacity to convey the full range of flows including flood flows likely to be encountered without the crossing being overtopped.
- Be covered with clean inert material such as to allow for the safe crossing of the widest items of plant and equipment without cover material being dislodged and entering waters.

The approach and departure routes to temporary crossing structures should be designed and installed so that drainage will fall away from the watercourse being crossed. In the event that the fall of ground does not permit sufficient control on drainage, additional earthworks settlement areas shall be provided.

Temporary crossing structures should be fenced with terram or similar material to prevent wind blow carrying dusts and other potentially polluting matter to waters.

Side armour (e.g. reinforced concrete traffic barriers) should be provided on temporary crossing structures to ensure machinery cannot drive over its edge, or force the discharge of material from the bridge deck to waters.

IFI wish to emphasise that site selection for temporary crossings should have regard to all access and construction needs ranging from those of fencing contractors vehicles to the longest wheelbase of multi-axle cranes.

It is not permissible, except in exceptional circumstances, to reposition temporary crossing structures where these are not of a clear span type.

I trust these observations will be of assistance and wish to thank you for consulting with us.

Patrick Kilfeather
Senior Fisheries Environmental Officer - Inland Fisheries Ireland - Clonmel
---

Iascach Intíre Éireann
Inland Fisheries Ireland

Tel +353 (0)52 6123624
Fax +353 (0)52 6123971
Email pkilfeather@fisheriesireland.ie
Web www.fisheriesireland.ie

Anglesea Street, Clonmel, County Tipperary, IRELAND.

Kindly note the change of email address and update your address book.

From: Pat Groves [mailto:Pat.Groves@awnconsulting.com]
Sent: 10 February 2013 19:57
To: Patrick Kilfeather
Subject: RE: Inland Fisheries Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Hi Patrick,

Many thanks for your initial email.
I look forward to hearing from you in due course.

Regards,

Pat

PAT A. GROVES

Hydrogeologist
AWN Consulting Ltd.,
Mobile: +353 (0) 87 6383782
Office: +353 (0)1 847 4220
E-mail: pat.groves@awnconsulting.com
Website: www.awnconsulting.com

From: Patrick Kilfeather [mailto:pkilfeather@fisheriesireland.ie]
Sent: 09 February 2013 15:36
To: Pat Groves
Subject: RE: Inland Fisheries Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Mr. Pat A. Groves,
AWN Consulting Ltd.

Dear Pat,

Thank you for your email dated 7th inst. and attachments. I shall examine the proposals and revert at an early date.

Patrick Kilfeather
Senior Fisheries Environmental Officer - Inland Fisheries Ireland - Clonmel

Iascach Intíre Éireann
Inland Fisheries Ireland

Tel +353 (0)52 6123624
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Anglesea Street, Clonmel, County Tipperary, IRELAND.

Kindly note the change of email address and update your address book.

From: Pat Groves [mailto:Pat.Groves@awnconsulting.com]
Sent: 07 February 2013 11:24
To: Patrick Kilfeather
Subject: Inland Fisheries Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report

FAO: Patrick Kilfeather
Inland Fisheries Ireland

Dear Patrick,

AWN Consulting Ltd. has been commissioned by Kilkenny County Council to prepare the Soils & Geology and Hydrogeology chapters for an Environmental Impact Statement for Kilkenny Northern

Ring Road Extension road project which is the new ring road extension for Kilkenny City. The preferred route links the existing roundabout at the intersection of the N77 ring road extension with the N77 Castlecomer National Secondary Route to a new roundabout approximately 1.5 kilometres to the west on the R693 Kilkenny to Freshford Regional Route. The alignment will involve crossing the River Nore and also a local county road referred to as the 'Bleach Road' which runs in a north-south direction to the east of the River Nore. The total width of the alignment including verges will be 25.25 metres.

A plan of the proposed road including cross sections is enclosed herein (as 2 separate sheets) depicting the preferred alignment. Please note that the ring road extension is currently at a preliminary stage and as a result no detailed design drawings are available.

For the purpose of compiling this EIS, we would be very grateful for any comments and direction from Inland Fisheries Ireland as per EIA Scoping Requirements.
Please do not hesitate to contact the undersigned should you require any additional information.

Regards,

PAT A. GROVES
Hydrogeologist

AWN Consulting Ltd.,
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Republic of Ireland.

Mobile: +353 (0) 87 6383782
Office: +353 (0)1 847 4220
Facsimile: +353 (0)1 847 4257
E-mail: pat.groves@awnconsulting.com
Website: www.awnconsulting.com

From: Ian Lumley [mailto:keeptheduck@gmail.com]
Sent: 07 March 2013 11:07
To: Pat Groves
Subject: Re: An Taisce - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Pat,

Thanks for these detailed drawings

However in order to understand this proposal we need to have have an overall context map showing how what is proposed links to existing and future proposed Ring Road.

Ian

On Wed, Mar 6, 2013 at 9:37 PM, Pat Groves <Pat.Groves@awnconsulting.com> wrote:

Hi Ian,

Re Kilkenny Ring Road

Please find attached two more detailed drawings showing the tie-ins and proposed designs, as requested by you in your last email.

My apologies for the delay in getting these to you.

Again, I look forward to your comments/ observations with regard to the initial email on EIS requirements for this project.

Regards,

Pat

Cc Andrew Jackson at naturalenvironment@antaisce.org

PAT A. GROVES
Hydrogeologist

AWN Consulting
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w: www.awnconsulting.com

Clonshaugh

Dublin 17

From: Ian Lumley [mailto:keeptheduck@gmail.com]

Sent: 08 February 2013 11:58
To: Pat Groves
Subject: Re: An Taisce - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Thanks could you send more detailed map showing how road relate to network around the city and any other particulars you can give us.

Ian Lumley

On Thu, Feb 7, 2013 at 10:49 AM, Andrew Jackson <naturalenvironment@antaisce.org> wrote:

Any thoughts?

---------- Forwarded message ----------
From: **Pat Groves** <Pat.Groves@awnconsulting.com>
Date: Thu, Feb 7, 2013 at 9:08 AM
Subject: An Taisce - Re Scoping comments for Kilkenny Northern Ring Road EIS report
To: "naturalenvironment@antaisce.org" <naturalenvironment@antaisce.org>

FAO: Andrew Jackson

An Taisce

Dear Andrew,

AWN Consulting Ltd. has been commissioned by Kilkenny County Council to prepare the Soils & Geology and Hydrogeology chapters for an Environmental Impact Statement for Kilkenny Northern Ring Road Extension road project which is the new ring road extension for Kilkenny City. The

preferred route links the existing roundabout at the intersection of the N77 ring road extension with the N77 Castlecomer National Secondary Route to a new roundabout approximately 1.5 kilometres to the west on the R693 Kilkenny to Freshford Regional Route. The alignment will involve crossing the River Nore and also a local county road referred to as the 'Bleach Road' which runs in a north-south direction to the east of the River Nore. The total width of the alignment including verges will be 25.25 metres.

A plan of the proposed road including cross sections is enclosed herein (as 2 separate sheets) depicting the preferred alignment. Please note that the ring road extension is currently at a preliminary stage and as a result no detailed design drawings are available.

For the purpose of compiling this EIS, we would be very grateful for any comments and direction from An Taisce as per EIA Scoping Requirements.
Please do not hesitate to contact the undersigned should you require any additional information.

Regards,

PAT A. GROVES

Hydrogeologist

AWN Consulting Ltd.,
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E-mail: pat.groves@awnconsulting.com
Website: www.awnconsulting.com

From: Cyril McCarthy [mailto:cyril.mccarthy@opw.ie]
Sent: 07 February 2013 12:25
To: Pat Groves
Subject: Re: Fwd: OPW - Re Scoping comments for Kilkenny Northern Ring Road EIS report

Pat,
Re: your e-mail below - some general observations.

- Where any proposed road crosses a river or watercourse then consent from this office will be required in accordance with section 50 of the 1945 Arterial Drainage Act.

- It is to be ensured that any such construction does not create or exacerbate flood risk. For example the road should not have the effect of blocking or damming water.

- Maintenance access to the River, in the vicinity of the Flood Relief Scheme, should not be compromised.

Other bodies such as the DoEHLG (National Parks and Wildlife Service) and Inland Fisheries may also have an interest.

Regards,
Cyril Mc Carthy,
Chartered Engineer.

On 07/02/2013 09:29, richard dooley wrote:

-------- Original Message --------
Subject:OPW - Re Scoping comments for Kilkenny Northern Ring Road EIS report
Date: Thu, 7 Feb 2013 09:03:30 +0000
From: Pat Groves <Pat.Groves@awnconsulting.com>
To:richard.dooley@opw.ie <richard.dooley@opw.ie>

Dear Richard,

AWN Consulting Ltd. has been commissioned to prepare the Soils & Geology and Hydrogeology chapters for an Environmental Impact Statement for Kilkenny Northern Ring Road Extension road project which is the new ring road extension for Kilkenny City. The preferred route links the existing roundabout at the intersection of the N77 ring road extension with the N77 Castlecomer National Secondary Route to a new roundabout approximately 1.5 kilometres to the west on the R693 Kilkenny to Freshford Regional Route. The alignment will involve crossing the River Nore and also a local county road referred to as the 'Bleach Road' which runs in a north-south direction to the east of the River Nore. The total width of the alignment including verges will be 25.25 metres.

A plan of the proposed road including cross sections is enclosed herein (as 2 separate sheets) depicting the preferred alignment. Please note that the ring road extension is currently at a preliminary stage and as a result no detailed design drawings are available.

For the purpose of compiling this EIS, we would be very grateful for any comments and direction from OPW as per EIA Scoping Requirements.
Please do not hesitate to contact the undersigned should you require any additional information.

Regards,

PAT A. GROVES
Hydrogeologist

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An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Teach Naomh Máirtín / Bóthar Waterloo / Baile Átha Cliath 4
St. Martin's House / Waterloo Road / Dublin 4
Teil: / Tel: + 353 1 660 2511 Facs: / Fax: + 353 1 668 0009

Mr. Pat A. Groves,
AWN Consulting Ltd.,
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17.

Dáta | Date	Ár dTag. | Our Ref.	Bhur dTag. | Your Ref.
12 February 2013	**NRA 87122**	

Re: EIS Scoping for proposed Kilkenny Northern Ring Road.

Dear Mr. Groves,

I refer to your e-mail and enclosures of 7 February, 2013, regarding the above.

The Authority wishes to advise that it is not in a position to engage directly with planning applicants in respect to proposed developments. The Authority will endeavour to consider and respond to planning applications referred to it given its status and duties as a statutory consultee under the Planning Acts. The approach to be adopted by the Authority in making such submissions or comments will seek to uphold official policy and guidelines as outlined in the Spatial Planning and National Roads Guidelines for Planning Authorities (DoECLG, 2012). Regard should also be had to other relevant guidance and circulars available at www.nra.ie.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice the NRA's statutory right to make any observations, requests for further information, objections or appeals following the examination of any valid planning application referred.

With respect to EIS scoping issues, the recommendations indicated below provide only general guidance for the preparation of EIS, which may affect the National Roads Network.

The Authority would be concerned that any subsequent application would assess the impact of the road proposal on the operational capacity of the junction with the N77 and the national road network in the area and other potential impacts, such as drainage, that may arise from any required modification to the N77 junction.

With respect to EIS scoping issues, the recommendations indicated below provide only general guidance for the preparation of EIS, which may affect the National Roads Network.

The developer should have regard, *inter alia*, to the following;

- Consultations should be had with the relevant Local Authority/National Roads Design Office with regard to locations of existing and future national road schemes.
- The Authority would be specifically concerned as to potential impacts the development would have on any national roads in the proximity of the proposed development, N77;
- The developer should assess visual impacts from existing national roads;
- The developer should have regard to any Environmental Impact Statement and all conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the area. The developer should in particular have regard to any potential cumulative impacts;
- The developer, in conducting Environmental Impact Assessment, should have regard to the NRA DMRB and the NRA Manual of Contract Documents for Road Works;
- The developer, in conducting Environmental Impact Assessment, should have regard to the NRA's Environmental Assessment and Construction Guidelines, including the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (National Roads Authority, 2006);
- The EIS should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (1st Rev., National Roads Authority, 2004));
- It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria or in accordance with best practice, a Traffic and Transport Assessment be carried out in accordance with relevant guidelines and best practice, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. As indicated above, the Authority are not in a position to engage directly with applicants in respect to proposed developments, however, it is advised that the Authority's Traffic and Transport Assessment Guidelines (2007) should be referred to in this regard. It is important that TTA would consider the cumulative impact of developments in the area and in addition, the applicant team should also consider Table 2.3 of the Guidelines which advise on circumstances where sub-threshold TTA may be warranted;
- The designers are asked to consult the National Roads Authority's DMRB *Road Safety Audit* (NRA HD 19/09) to determine whether a Road Safety Audit is required.

Notwithstanding, any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practise.

I hope that the above comments are of use in your scoping process.

Yours sincerely

Raymond Foley

Raymond Foley,
Programme & Regulatory Unit.

APPENDIX D

Factual Ground Investigation Report

Kllkenny Northern Ring Road Extension

(R693 Freshford Road to N78 Castlecomer Road)

Factual Ground Investigation Report

(Report No. 14367)

Client: Kilkenny County Council

Engineer: Clifton Scannell Emerson

November 2009

IGSL Ltd

DOCUMENT ISSUE REGISTER

Distribution	Copies	Rev.	Date of Issue	Report Prepared By:
CSEA	Draft - 1 No hard copy	A	15 October 2009	CK / PQ
CSEA & Kilkenny County Council	Final - 4 No hard copies & CD with data in PDF	B	25 November 2009	CK / PQ

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APPENDICES

FOREWORD

The following conditions and notes on site investigation procedures should be read in conjunction with this report.

General

The ground investigation works have been carried out in accordance with BS 5930 (1990) and the IEI Specification & Related Documents for Ground Investigation in Ireland (2006).

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations.

Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

Boring Procedures

Unless otherwise stated, the 'Shell and Auger' technique of soft ground boring has been employed. All boring operations sampling and/or logging of soils and in-situ testing complies with the recommendations of the British Standard Code of Practice BS 5930 (1981), 'Site Investigation' and BS 1377:1990, 'Methods of test for soils for civil engineering purposes'.

Whilst the technique allows the maximum data to be obtained in soft ground, some disturbance and variation of soft and layered soils is unavoidable. Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Where peat has been encountered during siteworks, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 & Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986).

Routine Sampling

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

In-Situ Testing

Standard penetration tests, utilising either the standard split spoon sampler or solid cone and automatic trip-hammer are conducted unless otherwise where required by instruction. Subsequent to a seating drive of 150mm, a summation for the number of blows for 300mm penetration is recorded on the boring records together with the blow count for each 75mm penetration. In cases where incomplete penetration is obtained, the number of blows for the depth of penetration are recorded. In coarse granular soils, a cone end is fitted to the sampler and a similar procedure adopted.

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level.

Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage condition, tidal variation or other causes.

Retention of Samples
After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

Disclaimer
This report has been prepared for Clifton Scannel Emerson Consulting Engineers and Kilkenny County Council and the information should not be used without written permission of either party. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

1. INTRODUCTION

At the instruction of KIlkenny County Council and Clifton Scannell Emerson Associates (CSEA), IGSL has undertaken a programme of ground investigation works for the extension of the Kilkenny Northern Ring Road (N77). It is understood that KIlkenny County Council intend to link the Freshford Road (R693) with the Castlecomer Road (N78) and relieve traffic from the northwest of the city. The western section of the route is characterized by agricultural sloping ground, most prominently from the Freshford Road to the River Nore. The eastern portion of the relief road is largely low-lying floodplain and will entail construction of embankments to protect the road from flooding.

The investigatory works included trial pits, cable percussion boreholes, dynamic probes, window sampling and rotary core drillholes at locations agreed with CSEA. The investigations were carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999) and the British Drilling Association (BDA) guidelines for ground investigation. Geotechnical laboratory testing has been performed on representative samples in accordance with BS 1377 (1990) and included classification tests, oedometer consolidations, triaxial compressions, sulphates, MCV's, CBR's and Point Load Strength Index tests.

The primary objectives of this investigation were as follows:

- Determine the composition and strength of the superficial deposits
- Establish bedrock elevation (rockhead) and rock mass characteristics (i.e. weathering profile, discontinuity spacings, strength etc)
- Assess groundwater conditions
- Evaluate the earthwork properties of the soils and rocks and assess suitability for re-use in engineering fill applications

This report (factual) presents the geotechnical data and associated laboratory test results obtained from the exploratory locations. A separate geotechnical interpretative report (GIR) has been prepared and includes a discussion of the ground conditions and engineering properties of the soils and bedrock. The GIR also presents recommendations on the key geotechnical issues impacting on the proposed road development. The locations of the exploratory holes are shown on the site plans in Appendix 10.

2. FIELDWORK

2.1 General

The fieldworks were carried out during the period August and September 2009 and comprised the following:

- Cable percussion boreholes (6 No.)
- Trial pits (6 No.)
- Dynamic probes (32 No.)
- Window samples (10 No.) with in-situ shear vane testing
- Rotary core drillholes (2 No.)
- Associated sampling & in-situ testing

2.2 Cable Percussion Boreholes

Cable percussion boring (200mm diameter) was carried out at six locations using a Dando 2000 rig. The boreholes are denoted BH 1 to 6 and terminated at a depths of between 7.00 and 11.20m. It is highlighted that chiselling methods (i.e. hard strata boring) were employed to advance the boreholes through dense soils or cobble obstructions.

Representative bulk disturbed samples were taken at approximately 1.00m intervals or change of stratum and double sealed in polyethene bags. Undisturbed samples (U100's) were recovered where appropriate in fine grained or cohesive deposits. Standpipes (50mm diameter) were installed in BH's 3, 5 and 5 and incorporated pea gravel response zones and bentonite pellet seals. Protective steel headwork covers were concreted in place.

Standard Penetration Tests (SPT's) were performed at 1m depth intervals in accordance with Section 3.3, Part 9 of BS 1377 (1990). The SPT measures the number of blows required by a 63 kg hammer falling through a drop height of 760mm to drive a cone or a split spoon a distance of 300mm through the soil. Prior to the commencement of the test, the cone or split spoon is driven an initial distance of 150mm into the soil and the number of blows for this penetration depth are recorded as the "seating blows". The subsequent blowcounts for each 75mm increment (300mm) of penetration are recorded and summated to give an 'N-Value' as reported on the borehole log. The seating and test blow counts are reported in brackets with the N-Value recorded accordingly e.g. BH 1 at 1m where N=16 (2, 3, 4, 4, 3, 5).

Details of the soils (strata) encountered, SPT N-Values, samples recovered and chiselling durations (hard strata boring) are presented on the boring records in Appendix 1. Groundwater observations are also presented on the boring records

2.3 Trial Pits

Trial pitting was undertaken at six locations using a 13t tracked excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930 (1999). The pits attained depths of up to 4.50m bgl and terminated in boulder obstructions or due to sidewall stability.

Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The samples were placed in heavy duty polyethene bags and sealed before being transported to Naas for laboratory testing. The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site engineer. The trial pit logs are presented in Appendix 2 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

2.4 Dynamic Probes

Dynamic probing (DPH) was carried out at thirty two locations using a Terrier 2000 rig. This unit meets the requirements of BS 1377, Part 9 (1990) and Eurocode 7:Part 3. The probe testing utilized a 50 kg drop weight ('heavy weight'), 500mm drop height and 43.7mm diameter (60°) cone. In accordance with the standards, the number of blows required to drive the cone each 100mm

increment into the sub-soil is recorded. The probes attained depths of between 0.70 and 13.10m with refusal on suspected boulders. The dynamic probe records are presented in Appendix 3 and include blow-counts in both numerical and graphical format.

Although probing designed primarily to determine the relative consistency of soils, relationships are available from published data between blow counts and standard penetration test N values for granular soils, and blow counts and shear strength for cohesive soils. In this regard, the most relevant published data for Irish soils is presented in the 'Proceedings of the Trinity College Dublin Symposium of Field and Laboratory Testing of Soils for Foundations and Embankments'.

A paper presented by Eolas at this symposium suggests the following relationships can be applied.....

$$\text{DPH } N_{100} \times 2.5 = \text{SPT N value (Granular Soils)}$$

$$C_u = 15 \times \text{DPH } N_{100} + 30 \text{ kPa (Cohesive Soils)}$$

2.5 Window Sampling

Window sample boreholes were performed at ten locations using a Terrier 2000 rig. The window samples focused on soft ground areas with the aim being to recover the strata for consolidation and strength assessment. The window samples are denoted WS 2, 5, 6, 10, 25, 30 & 30A respectively and terminated at depths of between 3.00 and 5.00m. The window sample logs are presented in Appendix 4 and include percent recovery and blowcounts for each run.

2.6 Shear Vane Testing

Shear vane testing was carried out adjacent to the window sample boreholes using a Genor H-70 apparatus. The vane was pushed into the soils at 0.5m increments and measured peak and residual undrained shear strengths (Cu). The vane testing was supervised and measurements were recorded by an IGSL engineer / geologist. The shear vane test results are presented in Appendix 5.

2.7 Rotary Drillholes

Rotary drilling was undertaken at two locations (RC 1 & 2) using a top drive Casagrande rig. Symmetrix drilling was utilized within the superficial deposits, with conventional coring techniques used in the bedrock. The drilling produced 84mm diameter (P Size) cores using air mist flush and core recovery was 100% in each of the runs. A standpipe was installed in RC 2 and incorporated a pea gravel response zone, bentonite pellet grout seal and protective headwork cover.

The rotary holes extended to depths of between 16.20 and 19.00m and the rock cores were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. The core log records are presented in Appendix 6 and include engineering geological descriptions of the rock cores, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run.

Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

2.8 Groundwater Monitoring

The groundwater levels in the standpipes were measured during the course of the fieldworks and results are presented in Appendix 7.

2.9 Surveying

The as-built exploratory holes and trial pits were surveyed using GPS methods and co-ordinates and ground levels (X, Y, Z) are presented on the exploratory records. The site plan / drawings are presented in Appendix 10.

3. LABORATORY TESTING

Geotechnical laboratory testing has been carried out on representative soil samples and on rock cores. The soils testing was undertaken in accordance with BS 1377 (1990) and included:

- Moisture contents
- Particle size gradings
- Atterberg Limits
- Sulphates
- Organic contents
- Triaxial compressions
- Oedometer consolidations
- Moisture Condition Values (MCV)
- California Bearing Ratios (CBR)

Point Load Strength Index (PLSI) tests were performed on representative rock cores. The results of the soil and rock laboratory testing are presented in Appendices 8 and 9 respectively.

References

- BS 5930 (1999) Code of Practice for Site Investigation, British Standards Institution (BSI).
- BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.
- Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

KEY TO EXPLORATORY RECORDS

Cable Percussion Boreholes

D	Small Disturbed Sample
B	Large Disturbed Sample
T	Tub Sample (for moisture content profiling)
U100	Undisturbed Sample (driven tube sample)
W	Groundwater Sample
C	SPT N-Value (Solid Cone)
S	SPT N-Value (Split Spoon / Open Shoe)
FHT	Falling Head Permeability Test
RHT	Rising Head Permeability Test

Rotary Core Drillholes

TCR	Total Core Recovery (%)
SCR	Solid Core Recovery (%)
RQD	Rock Quality Designation Value (%)
FS	Fracture Spacing (mm) Presented as Graphic Fracture Log
NI	Non-Intact (where rock core is highly fractured)
ECL	Estimated Core Loss

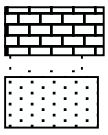
Trial Pits

B	Bulk Disturbed Sample
T	Tub Sample
VT	Vane Test (KPa) Using Genor H-70 Hand Vane
HP	Hand Penetrometer Test (KPa)
W	Groundwater Sample

Groundwater Installations

SP	Standpipe (uPVC 50mm diameter with 1mm slots)
Piez	Casagrande Piezometer (19mm diameter)

Strata Legends / Symbolic Logs



Strata legends / symbolic logs are in accordance with BS 5930 (1999). Legend codes are selected from GINT to reflect stratum.

Appendix 1

Cable Percussion Borehole Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**BOREHOLE NO.**	**BH01**
		SHEET	Sheet 1 of 1
CO-ORDINATES	249,310.87 E 158,721.68 N	**RIG TYPE**	Dando
GROUND LEVEL (m AOD)	55.43	**BOREHOLE DIAMETER (mm)**	
		DATE STARTED	11/08/2009
		DATE COMPLETED	11/08/2009
CLIENT	Kilkenny County Council	**BOREHOLE DEPTH (m)**	7.00
		BORED BY	B. Cahill
ENGINEER	CSEA Consulting	**CASING DEPTH (m)**	7.00
		PROCESSED BY	T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL									
	Firm dark brown slightly sandy gravelly CLAY with occasional cobbles		55.23	0.20	AF0001	B	0.50-1.00			
1					AF0002	B	1.00-1.45		N = 16 (2, 3, 4, 4, 3, 5)	
	Firm and firm / stiff light brown sandy gravelly CLAY (locally grades to sandy gravelly SILT)		53.63	1.80	AF0003	U	2.00-2.45	95% rec 32 blows		
2					AF0004	D	2.50-2.50			
3					AF0005 AF0006	D B	3.00-3.45 3.00-3.50		N = 18 (3, 4, 4, 4, 5, 5)	
4					AF0007	U	4.00-4.45	100% rec 30 blows		
					AF0008	D	4.50-4.50			
5					AF0009 AF0010	D B	5.00-5.45 5.00-5.55		N = 12 (2, 2, 3, 3, 2, 4)	
6					AF0011	U	6.00-6.45	100% rec 20 blows		
					AF0012	D	6.50-6.50			
7	End of Borehole at 7.00 m		48.43	7.00	AF0013	D	7.00-7.00			
8										
9										
10										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 14367.GPJ IGSL.GDT 26/11/09

GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**BOREHOLE NO.**	**BH02**
		SHEET	Sheet 1 of 1
CO-ORDINATES	249,397.90 E 158,748.21 N	**RIG TYPE**	Dando
GROUND LEVEL (m AOD)	55.53	**BOREHOLE DIAMETER (mm)**	
		DATE STARTED	11/08/2009
		DATE COMPLETED	12/08/2009
CLIENT	Kilkenny County Council	**BOREHOLE DEPTH (m)**	10.00
		BORED BY	B. Cahill
ENGINEER	CSEA Consulting	**CASING DEPTH (m)**	10.00
		PROCESSED BY	T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL									
	Medium dense dark brown clayey very gravelly medium SAND with occasional angular cobbles		55.33	0.20	AF0014	B	0.50-1.00			
1					AF0015	B	1.00-1.45		N = 19 (2, 3, 4, 4, 5, 6)	
2					AF0016	B	2.00-2.45		N = 22 (1, 4, 4, 5, 6, 7)	
3					AF0017	B	3.00-3.45		N = 14 (2, 3, 3, 4, 3, 4)	
	Soft / firm (becoming firm from approximately 8m) light brown sandy gravelly SILT with occasional angular cobbles		52.13	3.40						
4					AF0018	U	4.00-4.45	100% rec 20 blows		
					AF0019	D	4.50-4.50			
5					AF0020 AF0021	D B	5.00-5.45 5.00-5.50		N = 9 (1, 2, 2, 2, 2, 3)	
6					AF0022	U	6.00-6.45	80% rec 20 blows		
					AF0023	D	6.50-6.50			
7					AF0024	D	7.00-7.00			
					AF0025 AF0026	D B	7.50-7.95 7.50-8.00		N = 16 (2, 2, 2, 3, 5, 6)	
8										
					AF0027 AF0028	D B	8.50-8.95 8.50-9.00		N = 14 (2, 3, 3, 3, 4, 4)	
9										
					AF0029 AF0030	D B	9.50-9.95 9.50-10.00		N = 16 (1, 2, 3, 4, 4, 5)	
10	End of Borehole at 10.00 m		45.53	10.00						

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
7	7.3	0.75	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.40	3.40	no	3.40	20	Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
12-08-09	10.00	1.00	10.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Requested by Engineer advance borehole to 10.00m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

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GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT Northern Ring Road Extension, Kilkenny

BOREHOLE NO. **BH03**
SHEET Sheet 1 of 2

CO-ORDINATES 249,477.13 E, 158,779.88 N
GROUND LEVEL (m AOD) 47.09

RIG TYPE Dando
BOREHOLE DIAMETER (mm)
BOREHOLE DEPTH (m) 11.20
CASING DEPTH (m) 11.20

DATE STARTED 12/08/2009
DATE COMPLETED 13/08/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

BORED BY B. Cahill
PROCESSED BY T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL									
	Soft / firm pale brown sandy CLAY with root hairs		46.79	0.30	AF0031	B	0.50-1.00			
1					AF0032	B	1.00-1.45		N = 9 (1, 1, 2, 2, 2, 3)	
2					AF0033	B	2.00-2.45	0% rec 10 blows		
3	Medium dense dark brown very sandy medium to coarse GRAVEL with occasional angular cobbles		44.29	2.80	AF0034	B	3.00-3.45		N = 22 (2, 4, 4, 5, 6, 7)	
4	Medium dense dark brown clayey gravelly medium to coarse SAND with occasional sub-angular to sub-rounded cobbles		43.19	3.90	AF0035	B	4.00-4.45		N = 15 (2, 2, 3, 4, 4, 4)	
5	Medium dense dark brown very sandy medium to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles		42.29	4.80	AF0036	B	5.00-5.45		N = 22 (3, 3, 4, 6, 6, 6)	
6	Firm dark brown sandy gravelly CLAY with occasional sub angular to sub-rounded cobbles		41.39	5.70	AF0037	U	6.00-6.45	100% rec 15 blows		
					AF0038	D	6.50-6.50			
7					AF0039 AF0040	D B	7.00-7.45 7.00-7.50		N = 10 (2, 2, 2, 2, 3, 3)	
8					AF0041 AF0042	D B	8.00-8.45 8.00-8.50		N = 8 (2, 2, 1, 2, 2, 3)	
9					AF0043	B	9.00-9.45	0% rec 10 blows		
	Stiff pale brown sandy SILT		37.39	9.70						
10					AF0044 AF0045	D B	10.00-10.00 10.00-10.45		N = 30 (2, 4, 4, 6, 8, 12)	
	Medium dense to dense sandy fine to coarse GRAVEL with some angular cobbles		36.89	10.20						

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
11.2	11.2	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80	no	2.00	20	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Obstruction at 11.2m due to possible boulders present

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

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GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**BOREHOLE NO.**	**BH03**
		SHEET	Sheet 2 of 2
CO-ORDINATES	249,477.13 E 158,779.88 N	**RIG TYPE**	Dando
GROUND LEVEL (m AOD)	47.09	**BOREHOLE DIAMETER (mm)**	
		DATE STARTED	12/08/2009
		DATE COMPLETED	13/08/2009
CLIENT	Kilkenny County Council	**BOREHOLE DEPTH (m)**	11.20
		BORED BY	B. Cahill
ENGINEER	CSEA Consulting	**CASING DEPTH (m)**	11.20
		PROCESSED BY	T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
11					AF0046	B	11.00-11.45		N = 60/150 mm (11, 10, 14, 46)	
	OBSTRUCTION End of Borehole at 11.20 m		35.89	11.20						
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
11.2	11.2	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Obstruction at 11.2m due to possible boulders present

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 14367.GPJ IGSL.GDT 26/11/09

GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**BOREHOLE NO.**	**BH04**
		SHEET	Sheet 1 of 1
CO-ORDINATES	249,487.90 E 158,764.33 N	**RIG TYPE**	Dando
GROUND LEVEL (m AOD)	47.20	**BOREHOLE DIAMETER (mm)**	
		DATE STARTED	13/08/2009
		DATE COMPLETED	13/08/2009
CLIENT	Kilkenny County Council	**BOREHOLE DEPTH (m)**	10.00
		BORED BY	B. Cahill
ENGINEER	CSEA Consulting	**CASING DEPTH (m)**	10.00
		PROCESSED BY	T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL									
	Soft / firm dark brown sandy CLAY		46.90	0.30	AF0047	B	0.50-1.00			
1					AF0048	B	1.00-1.45		N = 6 (1, 1, 1, 2, 1, 2)	
2					AF0049	U	2.00-2.45	60% rec 10 blows		
	Soft / firm pale brown sandy SILT		45.00	2.20	AF0050	D	2.50-2.50			
3	Medium dense pale brown gravelly medium to coarse SAND with occasional sub-angular cobbles		44.30	2.90	AF0051	B	3.00-3.45		N = 18 (2, 4, 4, 4, 5, 5)	
	Medium dense brown very sandy medium to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles		44.00	3.20						
4					AF0052	B	4.00-4.45		N = 20 (3, 4, 4, 5, 5, 6)	
	Soft / firm dark brown sandy slightly gravelly CLAY		42.40	4.80						
5					AF0053	B	5.00-5.45		N = 6 (1, 1, 1, 2, 2, 1)	
6					AF0054	U	6.00-6.45	75% rec 8 blows		
					AF0055	D	6.50-6.50			
7					AF0056	B	7.00-7.45		N = 7 (1, 0, 1, 1, 2, 3)	
	Medium dense brown very sandy silty medium to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles		39.70	7.50						
8					AF0057	B	8.00-8.45		N = 29 (3, 4, 6, 7, 7, 9)	
9					AF0058	B	9.00-9.45		N = 49 (5, 7, 10, 10, 14, 15)	
					AF0059	B	9.50-10.00			
10	End of Borehole at 10.00 m		37.20	10.00						

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
9.5	9.7	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.90	2.90	no	2.00	20	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 14367.GPJ IGSL.GDT 26/11/09

GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT Northern Ring Road Extension, Kilkenny

BOREHOLE NO. **BH05**
SHEET Sheet 1 of 1

CO-ORDINATES 249,520.24 E, 158,780.69 N
GROUND LEVEL (m AOD) 47.23

RIG TYPE Dando
BOREHOLE DIAMETER (mm)
BOREHOLE DEPTH (m) 10.00
CASING DEPTH (m) 10.00

DATE STARTED 18/08/2009
DATE COMPLETED 18/08/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

BORED BY B. Cahill
PROCESSED BY T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL									
	Soft brown sandy CLAY with root hairs		46.93	0.30	AG1135	B	0.50-1.00			
1					AG1136	B	1.00-1.45		N = 7 (1, 1, 2, 2, 1, 2)	
2					AG1137	U	2.00-2.45	90% rec 6 blows		
	Soft mottled brown orange sandy slightly gravelly CLAY		45.03	2.20	AG1138	D	2.50-2.50			
3	Loose to medium dense brown very sandy medium to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles		44.43	2.80	AG1139	B	3.00-3.45		N = 10 (1, 2, 2, 2, 3, 3)	
4					AG1140	B	4.00-4.45		N = 10 (2, 2, 2, 3, 2, 3)	
5					AG1141	B	5.00-5.45		N = 14 (2, 3, 3, 3, 4, 4)	
6					AG1142	B	6.00-6.45		N = 15 (2, 2, 3, 3, 4, 5)	
	Firm dark brown sandy slightly gravelly SILT		40.53	6.70	AG1143	U	7.00-7.45	100% rec 12 blows		
7					AG1144	D	7.50-7.50			
8					AG1145 AG1146	D B	8.00-8.45 8.00-8.50		N = 13 (2, 2, 3, 3, 3, 4)	
9					AG1147	U	9.00-9.45	60% rec 12 blows		
					AG1148	D	9.50-9.50			
10	End of Borehole at 10.00 m		37.23	10.00	AG1149	D	10.00-10.00			

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
5.6	5.7	0.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80	no	1.70	20	Rapid

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
18-08-09	10.00	1.00	10.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 14367.GPJ IGSL.GDT 26/11/09

GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**BOREHOLE NO.**	**BH06**
		SHEET	Sheet 1 of 2
CO-ORDINATES	249,508.91 E 158,796.84 N	**RIG TYPE**	Dando
GROUND LEVEL (m AOD)	47.17	**BOREHOLE DIAMETER (mm)**	
		DATE STARTED	14/08/2009
		DATE COMPLETED	14/08/2009
CLIENT	Kilkenny County Council	**BOREHOLE DEPTH (m)**	10.80
		BORED BY	B. Cahill
ENGINEER	CSEA Consulting	**CASING DEPTH (m)**	10.80
		PROCESSED BY	T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL									
	Firm dark brown sandy CLAY		46.82	0.35	AF0060	B	0.50-1.00			
1					AF0061	B	1.00-1.45		N = 14 (1, 1, 2, 3, 3, 6)	
2					AF0062	B	2.00-2.45		N = 23 (6, 10, 6, 6, 5, 6)	
	Medium dense to dense brown very sandy silty medium to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles		45.07	2.10						
3					AF0063	B	3.00-3.45		N = 17 (3, 3, 4, 4, 4, 5)	
4					AF0064	B	4.00-4.45		N = 13 (2, 2, 3, 3, 3, 4)	
5					AF0065	B	5.00-5.45		N = 27 (3, 5, 6, 6, 7, 8)	
6					AF0066	B	6.00-6.45		N = 41 (5, 6, 8, 10, 10, 13)	
7					AF0067	B	7.00-7.45		N = 24 (6, 7, 10, 8, 4, 2)	
	Firm dark brown sandy slightly gravelly SILT		39.77	7.40						
8					AF0068	U	8.00-8.45	90% rec 15 blows		
					AF0069	D	8.50-8.50			
9					AF0070	B	9.00-9.45		N = 16 (3, 3, 4, 4, 4, 4)	
	Stiff mottled dark blue grey sandy slightly gravelly SILT/CLAY		37.77	9.40						
10					AF0072	B	10.00-10.45		N = 28 (3, 4, 6, 7, 7, 8)	
	Stiff / very stiff brown sandy slightly gravelly SILT/CLAY		37.07	10.10	AF0073	B	10.50-10.80			
	OBSTRUCTION		36.37	10.80						

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
10.8	10.8	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.10	2.10	no	1.60	20	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Obstruction at 10.8m due to possible boulders present

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 14367.GPJ IGSL.GDT 26/11/09

GEOTECHNICAL BORING RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**BOREHOLE NO.**	**BH06**
		SHEET	Sheet 2 of 2
CO-ORDINATES	249,508.91 E 158,796.84 N	**RIG TYPE**	Dando
GROUND LEVEL (m AOD)	47.17	**BOREHOLE DIAMETER (mm)**	
		DATE STARTED	14/08/2009
		DATE COMPLETED	14/08/2009
CLIENT	Kilkenny County Council	**BOREHOLE DEPTH (m)**	10.80
		BORED BY	B. Cahill
ENGINEER	CSEA Consulting	**CASING DEPTH (m)**	10.80
		PROCESSED BY	T.D

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
11	End of Borehole at 10.80 m									
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
10.8	10.8	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Obstruction at 10.8m due to possible boulders present

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample

IGSL BH LOG 11M 14367.GPJ IGSL.GDT 26/11/09

Appendix 2

Trial Pit Records

TRIAL PIT RECORD

REPORT NUMBER 14367

CONTRACT	The Northern Ring Road Extension	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**CO-ORDINATES(_)**	
		DATE STARTED	31/08/2009
		DATE COMPLETED	31/08/2009
CLIENT	Kilkenny County Council	**GROUND LEVEL (m)**	
ENGINEER	CSEA Consulting	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (comprised of sandy clay, gravel, cobbles, concrete, tarmac, old pipes, plastic)									
1.0									
2.0									
3.0									
4.0									
MADE GROUND (comprised of old topsoil)		4.50							
End of Trial Pit at 4.70m		4.70							

Groundwater Conditions
No Groundwater observed

Stability
Very unstable

General Remarks

TRIAL PIT RECORD

REPORT NUMBER 14367

CONTRACT	The Northern Ring Road Extension	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	C.Killaly	**CO-ORDINATES(_)**	
		DATE STARTED	16/09/2009
		DATE COMPLETED	16/09/2009
CLIENT	Kilkenny County Council	**GROUND LEVEL (m)**	
ENGINEER	CSEA Consulting	**EXCAVATION METHOD**	CAT32X

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.30							
MADE GROUND comprised of brown sandy gravelly CLAY with plastic		0.70			AJ5306	B	0.50-0.50		
MADE GROUND comprised of grey brown sandy gravel with cobbles, boulders, concrete, plastic, concrete pipes, plastic pipes.					AJ5307	B	1.50-1.50		
1.0				1 (Rapid)					
2.0 End of Trial Pit at 2.00m		2.00							
3.0									
4.0									

Groundwater Conditions
Rapid flow from 1.9mbgl

Stability
Unstable from 1.0mbgl

General Remarks

IGSL TP LOG 14367.GPJ IGSL.GDT 14/10/09

TRIAL PIT RECORD

REPORT NUMBER 14367

CONTRACT	The Northern Ring Road Extension	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	C.Killaly	**CO-ORDINATES(_)**	
		DATE STARTED	16/09/2009
		DATE COMPLETED	16/09/2009
CLIENT	Kilkenny County Council	**GROUND LEVEL (m)**	
ENGINEER	CSEA Consulting	**EXCAVATION METHOD**	CAT32X

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil									
	MADE GROUND comprised of grey sandy clayey GRAVEL with concrete, plastic, pipes and steel		0.30			AJ5301	B	0.50-0.50		
1.0					1 (Seepage)					
	Soft grey sandy slightly gravelly organic SILT		1.50			AJ5302	B	1.50-1.50		
	Firm brown fibrous PEAT (VON POST H4 & H5)		1.90			AJ5303	B	1.90-1.90		
2.0						AJ5304	B	2.50-2.50		
	Soft thinly laminated grey sandy SILT with occasional sub rounded to sub angular cobbles, boulders maximum diameter 300mm) and horizons of grey sand		2.70							
3.0						AJ5305	B	3.50-3.50		
4.0	End of Trial Pit at 4.00m		4.00							

Groundwater Conditions
Seepage from 1.5mbgl, slow ingress noted

Stability
Unstable from Ground Level to 1.5mbgl

General Remarks

TRIAL PIT RECORD

REPORT NUMBER 14367

CONTRACT	The Northern Ring Road Extension	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	C.Killaly	**CO-ORDINATES(_)**	
		DATE STARTED	16/09/2009
		DATE COMPLETED	16/09/2009
CLIENT	Kilkenny County Council	**GROUND LEVEL (m)**	
ENGINEER	CSEA Consulting	**EXCAVATION METHOD**	CAT32X

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil									
	Firm reddish brown sandy gravelly CLAY with occasional sub rounded to angular cobbles		0.30			AJ5315	B	0.50-0.50		
1.0	Medium dense grey fine to coarse gravelly SAND with occasional rounded to sub rounded cobbles and boulders maximum diameter 800mm)		0.80			AJ5316	B	1.50-1.50		
2.0	Firm/stiff thickly laminated grey sandy slightly gravelly SILT with occasional sub rounded to sub angular cobbles and horizons of grey fine to coarse sand		1.90			AJ5317	B	2.50-2.50		
3.0						AJ5318	B	3.50-3.50		
4.0	End of Trial Pit at 4.00m		4.00							

Groundwater Conditions
No Groundwater observed

Stability
Unstable from 0.3 to 1.9mbgl

General Remarks

IGSL TP LOG 14367.GPJ IGSL.GDT 14/10/09

TRIAL PIT RECORD

REPORT NUMBER 14367

CONTRACT	The Northern Ring Road Extension	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	C.Killaly	**CO-ORDINATES(_)**	
		DATE STARTED	16/09/2009
		DATE COMPLETED	16/09/2009
CLIENT	Kilkenny County Council	**GROUND LEVEL (m)**	
ENGINEER	CSEA Consulting	**EXCAVATION METHOD**	CAT32X

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.30							
Firm mottled brown sandy slightly gravelly CLAY with occasional sub rounded cobbles		1.00			AJ5311	B	0.50-0.50		
1.0 Firm/stiff thinly laminated grey sandy gravelly SILT with occasional cobbles, boulders maximum diameter 300mm) and horizons of grey medium to coarse sand					AJ5312	B	1.50-1.50		
2.0					AJ5313	B	2.50-2.50		
3.0 Firm thinly laminated grey sandy SILT		3.10		1 (Seepage)	AJ5314	B	3.50-3.50		
4.0 End of Trial Pit at 4.00m		4.00							

Groundwater Conditions
Seepage observed at 3.1mbgl, no ingress noted

Stability
Slightly unstable from 1.5mbgl

General Remarks

IGSL TP LOG 14367.GPJ IGSL.GDT 14/10/09

TRIAL PIT RECORD

REPORT NUMBER 14367

CONTRACT	The Northern Ring Road Extension	**TRIAL PIT NO.**	**TP06**
		SHEET	Sheet 1 of 1
LOGGED BY	C.Killaly	**CO-ORDINATES(_)**	
		DATE STARTED	16/09/2009
		DATE COMPLETED	16/09/2009
CLIENT	Kilkenny County Council	**GROUND LEVEL (m)**	
ENGINEER	CSEA Consulting	**EXCAVATION METHOD**	CAT32X

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.30							
Medium dense grey fine to coarse gravelly SAND with occasional rounded to sub rounded cobbles and boulders maximum diameter 300mm)					AJ5308	B	1.00-1.00		
1.0									
2.0					AJ5309	B	2.00-2.00		
3.0					AJ5310	B	3.00-3.00		
End of Trial Pit at 3.50m		3.50							
4.0									

Groundwater Conditions
No Groundwater observed

Stability
Unstable from 0.3mbgl

General Remarks

Appendix 3

Dynamic Probe Records

DYNAMIC PROBE RECORD

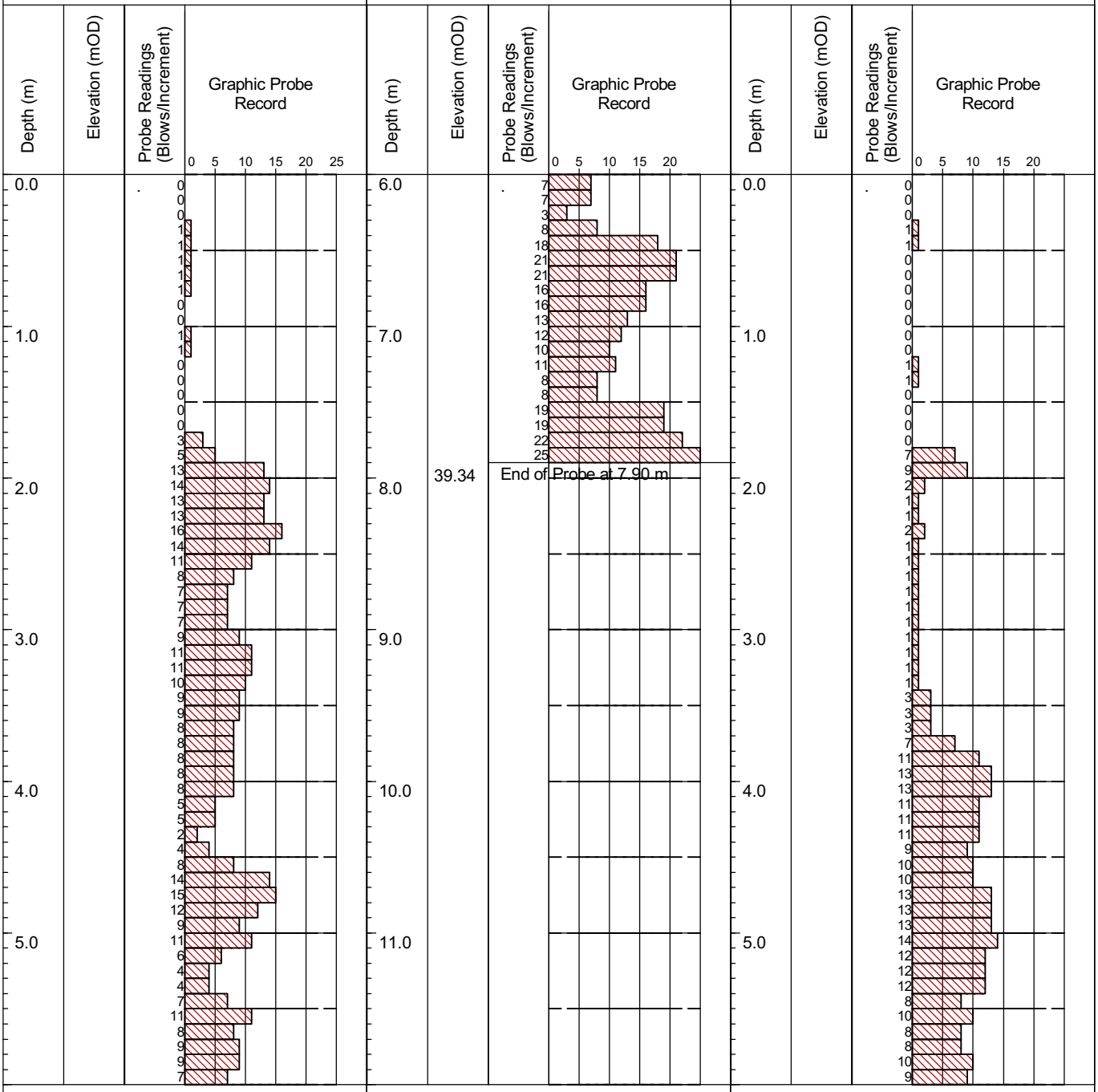
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP01	DP01	DP02
CO-ORDINATES(_)	249,516.63 E 158,783.24 N	249,516.63 E 158,783.24 N	249,547.92 E 158,784.05 N
GROUND LEVEL (m)	47.24	47.24	46.63
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

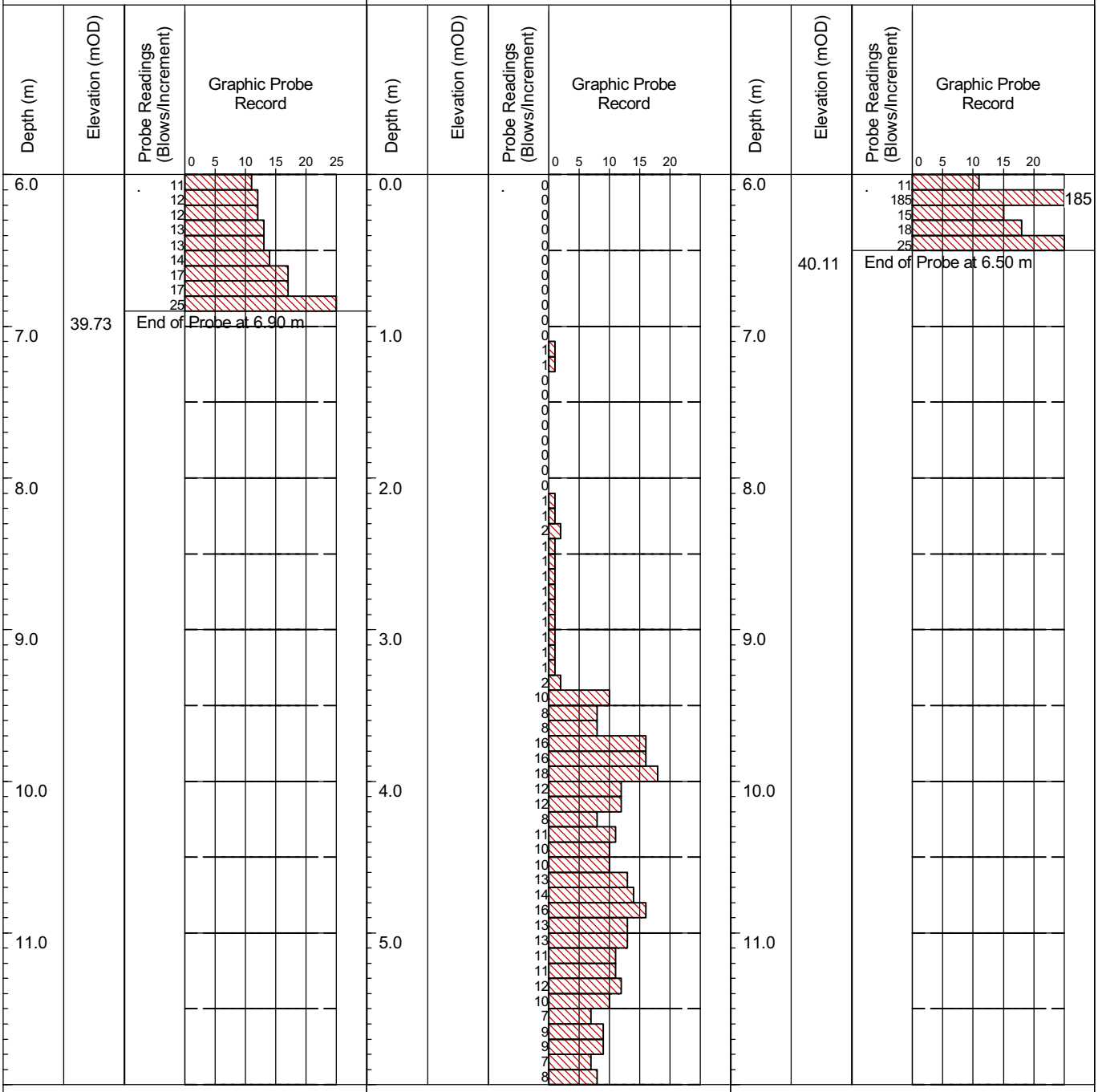
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP02	DP03	DP03
CO-ORDINATES(_)	249,547.92 E 158,784.05 N	249,577.94 E 158,789.98 N	249,577.94 E 158,789.98 N
GROUND LEVEL (m)	46.63	46.61	46.61
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

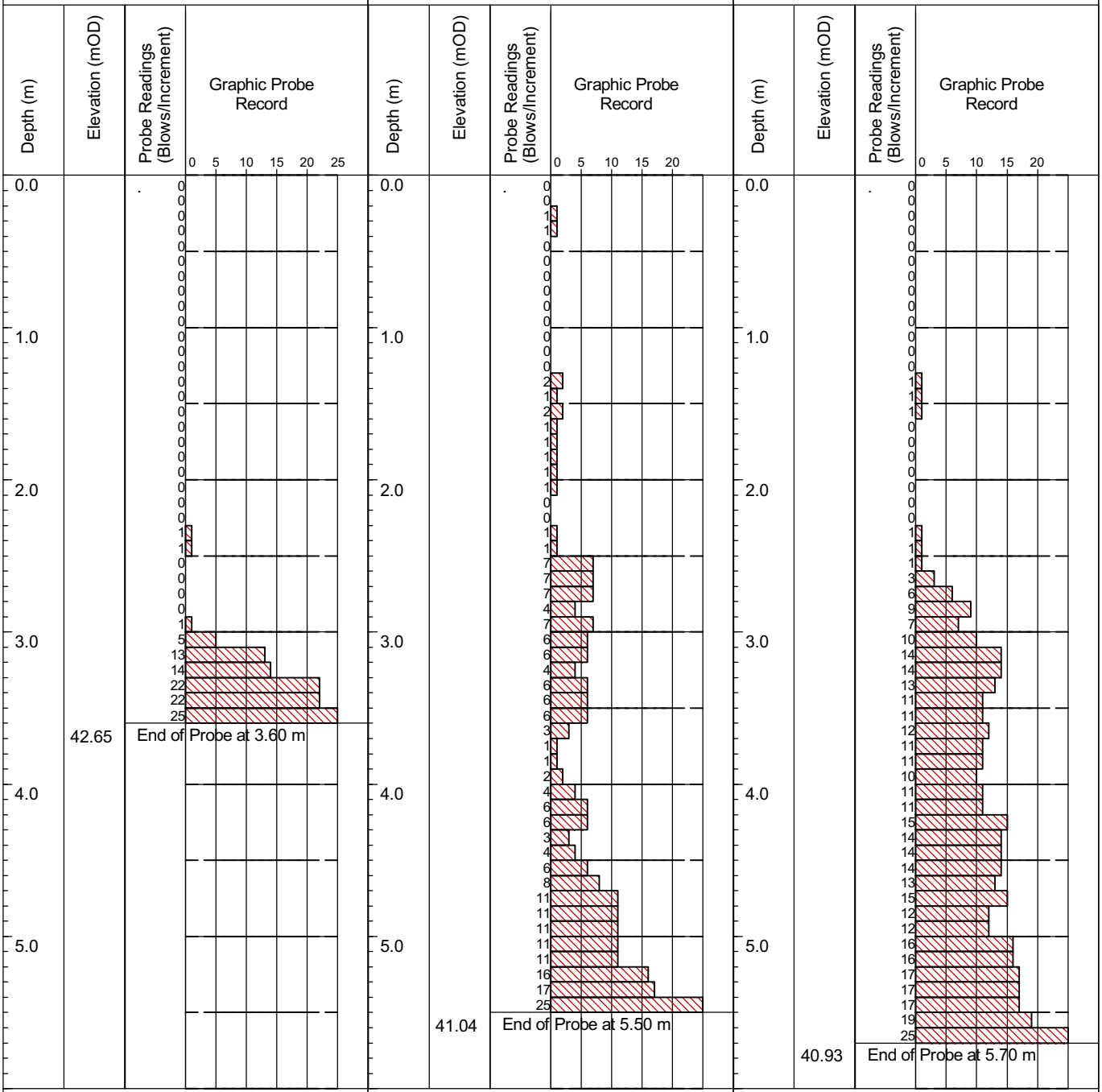
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP04	DP05	DP06
CO-ORDINATES(_)	249,605.34 E 158,794.87 N	249,638.02 E 158,791.57 N	249,667.59 E 158,789.30 N
GROUND LEVEL (m)	46.25	46.54	46.63
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 11/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

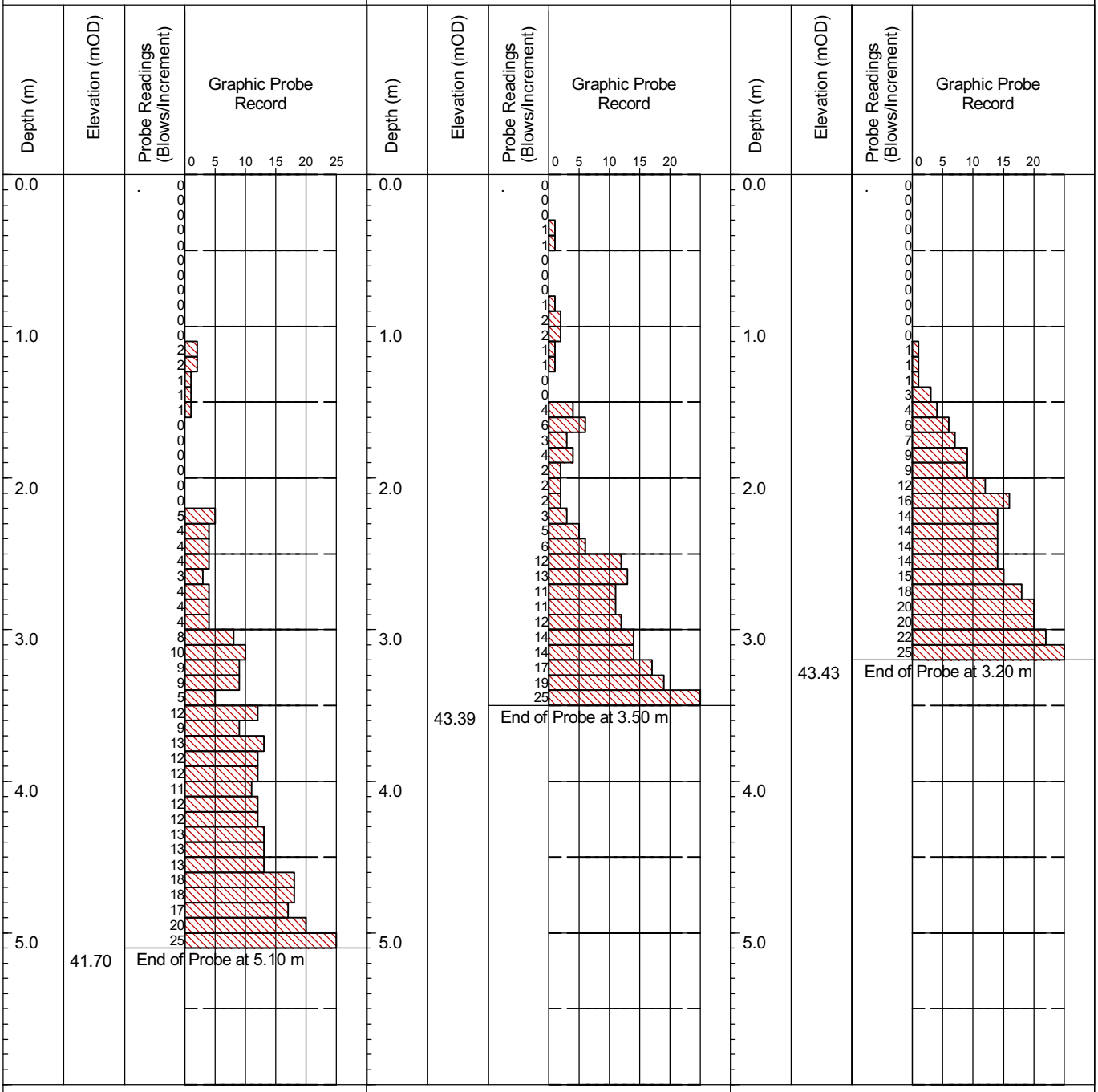
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP07	DP08	DP09
CO-ORDINATES(_)	249,698.32 E 158,787.10 N	249,726.26 E 158,784.71 N	249,757.28 E 158,781.26 N
GROUND LEVEL (m)	46.80	46.89	46.63
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS	**GROUNDWATER OBSERVATIONS**	**GROUNDWATER OBSERVATIONS**
REMARKS	**REMARKS**	**REMARKS**
DATE: 11/08/2009	DATE: 12/08/2009	DATE: 12/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

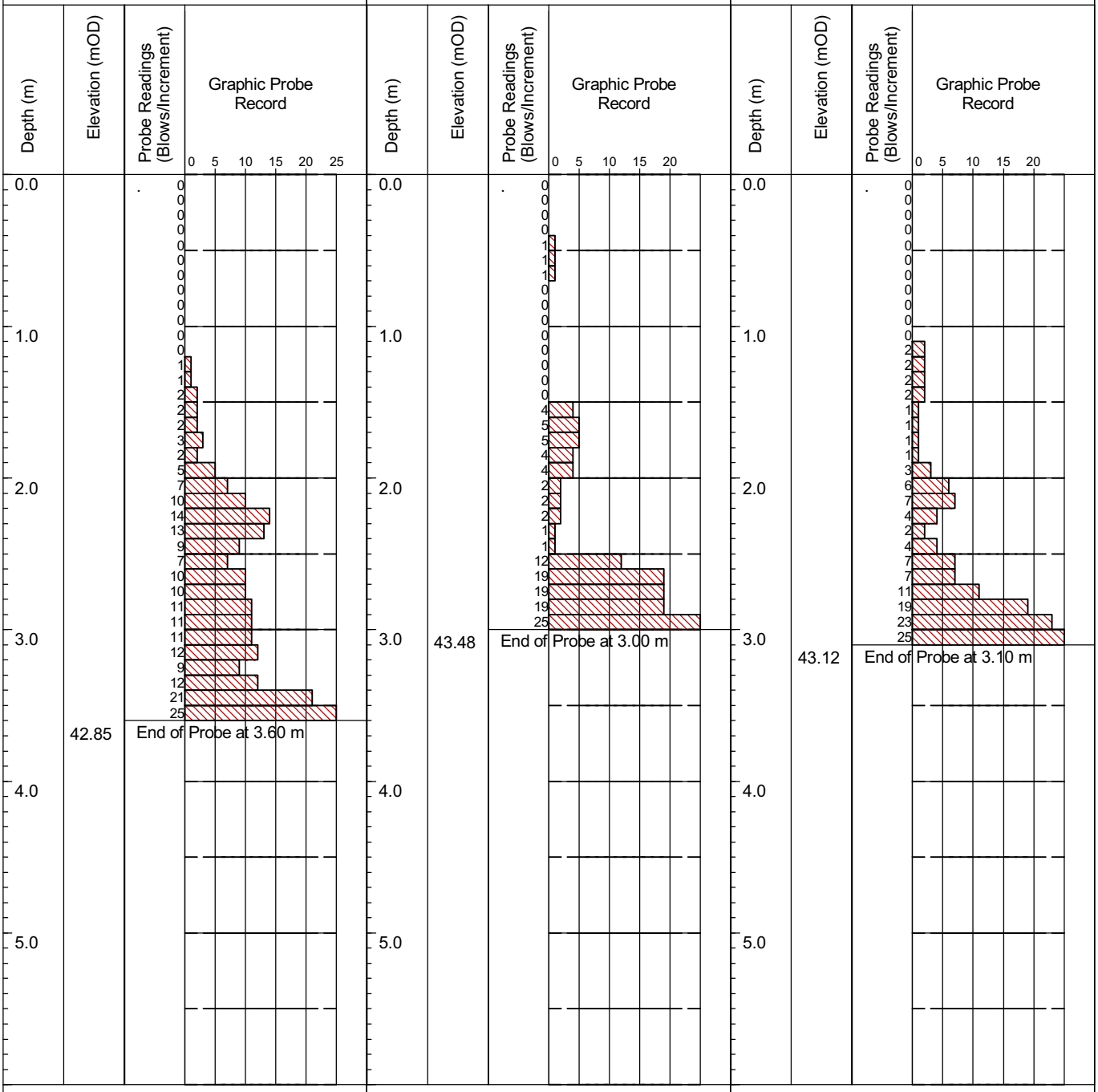
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP10	DP11	DP12
CO-ORDINATES(_)	249,787.28 E 158,777.01 N	249,818.37 E 158,767.56 N	249,847.79 E 158,775.24 N
GROUND LEVEL (m)	46.45	46.48	46.22
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

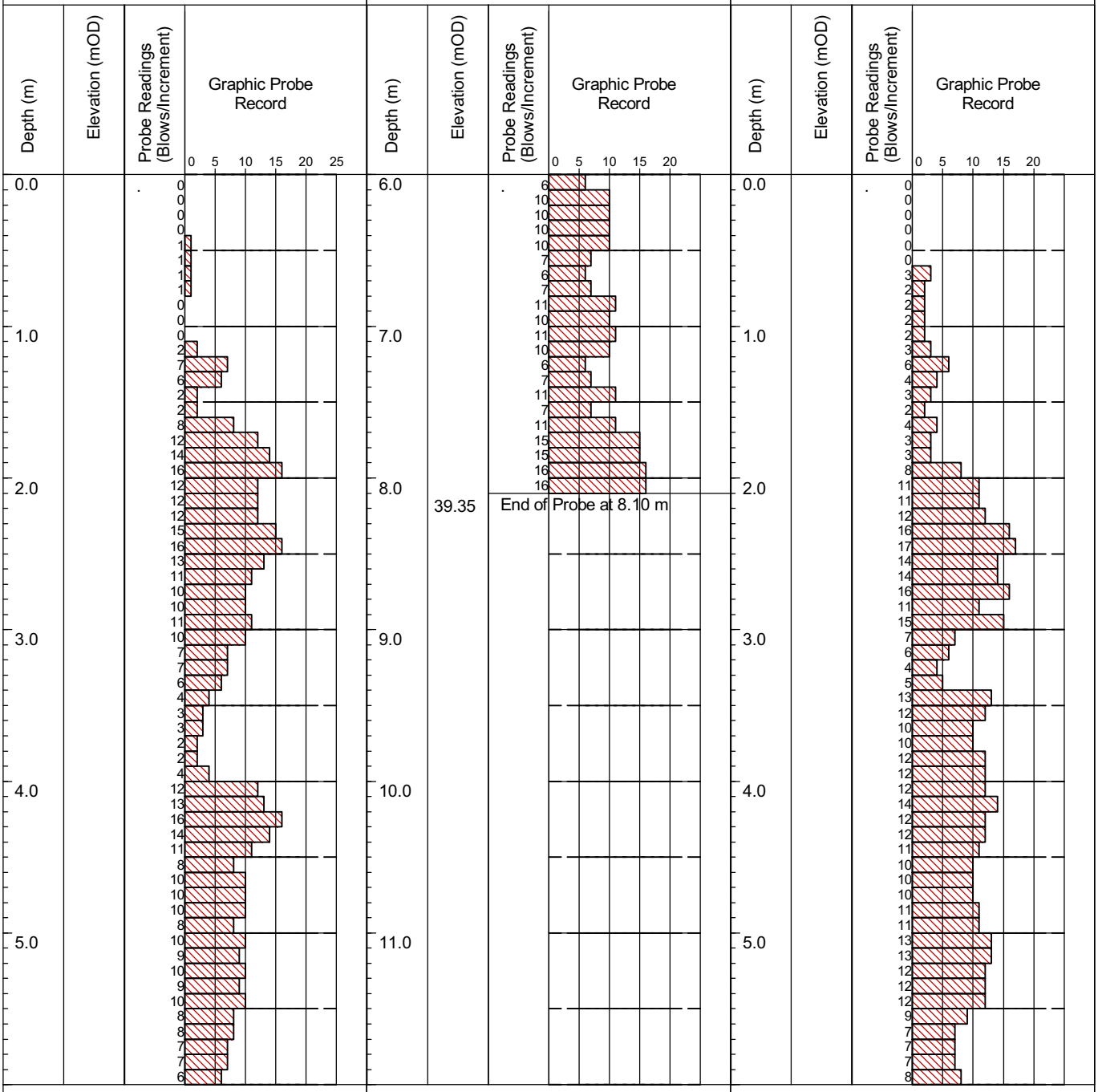
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP13	DP13	DP14
CO-ORDINATES(_)	249,874.75 E 158,780.13 N	249,874.75 E 158,780.13 N	249,906.78 E 158,768.53 N
GROUND LEVEL (m)	47.45	47.45	46.32
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

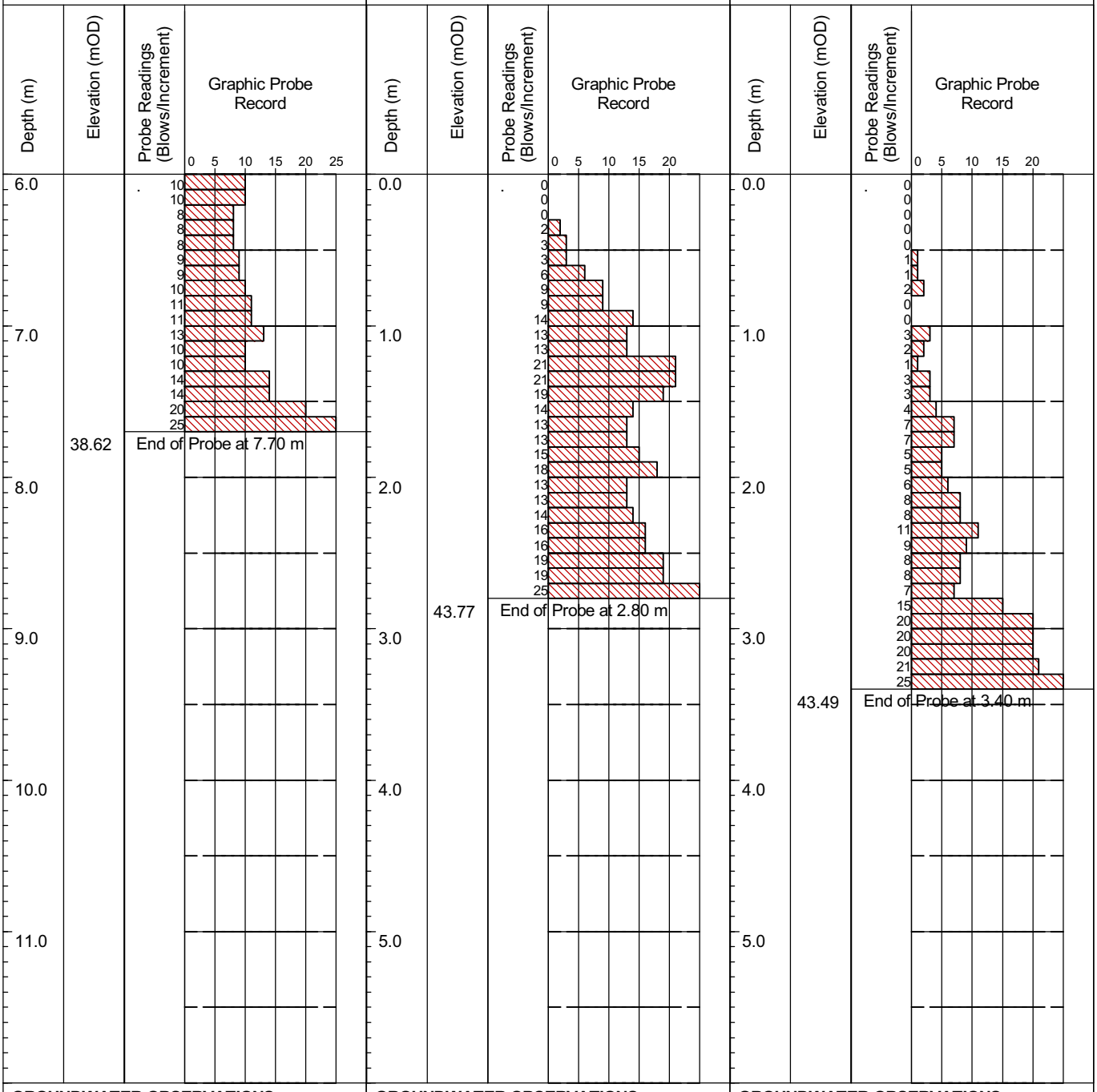
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP14	DP15	DP16
PROBE NO.			
CO-ORDINATES(_)	249,906.78 E 158,768.53 N	249,935.80 E 158,765.10 N	249,966.86 E 158,762.70 N
GROUND LEVEL (m)	46.32	46.57	46.89
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 12/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

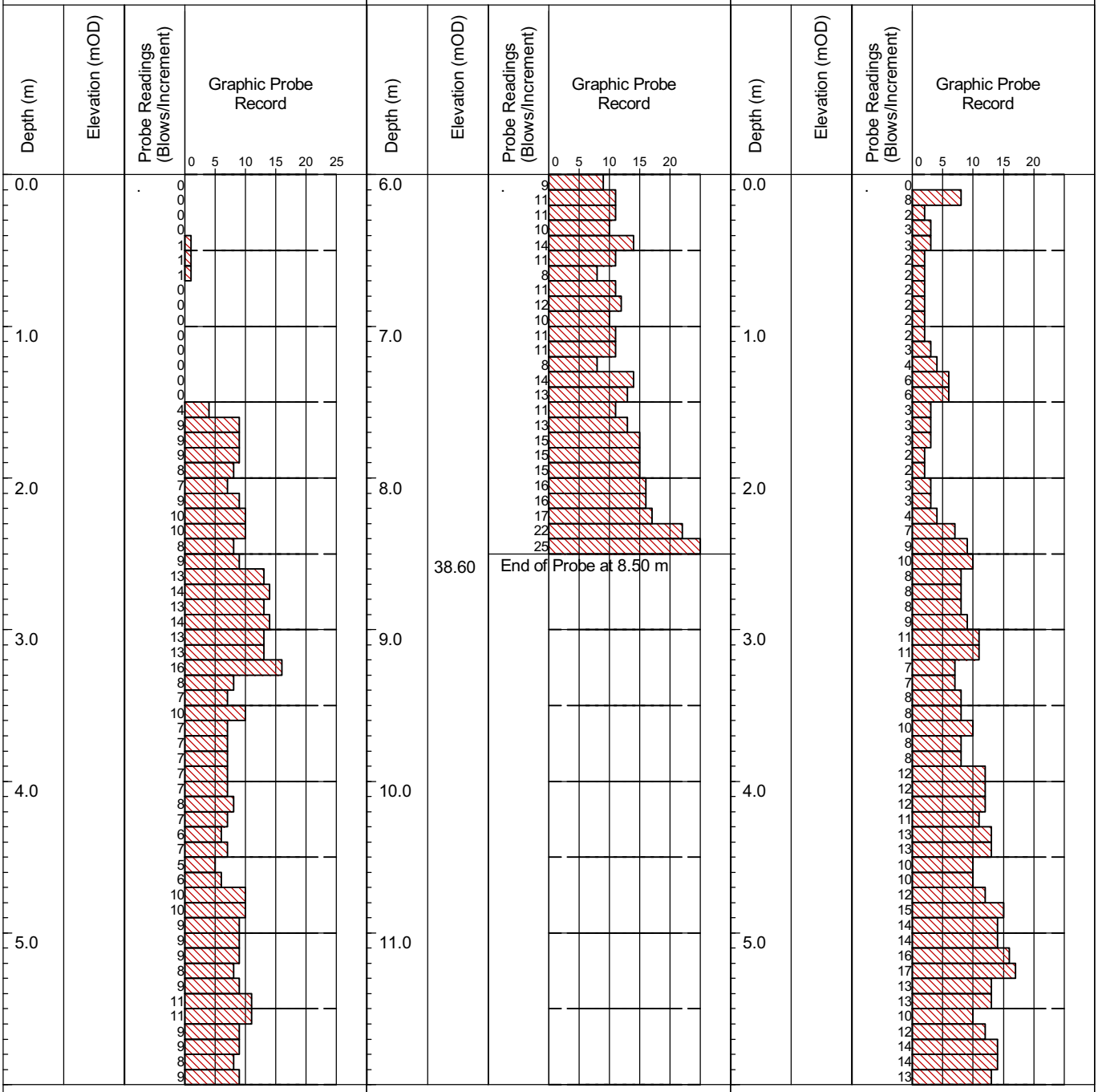
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP17	DP17	DP18
CO-ORDINATES(_)	249,997.89 E 158,761.51 N	249,997.89 E 158,761.51 N	250,027.08 E 158,758.08 N
GROUND LEVEL (m)	47.10	47.10	47.11
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

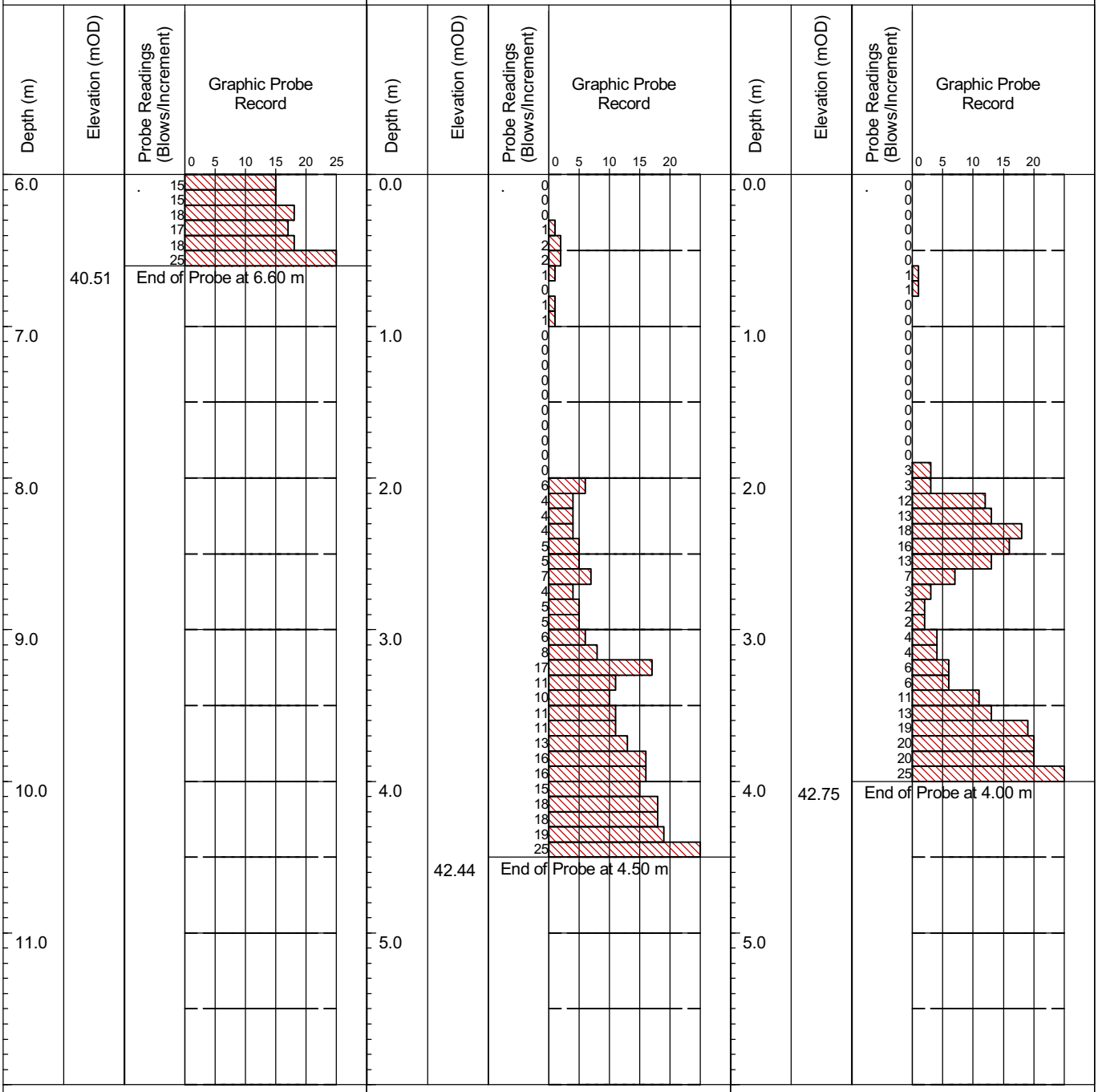
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP18	DP19	DP20
CO-ORDINATES(_)	250,027.08 E 158,758.08 N	250,057.58 E 158,754.24 N	250,088.94 E 158,750.28 N
GROUND LEVEL (m)	47.11	46.94	46.75
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

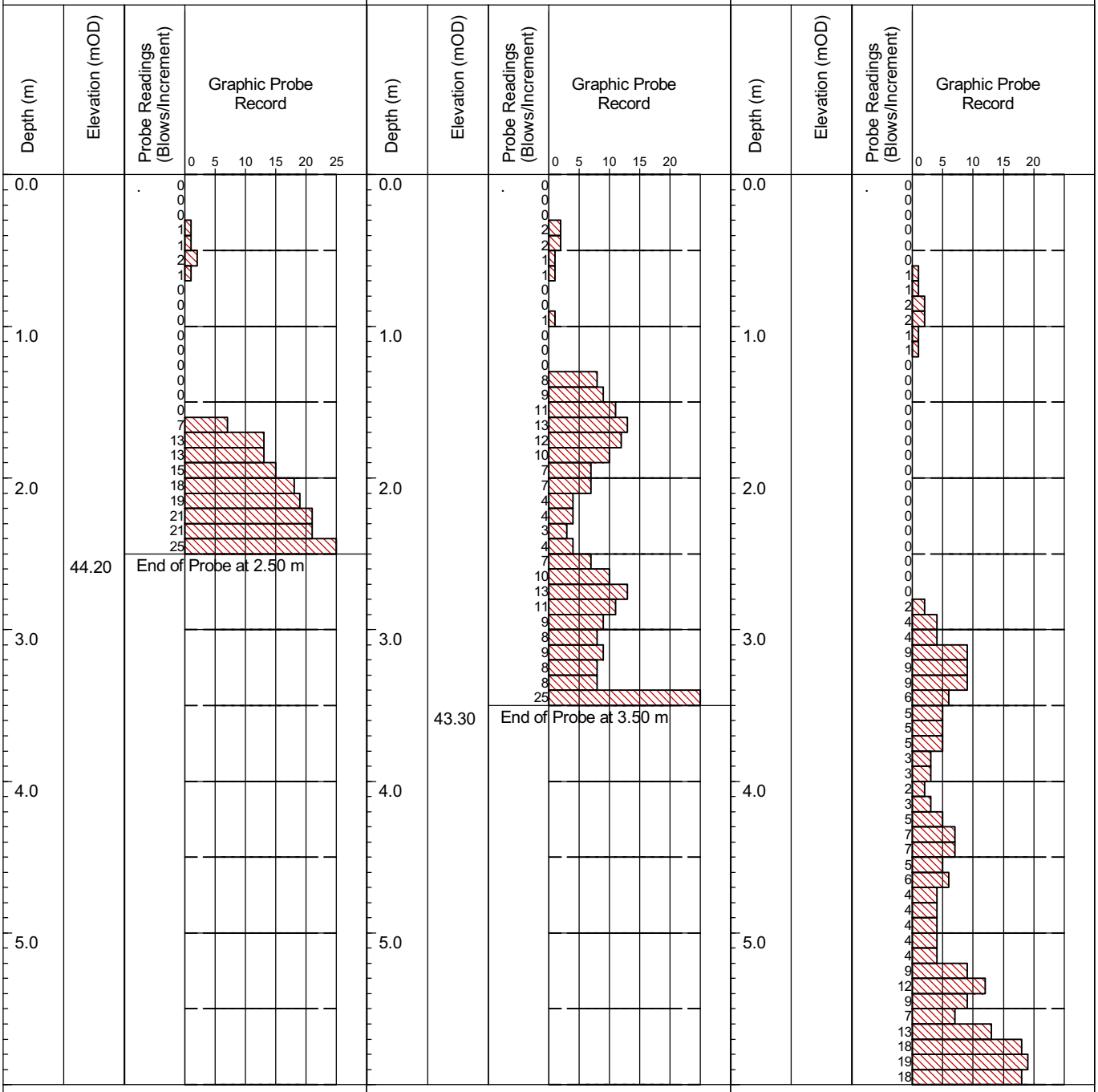
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP21	DP22	DP23
PROBE NO.			
CO-ORDINATES(_)	250,116.09 E 158,747.81 N	250,144.56 E 158,745.25 N	250,174.53 E 158,743.18 N
GROUND LEVEL (m)	46.70	46.80	46.80
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

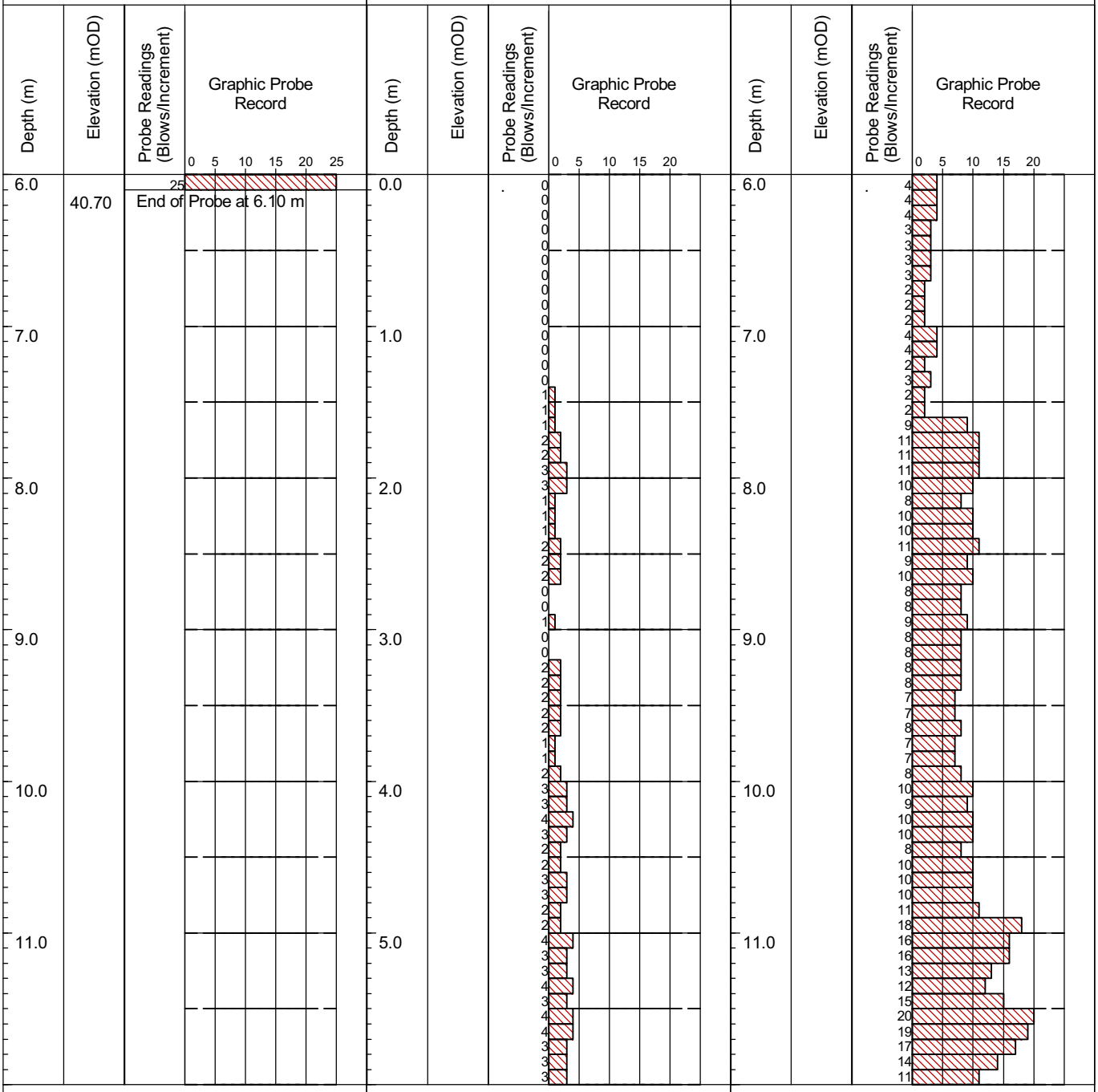
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP23	DP24	DP24
CO-ORDINATES(_)	250,174.53 E 158,743.18 N	250,196.87 E 158,745.79 N	250,196.87 E 158,745.79 N
GROUND LEVEL (m)	46.80	46.29	46.29
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

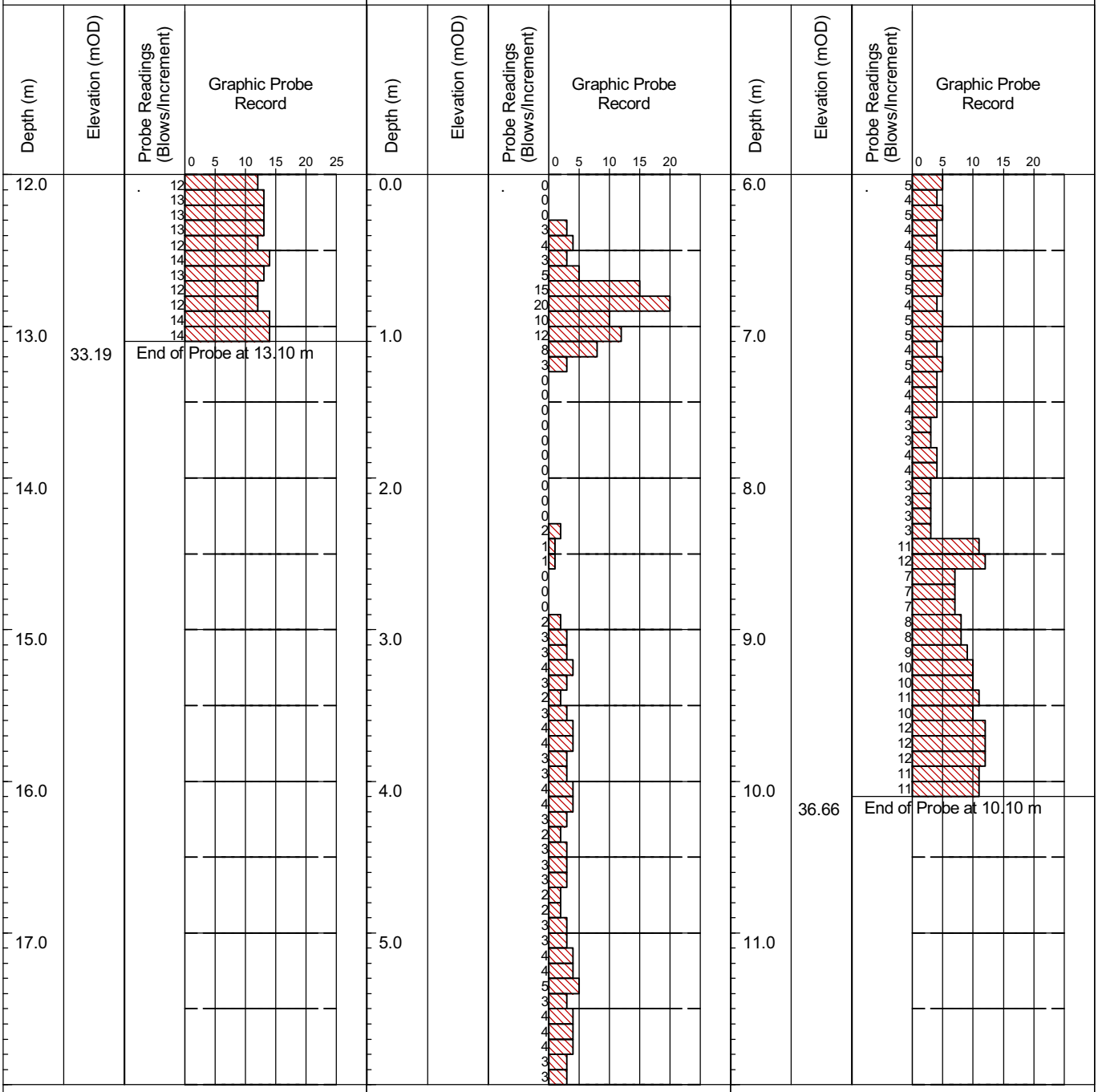
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP24	DP25	DP25
CO-ORDINATES(_)	250,196.87 E 158,745.79 N	250,208.36 E 158,741.25 N	250,208.36 E 158,741.25 N
GROUND LEVEL (m)	46.29	46.76	46.76
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 13/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

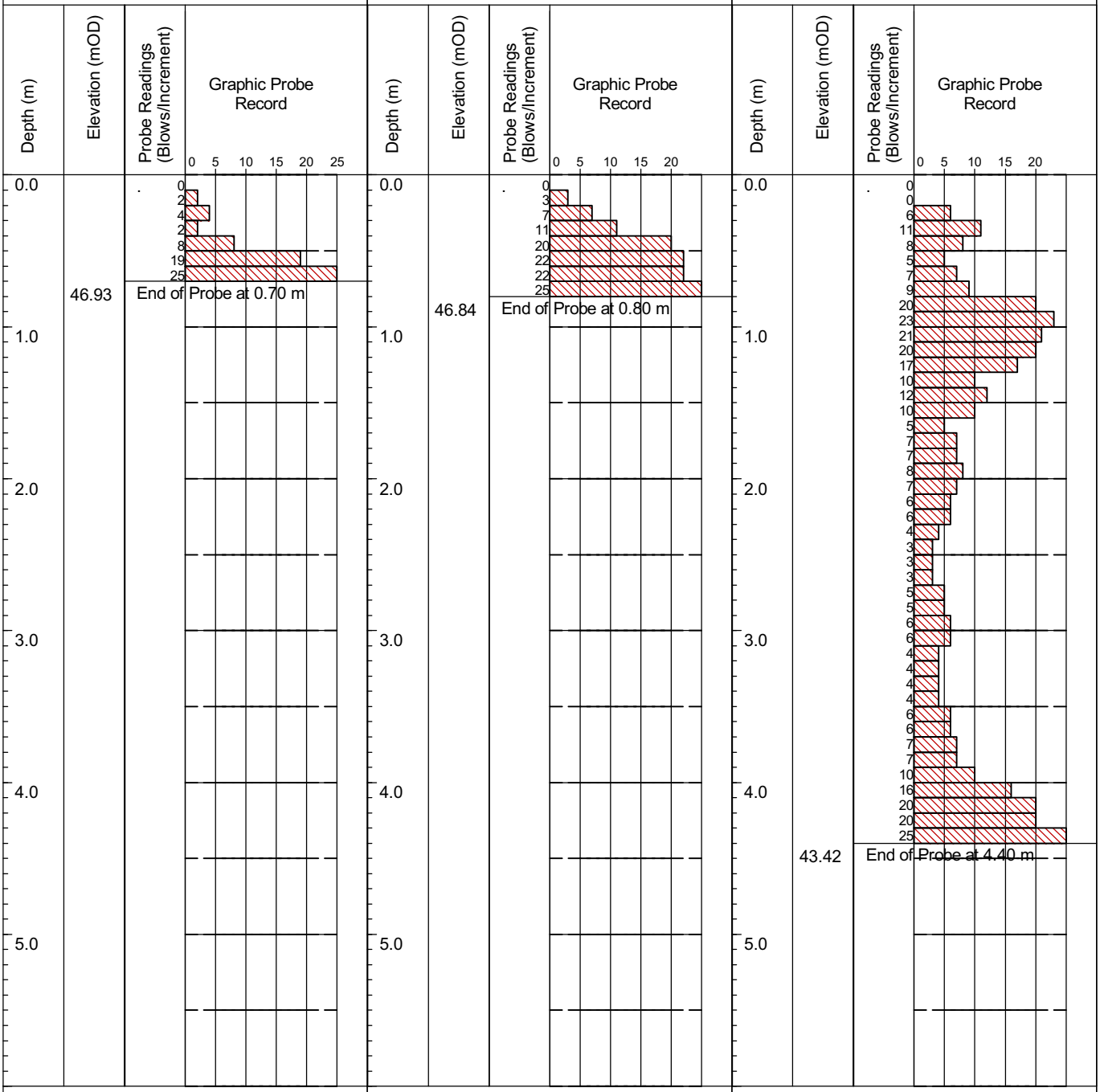
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP26	DP26A	DP27
CO-ORDINATES(_)	250,231.03 E 158,733.19 N	250,231.90 E 158,734.25 N	250,254.16 E 158,730.95 N
GROUND LEVEL (m)	47.63	47.64	47.82
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

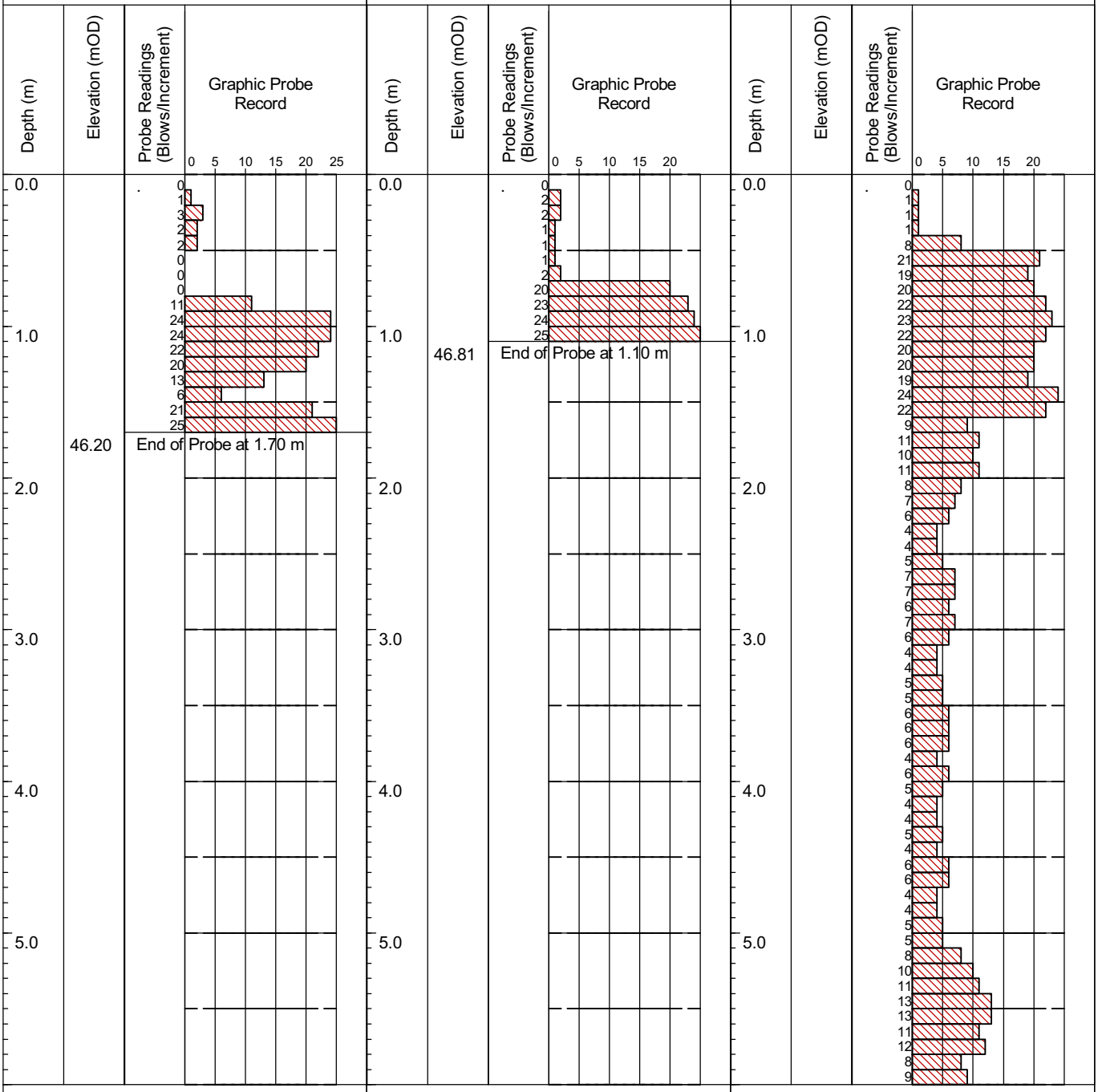
REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

	DP28	DP28A	DP29
CO-ORDINATES(_)	250,280.46 E 158,727.50 N	250,281.26 E 158,727.99 N	250,309.05 E 158,718.62 N
GROUND LEVEL (m)	47.90	47.91	47.50
HAMMER MASS (kg)	50	50	50
INCREMENT SIZE (mm)	100	100	100
FALL HEIGHT (mm)	500	500	500
PROBE TYPE	DPH	DPH	DPH



GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

DYNAMIC PROBE RECORD

REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

CLIENT Kilkenny County Council

ENGINEER CSEA Consulting

PROBE NO. DP29

CO-ORDINATES(_) 250,309.05 E
158,718.62 N

GROUND LEVEL (m)	47.50
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
PROBE TYPE	DPH

Depth (m)	Elevation (mOD)	Probe Readings (Blows/Increment)	Graphic Probe Record
6.0		9 8 9 7 7 7 9 10 16 14 16 16 17 17 17 25	0 5 10 15 20 25
7.0	39.90	End of Probe at 7.60 m	
8.0			
9.0			
10.0			
11.0			

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

PROBE NO. DP30

CO-ORDINATES(_) 250,324.07 E
158,714.99 N

GROUND LEVEL (m)	47.01
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
PROBE TYPE	DPH

Depth (m)	Elevation (mOD)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0		0 0 1 1 0 0 0 0 1 1 0 0 0 9 3 3 1 0 0 0 0 0 3 3 6 8 11 12 7 4 3 2 3 3 4 4 6 4 4 4 4 3 3 4 5 5 6 6 7 7 8 10 13 13 15 15 17 18 18 21 25	0 5 10 15 20
1.0			
2.0			
3.0			
4.0			
5.0	41.21	End of Probe at 5.80 m	

GROUNDWATER OBSERVATIONS

REMARKS

DATE: 14/08/2009

IGSL DP 3 LOGS PER PAGE 14367.GPJ IGSL.GDT 15/10/09

Appendix 4

Window Sample Records

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT Northern Ring Road Extension, Kilkenny

PROBE NO. **WS02**
SHEET Sheet 1 of 1

CO-ORDINATES 249,547.92 E
158,784.05 N
GROUND LEVEL (mOD) 46.63

DATE STARTED 03/09/2009
DATE COMPLETED 03/09/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

SAMPLED BY D. Hunston
LOGGED BY I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
			0.30	46.33						
	Soft brown slightly sandy CLAY		0.50	46.13						
	Medium dense brown fine SAND					0.00-1.00	100	42 blows		
1.0										
	Medium dense to dense brown sandy fine to coarse GRAVEL		1.50	45.13		1.00-2.00	80	76 blows		
2.0										
						2.00-3.00	80	111 blows		
3.0										
						3.00-4.00	70	113 blows		
4.0	Final Depth 4.00m		4.00	42.63						
5.0										

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**PROBE NO.**	**WS06**
		SHEET	Sheet 1 of 1
CO-ORDINATES	249,667.59 E 158,789.30 N	**DATE STARTED**	03/09/2009
GROUND LEVEL (mOD)	46.63	**DATE COMPLETED**	03/09/2009
CLIENT	Kilkenny County Council	**SAMPLED BY**	D. Hunston
ENGINEER	CSEA Consulting	**LOGGED BY**	I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Soft, brown slightly sandy CLAY		0.30	46.33					40	
	Soft to firm reddish brown slightly sandy CLAY with gravel		0.80	45.83		0.00-1.00	90	58 blows		
1.0									85	
	Medium dense fine to coarse SAND with gravel		1.50	45.13					40	
						1.00-2.00	70	22 blows		
2.0										
	Dense brown sandy fine to coarse GRAVEL		2.80	43.83		2.00-3.00	50	60 blows		
3.0										
						3.00-4.00	70	100 blows		
4.0										
						4.00-5.00	80	125 blows		
5.0	Final Depth 5.00m		5.00	41.63						

General Remarks

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT Northern Ring Road Extension, Kilkenny

PROBE NO. **WS10**
SHEET Sheet 1 of 1

CO-ORDINATES 249,787.28 E
158,777.01 N
GROUND LEVEL (mOD) 46.45

DATE STARTED 03/09/2009
DATE COMPLETED 03/09/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

SAMPLED BY D. Hunston
LOGGED BY I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Soft brown sandy SILT/CLAY		0.20	46.25						
	Soft to firm reddish brown slightly sandy CLAY with gravel		0.60	45.85		0.00-1.00	90	50 blows	30	
1.0									20	
	Medium dense brown/black sandy GRAVEL (possible stone drain)		1.50	44.95		1.00-2.00	90	33 blows	30	
2.0									30	
	Medium dense grey/brown gravelly fine to coarse SAND		2.30	44.15		2.00-3.00	90	102 blows		
3.0	Final Depth 3.00m		3.00	43.45						
4.0										
5.0										

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny
PROBE NO.	**WS14**
SHEET	Sheet 1 of 1
CO-ORDINATES	249,906.78 E 158,768.53 N
GROUND LEVEL (mOD)	46.32
DATE STARTED	18/09/2009
DATE COMPLETED	18/09/2009
CLIENT	Kilkenny County Council
ENGINEER	CSEA Consulting
SAMPLED BY	D. Hunston
LOGGED BY	I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm brown slightly sandy slightly gravelly CLAY		0.30	46.02						
1.0	Medium dense light brown/grey clayey sandy GRAVEL with occasional cobbles		0.90	45.42		0.00-1.00	90	52 blows		
						1.00-2.00	100	53 blows		
2.0	Dense dark brown and grey, sandy fine to coarse GRAVEL		2.00	44.32						
	Dense fine to medium subangular GRAVEL		2.40	43.92						
						2.00-2.80	100	143 blows		
	Final Depth 2.80m		2.80	43.52						
3.0										
4.0										
5.0										

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT Northern Ring Road Extension, Kilkenny

PROBE NO. **WS18**
SHEET Sheet 1 of 1

CO-ORDINATES 250,027.08 E
158,758.08 N
GROUND LEVEL (mOD) 47.11

DATE STARTED 18/09/2009
DATE COMPLETED 18/09/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

SAMPLED BY D. Hunston
LOGGED BY I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Loose to mediun dense, brown, clayey fine SAND		0.40	46.71						
	Firm brown sandy gravelly CLAY		0.85	46.26		0.00-1.00	60	58 blows		
1.0	Medium dense grey sandy fine to coarse subangular GRAVEL		1.00	46.11		1.00-2.00	60	12 blows		
2.0						2.00-3.00	100	151 blows		
3.0	Final Depth 3.00m		3.00	44.11						
4.0										
5.0										

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny
PROBE NO.	**WS23**
SHEET	Sheet 1 of 1
CO-ORDINATES	
GROUND LEVEL (mOD)	
DATE STARTED	18/09/2009
DATE COMPLETED	18/09/2009
CLIENT	Kilkenny County Council
ENGINEER	CSEA Consulting
SAMPLED BY	D. Hunston
LOGGED BY	I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm light brown sandy CLAY		0.30			0.00-1.00	100	57 blows		
1.0	NO RECOVERY		1.00							
	Firm brown/grey sandy CLAY		1.30							
	Soft to firm grey sandy SILT with organic pieces		1.50			1.00-2.00	100	14 blows	40	
2.0	Loose to mediun dense light brown, silty fine SAND with silt partings		2.10			2.00-3.00	100	9 blows	20	
3.0	Medium dense grey sandy fine to medium GRAVEL		3.00			3.00-4.00	100	25 blows		
	Medium dense brown clayey sandy GRAVEL		3.80			4.00-5.00	100	35 blows		
4.0										
5.0	Final Depth 5.00m		5.00							

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT Northern Ring Road Extension, Kilkenny

PROBE NO. **WS25**
SHEET Sheet 1 of 1

CO-ORDINATES 250,208.36 E 158,741.25 N
GROUND LEVEL (mOD) 46.76

DATE STARTED 01/09/2009
DATE COMPLETED 01/09/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

SAMPLED BY D. Hunston
LOGGED BY I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
			0.30	46.46						
	Soft brown CLAY		0.50	46.26					200	
	MADE GROUND (comprised of brown/grey, sandy gravel, cobbles)					0.00-1.00	85	84 blows		
1.0										
			1.65	45.11						
	Soft grey SILT/CLAY		1.85	44.91						
	Soft dark brown PEAT (Von Post H5 / H6)					1.00-2.00	60	49 blows		
2.0			2.10	44.66						
	Medium dense grey fine to coarse SAND with occasional gravel									
			2.50	44.26						
	Soft grey slightly sandy SILT		2.80	43.96						
	Medium dense grey fine SAND with many silty pockets					2.00-3.00	90	35 blows		
3.0										
						3.00-4.00	70	18 blows		
4.0										
						4.00-5.00	70	7 blows		
5.0	Final Depth 5.00m		5.00	41.76						

General Remarks

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny
PROBE NO.	**WS30**
SHEET	Sheet 1 of 1
CO-ORDINATES	250,324.07 E 158,714.99 N
GROUND LEVEL (mOD)	47.01
DATE STARTED	01/09/2009
DATE COMPLETED	01/09/2009
CLIENT	Kilkenny County Council
ENGINEER	CSEA Consulting
SAMPLED BY	D. Hunston
LOGGED BY	I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Soft / firm brown/grey slightly sandy CLAY with occasional gravel (possible fill)		0.30	46.71		0.00-1.00	100	42 blows	60	
1.0									85	
	Soft / firm dark brown clayey PEAT (Von Post H8 / H9)		1.60	45.41		1.00-2.00	85	33 blows	40	
2.0									55	
	Medium dense grey slightly silty fine SAND		2.80	44.21		2.00-3.00	100	10 blows	65	
3.0									70	
						3.00-4.00	100	38 blows		
4.0										
						4.00-5.00	70	45 blows		
5.0	Final Depth 5.00m		5.00	42.01						

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**PROBE NO.**	**WS30A**
		SHEET	Sheet 1 of 1
CO-ORDINATES	250,419.31 E 158,653.55 N	**DATE STARTED**	02/09/2009
GROUND LEVEL (mOD)	52.55	**DATE COMPLETED**	02/09/2009
CLIENT	Kilkenny County Council	**SAMPLED BY**	D. Hunston
ENGINEER	CSEA Consulting	**LOGGED BY**	I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
			0.30	52.25						
	Soft brown slightly sandy CLAY with occasional gravel		0.50	52.05						
	MADE GROUND (comprised of brown/grey sandy gravel, cobbles, concrete, clay)					0.00-1.00	80	128 blows		
1.0						1.00-2.00	70	154 blows		
2.0						2.00-3.00	60	59 blows		
3.0										
	Soft dark brown clayey PEAT(Von Post H8 / H9)		3.50	49.05						
	Medium dense grey slightly clayey fine SAND		3.70	48.85		3.00-4.00	90	55 blows		
4.0						4.00-5.00	70	84 blows		
5.0	Final Depth 5.00m		5.00	47.55						

General Remarks

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 14367

CONTRACT	Northern Ring Road Extension, Kilkenny	**PROBE NO.**	**WS-TP05**
		SHEET	Sheet 1 of 1
CO-ORDINATES	250,296.97 E 158,705.50 N	**DATE STARTED**	01/09/2009
GROUND LEVEL (mOD)	47.61	**DATE COMPLETED**	01/09/2009
CLIENT	Kilkenny County Council	**SAMPLED BY**	D. Hunston
ENGINEER	CSEA Consulting	**LOGGED BY**	I.Reder

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	MADE GROUND (comprised of brown/grey sandy gravel, cobbles, concrete, tarmac, clay)		0.30	47.31		0.00-1.00	100	131 blows		
1.0										
						1.00-2.00	100	172 blows		
2.0										
	Soft dark brown PEAT (Von Post H4/ H5)		2.50	45.11		2.00-3.00	70	35 blows		
3.0									20	
						3.00-4.00	60	30 blows		
	Medium dense grey fine SAND (no recovery from 4 to 5m)		3.90	43.71						
4.0										
						4.00-5.00	0	14 blows		
5.0	Final Depth 5.00m		5.00	42.61						

General Remarks

Installations

IGSL WS LOG 14367.GPJ IGSL.GDT 26/11/09

Appendix 5

Shear Vane Data

Project No. 14369	In-Situ Shear Vane Data	IGSL

Project: Kilkenny Northern Ring Road Extension

Engineer: CSEA

Hole No.	Hole Depth (m bgl)	Peak Shear Strength (kN/m2)	Residual Shear Strength (kN/m2)	Comments
WS 6	0.50	40		
	1.00	85		
	1.50	40		
WS 10	0.50	30		
	1.00	20		
	1.50	30		
	2.00	30		
WS 23	1.50	40		
	2.00	20		
WS 25	0.50	200		MADE GROUND / FILL
WS 30	0.50	60		
	1.00	85		
	1.50	40		
	2.00	55		
	2.50	65		
	3.00	70		
WS/TP 5	3.00	20		

Remarks: Vane tests performed with Genor H-70 apparatus.

Appendix 6

Rotary Drillhole Records & Core Photographs

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

DRILLHOLE NO RC1
SHEET Sheet 1 of 2

CO-ORDINATES 249,481.38 E
158,772.03 N
GROUND LEVEL (mOD) 47.17

RIG TYPE
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 84

DATE STARTED 17/08/2009
DATE COMPLETED 17/08/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

DRILLED BY Millennium
LOGGED BY A. Mahony

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of clay				
1												
2												
3												
4												
5									5.70			
6								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silt		41.47		
7												
8												
9									9.80			
										37.37		

REMARKS
2 Core boxes

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

DRILLHOLE NO RC1
SHEET Sheet 2 of 2

CO-ORDINATES 249,481.38 E, 158,772.03 N
GROUND LEVEL (mOD) 47.17

RIG TYPE
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 84

DATE STARTED 17/08/2009
DATE COMPLETED 17/08/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

DRILLED BY Millennium
LOGGED BY A. Mahony

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of gravel *(continued)*	10.60			
11	11.20							SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular gravel size returns of limestone (probable upper bedrock)	11.20	36.57		
12		100	56	51				Strong to locally moderately strong, thin to medium bedded, dark grey, fine grained LIMESTONE, fresh to slightly weathered. Discontinuities are smooth and undulose to locally planar. Apertures are tight to open with local slightly iron oxide staining. Dips are sub-0-30° with variable fractures throughout.		35.97		
13	12.80	100	68	55								
14	14.30											
15		100	36	21								
16	15.80 / 16.20	100	40	0					16.20			
								End of Borehole at 16.20 m		30.97		
17												
18												
19												

REMARKS
2 Core boxes

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17-08-09	16.20	16.20		No goundwater encountered

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

DRILLHOLE NO RC2
SHEET Sheet 1 of 2

CO-ORDINATES 249,515.51 E
158,789.41 N
GROUND LEVEL (mOD) 47.18

RIG TYPE
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 84

DATE STARTED 17/08/2009
DATE COMPLETED 18/08/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

DRILLED BY Millennium
LOGGED BY A. Mahony

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of clay				
1												
2									2.40			
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of gravelly clay		44.78		
3												
4												
5												
6												
7									7.10			
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silt		40.08		
8												
9												

REMARKS
2 Core boxes

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
18-08-09	19.00	13.70	19.00	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 14369

CONTRACT The Northern Ring Road Extension

DRILLHOLE NO RC2
SHEET Sheet 2 of 2

CO-ORDINATES 249,515.51 E
158,789.41 N
GROUND LEVEL (mOD) 47.18

RIG TYPE
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 84

DATE STARTED 17/08/2009
DATE COMPLETED 18/08/2009

CLIENT Kilkenny County Council
ENGINEER CSEA Consulting

DRILLED BY Millennium
LOGGED BY A. Mahony

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of silt *(continued)*				
11									11.20			
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of gravel		35.98		
12												
13									13.40			
								SYMMETRIX OPEN HOLE DRILLING: Observed by driller as angular gravel size returns of limestone (probable upper bedrock)		33.78		
14	14.10								14.10			
		100	45	37				Strong to locally moderately strong, thin to medium bedded, dark grey, fine grained LIMESTONE, fresh to slightly weathered.		33.08		
15	15.20							Discontinuities are smooth and undulose to locally planar. Apertures are tight to open with local slightly iron oxide staining. Dips are sub-40-10° with variable fractures throughout.				
		100	78	63	510							
16	16.40											
		100	88	62								
17	17.50											
18		100	82	73								
	19.00								19.00			
19								End of Borehole at 19.00 m		28.18		

REMARKS
2 Core boxes

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
18-08-09	19.00	13.70	19.00	50mm SP

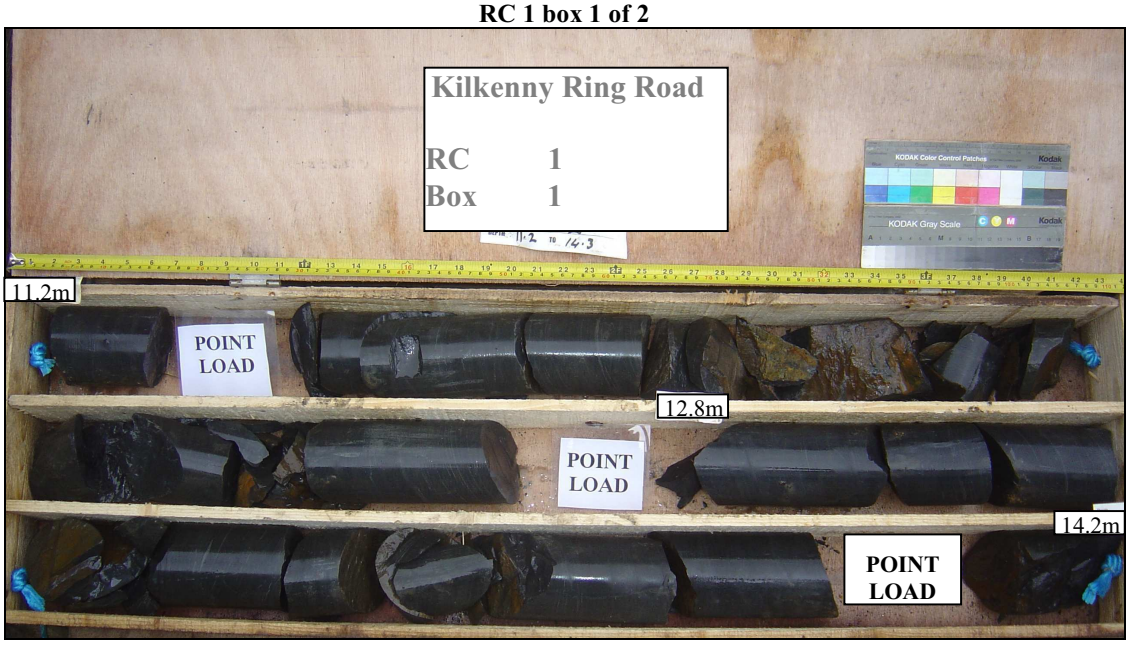
GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
18-08-09	19.00	19.00		No goundwater encountered

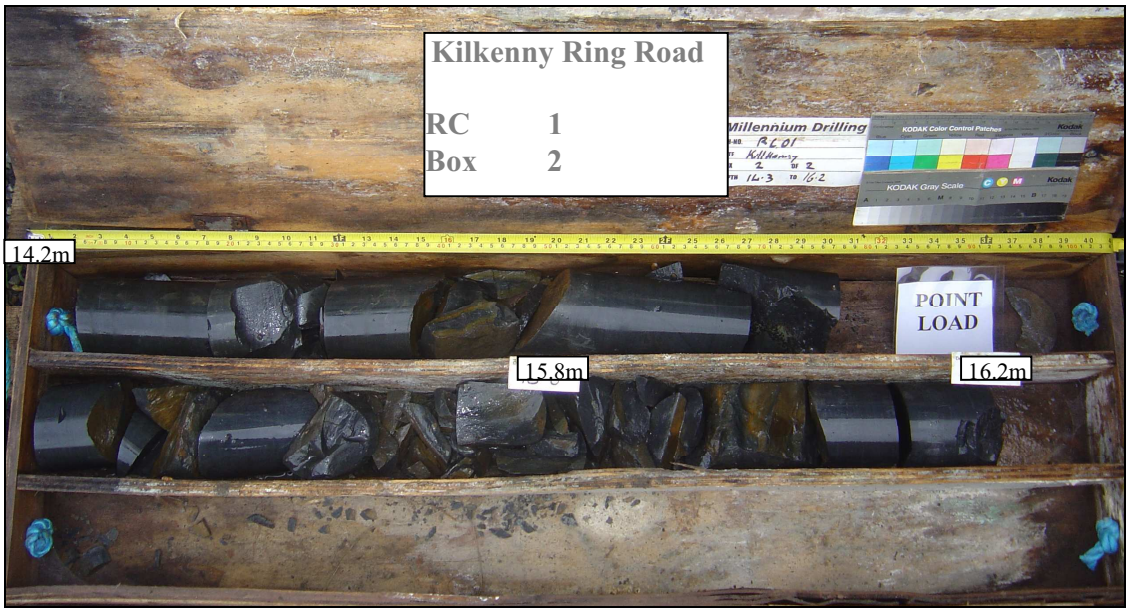
IGSL RC FI 10M 14367.GPJ IGSL.GDT 15/10/09

Core Photography – Kilkenny Ring Road (14367)

RC 1 box 1 of 2



RC 1 box 2 of 2



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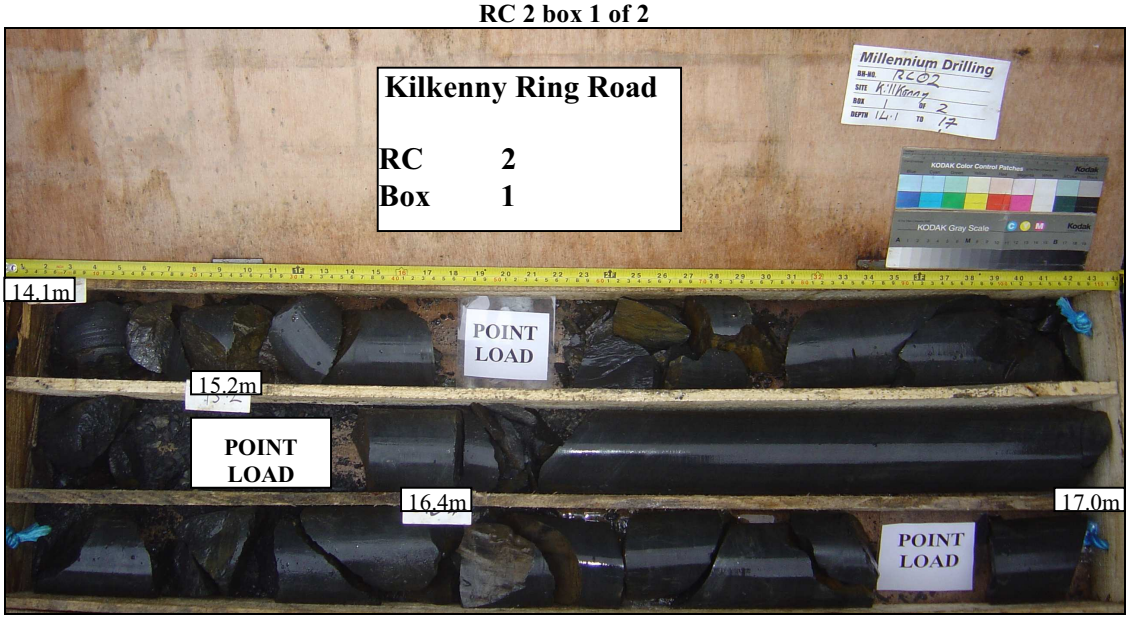

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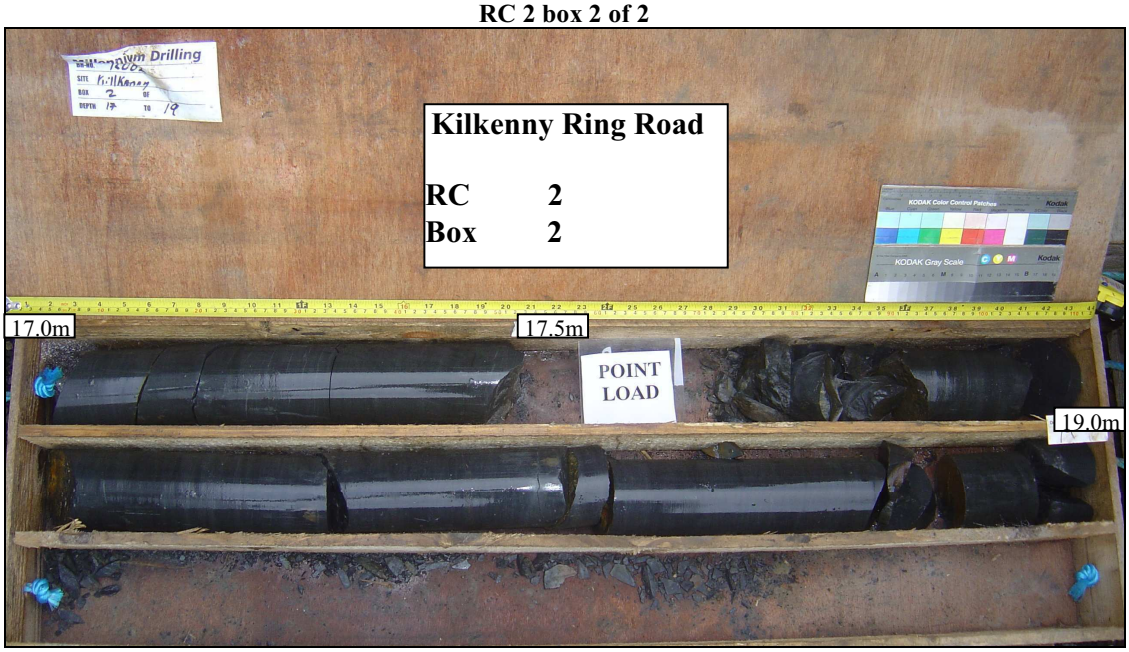

Appendix 7

Groundwater Monitoring Data

Project No.14367	GROUNDWATER MONITORING DATA SHEET	*IGSL Ltd*

Project: Kilkenny Northern Ring Road
Engineer: CSEA

Exploratory Hole	Location Type	Date Installed	Response Zone Top (m bgl)	Response Zone Base (m bgl)	Groundwater Level (m bgl) (16/9.2009)	Groundwater Level (m bgl) (6/10/2009)	Comments
BH02	Cut Area	12/08/2009	1.00	10.00	5.05	4.96	Readings of 6 Oct taken afer heavy ra
BH05	Abutment	18/08/2009	1.00	10	1.5	1.46	
RC02	Abutment	18/08/2009	13.75	19.00	1.28	1.38	

Remarks:

Appendix 8

Soil Laboratory Test Records

Determination of Moisture Content

BS1377:Part 2:1990, clauses 3.2

BH/TP No.	Sample No.	Depth (M)	Sample Type	Moisture Content %	Description
TP4	AJ5316	1.50	Db	4.7	Grey brown clayey/silty very sandy GRAVEL
TP4	AJ5317/18	2.5-3.5	Db	19.5	Light brown slightly sandy slightly gravelly CLAY
TP5	AJ5311	0.50	Db	17.7	Brown slightly sandy slightly gravelly SILT/CLAY
TP5	AJ5312/13	1.5-2.5	Db	19.3	Light brown slightly sandy slightly gravelly CLAY
TP6	AJ5308	1.00	Db	3.1	Grey brown slghtly clayey/silty very sandy GRAVEL some cobbles
TP6	AJ5309	2.00	Db	2.6	Grey brown slghtly clayey/silty very sandy GRAVEL some cobbles
TP6	AJ5310	3.00	Db	2.9	Grey brown slghtly clayey/silty very sandy GRAVEL some cobbles
BH1	AF0005	3.00	Db	23.6	Brown slightly sandy SILT/CLAY
BH1	AF0011	6.00	U	21	Light brown slightly sandy slightly gravelly SILT/CLAY
BH2	AF0016	2.00	Db	10.6	Brown slightly sandy gravelly SILT/CLAY
BH2	AF0021	5.00	Db	25.6	Brown slightly sandy SILT/CLAY
BH5	AF1137	2.00	U	26	Grey brown sandy SILT/CLAY
BH6	AF0061	1.00	Db	18.4	Grey brown very sandy SILT/CLAY
BH6	AF0063	3.00	Db	5.7	Brown slghtly clayey/silty very sandy GRAVEL

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Summary of Classification Tests

BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4

BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425µm %	Preparation	Description	Classification
BH1	AF0002	1.00	Db	9.7	28	17	11	28	WS	Brown slightly sandy gravelly CLAY with many cobbles	C L
BH1	AF0007	4.00	U	18.2	26	20	6	96	WS	Brown slightly sandy slightly gravelly CLAY	C L
BH2	AF0018	4.00	U	20	28	NP		100	WS	Brown slightly sandy SILT	M L
BH3	AF0032	1.00	Db	30.5	46	25	21	99	WS	Grey brown slightly sandy CLAY with root hairs	C I
BH3	AF0037	6.00	U	20.7	24	16	8	98	WS	Grey slightly sandy slightly gravelly CLAY	C L
BH4	AF0049	2.00	U	50.2	71	35	36	99	WS	Light brown slightly sandy SILT	M V
BH4	AF0054	6.00	U	21.5	23	16	7	98	WS	Grey brown sandy slightly gravelly CLAY	C L
BH5	AF1143	7.00	U	23.7	23	16	7	99	WS	Grey slightly sandy CLAY	C L
BH6	AF0068	8.00	U	19	27	NP		93	WS	Grey brown slightly sandy slightly gravelly SILT	M L
WS6	W2720	0.3-1.5	Db	27.4	44	23	21		NAT	Grey brown slightly sandy CLAY	C I
WS10	W2722	0.6-1.5	Db	33.3	46	25	21		NAT	Grey brown slightly sandy slightly gravelly CLAY with root hairs	C I
WS30	w2724	0.3-1.6	Db	68.9	98	53	45	74	WS	Grey brown organic slightly sandy slightly gravelly SILT	M E
TP4	AJ5317/18	2.5-3.5	Db	19.5	27	17	10	94	WS	Light brown slightly sandy slightly gravelly CLAY	C L
TP5	AJ5212/13	1.5/2.5	Db	19.3	35	17	18	85	WS	Light brown slightly sandy slightly gravelly CLAY	C L

Notes: NAT - tested as received WS - Wet sieved (425µm) NP - Non Plastic

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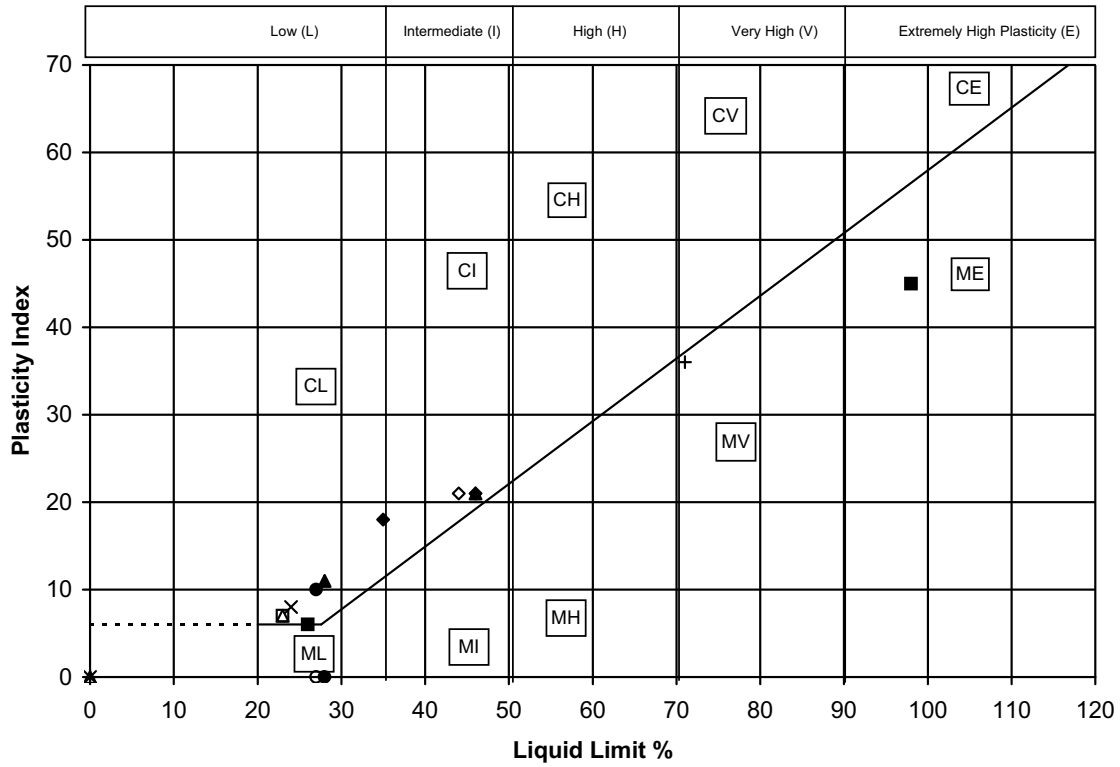
Plasticity Chart - Summary of Liquid & Plastic Limit Tests

BS1377:Part 2:1990, clauses 3.2, 4 & 5

Chart in accordance with BS5930:1999, fig.18

Contract No. 14367 Contract: Kilkenny Northern Ring Rd Extension



Code	BH/TP	Sample	Depth (m)	MC%	LL%	PL%	PI%	%<425μm	Description
▲	BH1	AF0002	1.00	9.7	28	17	11	28	Brown slightly sandy gravelly CLAY with many cobbles
■	BH1	AF0007	4.00	18.2	26	20	6	96	Brown slightly sandy slightly gravelly CLAY
●	BH2	AF0018	4.00	20	28	NP	0	100	Brown slightly sandy SILT
◆	BH3	AF0032	1.00	30.5	46	25	21	99	Grey brown slightly sandy CLAY with root hairs
×	BH3	AF0037	6.00	20.7	24	16	8	98	Grey slightly sandy slightly gravelly CLAY
+	BH4	AF0049	2.00	50.2	71	35	36	99	Light brown slightly sandy SILT
△	BH4	AF0054	6.00	21.5	23	16	7	98	Grey brown sandy slightly gravelly CLAY
□	BH5	AF1143	7.00	23.7	23	16	7	99	Grey slightly sandy CLAY
○	BH6	AF0068	8.00	19	27	NP	0	93	Grey brown slightly sandy slightly gravelly SILT
◇	WS6	W2720	0.3-1.5	27.4	44	23	21	0	Grey brown slightly sandy CLAY
▲	WS10	W2722	0.6-1.5	33.3	46	25	21	0	Grey brown slightly sandy slightly gravelly CLAY with root hairs
■	WS30	w2724	0.3-1.6	68.9	98	53	45	74	Grey brown organic slightly sandy slightly gravelly SILT
●	TP4	AJ5317/18	2.5-3.5	19.5	27	17	10	94	Light brown slightly sandy slightly gravelly CLAY
◆	TP5	AJ5212/13	1.5/2.5	19.3	35	17	18	85	Light brown slightly sandy slightly gravelly CLAY
×									
+									
△									

NP denotes specimen is non-plastic.

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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	75	COBBLES
63	75	GRAVEL
50	69	
37.5	56	
28	52	
20	47	
14	44	
10	41	
6.3	39	
5	38	
3.35	36	
2	34	SAND
1.18	32	
0.6	29	
0.425	28	
0.3	26	
0.15	23	
0.063	21	SILT/CLAY
0.037	19	
0.027	16	
0.017	13	
0.010	9	
0.007	8	
0.004	6	
0.002	3	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

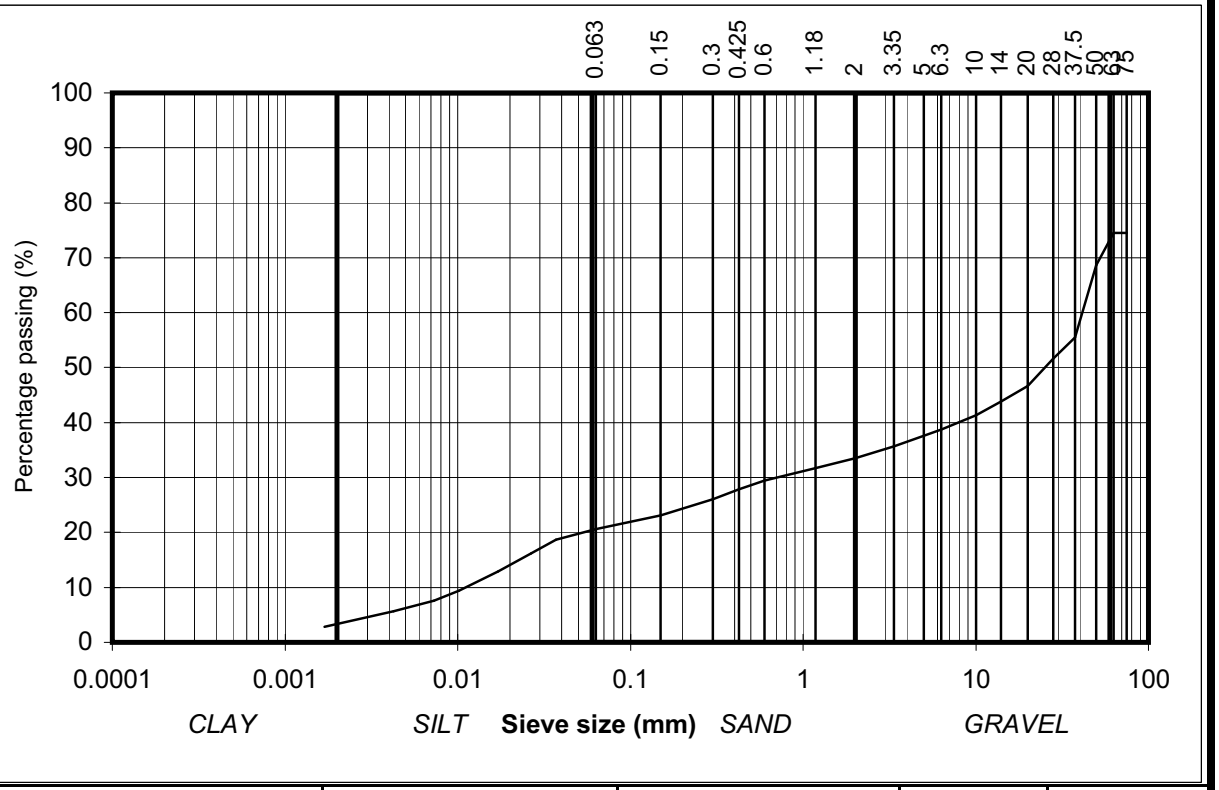
BH/TP No: BH1

SAMPLE No.: AF0002 SAMPLE TYPE: Db

DEPTH (m): 1.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Brown slightly sandy, gravelly, CLAY with many cobbles



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	GRAVEL
14	100	
10	100	
6.3	99	
5	99	
3.35	99	
2	98	
1.18	97	
0.6	97	SAND
0.425	96	
0.3	96	
0.15	96	
0.063	82	
0.038	67	
0.027	51	
0.018	34	SILT/CLAY
0.011	19	
0.008	14	
0.004	9	
0.002	5	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

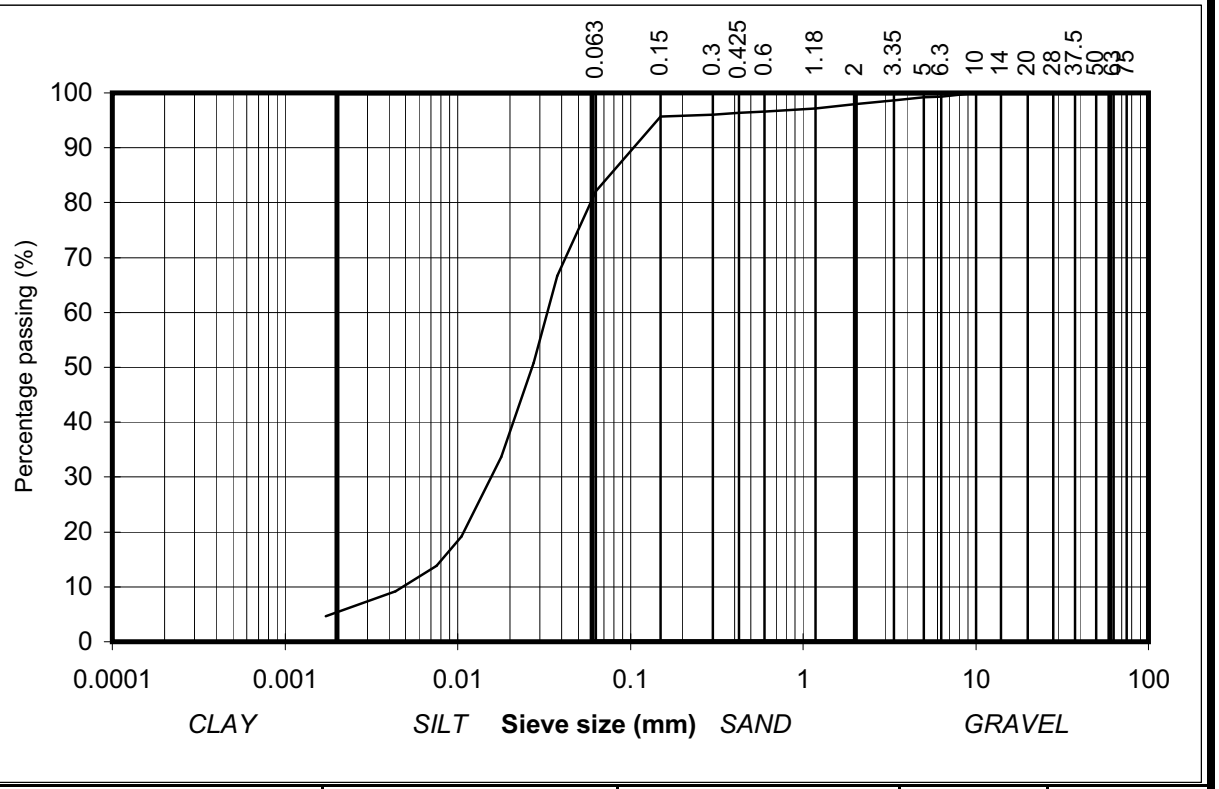
BH/TP No: BH1

SAMPLE No.: AF0007 SAMPLE TYPE: U

DEPTH (m): 4.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Brown slightly sandy, slightly gravelly, CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	GRAVEL
14	100	
10	100	
6.3	99	
5	98	
3.35	95	
2	91	
1.18	88	
0.6	85	SAND
0.425	83	
0.3	82	
0.15	81	
0.063	74	
0.037	66	
0.027	49	
0.018	32	SILT/CLAY
0.010	17	
0.007	13	
0.004	10	
0.002	6	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

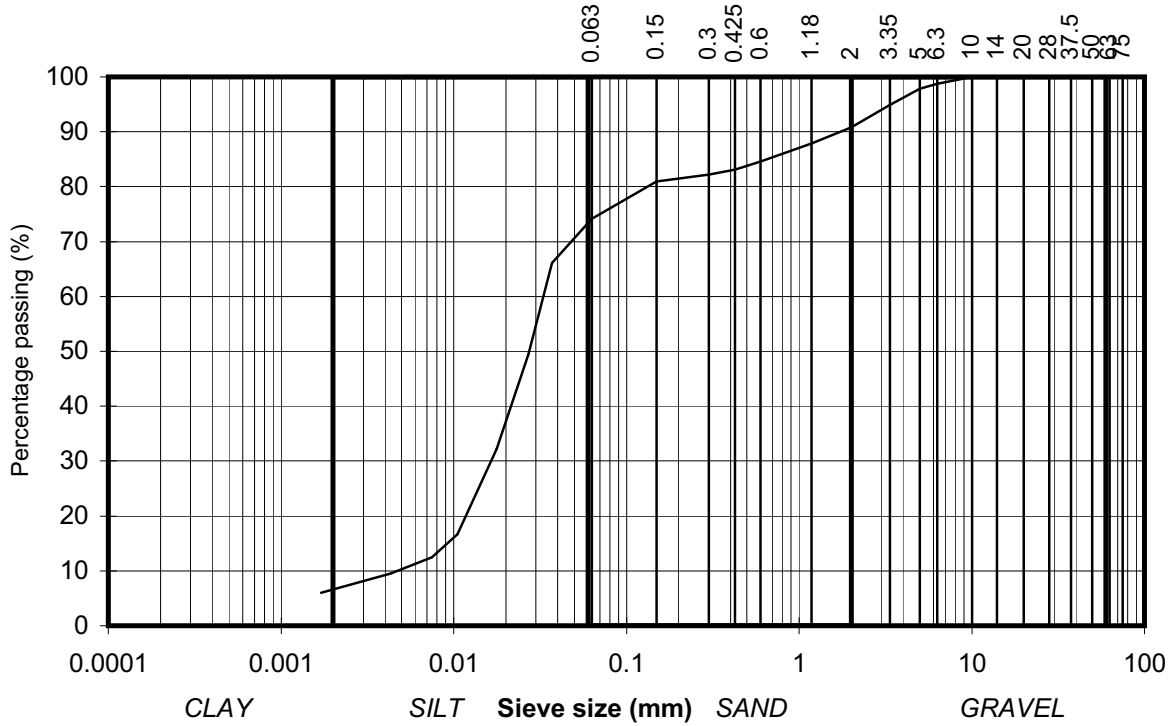
BH/TP No: BH1

SAMPLE No.: AF0011 SAMPLE TYPE: U

DEPTH (m): 6.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Light brown slightly sandy, slightly gravelly, SILT/CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	88	
37.5	84	
28	81	
20	76	
14	70	
10	66	
6.3	63	
5	61	
3.35	55	
2	49	SAND
1.18	44	
0.6	40	
0.425	38	
0.3	36	
0.15	33	
0.063	29	SILT/CLAY
0.038	27	
0.028	23	
0.018	18	
0.011	13	
0.008	10	
0.004	7	
0.002	5	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

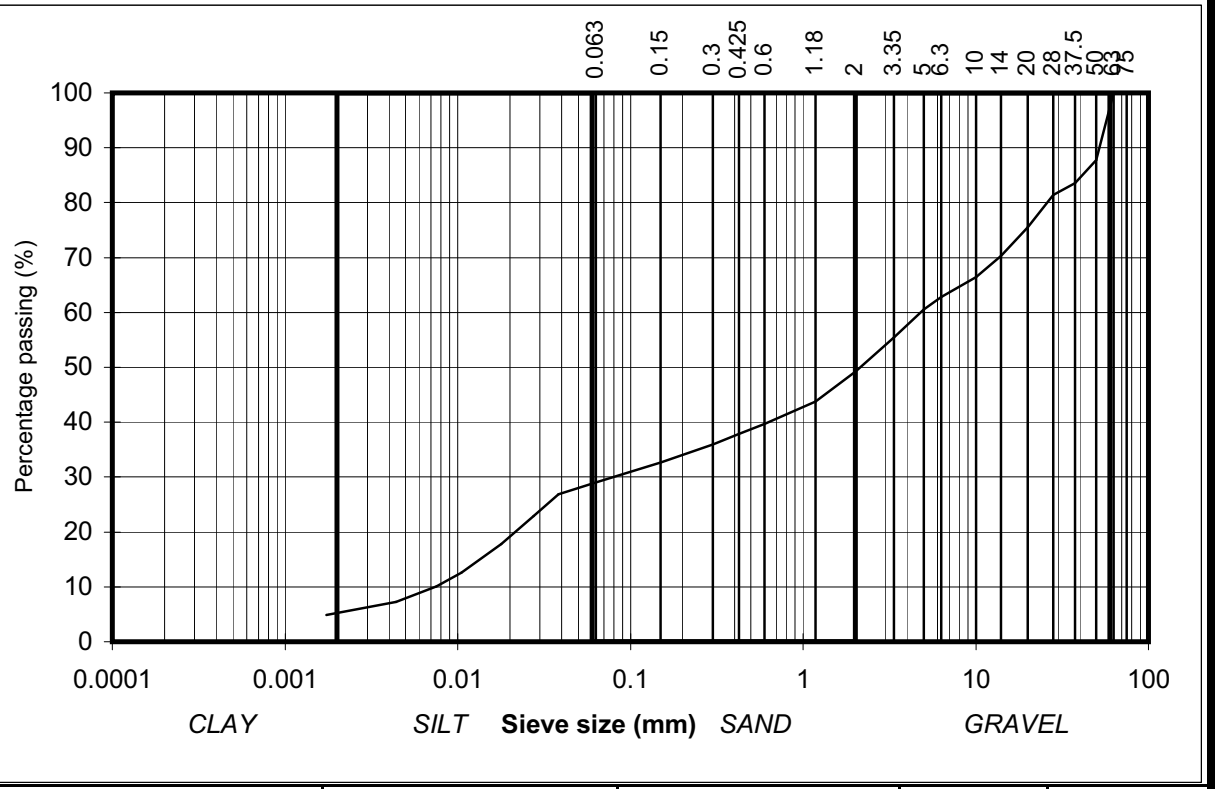
BH/TP No: BH2

SAMPLE No.: AF0016 SAMPLE TYPE: Db

DEPTH (m): 2.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Brown slightly sandy, gravelly, SILT/CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	GRAVEL
14	100	
10	100	
6.3	100	
5	100	
3.35	100	
2	100	
1.18	100	
0.6	100	SAND
0.425	100	
0.3	100	
0.15	99	
0.063	91	
0.037	78	
0.027	60	
0.018	41	SILT/CLAY
0.010	24	
0.007	17	
0.004	10	
0.002	7	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

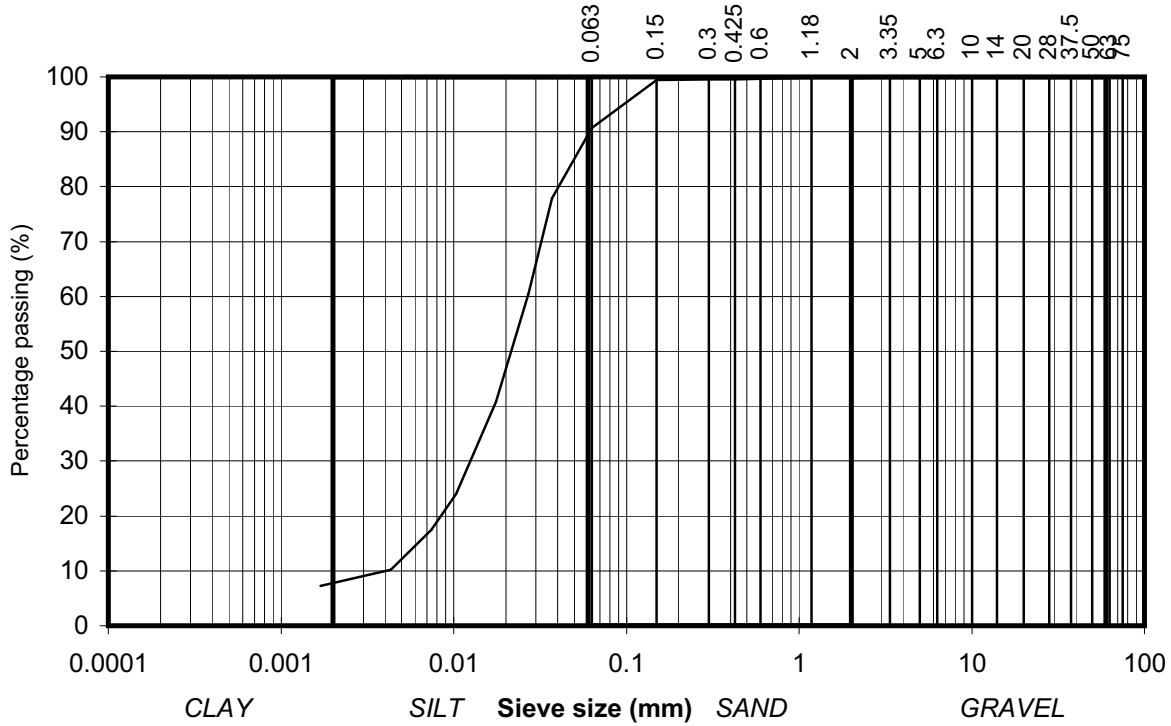
BH/TP No: BH2

SAMPLE No.: AF0018 SAMPLE TYPE: U

DEPTH (m): 4.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Brown slightly sandy, SILT



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	100	
20	100	
14	100	
10	100	
6.3	100	
5	100	
3.35	100	
2	100	SAND
1.18	100	
0.6	100	
0.425	100	
0.3	100	
0.15	100	
0.063	95	SILT/CLAY
0.038	77	
0.027	60	
0.018	43	
0.011	21	
0.007	18	
0.004	10	
0.002	3	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

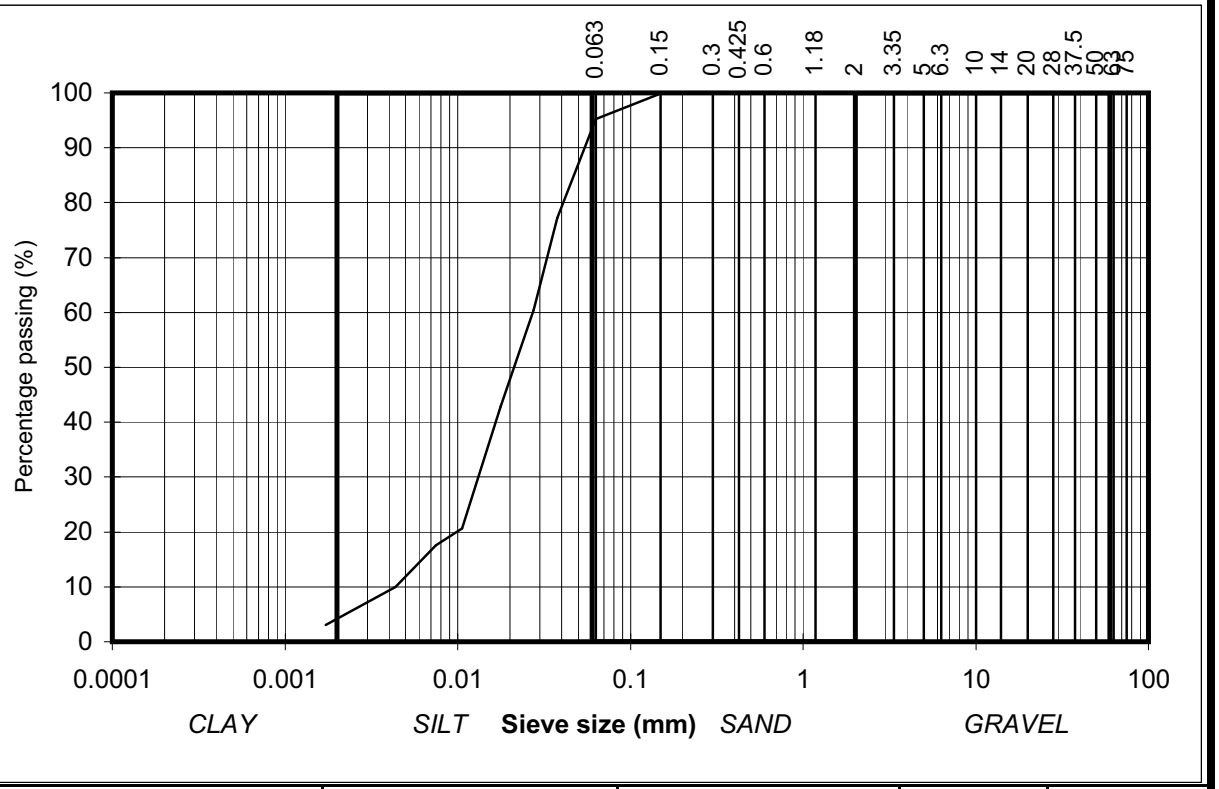
BH/TP No: BH2

SAMPLE No.: AF0021 SAMPLE TYPE: Db

DEPTH (m): 5.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Brown slightly sandy, SILT/CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	86	COBBLES
63	86	GRAVEL
50	83	
37.5	80	
28	70	
20	56	
14	45	
10	36	
6.3	29	
5	27	
3.35	23	
2	20	SAND
1.18	18	
0.6	17	
0.425	16	
0.3	15	
0.15	13	
0.063	10	SILT/CLAY
0.037	8	
0.027	7	
0.017	5	
0.010	4	
0.007	3	
0.004	2	
0.002	1	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

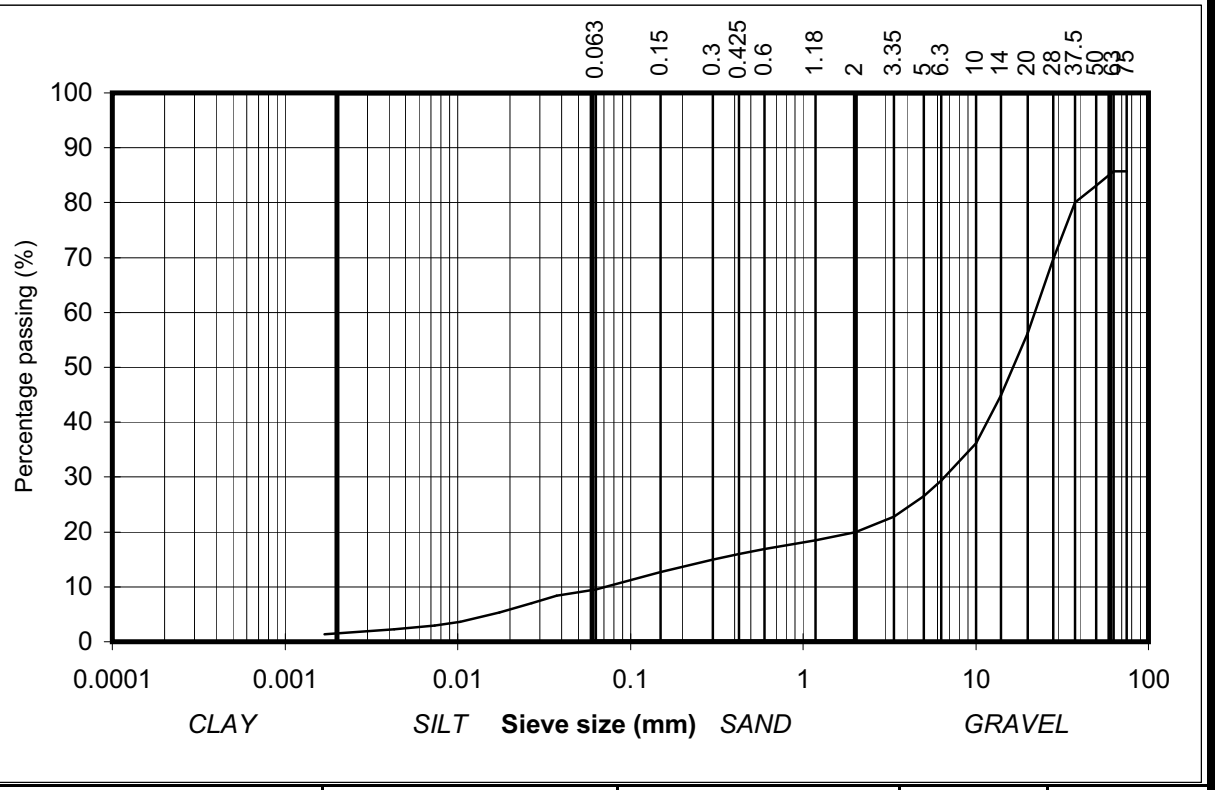
BH/TP No: BH3

SAMPLE No.: AF0034 SAMPLE TYPE: Db

DEPTH (m): 3.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Brown clayey/silty, sandy, GRAVEL with some cobbles



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	GRAVEL
14	100	
10	100	
6.3	100	
5	100	
3.35	99	
2	99	
1.18	99	
0.6	98	SAND
0.425	98	
0.3	98	
0.15	97	
0.063	87	
0.037	80	
0.026	72	
0.017	54	SILT/CLAY
0.010	39	
0.007	29	
0.004	20	
0.002	12	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

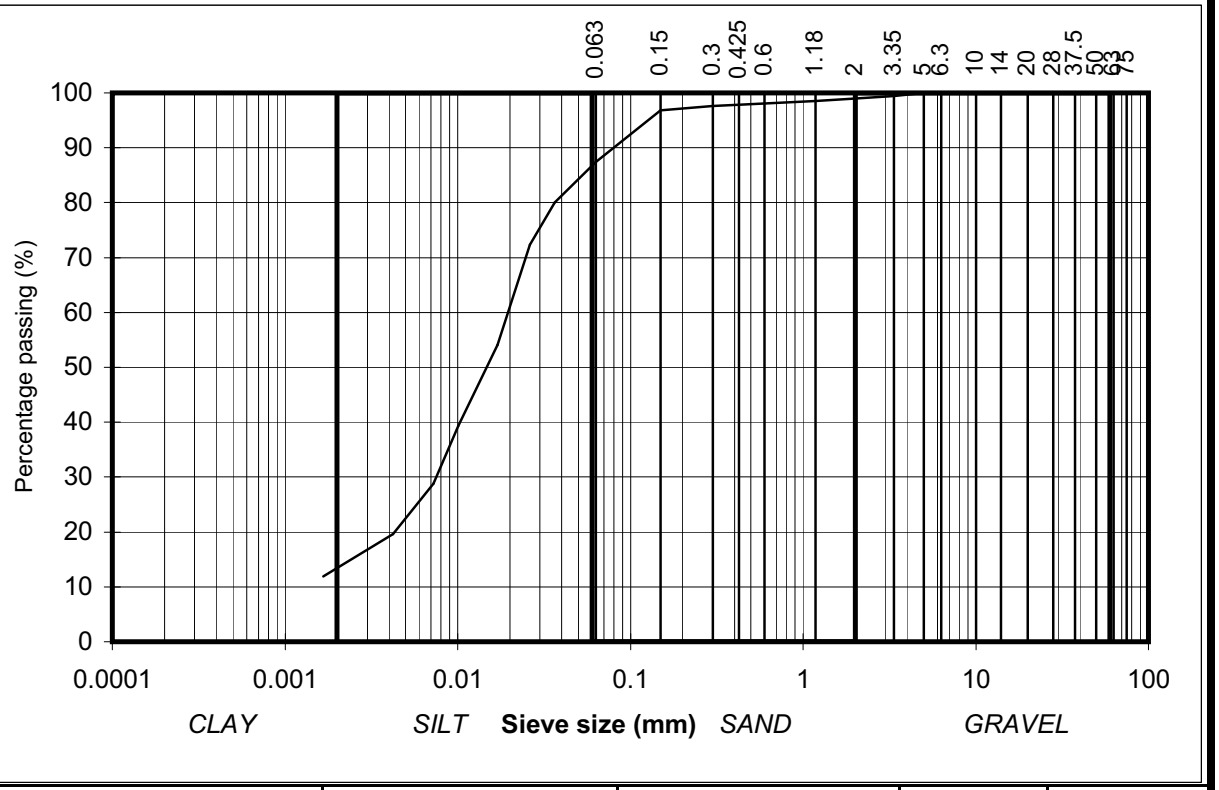
BH/TP No: BH3

SAMPLE No.: AF0037 SAMPLE TYPE: U

DEPTH (m): 6.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey slightly sandy, slightly gravelly, CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	96	
37.5	85	
28	78	
20	68	
14	62	
10	55	
6.3	47	
5	44	
3.35	37	
2	32	SAND
1.18	26	
0.6	20	
0.425	19	
0.3	18	
0.15	16	
0.063	9	SILT/CLAY
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

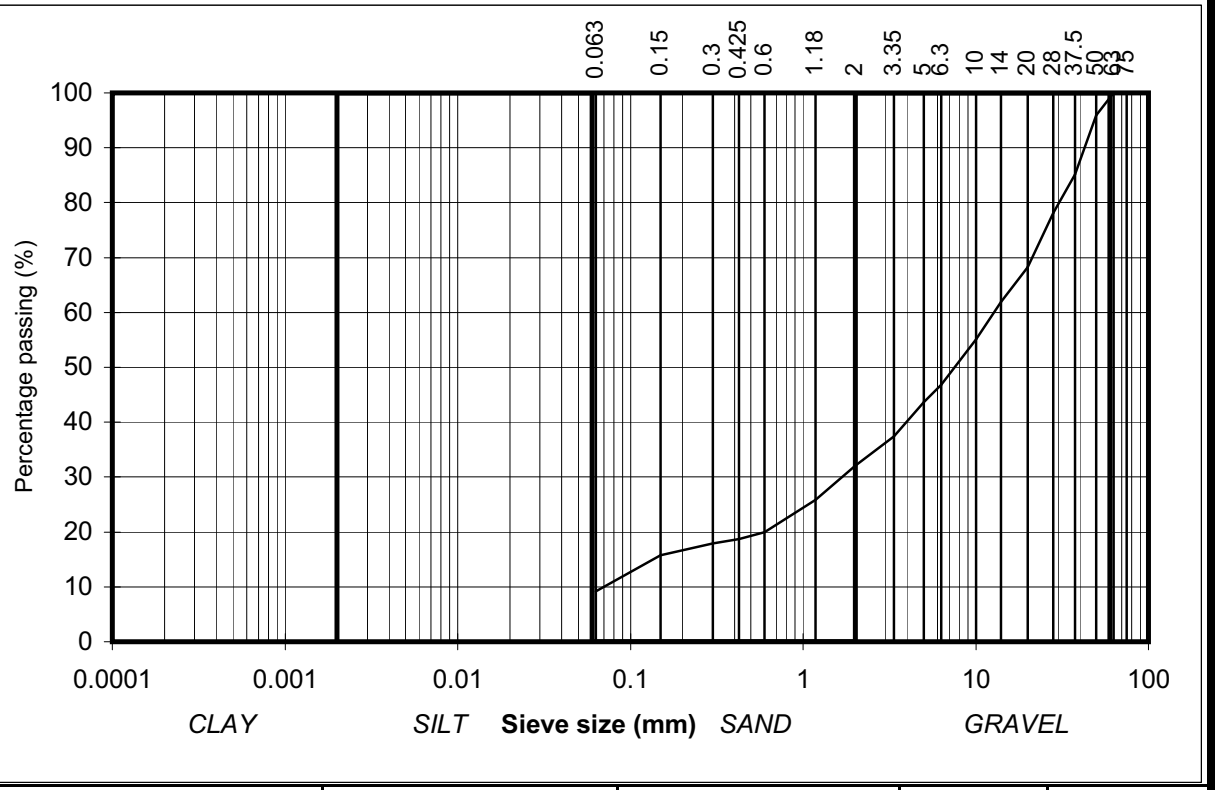
BH/TP No: BH3

SAMPLE No.: AF0044 SAMPLE TYPE: Db

DEPTH (m): 10.00

TEST METHOD: Wet sieve

DESCRIPTION: Grey clayey/silty, very sandy, GRAVEL



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	96	
28	84	
20	75	
14	68	
10	63	
6.3	57	
5	52	
3.35	44	
2	34	SAND
1.18	26	
0.6	16	
0.425	11	
0.3	8	
0.15	5	
0.063	3	SILT/CLAY
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

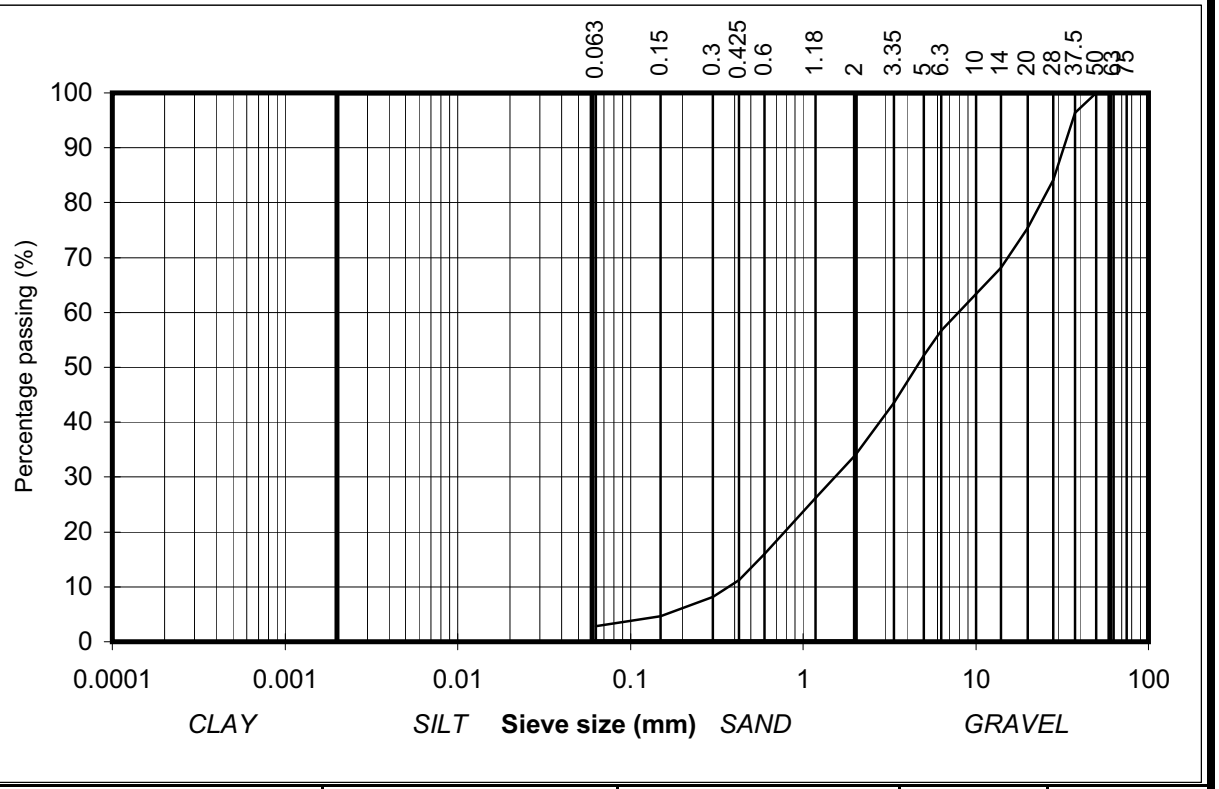
BH/TP No: BH4

SAMPLE No.: AF0052 SAMPLE TYPE: Db

DEPTH (m): 4.00

TEST METHOD: Wet sieve

DESCRIPTION: Grey slightly clayey/silty, very sandy, GRAVEL



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	GRAVEL
14	99	
10	99	
6.3	99	
5	99	
3.35	99	
2	99	
1.18	99	
0.6	99	SAND
0.425	98	
0.3	98	
0.15	97	
0.063	83	
0.039	66	
0.028	53	
0.018	36	SILT/CLAY
0.011	22	
0.008	17	
0.004	13	
0.002	7	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

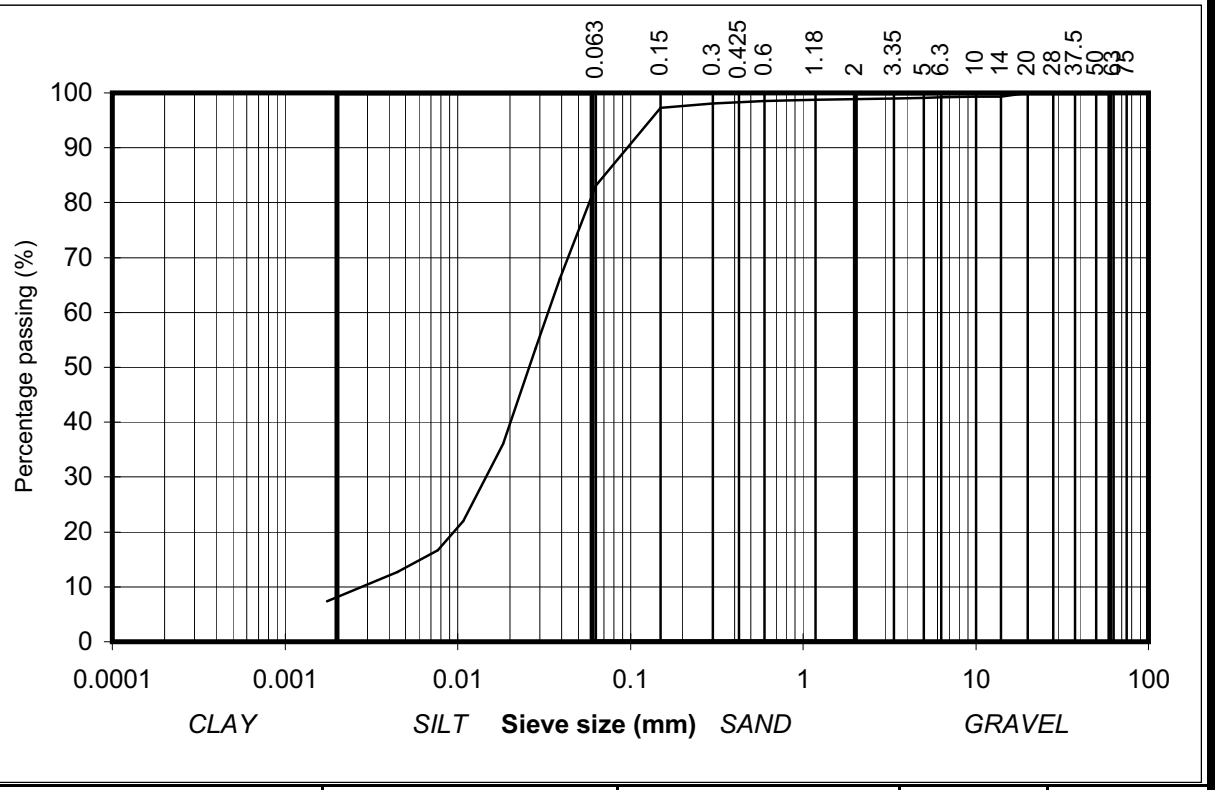
BH/TP No: BH4

SAMPLE No.: AF0054 SAMPLE TYPE: U

DEPTH (m): 6.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey slightly sandy, slightly gravelly, CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	79	COBBLES
63	79	GRAVEL
50	71	
37.5	69	
28	69	
20	62	
14	55	
10	47	
6.3	37	
5	33	
3.35	29	
2	26	SAND
1.18	24	
0.6	22	
0.425	21	
0.3	20	
0.15	16	
0.063	9	SILT/CLAY
0.038	6	
0.028	5	
0.018	3	
0.011	2	
0.007	1	
0.004	1	
0.002	1	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

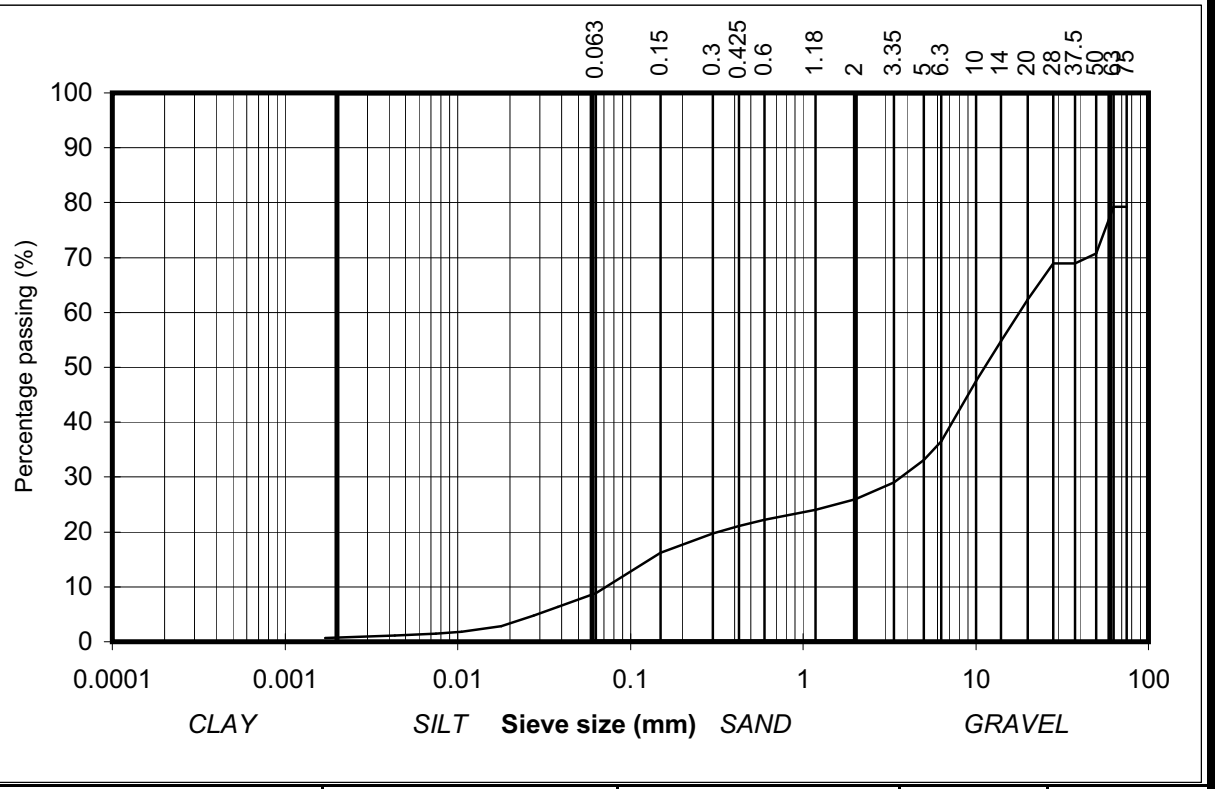
BH/TP No: BH4

SAMPLE No.: AF0058 SAMPLE TYPE: Db

DEPTH (m): 9.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey clayey/silty, sandy, GRAVEL with many cobbles



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	94	
28	86	
20	76	
14	72	
10	67	
6.3	54	
5	47	
3.35	36	
2	28	SAND
1.18	21	
0.6	11	
0.425	7	
0.3	5	
0.15	2	
0.063	2	SILT/CLAY
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

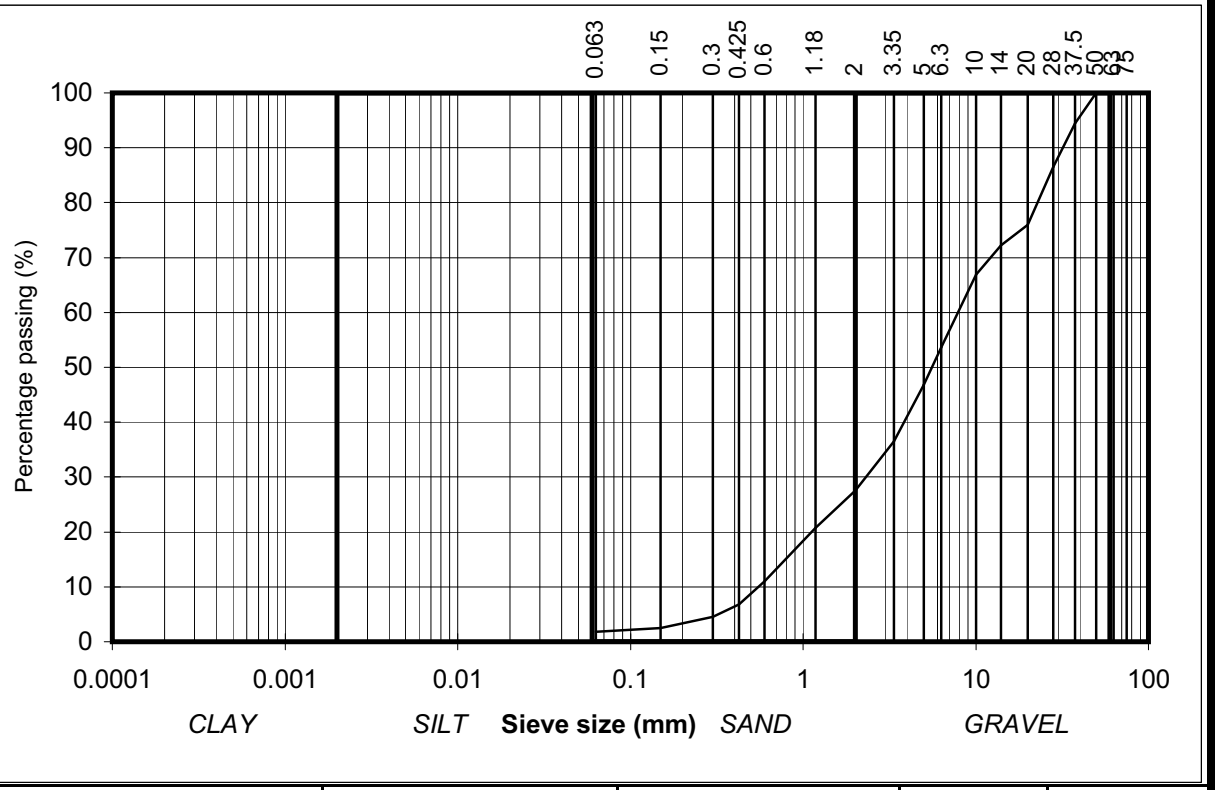
BH/TP No: BH5

SAMPLE No.: AF1140 SAMPLE TYPE: Db

DEPTH (m): 4.00

TEST METHOD: Wet sieve

DESCRIPTION: Dark grey brown slightly clayey/silty, very sandy, GRAVEL



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	GRAVEL
14	100	
10	100	
6.3	100	
5	100	
3.35	100	
2	100	
1.18	99	
0.6	99	SAND
0.425	99	
0.3	99	
0.15	99	
0.063	95	
0.037	81	
0.027	66	
0.017	50	SILT/CLAY
0.010	32	
0.007	29	
0.004	22	
0.002	14	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

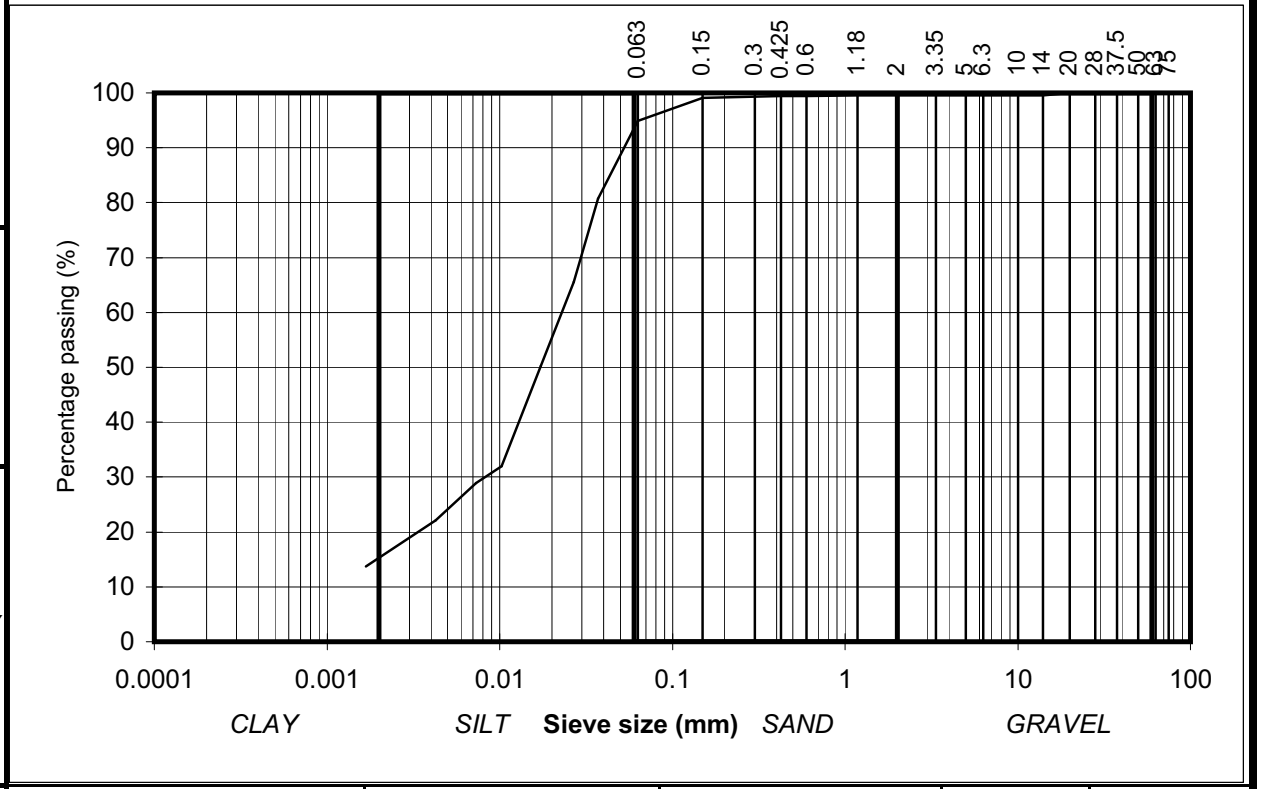
BH/TP No: BH5

SAMPLE No.: AF1143 SAMPLE TYPE: U

DEPTH (m): 7.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey slightly sandy, CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	100	
14	100	GRAVEL
10	98	
6.3	97	
5	96	
3.35	94	
2	94	
1.18	94	
0.6	93	
0.425	93	SAND
0.3	93	
0.15	92	
0.063	61	
0.038	45	
0.028	31	
0.018	19	
0.011	11	SILT/CLAY
0.008	9	
0.004	7	
0.002	6	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

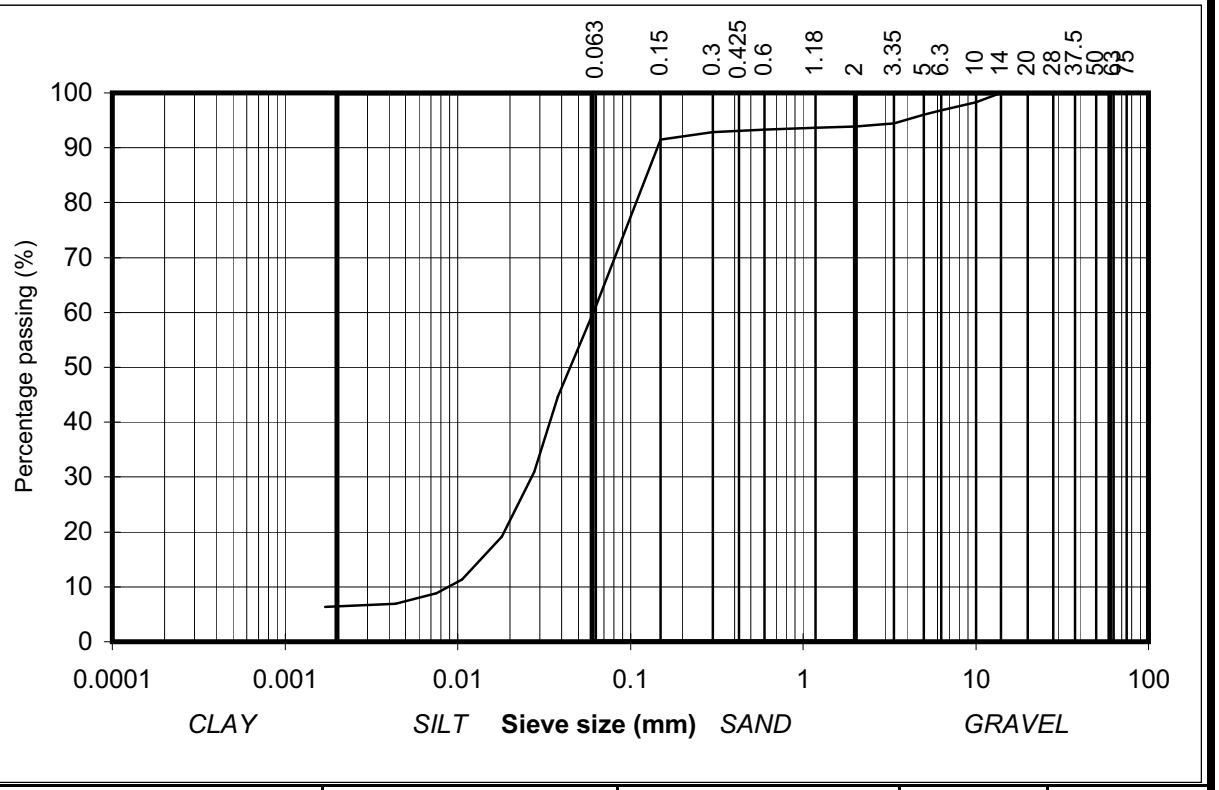
BH/TP No: BH6

SAMPLE No.: AF0068 SAMPLE TYPE: U

DEPTH (m): 8.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey brown slightly sandy, slightly gravelly, SILT



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	93	
28	78	
20	70	
14	65	
10	63	
6.3	58	
5	56	
3.35	50	
2	41	SAND
1.18	30	
0.6	18	
0.425	13	
0.3	11	
0.15	8	
0.063	6	SILT/CLAY
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

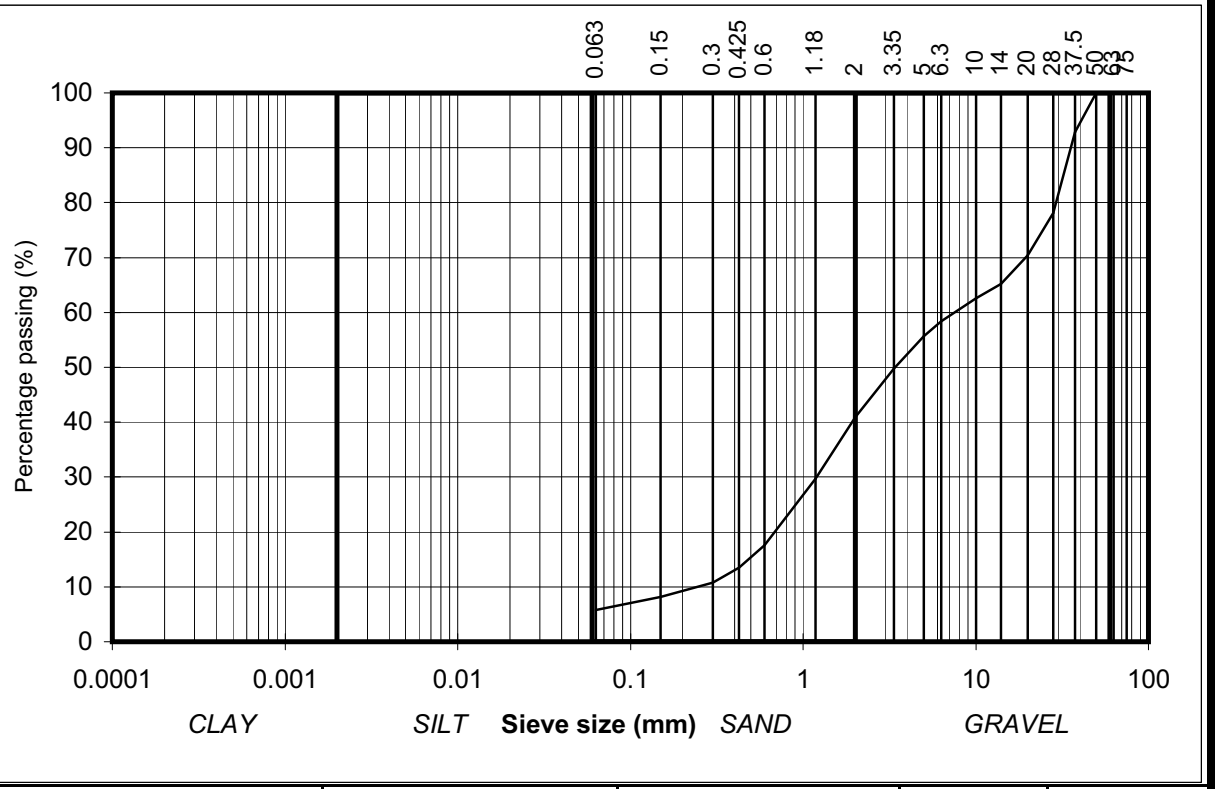
BH/TP No: TP4

SAMPLE No.: AJ5316 SAMPLE TYPE: Db

DEPTH (m): 1.50

TEST METHOD: Wet sieve

DESCRIPTION: Grey brown clayey/silty, very sandy, GRAVEL



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	99	GRAVEL
14	99	
10	99	
6.3	98	
5	98	
3.35	98	
2	97	
1.18	96	
0.6	94	SAND
0.425	94	
0.3	93	
0.15	92	
0.063	89	
0.037	80	
0.026	71	
0.017	56	SILT/CLAY
0.010	41	
0.007	31	
0.004	24	
0.002	15	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

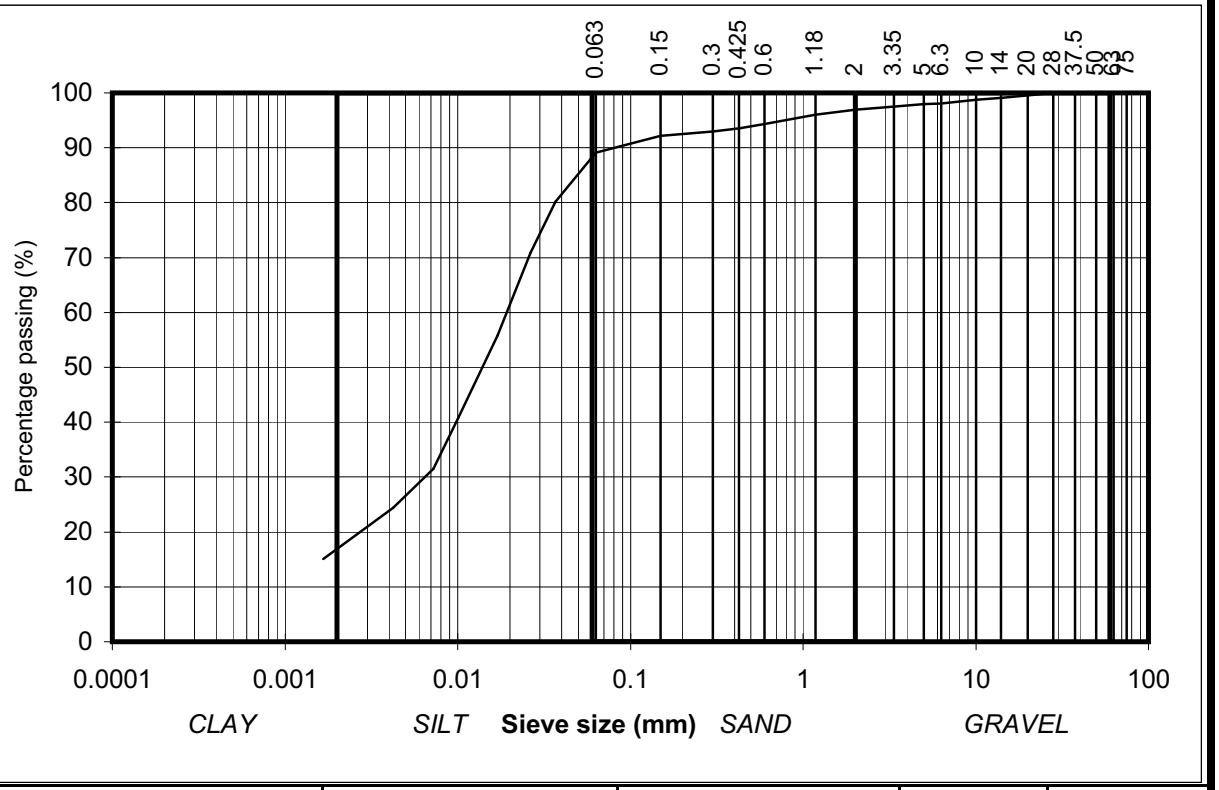
BH/TP No: TP4

SAMPLE No.: AJ5317/18 SAMPLE TYPE: Db

DEPTH (m): 2.5-3.5

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Light brown slightly sandy, slightly gravelly, CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	96	
28	96	
20	95	GRAVEL
14	93	
10	92	
6.3	91	
5	91	
3.35	90	
2	89	
1.18	88	
0.6	87	SAND
0.425	85	
0.3	84	
0.15	83	
0.063	82	
0.036	77	
0.026	68	
0.017	56	SILT/CLAY
0.010	43	
0.007	32	
0.004	24	
0.002	16	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

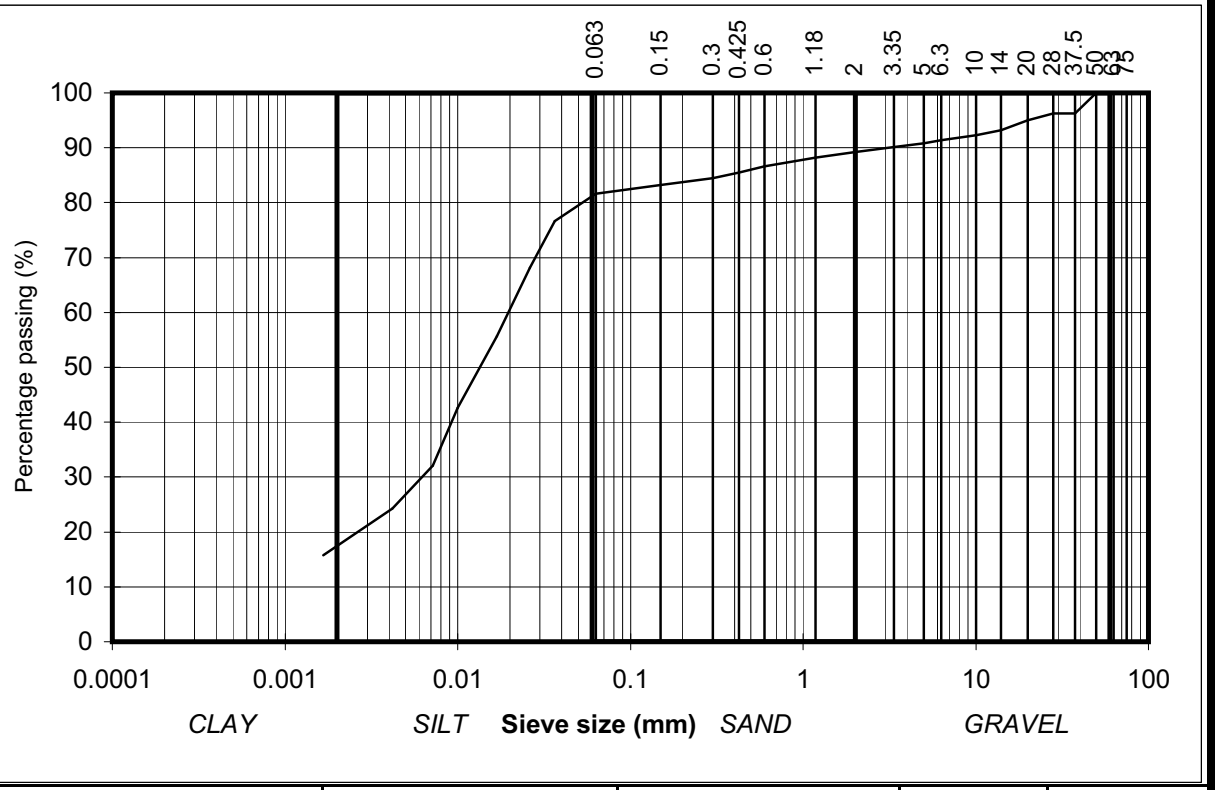
BH/TP No: TP5

SAMPLE No.: AJ5312/13 SAMPLE TYPE: Db

DEPTH (m): 1.5/2.5

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Light brown slightly sandy, slightly gravelly, CLAY



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	85	
50	81	
37.5	78	
28	72	
20	64	
14	55	GRAVEL
10	52	
6.3	45	
5	41	
3.35	34	
2	27	
1.18	22	
0.6	14	
0.425	10	SAND
0.3	6	
0.15	3	
0.063	2	
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	SILT/CLAY
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

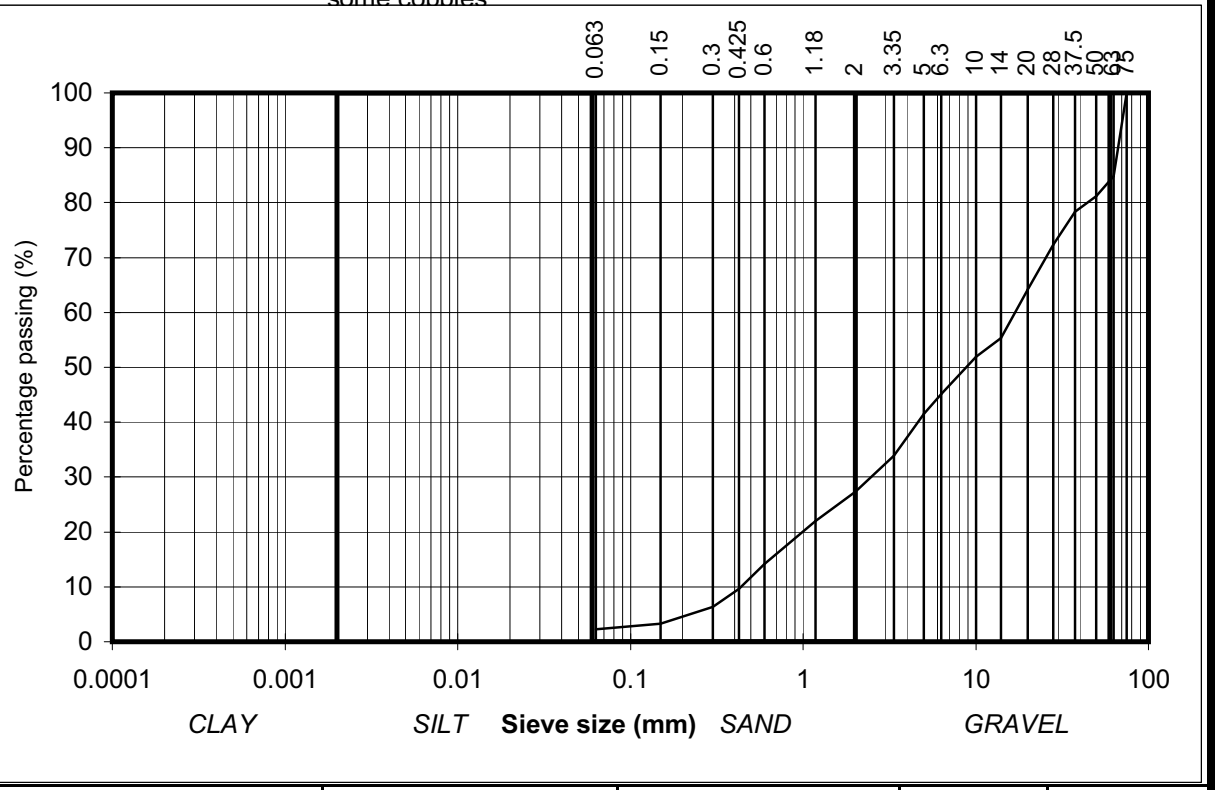
BH/TP No: TP6

SAMPLE No.: AJ5308 SAMPLE TYPE: Db

DEPTH (m): 1.00

TEST METHOD: Wet sieve

DESCRIPTION: Grey brown slightly clayey/silty, very sandy, GRAVEL with some cobbles



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	92	COBBLES
63	92	GRAVEL
50	81	
37.5	78	
28	68	
20	61	
14	54	
10	48	
6.3	39	
5	35	
3.35	29	
2	23	SAND
1.18	18	
0.6	11	
0.425	7	
0.3	5	
0.15	2	
0.063	2	SILT/CLAY
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

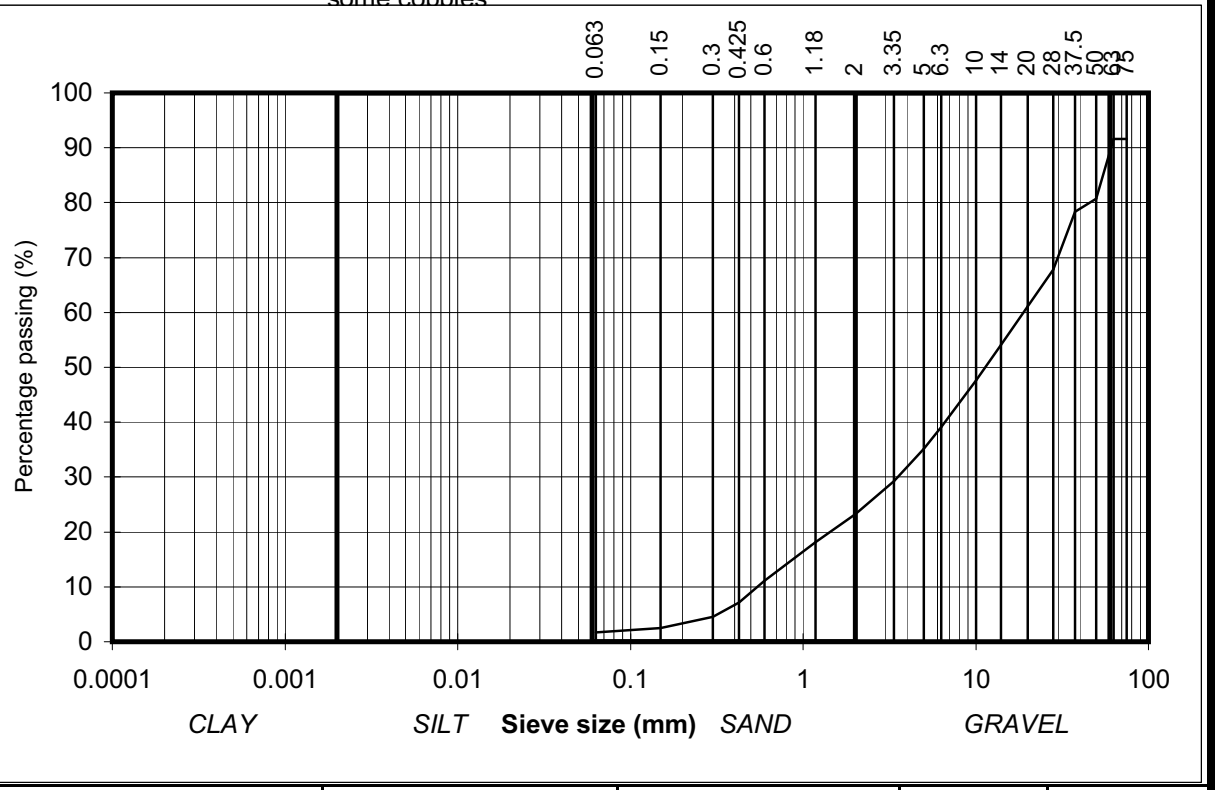
BH/TP No: TP6

SAMPLE No.: AJ5309 SAMPLE TYPE: Db

DEPTH (m): 2.00

TEST METHOD: Wet sieve

DESCRIPTION: Grey brown slightly clayey/silty, very sandy, GRAVEL with some cobbles



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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	85	GRAVEL
50	81	
37.5	78	
28	72	
20	64	
14	55	
10	52	
6.3	45	
5	41	
3.35	34	
2	27	SAND
1.18	22	
0.6	14	
0.425	10	
0.3	6	
0.15	3	
0.063	2	SILT/CLAY
0.043	#N/A	
0.030	#N/A	
0.019	#N/A	
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 14367

Contract: KILKENNY NORTHERN RING ROAD EXTENSION

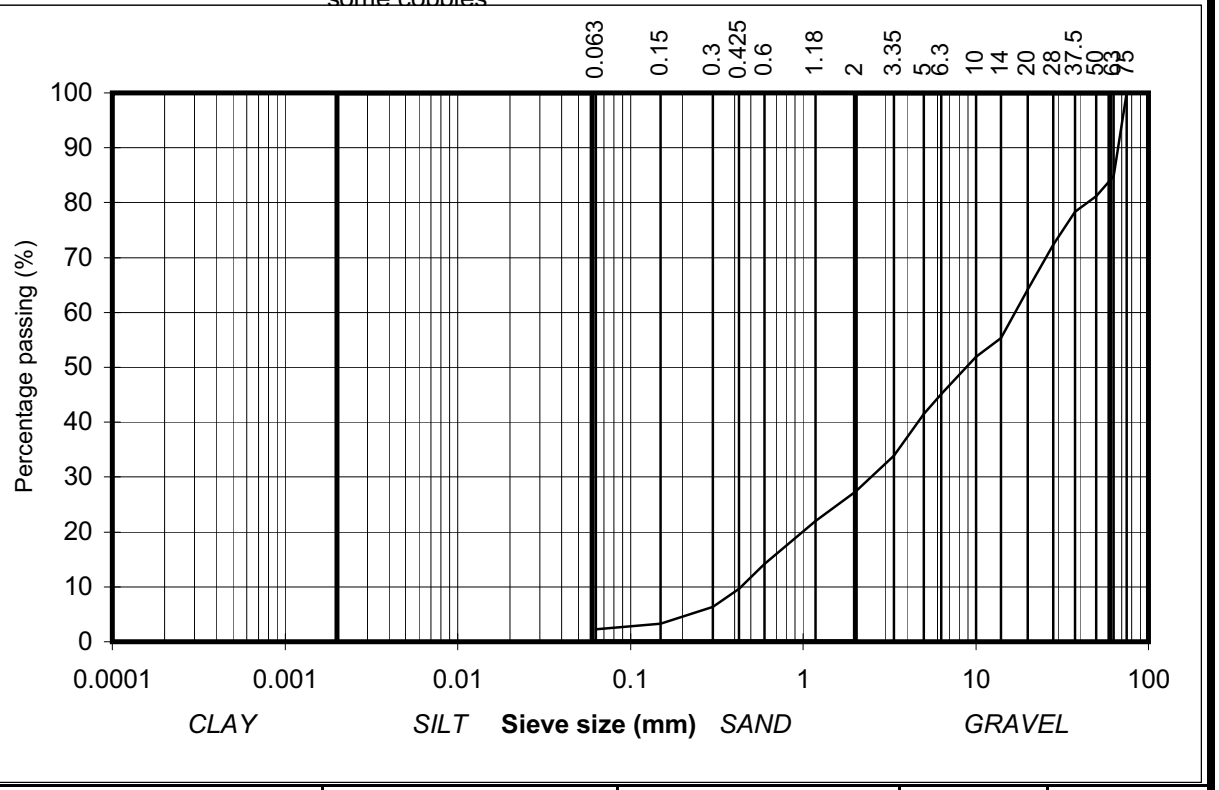
BH/TP No: TP6

SAMPLE No.: AJ5310 SAMPLE TYPE: Db

DEPTH (m): 3.00

TEST METHOD: Wet sieve

DESCRIPTION: Grey brown slightly clayey/silty, very sandy, GRAVEL with some cobbles



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Report No.

CALIFORNIA BEARING RATIO

I.G.S.L.

Contract: **Kilkenny Northern Ring Rd Extension** **DATE 09/10/2009** CONTRACT No 14367

Location	Sample No.	Depth of Sample	Sample Description	Water Content %	Test Code	Water Content Top %	Water Content Bottom %	Bulk Density Mg/M3	% Passing 20mm	C.B.R. Top %	C.B.R. Base %	C.B.R. Average %
TP4	AJ5316	1.50	Grey brown clayey/silty very sandy GRAVEL	5.5	L/St	5.5	5.4	2.07	70.0	28.2	33.9	31.1
TP4	AJ5317/18	2.5-3.5	Light brown slightly sandy slightly gravelly CLAY	19.7	L/St	19.9	19.4	2.10	99.0	1.1	0.8	0.9
TP5	AJ5312/13	1.5-2.5	Light brown slightly sandy slightly gravelly CLAY	20.6	L/St	20.2	21.0	2.06	95.0	1.7	1.8	1.8
TP6	AJ5308	1.00	Grey brown slghtly clayey/silty very sandy GRAVEL some cobbles	3.8	L/St	3.7	3.8	2.12	64.0	40.5	29.9	35.2
TP6	AJ5309	2.00	Grey brown slghtly clayey/silty very sandy GRAVEL some cobbles	3.6	L/St	3.7	3.4	2.10	61.0	21.8	17.9	19.9
TP6	AJ5310	3.00	Grey brown slghtly clayey/silty very sandy GRAVEL some cobbles	3.9	L/St	3.8	4.0	2.14	64.0	45.5	33.8	39.7

Test Code U.-Undisturbed Sample L.-2.5Kg. Rammer A/5.-5% Air Voids Ratio V.- Vibrating Hammer
D.-Dynamic Compaction H.-4.5Kg. Rammer A10.-10% Air Voids Ratio M.- Method Number
St.-Static compaction RN29.- Road Note 29 (St. 95% H.)

Report No.

MCV SUMMARY

I.G.S.L.

Contract: **Kilkenny Northern Ring Rd Extension** CONTRACT No 14367

Location	Sample No.	Depth (m)	Sample Description	MCV	MC %	% Passing 20mm	REMARKS
BH1	AF0002	1.00	Brown slightly sandy gravelly CLAY with many cobbles	0	20	47	
BH1	AF0005	3.00	Brown slightly sandy SILT/CLAY	6.3	23.6	100.0	
BH2	AF0016	2.00	Brown slightly sandy gravelly SILT/CLAY	1.7	13.8	76.0	
BH2	AF0021	5.00	Brown slightly sandy SILT/CLAY	0.0	25.1	100.0	
TP4	AJ5317/18	2.5-3.5	Light brown slightly sandy slightly gravelly CLAY	4.1	19.8	99.0	
TP5	AJ5311	0.50	Brown slightly sandy slightly gravelly SILT/CLAY	6.5	18.2	93.5	
TP5	AJ5312/13	1.5-2.5	Light brown slightly sandy slightly gravelly CLAY	5.6	21.0	95.0	

Test Code:

Report No.

TRIAXIAL COMPRESSION TEST

IGSL

Contract: **Kilkenny Northern Ring Rd Extension**

Bore-hole No	Sample No.	Depth metres	Description of Sample	Test Code	Lateral Pressure kN/m2	Compres Strength kN/m2	Co-hesion kN/m2	Ang. of Fricn. deg.	Bulk Density Mg/m3	Water Content %	Remarks
BH1	AF0007	4.00	Brown slightly sandy slightly gravelly CLAY	U100	50 100 150	184 251 301	122	0	2.47	21.1	SINGE SAMPLE MULTI STAGE TRIAXIAL
BH1	AF0011	6.00	Light brown slightly sandy slightly gravelly SILT	U100	75 125 175	39 42 53	22	0	2.11	23.3	SINGE SAMPLE MULTI STAGE TRIAXIAL
BH2	AF0018	4.00	Brown sandy SILT	U100	50 100 150	125 147 176	75	0	1.96	23.0	SINGE SAMPLE MULTI STAGE TRIAXIAL
BH3	AF0037	6.00	Grey brown slightly sandy slightly gravelly CLAY	U100	75 150 200	319 426 529	212	0	2.15	18.2	SINGE SAMPLE MULTI STAGE TRIAXIAL
BH4	AF0049	2.00	Light brown slightly sandy SILT with root hairs	U100	50 100 150	36 43 24	17	0	1.68	49.2	SINGE SAMPLE MULTI STAGE TRIAXIAL
BH4	AF0054	6.00	Grey sandy slightly gravelly CLAY	U100	75 125 175	40 61 80	30	0	1.99	21.2	SINGE SAMPLE MULTI STAGE TRIAXIAL

Triaxial Compression Code: 38/100 - Specimen diameter U - Undisturbed M - Multi-stage R - Remoulded

Contract: **Kilkenny Northern Ring Rd Extension**

Bore-hole No	Sample No.	Depth metres	Description of Sample	Test Code	Lateral Pressure kN/m2	Compres Strength kN/m2	Co-hesion kN/m2	Ang. of Fricn. deg.	Bulk Density Mg/m3	Water Content %	Remarks
BH6	AF0068	8.00	Grey brown slightlly sandy slightly gravelly SILT	U100	75 125 175	251 377 432	177	0	2.09	21.6	SINGE SAMPLE MULTI STAGE TRIAXIAL

Triaxial Compression Code: 38/100 - Specimen diameter U - Undisturbed M - Multi-stage R - Remoulded

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	20	
Wt. soil+ring	124.9	
final wet wt.	115.1	
final dry wt	95.1	
wt. of ring	87	
w/c initial	367.9%	
w/c final	246.9%	
S.G.	1.65	Assumed
e final	4.0740741	
change in e	0.4260348	*change in Ht.
Final Height		11.91

Contract:	Kilkenny Northern Ring Rd Extension
Borehole No:	WS TP5
Sample No:	W2723
Sample Type	WS
Depth:	2.90

Pressure range		increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
from	to				7.521			20	
0	10	10	0.7	0.298	7.222	7.372	3.562	19.3	19.65
10	20	10	0.944	0.402	6.820	7.021	5.014	18.356	18.828
20	40	20	2.146	0.914	5.906	6.363	6.208	16.21	17.283
40	80	40	2.6	1.108	4.798	5.352	4.359	13.61	14.91
80	160	80	2.272	0.968	3.830	4.314	2.277	11.338	12.474
160	80	-80	-0.212	-0.090	3.921	3.876	0.232	11.55	11.444
80	40	-40	-0.36	-0.153	4.074	3.997	0.767	11.91	11.73
					4.074				
					4.074				
					4.074				

I.G.S.L.

CV calculations

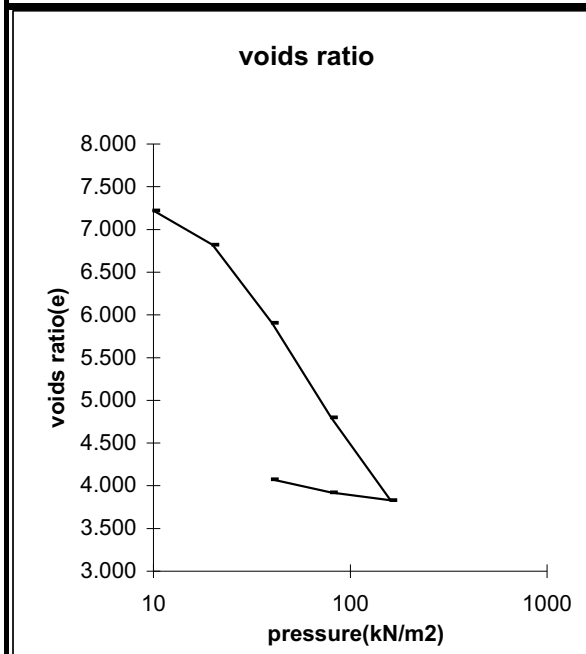
Pressure Range from	to	t 50 mins	t 90 mins	av. Height	Cv =0.026H2 / t50	Cv=0.111H2 / t90
0	10		12.25	19.65		3.50
10	20		210.25	18.828		0.19
20	40		59.29	17.283		0.56
40	80		64	14.91		0.39
80	160		72.25	12.474		0.24

Contract	Kilkenny Northern Ring Rd Extension
Borehole No.	WS TP5
Sample No.	W2723
Depth	2.9

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Brown slightly fibrous PEAT



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN)	CV(m2/year)
0	10	7.222	3.56	3.50
10	20	6.820	5.01	0.19
20	40	5.906	6.21	0.56
40	80	4.798	4.36	0.39
80	160	3.830	2.28	0.24
160	80	3.921		
80	40	4.074		

Contract: Kilkenny Northern Ring Rd Extension
Borehole No. WS TP5
Sample No. W2723
Depth: 2.90

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	25	
Wt. soil+ring	494.9	
final wet wt.	490.3	
final dry wt	449.6	
wt. of ring	292.7	
w/c initial	28.9%	
w/c final	25.9%	
S.G.	2.65	Assumed
e final	0.6874124	
change in e	0.0783895	*change in Ht.
Final Height	21.526	

Contract:	Kilkenny Northern Ring Rd Extension
Borehole No:	WS 6
Sample No:	W2720
Sample Type	WS
Depth:	0.60

Pressure range		increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
from	to				0.960			25	
0	10	10	0.162	0.013	0.947	0.953	0.650	24.838	24.919
10	20	10	0.444	0.035	0.912	0.930	1.804	24.394	24.616
20	40	20	0.494	0.039	0.874	0.893	1.023	23.9	24.147
40	80	40	0.592	0.046	0.827	0.850	0.627	23.308	23.604
80	160	80	0.874	0.069	0.759	0.793	0.478	22.434	22.871
160	320	160	1.042	0.082	0.677	0.718	0.297	21.392	21.913
320	160	-160	-0.054	-0.004	0.681	0.679	0.016	21.446	21.419
160	80	-80	-0.08	-0.006	0.687	0.684	0.047	21.526	21.486
					0.687				
					0.687				

I.G.S.L.

CV calculations

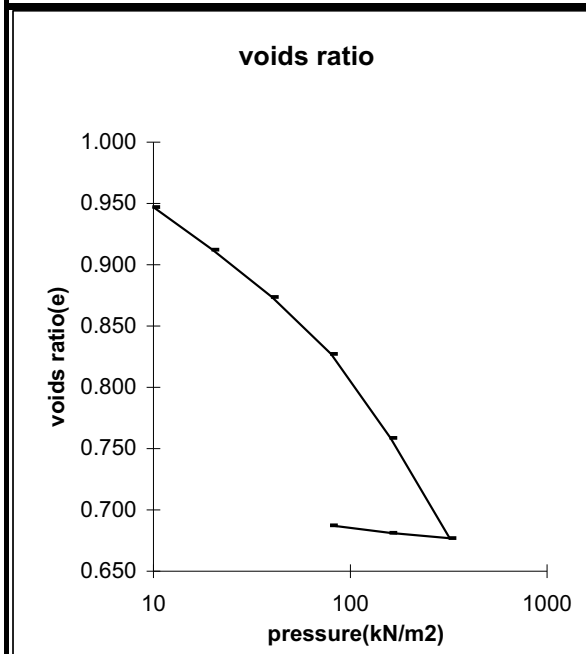
Pressure Range from	to	t 50 mins	t 90 mins	av. Height	Cv =0.026H2 / t50	Cv=0.111H2 / t90
0	10		132.25	24.919		0.52
10	20		4	24.616		16.82
20	40		20.25	24.147		3.20
40	80		20.25	23.604		3.05
80	160		15.21	22.871		3.82
160	320		12.25	21.913		4.35

Contract	Kilkenny Northern Ring Rd Extension
Borehole No.	WS 6
Sample No.	W2720
Depth	0.6

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Grey brown slightly sandy CLAY



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN)	CV(m2/year)
0	10	0.947	0.65	0.52
10	20	0.912	1.80	16.82
20	40	0.874	1.02	3.20
40	80	0.827	0.63	3.05
80	160	0.759	0.48	3.82
160	320	0.677	0.30	4.35
320	160	0.681		
160	80	0.687		

Contract: Kilkenny Northern Ring Rd Extension
Borehole No. WS 6
Sample No. W2720
Depth: 0.60

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	25	
Wt. soil+ring	365.4	
final wet wt.	360.7	
final dry wt	317.9	
wt. of ring	164.6	
w/c initial	31.0%	
w/c final	27.9%	
S.G.	2.65	Assumed
e final	0.7398565	
change in e	0.0779506	*change in Ht.
Final Height	22.32	

Contract:	Kilkenny Northern Ring Rd Extension
Borehole No:	WS 10
Sample No:	W2722
Sample Type	WS
Depth:	0.70

Pressure range		increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
from	to				0.949			25	
0	10	10	0.17	0.013	0.936	0.942	0.682	24.83	24.915
10	20	10	0.124	0.010	0.926	0.931	0.501	24.706	24.768
20	40	20	0.272	0.021	0.905	0.915	0.554	24.434	24.57
40	80	40	0.346	0.027	0.878	0.891	0.357	24.088	24.261
80	160	80	0.706	0.055	0.823	0.850	0.372	23.382	23.735
160	320	160	1.21	0.094	0.728	0.775	0.332	22.172	22.777
320	160	-160	-0.062	-0.005	0.733	0.731	0.017	22.234	22.203
160	80	-80	-0.086	-0.007	0.740	0.737	0.048	22.32	22.277
					0.740				
					0.740				

I.G.S.L.

CV calculations

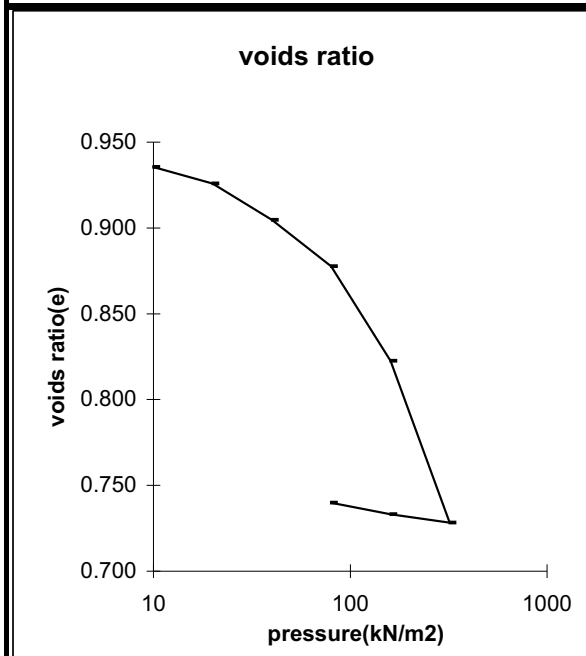
Pressure Range from	to	t 50 mins	t 90 mins	av. Height	Cv =0.026H2 / t50	Cv=0.111H2 / t90
0	10		6.25	24.915		11.02
10	20		19.36	24.768		3.52
20	40		17.64	24.57		3.80
40	80		18.49	24.261		3.53
80	160		14.44	23.735		4.33
160	320		10.24	22.777		5.62

Contract	Kilkenny Northern Ring Rd Extension
Borehole No.	WS 10
Sample No.	W2722
Depth	0.7

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Grey brown slightly sandy slightly gravelly CLAY with root hairs



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN)	CV(m2/year)
0	10	0.936	0.68	11.02
10	20	0.926	0.50	3.52
20	40	0.905	0.55	3.80
40	80	0.878	0.36	3.53
80	160	0.823	0.37	4.33
160	320	0.728	0.33	5.62
320	160	0.733		
160	80	0.740		

Contract: Kilkenny Northern Ring Rd Extension
Borehole No. WS 10
Sample No. W2722
Depth: 0.70

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	18	
Wt. soil+ring	212.7	
final wet wt.	193.9	
final dry wt	157.8	
wt. of ring	95	
w/c initial	87.4%	
w/c final	57.5%	
S.G.	2.65	Assumed
e final	1.523328	
change in e	0.2047823	*change in Ht.
Final Height	12.322	

Contract:	Kilkenny Northern Ring Rd Extension
Borehole No:	WS 30
Sample No:	W2724
Sample Type	WS
Depth:	1.50

Pressure range		increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
from	to				2.686			18	
0	10	10	0.772	0.158	2.528	2.607	4.383	17.228	17.614
10	20	10	0.564	0.115	2.412	2.470	3.328	16.664	16.946
20	40	20	1.112	0.228	2.185	2.299	3.452	15.552	16.108
40	80	40	0.98	0.201	1.984	2.084	1.627	14.572	15.062
80	160	80	1.266	0.259	1.725	1.854	1.135	13.306	13.939
160	320	160	1.268	0.260	1.465	1.595	0.625	12.038	12.672
320	160	-160	-0.114	-0.023	1.489	1.477	0.059	12.152	12.095
160	80	-80	-0.17	-0.035	1.523	1.506	0.174	12.322	12.237
					1.523				
					1.523				

I.G.S.L.

CV calculations

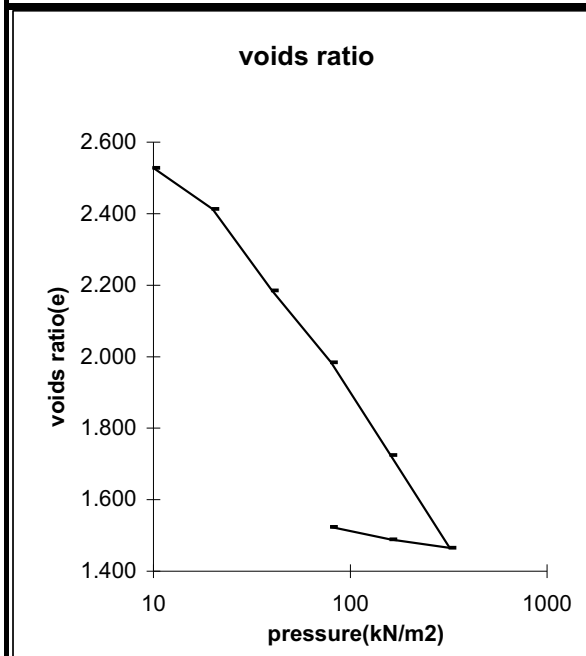
Pressure Range from	to	t 50 mins	t 90 mins	av. Height	Cv =0.026H2 / t50	Cv=0.111H2 / t90
0	10		132.25	17.614		0.26
10	20		4	16.946		7.97
20	40		20.25	16.108		1.42
40	80		20.25	15.062		1.24
80	160		15.21	13.939		1.42
160	320		12.25	12.672		1.46

Contract	Kilkenny Northern Ring Rd Extension
Borehole No.	WS 30
Sample No.	W2724
Depth	1.5

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Dark grey brown organic slightly sandy slightly gravelly SILT



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN)	CV(m2/year)
0	10	2.528	4.38	0.26
10	20	2.412	3.33	7.97
20	40	2.185	3.45	1.42
40	80	1.984	1.63	1.24
80	160	1.725	1.14	1.42
160	320	1.465	0.63	1.46
320	160	1.489		
160	80	1.523		

Contract: Kilkenny Northern Ring Rd Extension
Borehole No. WS 30
Sample No. W2724
Depth: 1.50

CONSOLIDATION TEST CALCULATIONS IGSL

initial height	20	
Wt. soil+ring	124.1	
final wet wt.	114.3	
final dry wt	94.3	
wt. of ring	87.7	
w/c initial	451.5%	
w/c final	303.0%	
S.G.	1.65	Assumed
e final	5	
change in e	0.5093379	*change in Ht.
Final Height	11.78	

Contract:	Kilkenny Northern Ring Rd Extension
Borehole No:	WS 30
Sample No:	W2721
Sample Type	WS
Depth:	2.70

Pressure range		increment	change in Ht.	change in e	e at end of stage	average e	MV (m2/MN.)	HEIGHT H	AV. HEIGHT
from	to				9.187			20	
0	10	10	1.28	0.652	8.535	8.861	6.612	18.72	19.36
10	20	10	0.954	0.486	8.049	8.292	5.229	17.766	18.243
20	40	20	2.074	1.056	6.993	7.521	6.199	15.692	16.729
40	80	40	2.2	1.121	5.872	6.432	3.769	13.492	14.592
80	160	80	2.128	1.084	4.788	5.330	2.140	11.364	12.428
160	80	-80	-0.16	-0.081	4.870	4.829	0.175	11.524	11.444
80	40	-40	-0.256	-0.130	5.000	4.935	0.549	11.78	11.652
					5.000				
					5.000				
					5.000				

I.G.S.L.

CV calculations

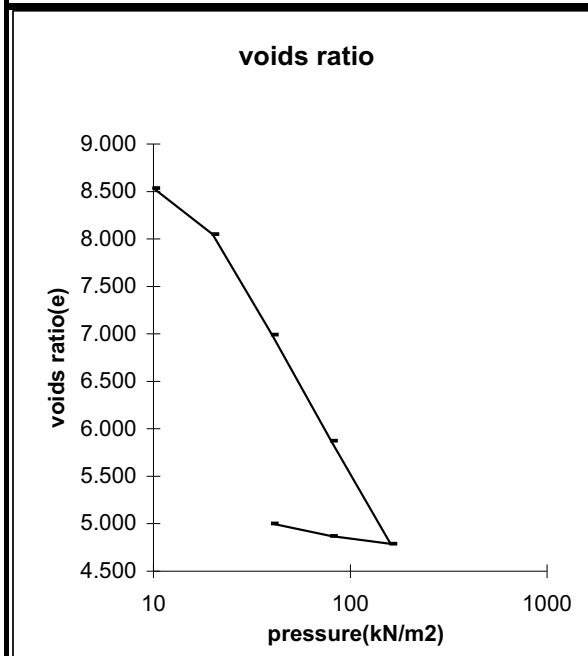
Pressure Range from	to	t 50 mins	t 90 mins	av. Height	Cv =0.026H2 / t50	Cv=0.111H2 / t90
0	10		7.84	19.36		5.31
10	20		12.25	18.243		3.02
20	40		46.24	16.729		0.67
40	80		46.24	14.592		0.51
80	160		60.84	12.428		0.28

Contract	Kilkenny Northern Ring Rd Extension
Borehole No.	WS 30
Sample No.	W2721
Depth	2.7

CONSOLIDATION TEST RESULTS

IGSL

Sample Description: Black slightly fibrous PEAT



Pressure Range (kN/M2) from	to	Voids Ratio e	MV(m2/MN)	CV(m2/year)
0	10	8.535	6.61	5.31
10	20	8.049	5.23	3.02
20	40	6.993	6.20	0.67
40	80	5.872	3.77	0.51
80	160	4.788	2.14	0.28
160	80	4.870		
80	40	5.000		

Contract: Kilkenny Northern Ring Rd Extension
Borehole No. WS 30
Sample No. W2721
Depth: 2.70

REPORT NO. 14367	LOSS ON IGNITION ANALYSIS					IGSL
CONTRACT: **Kilkenny Northern Ring Rd Extension**						
BOREHOLE NO.	SAMPLE NO.	DEPTH (METRES)	SAMPLE TYPE	% PASSING 2mm	L .O .I %	REMARKS
WS TP5	2723	2.5-3.9	WS	100	57.91	
WS30	2721	1.60-2.80	WS	100	76.4	

REPORT NO.

SULPHATE ANALYSIS

IGSL

CONTRACT: **Kilkenny Northern Ring Rd Extension** CONTRACT NO 14367

BH/TP NO.	DEPTH (M)	SAMPLE NO.	SAMPLE TYPE	TEST CODE	% Passing 2mm	SULPHUR TRIOXIDE		(so3 X 1.2)	pH
						2:1WATER SOIL EXTRACT So3 g/L	TOTAL SOIL so3 %	2:1WATER SOIL EXTRACT So4 g/L	VALUE
BH1	1.00	AF0011	U	A	91	0.021		0.025	8.1
BH3	3.00	AF0034	Db	A	20	0.055		0.066	8.1
BH4	4.00	AF0052	Db	A	34	0.034		0.041	8.3
BH5	2.00	AF1137	U	A	100	0.069		0.083	7.9
BH6	1.00	AF0061	Db	A	100	0.014		0.017	7.8

TEST CODE W = WATER S = SOIL A = AQUEOUS SOIL EXTRACT(2:1)

Appendix 9

Rock Laboratory Test Records

POINT LOAD DIAMETRAL - TEST RESULTS

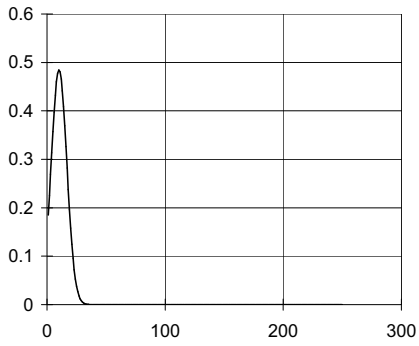
Contract: Kilkenny Ring Road
Contract no. 14367
Date of test: 21/09/2009 Tested by: A. Mahony

Sample Type:

Sample No.	Depth m	Diameter mm	*P kN	F	*Is Mpa	*Is(50) Mpa	*UCS MPa	approx. orientation of break to planes of weakness/bedding
RC1	11.4	84	1.8	1.263	0.26	0.32	6	//
	12.7	84	3.1	1.263	0.45	0.56	11	//
	14.1	84	3.3	1.263	0.46	0.59	12	//
	15.2	84	1.1	1.263	0.15	0.19	4	//
RC2	14.60	84	5.0	1.263	0.71	0.90	18	//
	15.20	84	1.9	1.263	0.27	0.33	7	//
	16.80	84	0.7	1.263	0.10	0.13	3	//
	17.60	84	5.8	1.263	0.82	1.04	21	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	8	8
Minimum	0.13	3
Average	0.51	10
Maximum	1.04	21
Standard Dev.	0.33	7
Upper 95% Confidence Limit	1.15	23.05
Lower 95% Confidence Limit	-0.14	-2.76

*UCS Normal Distribution Curve



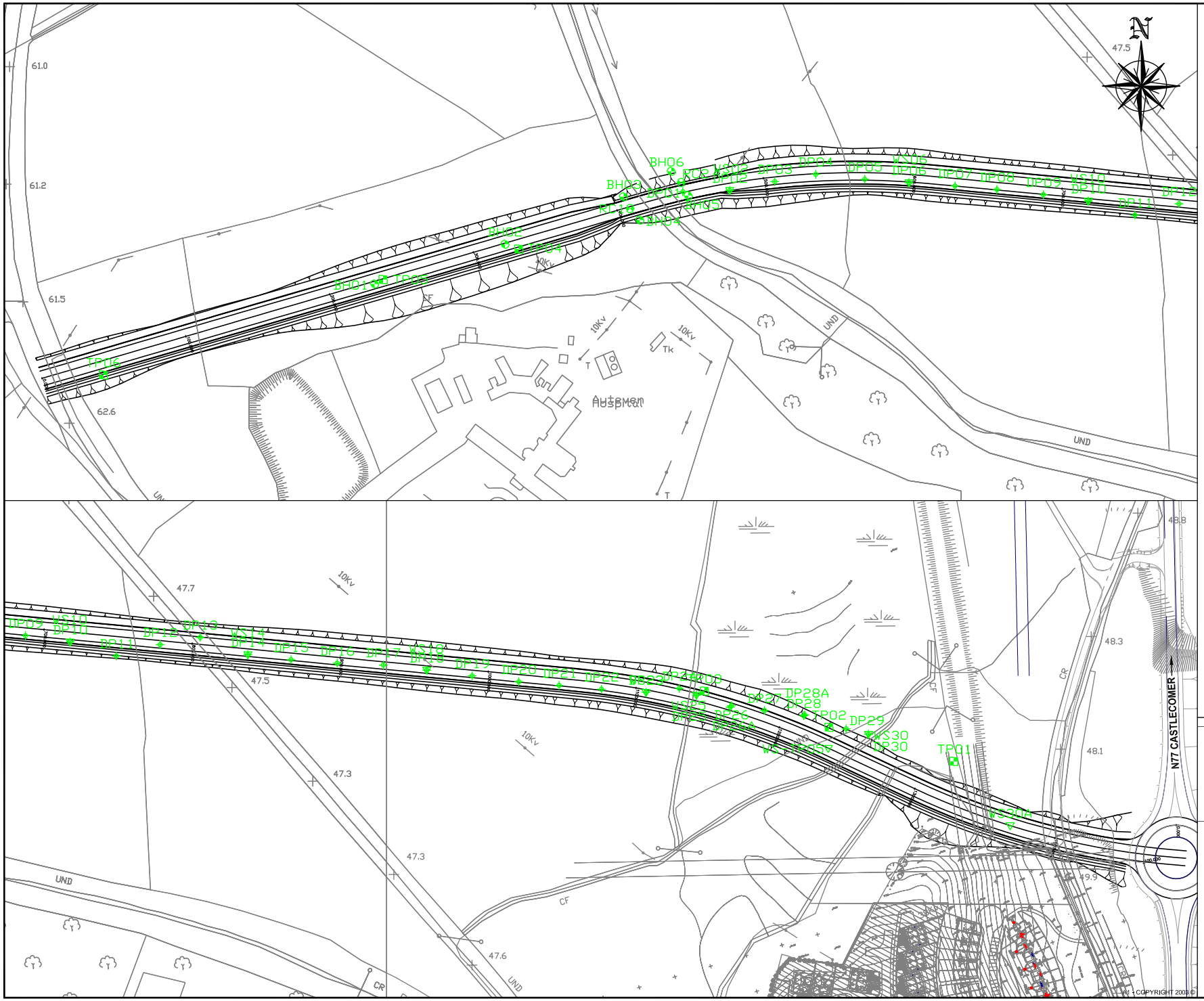
approx. orientation of break to planes of weakness/bedding

U - unknown
P - perpendicular
// - parallel

Comments:
*Is = Index Strength.
*Is(50) = Corrected Index Strength
*P = Failure Load
*UCS (Uniaxial Compressive Strength) taken as:
k x Point Load Is(50): k= 20

Appendix 10

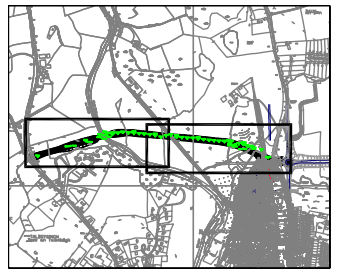
Exploratory Hole Site Plan



COMHAIRLE CONTAE CILL CHAINNIGH
KILKENNYCOUNTY COUNCIL

LEGEND

TRIAL PIT	
BORE HOLE	
CORE HOLE	
DYNAMIC PROBES, WINDOW SAMPLES, SHEAR VANE TESTS (DP,WS,SV)	



KEY PLAN

Revision	Description	Initials	Date
A	Locations of BH, TP, CH & DP moved	PW	11/08/09

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Consulting Engineers
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Architect

Client: Kilkenny County Council

Project: Proposed Kilkenny Relief Road
Castlecomer Road to Freshford Road

Dwg. Title: Preliminary Site Investigation

Drawn By: PW Date: June 08

Checked by: RG Scale: NTS

Dwg. No.: 07_088_014-A

APPENDIX E

Geotechnical Interpretative Report

Kilkenny Northern Ring Road Extension

(R693 Freshford Road to N77 Castlecomer Road)

Geotechnical Interpretative Report

(Report No. 14367)

Client: Kilkenny County Council

Engineer: Clifton Scannell Emerson

November 2009

IGSL Ltd

DOCUMENT ISSUE REGISTER

Distribution	Copies	Rev.	Date of Issue	Report Prepared By:
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FOREWORD

The following conditions and notes on site investigation procedures should be read in conjunction with this report.

General

The ground investigation works for this project have been carried out in accordance with BS 5930 (1990) and the IEI Specification & Related Documents for Ground Investigation in Ireland (2006).

Disclaimer

This interpretative report has been prepared for Clifton Scannell Emerson consulting engineers and Kilkenny County Council. The information and recommendations should not be used without written permission of either party. Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests.

No responsibility can be held by IGSL Ltd for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

1. INTRODUCTION

At the instruction of Kilkenny County Council and Clifton Scannell Emerson Associates (CSEA), IGSL has undertaken a programme of ground investigation works for the extension of the Kilkenny Northern Ring Road (N77). It is understood that Kilkenny County Council intend to link the Freshford Road (R693) with the Castlecomer Road (N77 / N78) and relieve traffic from the northwest portion of the city.

The western section of the route runs from the Freshford Road to the River Nore and is characterized by agricultural sloping ground. A section of cut (c5m) will be required close to the boundary of the Aut Even Hospital. A bridge structure will be required at the River Nore, with up to 4m of embankment on the eastern flank. An underpass and culverts will be required at the Bleach Road with approximately 1.5m of fill at this area. To the east of the River Nore, the relief road will be built on a low-lying floodplain and will entail embankments of 2.5 to 3m in height.

The investigatory works included trial pits, cable percussion boreholes, dynamic probes, window sampling and rotary core drillholes at locations agreed with CSEA. The investigations were carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999) and the British Drilling Association (BDA) guidelines for ground investigation. Geotechnical laboratory testing has been performed on representative samples in accordance with BS 1377 (1990) and included classification tests, oedometer consolidations, triaxial compressions, sulphates, MCV's, CBR's and Point Load Strength Index tests.

The primary objectives of this investigation were as follows:

- Determine the composition and strength of the superficial deposits
- Establish bedrock elevation (rockhead) and rock mass characteristics (i.e. weathering profile, discontinuity spacings, strength etc)
- Assess groundwater conditions
- Evaluate the earthwork properties of the soils and rocks and assess suitability for re-use in engineering fill applications

This report presents an interpretation of the geotechnical data and associated laboratory test results. A discussion of the ground conditions and engineering properties of the soils and bedrock is included, with recommendations on the key geotechnical issues impacting on the proposed road development.

2. FIELDWORK

2.1 General

The fieldworks were carried out during the period August and September 2009 and comprised the following:

- Cable percussion boreholes (6 No.)
- Trial pits (6 No.)
- Dynamic probes (32 No.)
- Window samples (7 No.) with shear vane testing
- Rotary core drillholes (2 No.)
- Associated sampling & in-situ testing

2.2 Cable Percussion Boreholes

Cable percussion boring (200mm diameter) was carried out at six locations using a Dando 2000 rig. The boreholes are denoted BH 1 to 6 and terminated at a depths of between 7.00 and 11.20m. It is highlighted that chiselling methods (i.e. hard strata boring) were employed to advance the boreholes through dense soils.

Representative bulk disturbed samples were taken at approximately 1.00m intervals or change of stratum and double sealed in polythene bags. Undisturbed samples (U100's) were recovered where appropriate in fine grained or cohesive deposits. Standpipes (50mm diameter) were installed in BH's 2 and 5 and incorporated a pea gravel response zone and bentonite pellet seal. A protective steel headwork cover was concreted in place.

Standard Penetration Tests (SPT's) were performed at 1m depth intervals in accordance with Section 3.3, Part 9 of BS 1377 (1990). The seating and test blow counts are reported in brackets with the N-Value recorded accordingly e.g. BH 1 at 1m where N=16 (2, 3, 4, 4, 3, 5). Details of the soils (strata) encountered, SPT N-Values, samples recovered and chiselling durations (hard strata boring) are presented on the boring records in Appendix 1 of the factual report.

2.3 Trial Pits

Trial pitting was performed at six locations using a 13t tracked excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930 (1999). The pits attained depths of up to 4.50m bgl and terminated in boulder obstructions or due to sidewall instability.

Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The samples were placed in heavy duty polyethene bags and sealed before being transported to Naas for laboratory testing. The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site engineer. The trial pit logs are presented in Appendix 2 of the factual report and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

2.4 Dynamic Probes

Dynamic probing (DPH) was undertaken at thirty two locations using a Terrier 2000 rig. This unit meets the requirements of BS 1377, Part 9 (1990) and Eurocode 7:Part 3. The probe testing utilized a 50 kg drop weight ('heavy weight'), 500mm drop height and 43.7mm diameter (60°) cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil is recorded. The probes attained depths of between 0.70 and 13.10m with refusal on suspected boulders. The dynamic probe records are presented in Appendix 3 of the factual report and include blow-counts in both numerical and graphical format.

Although probing is designed primarily to determine the relative consistency of soils, relationships are available from published data between blow counts and standard penetration test N values for granular soils, and blow counts and shear strength for cohesive soils. In this regard, the most

relevant published data for Irish soils is presented in the 'Proceedings of the Trinity College Dublin Symposium of Field and Laboratory Testing of Soils for Foundations and Embankments'.

A paper presented by Eolas at this symposium suggests the following relationships can be applied.....

$$\text{DPH } N_{100} \times 2.5 = \text{SPT N value (Granular Soils)}$$

$$C_u = 15 \times \text{DPH } N_{100} + 30 \text{ kPa (Cohesive Soils)}$$

2.5 Window Sampling

Window sample boreholes were performed at seven locations using the Terrier 2000 rig. The window samples were targeted at soft ground areas with the aim to recover the strata for logging and strength assessment. The window samples are denoted WS 2, 5, 6, 10, 25, 30 & 30A respectively and terminated at depths of between 3.00 and 5.00m. The window sample logs are presented in Appendix 4 of the factual report and include percent recovery and blowcounts for each run.

2.6 Shear Vane Testing

Shear vane testing was carried out adjacent to the window sample boreholes using a Genor H-70 apparatus. The vane was pushed into the soils at 0.5m increments and measured peak and residual undrained shear strengths (Cu). The vane testing was supervised and measurements were recorded by an IGSL engineer / geologist. The shear vane test results are presented in Appendix 5 of the factual report.

2.7 Rotary Drillholes

Rotary drilling was undertaken at two locations (RC 1 & 2) using a top drive Casagrande rig. Symmetrix drilling was utilized within the superficial deposits, with conventional coring techniques used in the bedrock. The drilling produced 84mm diameter (P Size) cores using air mist flush and core recovery was 100% in each of the runs. A standpipe was installed in RC 2 and incorporated a pea gravel response zone, bentonite pellet grout seal and protective headwork cover.

The rotary holes extended to depths of between 16.20 and 19.00m and the rock cores were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. The core log records are presented in Appendix 6 of the factual report and include engineering geological descriptions of the rock cores, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run.

Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

2.8 Groundwater Monitoring

The groundwater levels in the standpipes were measured during the course of the fieldworks and results are presented in Appendix 7 of the factual report.

2.9 Surveying

The as-built exploratory holes and trial pits were surveyed using GPS methods and co-ordinates and ground levels (X, Y, Z) are presented on the exploratory records. The site plan / drawings are presented in Appendix 10 of the factual report.

3. LABORATORY TESTING

Geotechnical laboratory testing has been carried out on representative soil samples and on rock cores. The soils testing was undertaken in accordance with BS 1377 (1990) and included:

- Moisture contents
- Particle size gradings
- Atterberg Limits
- Sulphates
- Organic contents
- Triaxial compressions
- Oedometer consolidations
- Moisture Condition Values (MCV)
- California Bearing Ratio (CBR)

Point Load Strength Index (PLSI) tests were performed on representative rock cores. The results of the soil and rock laboratory testing are presented in Appendices 8 and 9 of the factual report.

4. GROUND CONDITIONS & ENGINEERING PROPERTIES

4.1 Ground Profile

The investigatory works undertaken by IGSL have revealed the ground profile or conditions along the route to consist of the following:

- Topsoil
- Made Ground / Fill
- Superficial deposits comprising sandy CLAY, clayey PEAT, sandy SILT, silty very sandy GRAVEL, clayey gravelly SAND, sandy gravelly SILT / CLAY
- Limestone bedrock

Geological and geotechnical x-sections have been prepared to illustrate the ground profile along the proposed route and these are presented in Appendix 1. Inspection of the x-sections shows that two cut areas will be constructed. Cutting No. 1 extends from CH 50 to 400 while Cutting No. 2 runs from CH 1290 to 1380. The remainder of the route is in embankment, with typical fill depths of the order of 2.5 to 3m but locally up to 4m on the eastern flank of the River Nore. The ground profile at the two cuttings, River Nore bridge structure and Bleach Road underpass and culverts are summarized in Table 1.

Table 1 - Summary Details of Ground Profile at Cuttings & Structure Areas

Zone	Relevant Exploratory Data	Ground Profile
Cutting No. 1	TP's 4 & 5 BH's 1 & 2	Predominantly firm sandy gravelly CLAY / sandy gravelly SILT with coarse gravelly SAND
River Nore Bridge Structure	BHs 3, 4, 5 & 6 RC's 1 & 2	Western Abutment (BH 3 & 4) – Soft sandy CLAY, medium dense sandy GRAVEL / gravelly SAND & firm sandy gravelly CLAY Eastern Abutment (BH 5 & 6) – Soft sandy CLAY, loose to medium dense very sandy GRAVEL & firm / stiff sandy gravelly SILT Limestone bedrock established at c10.6 to 11.2 at western abutment & c13.4 to 14.1m at eastern abutment
Bleach Road Underpass & Culverts	DP 10, 11, 12 & 14 WS 14	Dynamic probes indicate soft deposits to depths of the order of 2m. Window sample 14 identified firm sandy gravelly CLAY & clayey sandy GRAVEL to 2.80m
Cutting No. 2	TP 1 & 2 WS 30	MADE GROUND / FILL extends to depths of at least 4.70m. Window sample 30 encountered possible fill to 1.6m underlain by peat and silty fine SAND

4.2 Superficial Deposits

4.2.1 Topsoil

Topsoil was encountered in the majority of the boreholes and trial pits and has a characteristic thickness of the order of 0.3m.

4.2.2 Made Ground

Made ground (fill) was encountered in TP's 1, 2 and 3 and was found to be most extensive in TP 1 where it was proven to a depth of 4.70m. It consists of construction and demolition building rubble (i.e. concrete, tarmacadam, pipes, mortar, plastic etc) in a sandy clay matrix. The matrix appears to be largely soft / firm in consistency and is not untypical of fill derived from construction sites and road surfacing (planings) projects.

4.1.3 Superficial Deposits

The indigenous soils comprise a complex and variable sequence of clayey PEAT, sandy CLAY, sandy SILT, silty very sandy GRAVEL, clayey gravelly SAND and sandy gravelly SILT / CLAY. It is thought that these soils represent glacial outwash or ablation till deposits, while the clayey PEAT and organic dominant soils are characteristic of estuarine deposits. Close examination of the samples recovered from the boreholes and trial pits showed subtle changes in colour and grading. The gravel constituents or clasts range from fine to coarse, subrounded to angular and appear to be derived from the underlying limestone bedrock.

In a number of boreholes, soft or soft / firm fine grained deposits were uncovered (e.g. BH 2 from 3.4 to c8m, BH 4 from 4.8 to 7.5m etc), and this is not unusual with heterogeneous glacial soils where low strength strata can be present at depth. Peat was encountered in TP 3 and window samples WS 5, 25, 30, and 30A respectively. A maximum peat thickness of 1.40m was determined in WS 5, where the shear vane produced an undrained shear strength of 20 kN/m^2. The peat in WS 30 (1.6 to 2.8m) is classed as firm in consistency with measured vane shear strengths of 55 to 65 kN/m^2.

The Standard Penetration Test (SPT) is widely used in establishing the strength or relative density of glacial till deposits and relationships exist between SPT N-Value (blows for 300mm penetration) and undrained shear strength (C_u). The most widely used correlation between N-Value and C_u for glacial till soils is that proposed by Stroud & Butler where $C_u \approx 4$ to 6N. An SPT data plot has been prepared from the cable percussion borehole data and is presented in Figure 1.

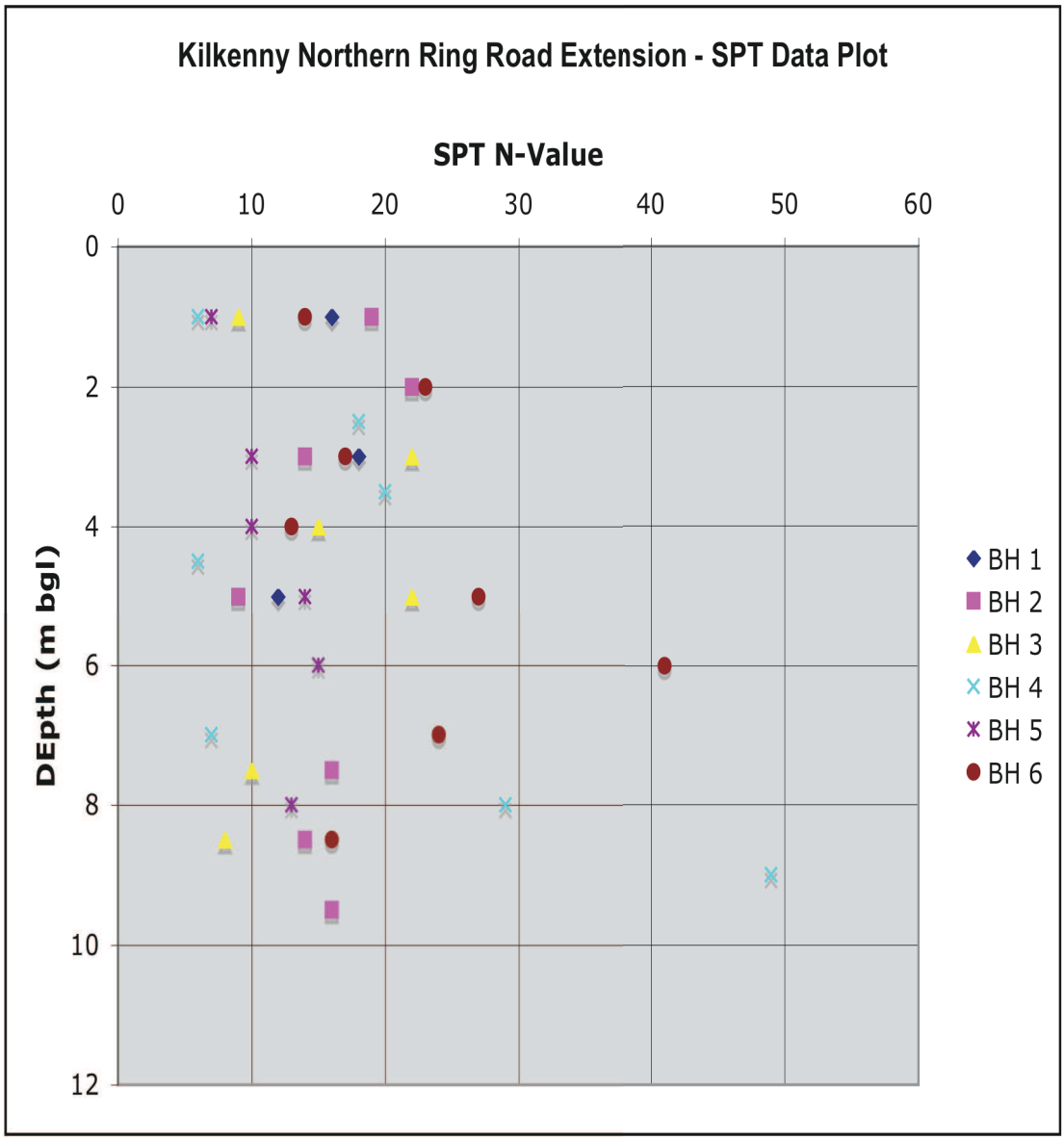
The N-Values show the fine grained or cohesive soils to be generally firm (SPT N-Values typically 8 to 15), while the granular dominant soils are mostly lower bound medium dense (N-Values typically 10 to 20). These soft / firm fine grained soils have undrained shear strength of the order of 40 to 60 kN/m^2. It is likely that due to groundwater ingress during boring and disturbance, the SPT N-Values may underestimate the strength of these soils. The principal range of N-Values shown in Figure 1 indicate a friction angle of the order 30 to 32° for the fine grained soils and 34 to 38° for the granular dominant deposits.

Natural moisture contents were determined on a number of samples and produced values ranging from 9.7 to 68.9%. Liquid and Plastic Limit tests (consistency indices) were also determined and these show the fine grained or cohesive soils to be mostly low and intermediate plasticity clays (CL / CI). The majority of the tests plot above the A-Line on the Casagrande Chart and Plasticity Indices are predominantly in the 7 to 21% range. Organic contents (loss on ignition method) were measured on peat samples from WS 5 and WS 30 and produced values of 57.9 to 76% respectively. These are indicative of clayey PEAT, which has undergone a significant degree of humification.

Particle size gradings were performed on a number of samples and a number show typical profiles for ablation till deposits (i.e. a predominance of sand & gravel). Fines contents (i.e. silt & clay) are

quite variable and generally range from > 20 to < 80%. The granular dominant soils (i.e. silty gravelly SAND / silty sandy GRAVEL) show variable fines and more typical of glacio-lacustrine deposits.

Figure 1 - SPT Data Plot



Unconsolidated undrained triaxial compression tests (multi-stage) were performed on undisturbed samples (U100's) recovered from the cable percussion boreholes. Summary details of the triaxial compression tests are presented in Table 2. Inspection of Table 2 shows undrained shear strengths ranging from 17 to 212 kN/m^2 and this data set confirms very large variations in strength or stiffness. The laboratory strengths obtained from BH's 3 and 6 are very much in contrast to the SPT N-Values obtained in the cable percussion boreholes. The N-Values closest to these samples indicate undrained shear strengths of 50 to 75 kN/m^2. The disparity between the data sets is difficult to rationalize and may be attributable to the softening in-situ due to groundwater. It is also noted that silt dominant fines tend to dilate ('cow-belly') and softening rapidly occurs during percussive boring and sampling below the water table.

Table 2 - Summary Details of Triaxial Compression Tests

Borehole	Sample Depth (m)	Moisture Content (%)	Undrained Shear Strength (kN/m²)	Soil Type
BH 1	4.00	21.1	122	Slightly sandy gravelly CLAY
BH 1	6.00	23.3	22	Slightly sandy gravelly SILT
BH 2	4.00	23.0	75	Brown sandy SILT
BH 3	6.00	18.2	212	Slightly sandy gravelly CLAY
BH 4	2.00	49.2	17	Slightly sandy SILT
BH 4	6.00	21.2	30	Sandy slightly gravelly CLAY
BH 6	8.00	21.3	177	Slightly sandy gravelly SILT

One dimensional consolidation tests (oedometer) were carried out on a selection of window samples to determine modulus of volume compressibility (Mv) and coefficients of consolidation (Cv) parameters. Summary details of the consolidation tests are presented in Table 3. Inspection of the data shows that the peat is highly compressible with Mv of 5 m^2/MN in the 10 to 20 kN/m^2 pressure range. The sandy gravelly CLAY / SILT material produced Mv's varying from 0.5 to 3.3 M^2/MN in the lower pressure range. These values indicate a low to medium compressible fine grained soil and show good agreement with the variations in undrained shear strengths as determined by the triaxial compression tests.

Table 3 - Summary Details of Oedometer Consolidation Tests

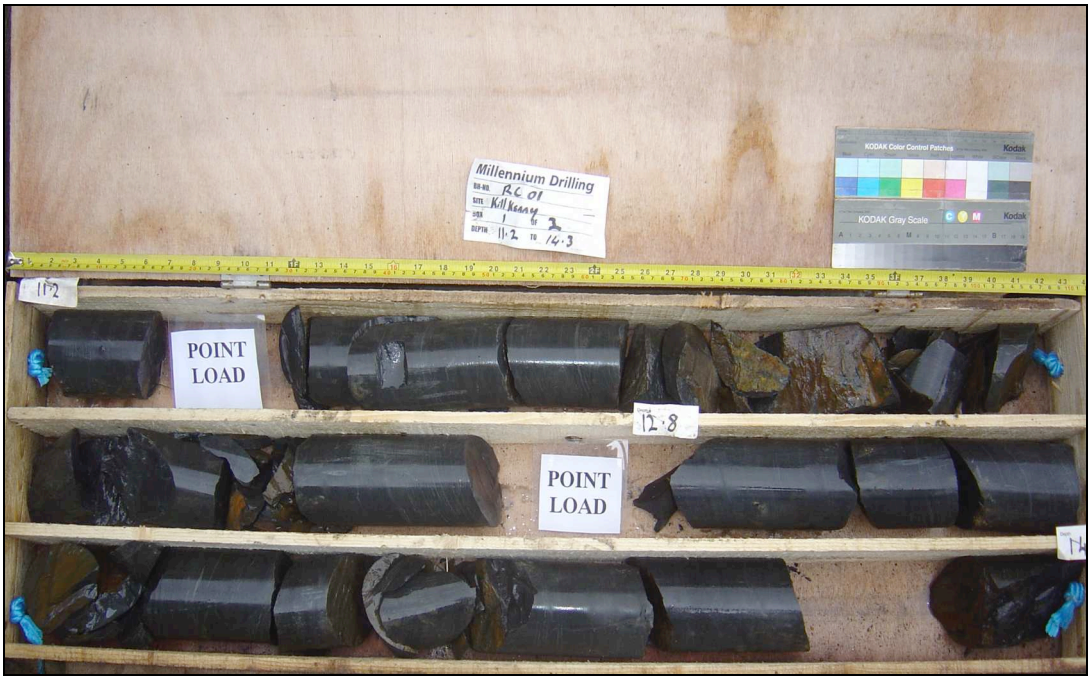
BH	Sample Depth (m)	Void Ratio	Mv (m^2/MN)	CV (m^2/yr)	Soil Type
WS 5	2.90	6.8	5	0.19	PEAT
WS 6	0.60	0.9	1.8	16.8	Slightly sandy slightly gravelly CLAY
WS 10	0.70	0.9	0.5	3.5	Slightly sandy gravelly CLAY
WS 30	1.50	2.4	3.3	7.9	Slightly sandy gravelly SILT/ CLAY

WS 30	2.70	8	5.2	3	PEAT

4.3 Bedrock

Reference to Sheet 19 of the GSI bedrock series (Geology of Carlow Wexford 1:100,000) shows that the northwestern area of Kilkenny City is underlain by the Ballyadams Formation (wackstone / packstone limestone). The core drilholes undertaken adjacent to the River Nore confirm that bedrock consists of dark grey / grey black, fine grained, fresh to slightly weathered LIMESTONE. Core recovery using air mist flush was excellent, with 100% total core recovery (TCR) in each of the core runs. Figure 1 illustrates the structure and composition of the upper limestone bedrock.

Figure 1 – Rock Core Quality (RC 1)



Rockhead depths range from approximately 11.2 to 14.1m and summary details are presented in Table 4. Weathering grades are typically fresh to slightly weathered and overall, rock quality is classed as good. RQD values are highly variable, with values ranging from 21 to 73%. Discontinuities are typically smooth and undulose to locally planar, while apertures appear to be 1 to 2mm. Dips are typically sub-horizontal to 30 / 40° and surfaces show localised iron staining or discolouration.

The Point Load Strength Index (PLSI) tests produced Is_{50} values ranging from 0.13 to 1.04 MPa with a mean value of 0.51 MPa. The compressive strength of the rock (q_c) can be established using a correlation suggested by Goodman where $q_c \approx 18$ to 24 x Is_{50}. Using a correlation value of 20, the point load test data suggests the limestone to be lower bound moderately strong (i.e. 12.5 to 50 MPa). However, it is thought that the point load data underestimates the compressive strength of the rock, as premature failure tended to occur parallel to the discontinuities. The limestone rock is visually classed as being strong to locally moderately strong and this is deemed to be more realistic with the known properties of the Ballyadams Formation limestone.

Table 4 - Summary Details of Rotary Drillholes

Rotary Hole	Total Depth (m bgl)	Approximate Rockhead Depths (m bgl)	Rock Strength & Weathering Grades
RC 1	16.20	10.6 to 11.2	Strong to locally moderately strong, fine grained LIMESTONE, fresh to slightly weathered. Smooth, undulose to planar discontinuities with occasional iron oxide staining surfaces, dips sub-horizontal to 30º
RC 2	19.00	13.4 to 14.1	Strong to locally moderately strong, fine grained LIMESTONE, fresh to slightly weathered. Smooth, undulose to planar discontinuities with local iron oxide staining surfaces, dips sub-horizontal to 40º

4.4 Groundwater

Groundwater was encountered in BH's 2, 3, 4, 5 and 6 at depths of between 2.10 and 3.40m bgl. In the case of the trial pits, groundwater was intercepted in TP 2, 3 and 5 respectively. Ingress in the pits was observed as ranging from seepages (TP 3 & 5) to rapid (TP 2) and gave rise to instability of the pit sidewalls.

Groundwater was not intercepted in either of the rotary core drillholes, however with air mist flush, detection of groundwater can be difficult. Standpipes were installed to establish equilibrium groundwater levels in the superficial deposits and bedrock, and details are summarized in Table 5. The standpipe in BH 2 (Cutting No, 1) indicates an equilibrium groundwater level of c5m bgl (50.5m OD).

With an excavation depth of approximately 5m proposed at Cutting No. 1, the equilibrium groundwater level is expected to be close to or above formation level. The groundwater level in RC 2 indicates confined conditions in the limestone bedrock with a hydrostatic head of approximately 12m. BH 5 is located at the eastern flank of the River Nore and the water level in the standpipe is 1.5m below ground level.

Table 5 - Summary Details of Groundwater Levels in Standpipes

BH / RC	Response Zone	Groundwater Level (16/9/2009)	Groundwater Level (6/10/2009)
BH 2	1.00 to 10.00	5.05	4.96
RC 2	13.75 to 19.00	1.28	1.38
BH 5	1.0 to 10.00	1.50	1.46

5. DISCUSSION & RECOMMENDATIONS

5.1 General

As outlined in the introduction, the western part of the proposed relief road is characterized by agricultural ground, sloping from the Freshford Road to the River Nore. Up to 5m of cut is proposed between CH 50 and CH 400 as the route approaches the River Nore. A bridge structure will be required at the River Nore, with up to 4m of embankment on the eastern flank. To the east of the River Nore, the relief road will be built on a low-lying floodplain and this will entail embankment heights of 2.5 to 3m. An underpass and culverts will be required at the Bleach Road with approximately 1.5m of fill at this area.

Given the findings from the ground investigation works and associated laboratory testing, the following geotechnical issues are developed and discussed:

- Bearing capacity
- Foundations for structures
- Earthworks & re-use of cuttings as engineering fill
- Embankment construction
- Pavement requirements
- Slopes
- Buried concrete

5.2 Bearing Capacity

The strength and relative density of the soils has been discussed in Section 4.2. The exploratory boreholes ad trial pits show large variations in strength or stiffness along the proposed route. Soft or soft/firm deposits were uncovered in a number of boreholes, probes and window samples. These layers will have a significant impact on bearing capacity and foundations and hence should be carefully evaluated. The weathering and strength of the bedrock has also been previously discussed in Section 4, and on foot of the strengths from visual examination and testing, safe bearing capacities (as defined in Section 2.2.8 of Tomlinson, 7th Ed) are presented in Table 6.

The soft and soft / firm fine grained or cohesive soils should be capable of supporting embankment loads of the order of 40 to 50 kN/m^2 but would not be suitable for bridge abutment structural loading. The firm sandy gravelly CLAY / SILT (glacial till) should provide a safe bearing capacity of 100 kN/m^2 while the medium dense granular deposits should be capable of providing a safe bearing capacity of the order of 150 to 175 kN/m^2. At a bearing pressure of 100 kN/m^2, long-term consolidation settlement for pads founded on the firm soils is unlikely to exceed 15 to 20mm. In the case of pads founded on the granular dominant material, elastic or immediate settlement will occur but is not expected to exceed 10mm.

Table 6 - Summary Details of Safe Bearing Capacities for Principal Soils / Bedrock

Stratum	Characteristic Strength or Relative Density Range	Safe Bearing Capacity
Soft / firm fine grained soils (peat / clay / silt)	20 to 30 kN/m^2	40 to 50 kN/m^2
Firm sandy gravelly CLAY / SILT	50 to 75 kN/m^2	100 to 125 kN/m^2
Medium dense silty sandy GRAVEL / gravelly SAND	Medium Dense (N-Values 15 to 20)	150 to 175 kN/m^2
Moderately strong LIMESTONE	12.5 to 50 MN/m^2	1250 to 1500 kN/m^2

5.3 Foundations

The River Nore bridge abutment loads are currently unknown but given the large variations in soil strength / stiffness (particularly at depths of 5 to 7m), piles are expected to be used. Bored piles are deemed most appropriate for the ground conditions, and would be expected to be founded or socketed in the upper limestone bedrock. A 600mm diameter bored pile, socketed in the upper limestone bedrock, would be expected to provide a safe working load of 1250 to 1500 kN. The piles could be expected to be formed using CFA or cased piling methods but the rig would need to have the torque / augering capacity to penetrate the upper bedrock. The two rotary core drillholes encountered intact bedrock at elevations of 33 to 36m OD, hence the piles would be expected to be achieve a minimum socket or seating depth of 1m below these elevations.

The dynamic probes carried out at the Bleach Road area (DP 10, 11, 12 & 14) have identified soft ground to depths of around 2m (44.5m OD). At these locations, the probe dropped under self weight (zero blowcounts) and this is indicative of soft compressible soils. It is expected that these soft deposits be removed and replaced with suitable engineering (granular) fill. The underlying soils appear to be largely stiff / dense and should be capable of supporting pad or raft foundations.

5.4 Earthworks & Re-Use of Excavated Materials As Engineering Fill

Given the alignment of the proposed road, cut and fill earthworks will be required. Acceptability assessment of soils is based on two approaches:

- Approach 1 - Soil Descriptions (i.e. proportion of fine / coarse soils and strengths derived from SPT's, DCP tests and laboratory testing)

- Approach 2 - Using MCV / Compaction / CBR data in conjunction with gradings and Atterberg Limits

As noted previously, the fine grained or cohesive soils are principally firm in consistency. Cohesive tills are generally categorised as Class 2C ('stony cohesive fill') in accordance with the NRA Specification for Road Works (SRW). On the basis of the gradings and Atterberg Limits, the soils at

Cutting No. 1 contain a mix of NRA Class 1 and Class 2 materials. Cutting No. 2 incorporates what is thought to be an old railway embankment and area of MADE GROUND (as identified by TP 1). The MADE GROUND comprises construction and demolition rubble in a sandy clay matrix and is not expected to be suitable for road embankment construction. It is thought that this material will be disposed off site, probably to landfill. It is possible that this material could be classed as inert waste but environmental testing (leachate suite) will be required for acceptability characterization.

The granular dominant material at Cutting No. 1 falls into Class 1 category and is expected to produce an acceptable NRA Class 1 material. Additional particle size gradings should be performed during the earthworks period to designate Class 1A / 1B or 1C respectively. The gradings indicate the fine grained soils at Cutting No. 1 to fall into NRA 2C material. Moisture Condition Value (MCV) and CBR tests were performed on samples from TP 4, TP 5 and BH's 1 and 2 respectively. MCV's were highly variable, ranging from 0 to 6.5. Likewise, the CBR values varied greatly with values ranging from 0.9 to 31.1%. A Class 2 material should achieve a minimum MCV of 7 or CBR value of approximately 2.5 to 3%.

On the basis of the geotechnical laboratory testing, the bulk of the fine grained soils from Cutting No. 1 are not expected to be suitable in their natural state as acceptable fill. However, it is advised that the soils could be modified by lime or cement binders, to render them suitable for trafficking and compaction. From in-house experience on earthworks and associated laboratory testing of modified soils, approximately 2% lime (calcium oxide) should be sufficient to produce an acceptable Class 2 material. It is recommended that a geotextile fabric (Polybrane PB 120 or similar approved) should be placed on the sub-grade to prevent mixing between imported granular fill and the formation soils.

5.5 Embankment Construction

Embankments will be required from the River Nore to the Bleach Road and eastwards to the tie-in with the Castlecomer Road. With typical embankment heights of 2 to 3m, this will impose loads of the order of 40 to 60 kN/m^2. Soil strengths over the embankment sections have been profiled by a combination of dynamic probing and window sampling. Summary details of the dynamic probes and depths of soft material are outlined in Table 7.

Table 7 - Summary Details of Dynamic Probes

Dynamic Probe	Total Depth (m)	Soft Ground
DP 1	7.90	GL to 1.7m
DP 2	6.90	GL to 3.3m
DP 3	6.50	GL to 3.4m
DP 4	3.60	GL to 3.1m
DP 5	5.50	GL to 2.5m
DP 6	5.70	GL to 2.3m
DP 7	5.10	GL to 2.2m
DP 8	3.50	GL to 1.4m
DP 9	3.20	GL to 1.4m
DP 10	3.60	GL to 1.2m
DP 11	3.00	GL to 1.4m
DP 12	3.10	GL to 1.1m
DP 13	8.10	GL to 1.1m
DP 14	7.70	GL to 0.6m
DP 15	2.80	GL to 1.0m
DP 16	3.40	GL to 0.5m
DP 17	8.50	GL to 1.4m

DP 18	6.60	Not encountered
DP 19	4.50	GL to 2.0m
DP 20	4.00	GL to 1.9m
DP 21	2.50	GL to 1.7m
DP 22	3.50	GL to 1.4m
DP 23	6.10	GL to 2.7m
DP 24	13.10	GL to 1.4m & 2.6 to 2.8m
DP 25	10.10	GL to 2.9m
DP 26	0.70	Not encountered
DP 26A	0.80	"
DP 27	4.40	"
DP 28	1.70	0.4 to 0.7m
DP 29	7.60	GL to 0.5m
DP 30	5.80	GL to 2.0m

Inspection of Table 7 shows significant thickness of soft compressible soils, with in excess of 3m in some instances. The consolidation tests showed the peat to be highly compressible with an Mv of the order of 5 m^2/MN. The sandy gravelly CLAY / SILT material varies from soft / firm to firm in consistency and is deemed to be less of a concern for embankment construction. Either excavate and replace or staged loading are recommended on soft ground areas.

Given the amount of material to be removed and volume of imported fill (and associated dewatering works), it is thought that staged loading may be most appropriate. The embankments could be formed in lifts (i.e. 1m increments) to ensure that the formation soils are not overstressed. Geofabric reinforcement (geotextile or geogrid) is advised, especially under the basal layer. Geotechnical instrumentation (e.g. settlement plates, piezometers etc) should be incorporated in the embankments to measure settlement and pore water pressure behaviour in the underlying soils.

5.6 Slopes

On the basis of the soil strengths encountered in the boreholes and dynamic probes, a slope angle of 1V to 2H (26°) is recommended for the cuttings. If steeper slopes are required, then ground retention measures are recommended. Provision should be made for the installation of herringbone drains at Cutting No. 1, as drainage and control of groundwater will be important in the silt dominant soils. Embankment slopes will be governed by the fill material properties used, but it is unlikely that slope batters would exceed 1V to 2H.

5.7 Pavement

Capping material is used to improve and protect the sub-grade and the sub-base material. Its purpose is to increase the stiffness modulus and strength of the formation. It is of vital importance to keep water out of the sub-base, capping and subgrade, both during construction and during the service life of the pavement. This is achieved by precluding water ingress and providing an escape route for water already in the foundation.

CBR tests were carried out on selected samples and produced a large degree of variability, with values ranging from 0.9 to 39.7.%. Capping layer thickness is governed by the CBR value of either the formation sub-grade or fill material (e.g. using excavated glacial soils or siltstone / sandstone fill). Where road pavements are constructed on formation soils with a CBR value of 2% or less, then a capping layer thickness of 600mm is recommended. Where CBR values are between 2 and 5% then a capping layer thickness of between 300 and 450mm is expected to be appropriate.

In accordance with DMRB Design Guidance for Road Pavement (HD 25) the lower-end equilibrium CBR values should be used to determine appropriate capping layer thickness. Taking the lower-end CBR values into consideration (i.e. 0.9%), a capping layer thickness of the order of 600mm is suggested for pavements constructed on the poorer quality or soft soils. At Cutting No. 1, a starter layer of NRA 6A/6B material should be considered, particularly in light of the silt dominant formation soils and excavations being close to or below the water table. A starter layer thickness of the order of 600 to 750 mm is suggested and this could lead to a significant reduction in capping layer thickness. As a rule, where excavation or cuttings involve soft soils, a starter layer of 6A/6B material is strongly recommended.

The capping layer thickness for the embankments will be governed by the CBR value of the fill material selected. Plate bearing tests are recommended on the embankment fill material to establish CBR values (derived in accordance with HD 25/94). Mould samples could also be taken to determine CBR values in the laboratory. The CBR values should then be used to define an appropriate capping layer thickness. CBR mould samples or plate tests should be carried out at 50 to 75m intervals along roads and there may be scope to reduce the capping layer thickness, pending CBR values obtained on the fill materials.

5.8 Buried Concrete

The chemical analysis laboratory tests on the soil samples produced pH values of between 7.8 and 8.3, while sulphates (SO_4) range from 0.017 to 0.083 g/l. In terms of BRE Special Digest SD 1 (2005), these values show DS-1 conditions (i.e. < 500 mg/l), hence ACEC concrete class AC-1^d is expected to be be suitable. However, further testing for sulphates should be considered if foundations are located on or within modified soils using lime or cement binders.

5.9 Further Geotechnical Investigations

The findings of the ground investigation works provides a good insight into the ground conditions and engineering properties of the soils and bedrock along the proposed route. However, further geotechnical and geophysical investigation works are strongly recommended for this project and would be expected to include the following:

- Geophysical surveying to map the thickness of the MADE GROUND / FILL material at the eastern end of the scheme. Geophysics should also be considered at the flanks of the River Nore to assess depth to rockhead and evaluate any significant variations in weathering and rock mass quality.

- Cable percussion boreholes (2 No.) at the Bleach Road structures to confirm the ground conditions assessed by the dynamic probes. An additional two boreholes are also recommended at the MADE GROUND area identified in TP 1.

- The dynamic probes at the embankment area have identified soft compressible soils to depths in excess of 3m. A number of cable percussion boreholes (with a large emphasis on recovering U100 samples) should be considered for this area.

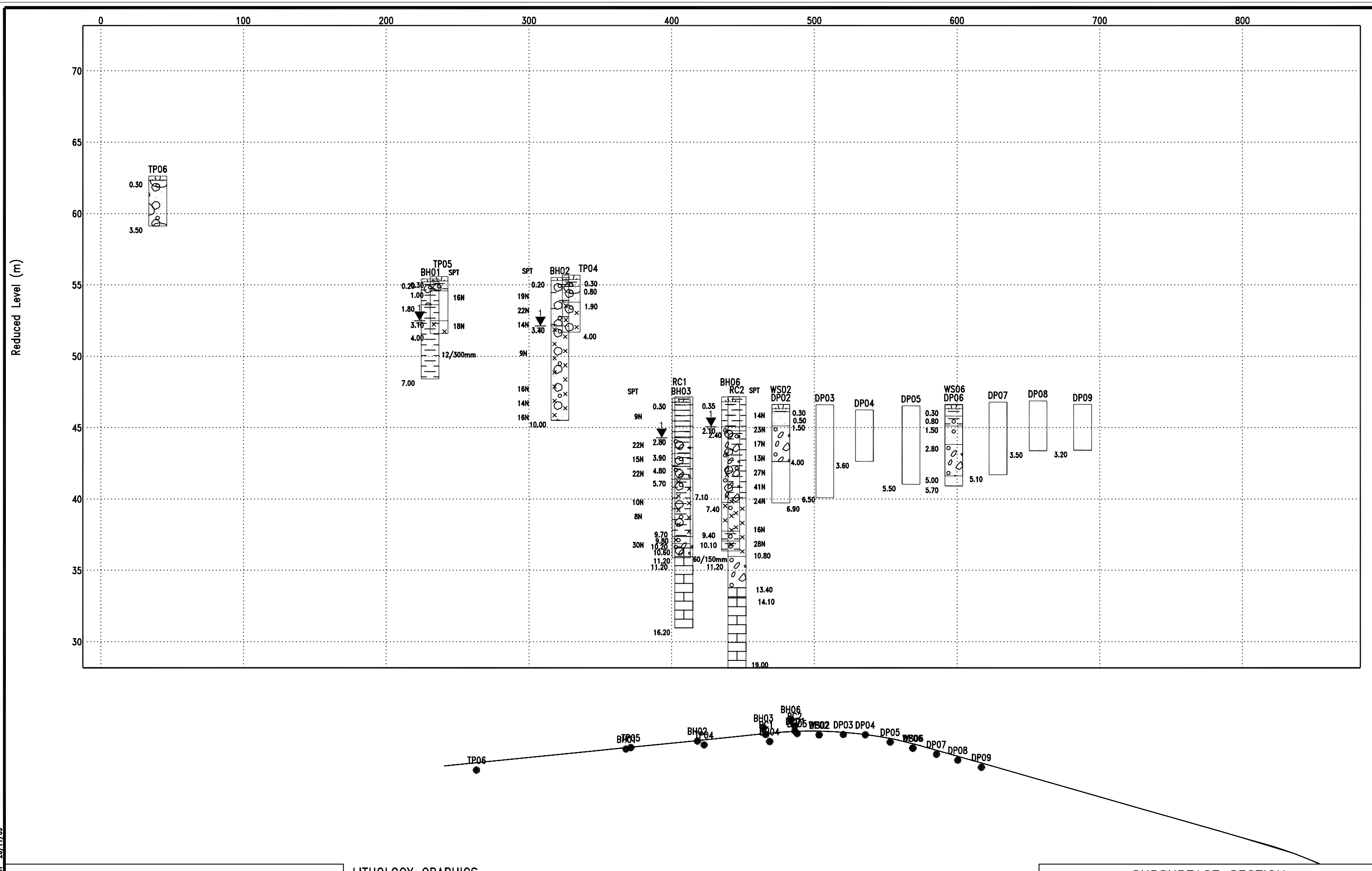
- Environmental laboratory testing should be carried out on samples of the MADE GROUND. This is to classify the geochemical characteristics of the MADE GROUND in the event that it requires disposal to licenced landfill.

References

1. BS 5930 (1999) Code of Practice for Site Investigation, British Standards Institution (BSI).
2. BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.
3. BS 8004 (1986) Code of Practice for Foundations, BSI.
4. BRE Special Digest SD 1, Concrete in Aggressive Ground, 2005
5. GSI, Geology of Carlow Wexford, Sheet 19 (1"100,000 Series)
6. NRA Specification for Road Works, March 2000
7. Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.
8. Sowers, G.F. (1962) Shallow Foundations, Foundation Engineering, McGraw Hill
9. Stroud, M.A & Butler, F.G (1975) ' The SPT and the Engineering properties of Glacial Materials". Proceedings of the Symposium on Engineering Behaviour of Glacial Materials, Birmingham
10. Tomlinson, M.J. Foundation Design & Construction, 7th Edition

Appendix 1

Geological & Geotechnical X-Sections



LITHOLOGY GRAPHICS

- TOPSOIL
- Sandy gravelly cobbly CLAY
- Sandy CLAY
- Clayey gravelly cobbly SAND
- Sandy gravelly cobbly SILT
- Sandy cobbly GRAVEL
- Sandy SILT
- Gravelly cobbly SAND
- Sandy gravelly CLAY
- Silty sandy cobbly GRAVEL
- Sandy gravelly SILT
- VOID
- CLAY
- SILT
- GRAVEL

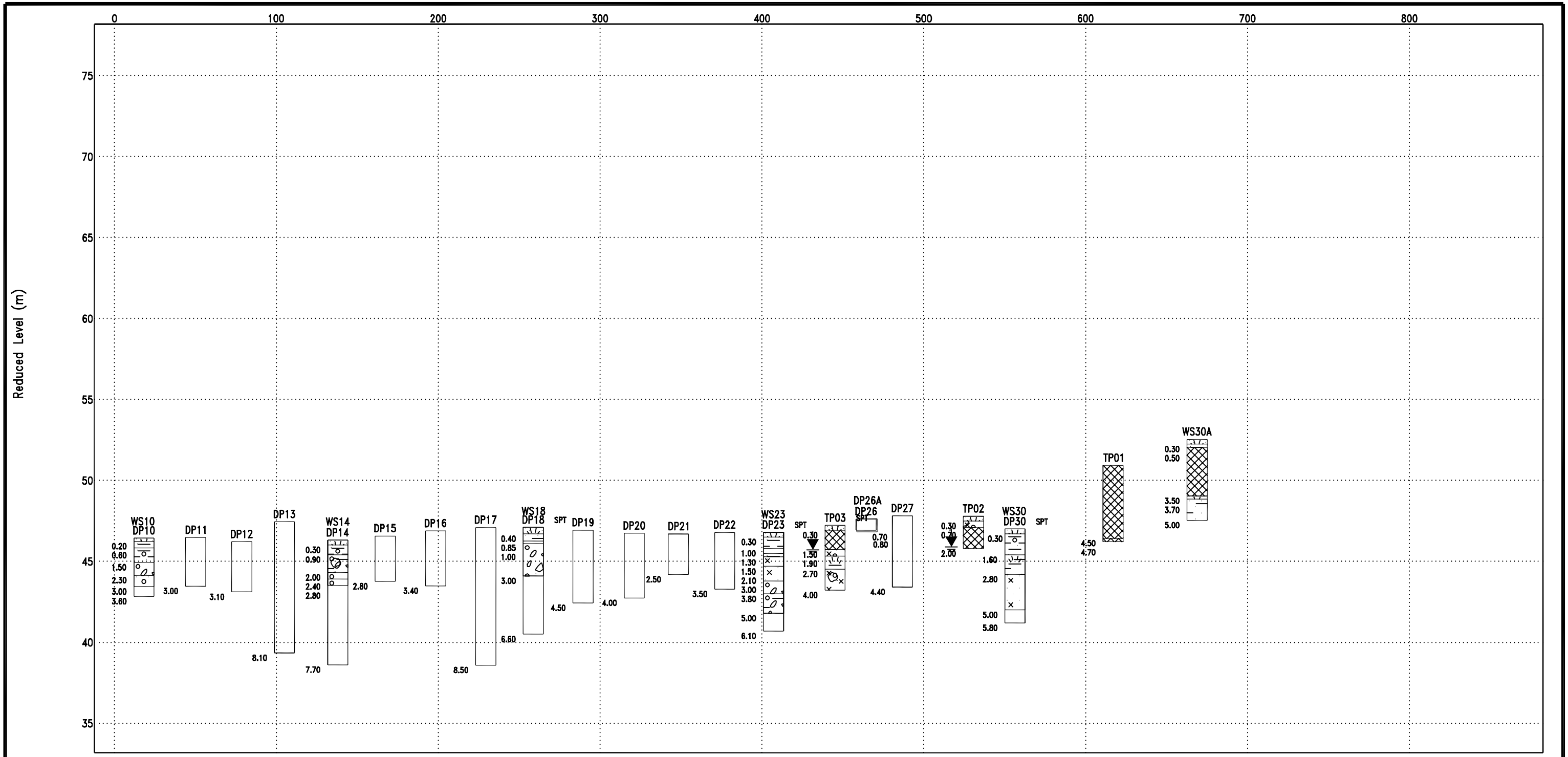
SUBSURFACE SECTION

Client: Kilkenny County Council

Project: The Northern Ring Road Extension

Number: 14367

A3 LAYOUT 14367.GPJ IGSL.GDT 26/11/09



LITHOLOGY GRAPHICS

- VOID
- MADE GROUND
- TOPSOIL
- Silty gravelly sandy COBBLES
- Sandy gravelly organic SILT
- PEAT
- Sandy gravelly cobbly SILT
- Sandy CLAY
- Sandy gravelly CLAY
- Sandy GRAVEL
- Gravelly SAND
- Clayey cobbly GRAVEL
- GRAVEL
- Clayey SAND
- Sandy organic SILT

SUBSURFACE SECTION

Client: Kilkenny County Council

Project: The Northern Ring Road Extension

Number: 14369

A3 LAYOUT 14367.GPJ IGSL.GDT 26/11/09

APPENDIX F

Traffic Counts

Sky High-Count On Us

Job Number: SC1596

Job Title: Kilkenny

Client: Clifton Scannell Emerson Associates

Survey Date: Wed 16/01/13

Survey Period: 07:00-19:00

Survey Type: Junction Turning Counts

Sky High-Count On Us

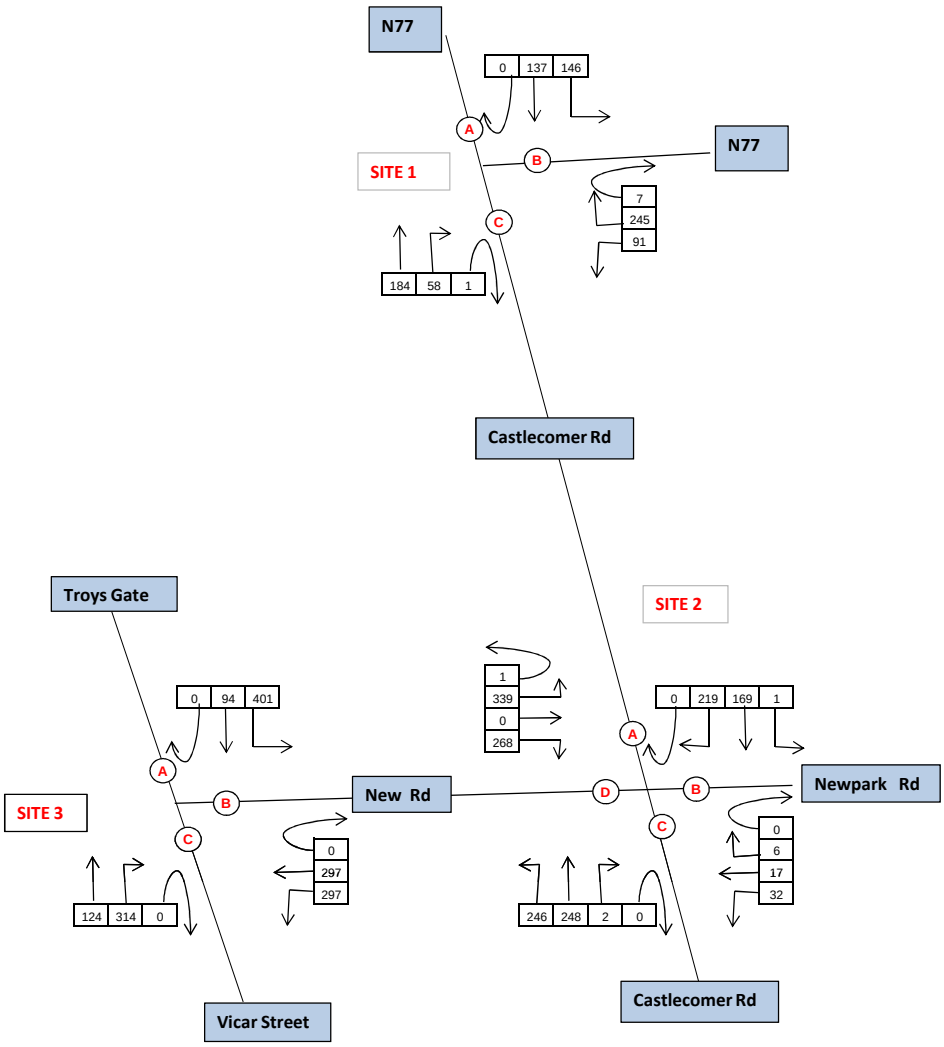
KILKENNY / SC1596
WED 16 JANUARY 2013
SITE PLAN

Sites/ Locations: 1 - N77/ Castlecomer Road
2 - Castlecomer Road/ Newpark Road/ New Road
3 - New Road/ Vicar Street

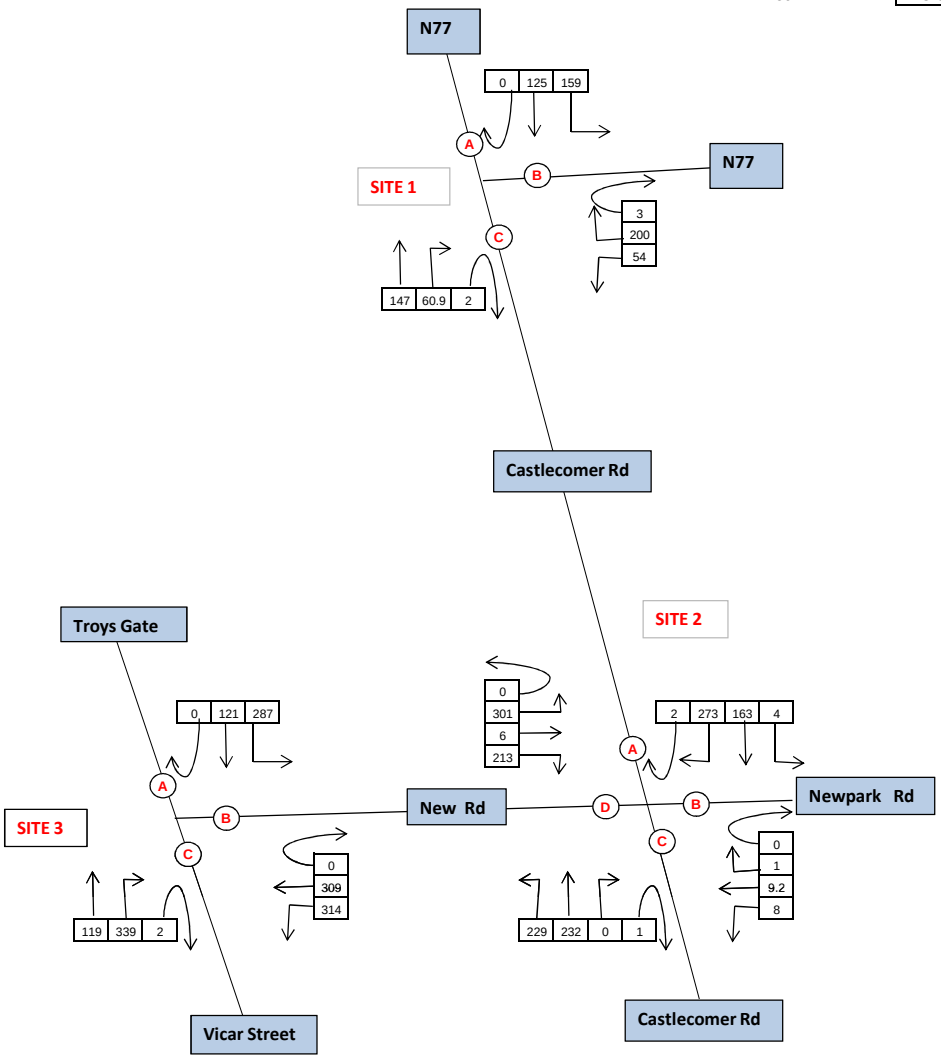
Diagram No: 1

N

Hour 16:00 - 17:00



Hour 13:00 - 14:00



Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

	A to B										A to C									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	15	2	5	0	2	0	0	0	24	33	8	0	0	0	0	0	0	0	8	8
07:15	20	4	2	0	0	0	0	0	26	29	17	3	0	0	0	0	0	0	20	20
07:30	29	8	4	0	0	0	0	0	41	46	24	6	0	0	0	0	0	0	30	30
07:45	32	13	5	0	1	0	0	0	51	59	43	9	2	0	0	0	0	0	54	57
H/TOT	96	27	16	0	3	0	0	0	142	166	92	18	2	0	0	0	0	0	112	115
08:00	32	7	7	0	0	0	0	0	46	55	44	9	2	0	1	0	0	0	56	60
08:15	72	12	3	0	0	0	0	0	87	91	59	3	0	0	2	0	0	0	64	66
08:30	95	8	0	0	0	0	0	0	103	103	51	3	0	0	1	0	0	0	55	56
08:45	90	18	7	0	0	0	0	0	115	124	76	4	0	0	2	1	0	0	83	85
H/TOT	289	45	17	0	0	0	0	0	351	373	230	19	2	0	6	1	0	0	258	267
09:00	43	3	3	0	0	0	0	0	49	53	58	2	0	0	0	0	0	0	60	60
09:15	47	6	6	0	0	0	0	0	59	67	56	4	3	0	0	0	0	0	63	67
09:30	46	5	1	0	0	0	0	0	52	53	53	4	2	0	0	0	0	0	59	62
09:45	33	5	4	0	0	0	0	0	42	47	39	2	1	0	1	0	0	0	43	45
H/TOT	169	19	14	0	0	0	0	0	202	220	206	12	6	0	1	0	0	0	225	234
3H/TOT	554	91	47	0	3	0	0	0	695	759	528	49	10	0	7	1	0	0	595	615
10:00	23	8	3	0	0	0	0	0	34	38	24	5	2	0	0	0	0	0	31	34
10:15	23	6	7	0	0	0	0	0	36	45	28	5	3	0	0	0	0	0	36	40
10:30	18	6	4	0	0	0	0	0	28	33	26	3	2	0	0	0	0	0	31	34
10:45	29	5	8	0	0	0	0	0	42	52	21	4	2	0	1	1	0	0	29	33
H/TOT	93	25	22	0	0	0	0	0	140	169	99	17	9	0	1	1	0	0	127	140
11:00	15	10	7	0	1	0	0	0	33	43	26	5	3	0	1	0	0	0	35	40
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11:30	20	3	7	0	0	0	0	0	30	39	26	4	3	0	0	0	1	0	34	37
11:45	21	0	15	0	0	0	0	0	36	56	26	4	1	0	0	1	0	0	32	33
H/TOT	78	15	35	0	1	0	0	0	129	176	110	17	9	0	1	1	1	0	139	151
12:00	18	4	8	0	0	0	0	0	30	40	28	4	3	0	0	0	0	0	35	39
12:15	14	5	6	0	0	0	0	0	25	33	28	5	3	0	0	0	0	0	36	40
12:30	17	4	6	0	0	0	0	0	27	35	25	2	0	0	2	0	0	0	29	31
12:45	19	3	1	0	0	0	0	0	23	24	20	2	1	0	0	0	0	0	23	24
H/TOT	68	16	21	0	0	0	0	0	105	132	101	13	7	0	2	0	0	0	123	134
3H/TOT	239	56	78	0	1	0	0	0	374	476	310	47	25	0	4	2	1	0	389	425
13:00	16	8	3	0	0	0	0	0	27	31	21	1	3	0	0	0	0	0	25	29
13:15	30	6	10	0	0	0	0	0	46	59	25	5	0	0	1	0	0	0	31	32
13:30	17	5	4	0	0	0	0	0	26	31	25	5	4	0	0	0	0	0	34	39
13:45	23	3	5	0	0	0	0	0	31	38	23	2	0	0	0	0	0	0	25	25
H/TOT	86	22	22	0	0	0	0	0	130	159	94	13	7	0	1	0	0	0	115	125
14:00	25	4	5	0	0	0	0	0	34	41	27	4	0	0	0	0	0	0	31	31
14:15	28	4	3	0	1	1	0	0	37	42	41	5	1	0	0	0	0	0	47	48
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14:45	22	6	7	0	0	0	0	0	35	44	18	2	2	0	0	1	0	0	23	26
H/TOT	92	20	21	0	1	1	0	0	135	163	117	13	7	0	0	1	0	0	138	147
15:00	21	8	9	0	0	0	0	0	38	50	33	4	0	0	0	0	0	0	37	37
15:15	28	2	7	0	0	0	0	0	37	46	26	5	3	0	1	0	0	0	35	40
15:30	24	8	5	0	0	0	0	0	37	44	26	5	0	0	1	0	0	0	32	33
15:45	33	4	6	0	0	0	0	0	43	51	28	1	2	0	1	0	0	0	32	36
H/TOT	106	22	27	0	0	0	0	0	155	190	113	15	5	0	3	0	0	0	136	146
3H/TOT	284	64	70	0	1	1	0	0	420	512	324	41	19	0	4	1	0	0	389	418
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16:15	22	7	4	0	0	0	0	0	33	38	34	3	2	0	1	0	0	0	40	44
16:30	31	6	2	0	0	0	0	0	39	42	28	1	0	0	0	0	0	0	29	29
16:45	26	8	1	0	0	0	0	0	35	36	29	4	1	0	0	1	0	0	35	36
H/TOT	109	27	10	0	0	0	0	0	146	159	119	12	4	0	1	1	0	0	137	143
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17:45	41	8	4	0	0	0	0	0	53	58	32	4	0	0	1	0	0	0	37	38
H/TOT	160	38	11	0	1	0	0	0	210	225	116	21	4	0	1	0	0	0	142	148
18:00	50	4	1	0	0	0	0	0	55	56	39	2	1	0	0	0	0	0	42	43
18:15	37	3	1	0	0	0	0	0	41	42	36	3	0	0	0	0	0	0	39	39
18:30	34	2	3	0	1	0	0	0	40	45	36	2	0	0	0	0	0	0	38	38
18:45	31	4	1	0	0	0	0	0	36	37	31	2	0	0	1	0	0	0	34	35
H/TOT	152	13	6	0	1	0	0	0	172	181	142	9	1	0	1	0	0	0	153	155
3H/TOT	421	78	27	0	2	0	0	0	528	565	377	42	9	0	3	1	0	0	432	447
P/TOT	1498	289	222	0	7	1	0	0	2017	2313	1539	179	63	0	18	5	1	0	1805	1904

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

	A to A										B to C									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
07:15	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	2
07:30	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1
07:45	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3	3
H/TOT	0	1	0	0	0	0	0	0	1	1	5	1	0	0	0	0	0	1	7	6
08:00	0	0	0	0	0	0	0	0	0	0	8	1	0	0	0	0	0	0	9	9
08:15	0	0	0	0	0	0	0	0	0	0	22	1	2	0	1	0	0	0	26	30
08:30	0	0	0	0	0	0	0	0	0	0	38	1	0	0	1	0	0	0	40	41
08:45	0	0	0	0	0	0	0	0	0	0	25	2	0	0	0	0	0	0	27	27
H/TOT	0	0	0	0	0	0	0	0	0	0	93	5	2	0	2	0	0	0	102	107
09:00	0	0	0	0	0	0	0	0	0	0	19	2	0	0	0	0	0	0	21	21
09:15	0	0	0	0	0	0	0	0	0	0	10	0	1	0	0	0	0	0	11	12
09:30	0	0	0	0	0	0	0	0	0	0	8	2	0	0	0	0	0	0	10	10
09:45	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	7	7
H/TOT	0	0	0	0	0	0	0	0	0	0	43	5	1	0	0	0	0	0	49	50
3H/TOT	0	1	0	0	0	0	0	0	1	1	141	11	3	0	2	0	0	1	158	163
10:00	0	0	0	0	0	0	0	0	0	0	6	1	2	0	1	0	0	0	10	14
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10:45	0	0	0	0	0	0	0	0	0	0	10	2	1	0	0	0	0	0	13	14
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11:00	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10	10
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11:30	0	0	0	0	0	0	0	0	0	0	9	3	0	0	0	0	0	0	12	12
11:45	0	0	0	0	0	0	0	0	0	0	8	2	0	0	0	0	0	0	10	10
H/TOT	0	0	0	0	0	0	0	0	0	0	35	6	0	0	0	0	0	0	41	41
12:00	0	0	0	0	0	0	0	0	0	0	6	1	1	0	0	0	0	0	8	9
12:15	0	0	0	0	0	0	0	0	0	0	14	2	0	0	0	0	0	0	16	16
12:30	0	1	0	0	0	0	0	0	1	1	9	0	1	0	1	0	0	0	11	13
12:45	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	13	13
H/TOT	0	1	0	0	0	0	0	0	1	1	42	3	2	0	1	0	0	0	48	52
3H/TOT	0	1	0	0	0	0	0	0	1	1	109	16	5	0	2	1	0	0	133	142
13:00	0	0	0	0	0	0	0	0	0	0	19	5	0	0	0	0	0	0	24	24
13:15	0	0	0	0	0	0	0	0	0	0	10	4	0	0	0	0	0	0	14	14
13:30	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	7	7
13:45	0	0	0	0	0	0	0	0	0	0	8	1	0	0	0	0	0	0	9	9
H/TOT	0	0	0	0	0	0	0	0	0	0	43	11	0	0	0	0	0	0	54	54
14:00	0	0	0	0	0	0	0	0	0	0	10	2	0	0	0	0	0	0	12	12
14:15	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	1	0	0	10	10
14:30	0	0	0	0	0	0	0	0	0	0	17	3	0	0	0	0	0	0	20	20
14:45	0	0	0	0	0	0	0	0	0	0	7	0	1	0	0	0	0	0	8	9
H/TOT	0	0	0	0	0	0	0	0	0	0	43	5	1	0	0	1	0	0	50	51
15:00	1	0	0	0	0	0	0	0	1	1	19	3	0	0	0	0	0	0	22	22
15:15	0	0	0	0	0	0	0	0	0	0	22	3	0	0	0	0	0	0	25	25
15:30	0	0	0	0	0	0	0	0	0	0	19	5	0	0	0	0	0	0	24	24
15:45	0	0	0	0	0	0	0	0	0	0	13	3	1	0	1	0	0	0	18	20
H/TOT	1	0	0	0	0	0	0	0	1	1	73	14	1	0	1	0	0	0	89	91
3H/TOT	1	0	0	0	0	0	0	0	1	1	159	30	2	0	1	1	0	0	193	197
16:00	0	0	0	0	0	0	0	0	0	0	20	1	0	0	1	0	0	0	22	23
16:15	0	0	0	0	0	0	0	0	0	0	18	2	0	0	0	0	0	0	20	20
16:30	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	21	21
16:45	0	0	0	0	0	0	0	0	0	0	22	6	0	0	0	0	0	0	28	28
H/TOT	0	0	0	0	0	0	0	0	0	0	81	9	0	0	1	0	0	0	91	92
17:00	0	0	0	0	0	0	0	0	0	0	30	1	0	0	0	0	0	0	31	31
17:15	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	1	30	29
17:30	1	0	0	0	0	0	0	0	1	1	31	1	0	0	0	0	0	0	32	32
17:45	0	0	0	0	0	0	0	0	0	0	32	1	0	0	0	0	0	0	33	33
H/TOT	1	0	0	0	0	0	0	0	1	1	122	3	0	0	0	0	0	1	126	125
18:00	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	25	25
18:15	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	25	25
18:30	0	0	0	0	0	0	0	0	0	0	23	2	0	0	0	0	0	2	27	25
18:45	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	21	21
H/TOT	0	0	0	0	0	0	0	0	0	0	94	2	0	0	0	0	0	2	98	96
3H/TOT	1	0	0	0	0	0	0	0	1	1	297	14	0	0	1	0	0	3	315	314
P/TOT	2	2	0	0	0	0	0	0	4	4	706	71	10	0	6	2	0	4	799	815

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

	B to A										B to B									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	16	1	2	0	0	0	0	0	19	22	0	0	0	0	0	0	0	0	0	0
07:15	16	4	5	0	0	0	0	0	25	32	0	0	0	0	0	0	0	0	0	0
07:30	33	8	4	0	0	0	0	0	45	50	0	0	0	0	0	0	0	0	0	0
07:45	26	5	4	0	0	0	0	0	35	40	0	0	0	0	0	0	0	0	0	0
H/TOT	91	18	15	0	0	0	0	0	124	144	0	0	0	0	0	0	0	0	0	0
08:00	42	10	3	0	0	0	0	0	55	59	1	0	0	0	0	0	0	0	1	1
08:15	36	7	2	0	0	0	0	0	45	48	0	0	0	0	0	0	0	0	0	0
08:30	56	10	12	0	2	0	0	0	80	98	0	0	0	0	0	0	0	0	0	0
08:45	34	12	8	0	0	0	0	0	54	64	0	0	0	0	0	0	0	0	0	0
H/TOT	168	39	25	0	2	0	0	0	234	269	1	0	0	0	0	0	0	0	1	1
09:00	24	7	9	0	0	0	0	0	40	52	0	0	0	0	0	0	0	0	0	0
09:15	23	2	6	0	0	1	0	0	32	40	0	0	0	0	0	0	0	0	0	0
09:30	22	4	8	0	1	0	0	0	35	46	0	0	0	0	0	0	0	0	0	0
09:45	28	3	8	0	0	0	0	0	39	49	0	0	1	0	0	0	0	0	1	2
H/TOT	97	16	31	0	1	1	0	0	146	187	0	0	1	0	0	0	0	0	1	2
3H/TOT	356	73	71	0	3	1	0	0	504	599	1	0	1	0	0	0	0	0	2	3
10:00	16	7	7	0	0	0	0	0	30	39	3	0	2	0	0	1	0	0	6	9
10:15	13	2	5	0	0	0	0	0	20	27	1	0	0	0	0	0	0	0	1	1
10:30	19	9	5	0	0	0	0	0	33	40	0	0	0	0	0	0	0	0	0	0
10:45	24	5	3	0	0	1	0	0	33	37	1	0	0	0	0	0	0	0	1	1
H/TOT	72	23	20	0	0	1	0	0	116	142	5	0	2	0	0	1	0	0	8	11
11:00	21	2	4	0	0	0	0	0	27	32	0	0	0	0	0	0	0	0	0	0
11:15	24	3	5	0	0	1	0	0	33	40	0	0	0	0	0	0	0	0	0	0
11:30	17	2	6	0	0	0	0	0	25	33	2	0	0	0	0	0	0	0	2	2
11:45	21	5	3	0	0	0	0	0	29	33	1	0	1	0	0	0	0	0	2	3
H/TOT	83	12	18	0	0	1	0	0	114	137	3	0	1	0	0	0	0	0	4	5
12:00	18	2	4	0	0	0	0	0	24	29	1	0	0	0	0	0	0	0	1	1
12:15	26	7	5	0	0	0	0	0	38	45	0	0	0	0	0	0	0	0	0	0
12:30	17	6	8	0	0	0	0	0	31	41	0	0	0	0	0	0	0	0	0	0
12:45	28	5	7	0	0	0	0	0	40	49	1	0	0	0	0	0	0	0	1	1
H/TOT	89	20	24	0	0	0	0	0	133	164	2	0	0	0	0	0	0	0	2	2
3H/TOT	244	55	62	0	0	2	0	0	363	444	10	0	3	0	0	1	0	0	14	18
13:00	36	5	8	0	0	0	0	0	49	59	0	0	0	0	0	0	0	0	0	0
13:15	23	5	7	0	0	1	0	0	36	45	0	0	0	0	0	0	0	0	0	0
13:30	20	6	7	0	0	1	0	0	34	43	1	0	0	0	0	0	0	0	1	1
13:45	29	8	6	0	1	0	0	0	44	53	1	1	0	0	0	0	0	0	2	2
H/TOT	108	24	28	0	1	2	0	0	163	200	2	1	0	0	0	0	0	0	3	3
14:00	30	5	7	0	0	0	0	0	42	51	0	0	0	0	0	0	0	0	0	0
14:15	32	7	5	0	0	0	0	0	44	51	0	0	0	0	0	0	0	0	0	0
14:30	33	7	6	0	0	0	0	0	46	54	0	0	0	0	0	0	0	0	0	0
14:45	25	11	3	0	0	1	0	0	40	44	1	0	0	0	0	0	0	0	1	1
H/TOT	120	30	21	0	0	1	0	0	172	199	1	0	0	0	0	0	0	0	1	1
15:00	30	7	8	0	0	0	0	0	45	55	0	0	0	0	0	0	0	0	0	0
15:15	33	3	6	0	0	0	0	0	42	50	2	0	0	0	0	0	0	0	2	2
15:30	37	8	4	0	0	0	0	0	49	54	1	0	0	0	0	0	0	0	1	1
15:45	24	5	9	0	1	0	0	0	39	52	0	0	0	0	0	0	0	0	0	0
H/TOT	124	23	27	0	1	0	0	0	175	211	3	0	0	0	0	0	0	0	3	3
3H/TOT	352	77	76	0	2	3	0	0	510	611	6	1	0	0	0	0	0	0	7	7
16:00	39	10	2	0	1	0	0	0	52	56	1	0	0	0	0	0	0	0	1	1
16:15	59	12	2	0	0	0	0	0	73	76	2	1	0	0	0	0	0	0	3	3
16:30	37	13	5	0	0	0	1	0	56	62	0	0	0	0	0	0	0	0	0	0
16:45	48	9	7	0	0	0	0	0	64	73	3	0	0	0	0	0	0	0	3	3
H/TOT	183	44	16	0	1	0	1	0	245	266	6	1	0	0	0	0	0	0	7	7
17:00	57	12	7	0	1	0	0	0	77	87	1	0	0	0	0	0	0	0	1	1
17:15	72	8	3	0	1	1	0	0	85	90	1	0	0	0	0	0	0	0	1	1
17:30	64	12	4	0	0	0	0	0	80	85	1	0	0	0	0	0	0	0	1	1
17:45	63	7	4	0	0	0	0	0	74	79	1	0	0	0	0	0	0	0	1	1
H/TOT	256	39	18	0	2	1	0	0	316	341	4	0	0	0	0	0	0	0	4	4
18:00	49	5	2	0	0	0	0	1	57	59	2	0	0	0	0	0	0	0	2	2
18:15	46	6	3	0	0	0	0	0	55	59	2	0	0	0	0	0	0	0	2	2
18:30	33	6	4	0	0	0	0	0	43	48	0	0	0	0	0	0	0	1	1	0
18:45	31	7	1	0	0	0	0	0	39	40	0	0	0	0	0	0	0	0	0	0
H/TOT	159	24	10	0	0	0	0	1	194	206	4	0	0	0	0	0	0	1	5	4
3H/TOT	598	107	44	0	3	1	1	1	755	814	14	1	0	0	0	0	0	1	16	15
P/TOT	1550	312	253	0	8	7	1	1	2132	2468	31	2	4	0	0	1	0	1	39	43

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

TIME	C to A Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	C to B Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	10	2	1	0	0	0	0	0	13	14	5	0	0	0	0	0	0	0	5	5
07:15	17	2	0	0	0	0	0	0	19	19	6	0	0	0	0	0	0	0	6	6
07:30	27	4	4	0	0	0	0	0	35	40	6	1	0	0	0	0	0	0	7	7
07:45	32	7	1	0	0	0	0	0	40	41	15	1	0	0	0	0	0	0	16	16
H/TOT	86	15	6	0	0	0	0	0	107	115	32	2	0	0	0	0	0	0	34	34
08:00	26	4	3	0	0	0	0	0	33	37	12	1	0	0	0	0	0	0	13	13
08:15	38	1	1	0	0	0	0	0	40	41	32	0	1	0	2	0	0	0	35	38
08:30	37	1	1	0	1	1	0	0	41	43	37	3	0	0	0	0	0	0	40	40
08:45	24	11	1	0	0	0	0	0	36	37	37	4	1	0	0	0	0	0	42	43
H/TOT	125	17	6	0	1	1	0	0	150	159	118	8	2	0	2	0	0	0	130	135
09:00	20	3	1	0	0	0	0	0	24	25	33	1	0	0	0	0	0	0	34	34
09:15	19	3	2	0	0	0	0	0	24	27	12	1	0	0	0	0	0	0	13	13
09:30	14	2	3	0	1	0	0	0	20	25	7	1	1	0	0	0	0	0	9	10
09:45	17	3	2	0	0	0	0	0	22	25	14	0	1	0	0	0	0	0	15	16
H/TOT	70	11	8	0	1	0	0	0	90	101	66	3	2	0	0	0	0	0	71	74
3H/TOT	281	43	20	0	2	1	0	0	347	375	216	13	4	0	2	0	0	0	235	242
10:00	13	1	1	0	0	0	0	0	15	16	8	0	0	0	0	0	0	0	8	8
10:15	17	4	1	0	1	0	0	0	23	25	8	0	1	0	0	0	0	0	9	10
10:30	20	3	2	0	0	1	0	0	26	29	7	0	1	0	0	0	0	0	8	9
10:45	20	1	1	0	0	0	0	0	22	23	7	2	0	0	0	0	0	0	9	9
H/TOT	70	9	5	0	1	1	0	0	86	94	30	2	2	0	0	0	0	0	34	37
11:00	25	1	1	0	0	0	0	0	27	28	10	1	1	0	0	0	0	0	12	13
11:15	29	1	3	0	1	0	0	0	34	39	8	0	2	0	0	0	0	0	10	13
11:30	29	5	2	0	1	0	0	0	37	41	12	1	0	0	0	0	0	0	13	13
11:45	32	1	3	0	1	0	0	0	37	42	11	2	0	0	0	0	0	0	13	13
H/TOT	115	8	9	0	3	0	0	0	135	150	41	4	3	0	0	0	0	0	48	52
12:00	27	6	1	0	0	0	0	0	34	35	12	1	1	0	1	0	0	0	15	17
12:15	21	4	1	0	0	0	0	0	26	27	10	0	1	0	0	0	0	0	11	12
12:30	24	1	2	0	0	0	0	0	27	30	10	1	0	0	0	0	0	0	11	11
12:45	38	4	0	0	0	0	0	0	42	42	11	1	0	0	0	0	0	0	12	12
H/TOT	110	15	4	0	0	0	0	0	129	134	43	3	2	0	1	0	0	0	49	53
3H/TOT	295	32	18	0	4	1	0	0	350	377	114	9	7	0	1	0	0	0	131	141
13:00	28	4	3	0	1	0	0	0	36	41	10	0	2	0	0	0	0	0	12	15
13:15	27	3	2	0	0	0	0	0	32	35	11	2	0	0	0	0	0	0	13	13
13:30	29	1	1	0	1	0	0	0	32	34	12	2	1	0	0	0	0	0	15	16
13:45	33	0	2	0	0	0	0	0	35	38	16	1	0	0	0	0	0	0	17	17
H/TOT	117	8	8	0	2	0	0	0	135	147	49	5	3	0	0	0	0	0	57	61
14:00	32	4	0	0	0	0	0	0	36	36	15	2	0	0	0	0	0	0	17	17
14:15	19	2	1	0	0	0	0	0	22	23	11	2	0	0	0	0	0	0	13	13
14:30	37	2	0	0	0	0	0	0	39	39	14	3	0	0	0	0	0	0	17	17
14:45	36	4	3	0	0	1	0	0	44	48	18	0	1	0	0	0	0	0	19	20
H/TOT	124	12	4	0	0	1	0	0	141	146	58	7	1	0	0	0	0	0	66	67
15:00	18	6	1	0	0	0	0	0	25	26	18	0	0	0	0	0	0	0	18	18
15:15	29	5	0	0	1	0	0	0	35	36	7	1	1	0	0	0	0	0	9	10
15:30	37	4	0	0	1	1	0	0	43	44	18	1	0	0	0	0	0	0	19	19
15:45	40	4	2	0	1	0	0	0	47	51	7	5	1	0	0	0	0	0	13	14
H/TOT	124	19	3	0	3	1	0	0	150	157	50	7	2	0	0	0	0	0	59	62
3H/TOT	365	39	15	0	5	2	0	0	426	451	157	19	6	0	0	0	0	0	182	190
16:00	36	5	1	0	0	0	0	0	42	43	14	0	0	0	0	0	0	0	14	14
16:15	34	6	0	0	4	0	0	0	44	48	11	2	1	0	1	0	0	0	15	17
16:30	40	5	1	0	0	0	1	0	47	48	13	0	0	0	0	0	0	0	13	13
16:45	42	7	1	0	0	1	0	0	51	52	14	1	0	0	0	1	0	0	16	16
H/TOT	152	23	3	0	4	1	1	0	184	191	52	3	1	0	1	1	0	0	58	60
17:00	56	5	0	0	0	1	0	0	62	62	18	4	0	0	0	0	0	0	22	22
17:15	62	3	1	0	1	0	0	0	67	69	18	0	0	0	0	1	0	0	19	19
17:30	51	1	0	0	1	1	0	0	54	55	19	0	0	0	0	0	0	0	19	19
17:45	49	7	0	0	0	0	0	0	56	56	11	2	0	0	0	0	0	0	13	13
H/TOT	218	16	1	0	2	2	0	0	239	242	66	6	0	0	0	1	0	0	73	73
18:00	59	3	0	0	1	0	0	0	63	64	14	0	1	0	0	0	0	0	15	16
18:15	62	8	0	0	1	0	0	0	71	72	5	1	1	0	0	0	0	0	7	8
18:30	36	5	0	0	0	1	0	0	42	42	9	1	0	0	0	0	0	0	10	10
18:45	28	3	0	0	1	0	0	0	32	33	12	0	0	0	0	0	0	0	12	12
H/TOT	185	19	0	0	3	1	0	0	208	211	40	2	2	0	0	0	0	0	44	47
3H/TOT	555	58	4	0	9	4	1	0	631	645	158	11	3	0	1	2	0	0	175	180
P/TOT	1496	172	57	0	20	8	1	0	1754	1848	645	52	20	0	4	2	0	0	723	753

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

TIME	Car	LGV	HGV	C to C Dublin Bus	C to C Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0
08:30	1	0	0	0	0	0	0	0	1	1
08:45	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1
09:00	1	0	0	0	0	0	0	0	1	1
09:15	0	0	0	0	0	0	0	0	0	0
09:30	1	0	0	0	0	0	0	0	1	1
09:45	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	0	2	2
3H/TOT	3	0	0	0	0	0	0	0	3	3
10:00	0	0	0	0	0	0	0	0	0	0
10:15	1	0	0	0	0	0	0	0	1	1
10:30	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1
11:00	1	0	0	0	0	0	0	0	1	1
11:15	0	0	1	0	0	0	0	0	1	2
11:30	1	0	0	0	0	0	0	0	1	1
11:45	1	0	0	0	0	0	0	0	1	1
H/TOT	3	0	1	0	0	0	0	0	4	5
12:00	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
3H/TOT	4	0	1	0	0	0	0	0	5	6
13:00	0	0	0	0	0	0	0	0	0	0
13:15	1	0	0	0	0	0	0	0	1	1
13:30	1	0	0	0	0	0	0	0	1	1
13:45	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	0	2	2
14:00	0	0	0	0	0	0	0	0	0	0
14:15	1	0	0	0	0	0	0	0	1	1
14:30	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1
15:00	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
3H/TOT	3	0	0	0	0	0	0	0	3	3
16:00	0	0	0	0	0	0	0	0	0	0
16:15	0	1	0	0	0	0	0	0	1	1
16:30	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	0	0	0	0	0	0	1	1
17:00	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0
17:30	1	1	0	0	0	0	0	0	2	2
17:45	0	0	0	0	0	0	0	0	0	0
H/TOT	1	1	0	0	0	0	0	0	2	2
18:00	0	0	0	0	0	0	0	0	0	0
18:15	1	0	0	0	0	0	0	0	1	1
18:30	1	0	0	0	0	0	0	0	1	1
18:45	1	0	0	0	0	0	0	0	1	1
H/TOT	3	0	0	0	0	0	0	0	3	3
3H/TOT	4	2	0	0	0	0	0	0	6	6
P/TOT	14	2	1	0	0	0	0	0	17	18

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

TIME	TO ARM A									FROM ARM A								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	26	3	3	0	0	0	0	0	32	23	2	5	0	2	0	0	0	32
07:15	33	6	5	0	0	0	0	0	44	37	7	2	0	0	0	0	0	46
07:30	60	13	8	0	0	0	0	0	81	53	15	4	0	0	0	0	0	72
07:45	58	12	5	0	0	0	0	0	75	75	22	7	0	1	0	0	0	105
H/TOT	177	34	21	0	0	0	0	0	232	188	46	18	0	3	0	0	0	255
08:00	68	14	6	0	0	0	0	0	88	76	16	9	0	1	0	0	0	102
08:15	74	8	3	0	0	0	0	0	85	131	15	3	0	2	0	0	0	151
08:30	93	11	13	0	3	1	0	0	121	146	11	0	0	1	0	0	0	158
08:45	58	23	9	0	0	0	0	0	90	166	22	7	0	2	1	0	0	198
H/TOT	293	56	31	0	3	1	0	0	384	519	64	19	0	6	1	0	0	609
09:00	44	10	10	0	0	0	0	0	64	101	5	3	0	0	0	0	0	109
09:15	42	5	8	0	0	1	0	0	56	103	10	9	0	0	0	0	0	122
09:30	36	6	11	0	2	0	0	0	55	99	9	3	0	0	0	0	0	111
09:45	45	6	10	0	0	0	0	0	61	72	7	5	0	1	0	0	0	85
H/TOT	167	27	39	0	2	1	0	0	236	375	31	20	0	1	0	0	0	427
3H/TOT	637	117	91	0	5	2	0	0	852	1082	141	57	0	10	1	0	0	1291
10:00	29	8	8	0	0	0	0	0	45	47	13	5	0	0	0	0	0	65
10:15	30	6	6	0	1	0	0	0	43	51	11	10	0	0	0	0	0	72
10:30	39	12	7	0	0	1	0	0	59	44	9	6	0	0	0	0	0	59
10:45	44	6	4	0	0	1	0	0	55	50	9	10	0	1	1	0	0	71
H/TOT	142	32	25	0	1	2	0	0	202	192	42	31	0	1	1	0	0	267
11:00	46	3	5	0	0	0	0	0	54	41	15	10	0	2	0	0	0	68
11:15	53	4	8	0	1	1	0	0	67	54	6	8	0	0	0	0	0	68
11:30	46	7	8	0	1	0	0	0	62	46	7	10	0	0	0	1	0	64
11:45	53	6	6	0	1	0	0	0	66	47	4	16	0	0	1	0	0	68
H/TOT	198	20	27	0	3	1	0	0	249	188	32	44	0	2	1	1	0	268
12:00	45	8	5	0	0	0	0	0	58	46	8	11	0	0	0	0	0	65
12:15	47	11	6	0	0	0	0	0	64	42	10	9	0	0	0	0	0	61
12:30	41	8	10	0	0	0	0	0	59	42	7	6	0	2	0	0	0	57
12:45	66	9	7	0	0	0	0	0	82	39	5	2	0	0	0	0	0	46
H/TOT	199	36	28	0	0	0	0	0	263	169	30	28	0	2	0	0	0	229
3H/TOT	539	88	80	0	4	3	0	0	714	549	104	103	0	5	2	1	0	764
13:00	64	9	11	0	1	0	0	0	85	37	9	6	0	0	0	0	0	52
13:15	50	8	9	0	0	1	0	0	68	55	11	10	0	1	0	0	0	77
13:30	49	7	8	0	1	1	0	0	66	42	10	8	0	0	0	0	0	60
13:45	62	8	8	0	1	0	0	0	79	46	5	5	0	0	0	0	0	56
H/TOT	225	32	36	0	3	2	0	0	298	180	35	29	0	1	0	0	0	245
14:00	62	9	7	0	0	0	0	0	78	52	8	5	0	0	0	0	0	65
14:15	51	9	6	0	0	0	0	0	66	69	9	4	0	1	1	0	0	84
14:30	70	9	6	0	0	0	0	0	85	48	8	10	0	0	0	0	0	66
14:45	61	15	6	0	0	2	0	0	84	40	8	9	0	0	1	0	0	58
H/TOT	244	42	25	0	0	2	0	0	313	209	33	28	0	1	2	0	0	273
15:00	49	13	9	0	0	0	0	0	71	55	12	9	0	0	0	0	0	76
15:15	62	8	6	0	1	0	0	0	77	54	7	10	0	1	0	0	0	72
15:30	74	12	4	0	1	1	0	0	92	50	13	5	0	1	0	0	0	69
15:45	64	9	11	0	2	0	0	0	86	61	5	8	0	1	0	0	0	75
H/TOT	249	42	30	0	4	1	0	0	326	220	37	32	0	3	0	0	0	292
3H/TOT	718	116	91	0	7	5	0	0	937	609	105	89	0	5	2	0	0	810
16:00	75	15	3	0	1	0	0	0	94	58	10	4	0	0	0	0	0	72
16:15	93	18	2	0	4	0	0	0	117	56	10	6	0	1	0	0	0	73
16:30	77	18	6	0	0	0	2	0	103	59	7	2	0	0	0	0	0	68
16:45	90	16	8	0	0	1	0	0	115	55	12	2	0	0	1	0	0	70
H/TOT	335	67	19	0	5	1	2	0	429	228	39	14	0	1	1	0	0	283
17:00	113	17	7	0	1	1	0	0	139	55	11	6	0	1	0	0	0	73
17:15	134	11	4	0	2	1	0	0	152	90	22	5	0	0	0	0	0	117
17:30	116	13	4	0	1	1	0	0	135	59	14	0	0	0	0	0	0	73
17:45	112	14	4	0	0	0	0	0	130	73	12	4	0	1	0	0	0	90
H/TOT	475	55	19	0	4	3	0	0	556	277	59	15	0	2	0	0	0	353
18:00	108	8	2	0	1	0	0	1	120	89	6	2	0	0	0	0	0	97
18:15	108	14	3	0	1	0	0	0	126	73	6	1	0	0	0	0	0	80
18:30	69	11	4	0	0	1	0	0	85	70	4	3	0	1	0	0	0	78
18:45	59	10	1	0	1	0	0	0	71	62	6	1	0	1	0	0	0	70
H/TOT	344	43	10	0	3	1	0	1	402	294	22	7	0	2	0	0	0	325
3H/TOT	1154	165	48	0	12	5	2	1	1387	799	120	36	0	5	1	0	0	961
P/TOT	3048	486	310	0	28	15	2	1	3890	3039	470	285	0	25	6	1	0	3826

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

TIME	TO ARM B									FROM ARM B								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	20	2	5	0	2	0	0	0	29	16	1	2	0	0	0	0	1	20
07:15	26	4	2	0	0	0	0	0	32	18	4	5	0	0	0	0	0	27
07:30	35	9	4	0	0	0	0	0	48	34	8	4	0	0	0	0	0	46
07:45	47	14	5	0	1	0	0	0	67	28	6	4	0	0	0	0	0	38
H/TOT	128	29	16	0	3	0	0	0	176	96	19	15	0	0	0	0	1	131
08:00	45	8	7	0	0	0	0	0	60	51	11	3	0	0	0	0	0	65
08:15	104	12	4	0	2	0	0	0	122	58	8	4	0	1	0	0	0	71
08:30	132	11	0	0	0	0	0	0	143	94	11	12	0	3	0	0	0	120
08:45	127	22	8	0	0	0	0	0	157	59	14	8	0	0	0	0	0	81
H/TOT	408	53	19	0	2	0	0	0	482	262	44	27	0	4	0	0	0	337
09:00	76	4	3	0	0	0	0	0	83	43	9	9	0	0	0	0	0	61
09:15	59	7	6	0	0	0	0	0	72	33	2	7	0	0	1	0	0	43
09:30	53	6	2	0	0	0	0	0	61	30	6	8	0	1	0	0	0	45
09:45	47	5	6	0	0	0	0	0	58	34	4	9	0	0	0	0	0	47
H/TOT	235	22	17	0	0	0	0	0	274	140	21	33	0	1	1	0	0	196
3H/TOT	771	104	52	0	5	0	0	0	932	498	84	75	0	5	1	0	1	664
10:00	34	8	5	0	0	1	0	0	48	25	8	11	0	1	1	0	0	46
10:15	32	6	8	0	0	0	0	0	46	25	2	5	0	0	1	0	0	33
10:30	25	6	5	0	0	0	0	0	36	24	13	5	0	0	0	0	0	42
10:45	37	7	8	0	0	0	0	0	52	35	7	4	0	0	1	0	0	47
H/TOT	128	27	26	0	0	1	0	0	182	109	30	25	0	1	3	0	0	168
11:00	25	11	8	0	1	0	0	0	45	31	2	4	0	0	0	0	0	37
11:15	30	2	8	0	0	0	0	0	40	32	4	5	0	0	1	0	0	42
11:30	34	4	7	0	0	0	0	0	45	28	5	6	0	0	0	0	0	39
11:45	33	2	16	0	0	0	0	0	51	30	7	4	0	0	0	0	0	41
H/TOT	122	19	39	0	1	0	0	0	181	121	18	19	0	0	1	0	0	159
12:00	31	5	9	0	1	0	0	0	46	25	3	5	0	0	0	0	0	33
12:15	24	5	7	0	0	0	0	0	36	40	9	5	0	0	0	0	0	54
12:30	27	5	6	0	0	0	0	0	38	26	6	9	0	1	0	0	0	42
12:45	31	4	1	0	0	0	0	0	36	42	5	7	0	0	0	0	0	54
H/TOT	113	19	23	0	1	0	0	0	156	133	23	26	0	1	0	0	0	183
3H/TOT	363	65	88	0	2	1	0	0	519	363	71	70	0	2	4	0	0	510
13:00	26	8	5	0	0	0	0	0	39	55	10	8	0	0	0	0	0	73
13:15	41	8	10	0	0	0	0	0	59	33	9	7	0	0	1	0	0	50
13:30	30	7	5	0	0	0	0	0	42	27	7	7	0	0	1	0	0	42
13:45	40	5	5	0	0	0	0	0	50	38	10	6	0	1	0	0	0	55
H/TOT	137	28	25	0	0	0	0	0	190	153	36	28	0	1	2	0	0	220
14:00	40	6	5	0	0	0	0	0	51	40	7	7	0	0	0	0	0	54
14:15	39	6	3	0	1	1	0	0	50	41	7	5	0	0	1	0	0	54
14:30	31	9	6	0	0	0	0	0	46	50	10	6	0	0	0	0	0	66
14:45	41	6	8	0	0	0	0	0	55	33	11	4	0	0	1	0	0	49
H/TOT	151	27	22	0	1	1	0	0	202	164	35	22	0	0	2	0	0	223
15:00	39	8	9	0	0	0	0	0	56	49	10	8	0	0	0	0	0	67
15:15	37	3	8	0	0	0	0	0	48	57	6	6	0	0	0	0	0	69
15:30	43	9	5	0	0	0	0	0	57	57	13	4	0	0	0	0	0	74
15:45	40	9	7	0	0	0	0	0	56	37	8	10	0	2	0	0	0	57
H/TOT	159	29	29	0	0	0	0	0	217	200	37	28	0	2	0	0	0	267
3H/TOT	447	84	76	0	1	1	0	0	609	517	108	78	0	3	4	0	0	710
16:00	45	6	3	0	0	0	0	0	54	60	11	2	0	2	0	0	0	75
16:15	35	10	5	0	1	0	0	0	51	79	15	2	0	0	0	0	0	96
16:30	44	6	2	0	0	0	0	0	52	58	13	5	0	0	0	1	0	77
16:45	43	9	1	0	0	1	0	0	54	73	15	7	0	0	0	0	0	95
H/TOT	167	31	11	0	1	1	0	0	211	270	54	16	0	2	0	1	0	343
17:00	51	11	4	0	1	0	0	0	67	88	13	7	0	1	0	0	0	109
17:15	67	16	3	0	0	1	0	0	87	102	8	3	0	1	1	0	1	116
17:30	59	7	0	0	0	0	0	0	66	96	13	4	0	0	0	0	0	113
17:45	53	10	4	0	0	0	0	0	67	96	8	4	0	0	0	0	0	108
H/TOT	230	44	11	0	1	1	0	0	287	382	42	18	0	2	1	0	1	446
18:00	66	4	2	0	0	0	0	0	72	76	5	2	0	0	0	0	1	84
18:15	44	4	2	0	0	0	0	0	50	73	6	3	0	0	0	0	0	82
18:30	43	3	3	0	1	0	0	1	51	56	8	4	0	0	0	0	3	71
18:45	43	4	1	0	0	0	0	0	48	52	7	1	0	0	0	0	0	60
H/TOT	196	15	8	0	1	0	0	1	221	257	26	10	0	0	0	0	4	297
3H/TOT	593	90	30	0	3	2	0	1	719	909	122	44	0	4	1	1	5	1086
P/TOT	2174	343	246	0	11	4	0	1	2779	2287	385	267	0	14	10	1	6	2970

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: N77/ Castlecomer Road

TIME	TO ARM C									FROM ARM C								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	8	0	0	0	0	0	0	1	9	15	2	1	0	0	0	0	0	18
07:15	19	3	0	0	0	0	0	0	22	23	2	0	0	0	0	0	0	25
07:30	25	6	0	0	0	0	0	0	31	33	5	4	0	0	0	0	0	42
07:45	45	10	2	0	0	0	0	0	57	47	8	1	0	0	0	0	0	56
H/TOT	97	19	2	0	0	0	0	1	119	118	17	6	0	0	0	0	0	141
08:00	52	10	2	0	1	0	0	0	65	38	5	3	0	0	0	0	0	46
08:15	81	4	2	0	3	0	0	0	90	70	1	2	0	2	0	0	0	75
08:30	90	4	0	0	2	0	0	0	96	75	4	1	0	1	1	0	0	82
08:45	101	6	0	0	2	1	0	0	110	61	15	2	0	0	0	0	0	78
H/TOT	324	24	4	0	8	1	0	0	361	244	25	8	0	3	1	0	0	281
09:00	78	4	0	0	0	0	0	0	82	54	4	1	0	0	0	0	0	59
09:15	66	4	4	0	0	0	0	0	74	31	4	2	0	0	0	0	0	37
09:30	62	6	2	0	0	0	0	0	70	22	3	4	0	1	0	0	0	30
09:45	45	3	1	0	1	0	0	0	50	31	3	3	0	0	0	0	0	37
H/TOT	251	17	7	0	1	0	0	0	276	138	14	10	0	1	0	0	0	163
3H/TOT	672	60	13	0	9	1	0	1	756	500	56	24	0	4	1	0	0	585
10:00	30	6	4	0	1	0	0	0	41	21	1	1	0	0	0	0	0	23
10:15	40	5	3	0	0	1	0	0	49	26	4	2	0	1	0	0	0	33
10:30	31	7	2	0	0	0	0	0	40	27	3	3	0	0	1	0	0	34
10:45	31	6	3	0	1	1	0	0	42	27	3	1	0	0	0	0	0	31
H/TOT	132	24	12	0	2	2	0	0	172	101	11	7	0	1	1	0	0	121
11:00	37	5	3	0	1	0	0	0	46	36	2	2	0	0	0	0	0	40
11:15	40	5	3	0	0	0	0	0	48	37	1	6	0	1	0	0	0	45
11:30	36	7	3	0	0	0	1	0	47	42	6	2	0	1	0	0	0	51
11:45	35	6	1	0	0	1	0	0	43	44	3	3	0	1	0	0	0	51
H/TOT	148	23	10	0	1	1	1	0	184	159	12	13	0	3	0	0	0	187
12:00	34	5	4	0	0	0	0	0	43	39	7	2	0	1	0	0	0	49
12:15	42	7	3	0	0	0	0	0	52	31	4	2	0	0	0	0	0	37
12:30	34	2	1	0	3	0	0	0	40	34	2	2	0	0	0	0	0	38
12:45	33	2	1	0	0	0	0	0	36	49	5	0	0	0	0	0	0	54
H/TOT	143	16	9	0	3	0	0	0	171	153	18	6	0	1	0	0	0	178
3H/TOT	423	63	31	0	6	3	1	0	527	413	41	26	0	5	1	0	0	486
13:00	40	6	3	0	0	0	0	0	49	38	4	5	0	1	0	0	0	48
13:15	36	9	0	0	1	0	0	0	46	39	5	2	0	0	0	0	0	46
13:30	32	6	4	0	0	0	0	0	42	42	3	2	0	1	0	0	0	48
13:45	31	3	0	0	0	0	0	0	34	49	1	2	0	0	0	0	0	52
H/TOT	139	24	7	0	1	0	0	0	171	168	13	11	0	2	0	0	0	194
14:00	37	6	0	0	0	0	0	0	43	47	6	0	0	0	0	0	0	53
14:15	51	5	1	0	0	1	0	0	58	31	4	1	0	0	0	0	0	36
14:30	48	5	4	0	0	0	0	0	57	51	5	0	0	0	0	0	0	56
14:45	25	2	3	0	0	1	0	0	31	54	4	4	0	0	1	0	0	63
H/TOT	161	18	8	0	0	2	0	0	189	183	19	5	0	0	1	0	0	208
15:00	52	7	0	0	0	0	0	0	59	36	6	1	0	0	0	0	0	43
15:15	48	8	3	0	1	0	0	0	60	36	6	1	0	1	0	0	0	44
15:30	45	10	0	0	1	0	0	0	56	55	5	0	0	1	1	0	0	62
15:45	41	4	3	0	2	0	0	0	50	47	9	3	0	1	0	0	0	60
H/TOT	186	29	6	0	4	0	0	0	225	174	26	5	0	3	1	0	0	209
3H/TOT	486	71	21	0	5	2	0	0	585	525	58	21	0	5	2	0	0	611
16:00	48	5	1	0	1	0	0	0	55	50	5	1	0	0	0	0	0	56
16:15	52	6	2	0	1	0	0	0	61	45	9	1	0	5	0	0	0	60
16:30	49	1	0	0	0	0	0	0	50	53	5	1	0	0	0	1	0	60
16:45	51	10	1	0	0	1	0	0	63	56	8	1	0	0	2	0	0	67
H/TOT	200	22	4	0	2	1	0	0	229	204	27	4	0	5	2	1	0	243
17:00	53	5	2	0	0	0	0	0	60	74	9	0	0	0	1	0	0	84
17:15	71	6	2	0	0	0	0	1	80	80	3	1	0	1	1	0	0	86
17:30	51	9	0	0	0	0	0	0	60	71	2	0	0	1	1	0	0	75
17:45	64	5	0	0	1	0	0	0	70	60	9	0	0	0	0	0	0	69
H/TOT	239	25	4	0	1	0	0	1	270	285	23	1	0	2	3	0	0	314
18:00	64	2	1	0	0	0	0	0	67	73	3	1	0	1	0	0	0	78
18:15	62	3	0	0	0	0	0	0	65	68	9	1	0	1	0	0	0	79
18:30	60	4	0	0	0	0	0	2	66	46	6	0	0	0	1	0	0	53
18:45	53	2	0	0	1	0	0	0	56	41	3	0	0	1	0	0	0	45
H/TOT	239	11	1	0	1	0	0	2	254	228	21	2	0	3	1	0	0	255
3H/TOT	678	58	9	0	4	1	0	3	753	717	71	7	0	10	6	1	0	812
P/TOT	2259	252	74	0	24	7	1	4	2621	2155	226	78	0	24	10	1	0	2494

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	A to B										A to C									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0	8	3	0	0	0	0	0	0	11	11
07:15	0	0	0	0	0	0	0	0	0	0	23	3	1	0	0	0	0	0	27	28
07:30	0	0	0	0	0	0	0	0	0	0	31	4	0	0	0	0	0	0	35	35
07:45	0	0	0	0	0	0	0	0	0	0	26	7	3	0	0	0	0	0	36	40
H/TOT	0	0	0	0	0	0	0	0	0	0	88	17	4	0	0	0	0	0	109	114
08:00	3	0	0	0	0	0	0	0	3	3	39	5	0	0	0	0	0	0	44	44
08:15	5	0	0	0	0	0	0	0	5	5	67	7	2	0	2	0	0	0	78	83
08:30	2	0	0	0	0	0	0	0	2	2	84	2	2	0	1	0	0	0	89	93
08:45	2	0	0	0	0	0	0	0	2	2	89	5	0	0	4	1	0	0	99	103
H/TOT	12	0	0	0	0	0	0	0	12	12	279	19	4	0	7	1	0	0	310	322
09:00	1	0	0	0	0	0	0	0	1	1	66	1	1	0	0	1	0	0	69	70
09:15	0	0	0	0	0	0	0	0	0	0	64	2	3	0	0	0	0	0	69	73
09:30	0	0	0	0	0	0	0	0	0	0	32	6	3	0	0	0	0	0	41	45
09:45	0	0	0	0	0	0	0	0	0	0	40	1	0	0	1	0	0	0	42	43
H/TOT	1	0	0	0	0	0	0	0	1	1	202	10	7	0	1	1	0	0	221	231
3H/TOT	13	0	0	0	0	0	0	0	13	13	569	46	15	0	8	2	0	0	640	668
10:00	0	0	0	0	0	0	0	0	0	0	25	5	0	0	0	0	0	0	30	30
10:15	0	0	0	0	0	0	0	0	0	0	49	4	1	0	1	0	0	0	55	57
10:30	1	0	0	0	0	0	0	0	1	1	40	4	1	0	0	0	0	0	45	46
10:45	0	0	0	0	0	0	0	0	0	0	27	7	2	0	0	0	0	1	37	39
H/TOT	1	0	0	0	0	0	0	0	1	1	141	20	4	0	1	0	0	1	167	172
11:00	0	0	0	0	0	0	0	1	1	0	38	7	1	0	1	0	0	0	47	49
11:15	0	0	0	0	0	0	0	0	0	0	41	3	2	0	0	0	0	0	46	49
11:30	0	0	0	0	0	0	0	0	0	0	25	5	1	0	0	0	1	0	32	33
11:45	0	0	0	0	0	0	0	0	0	0	34	1	1	0	0	0	0	1	37	38
H/TOT	0	0	0	0	0	0	0	1	1	0	138	16	5	0	1	0	1	1	162	168
12:00	1	0	0	0	0	0	0	0	1	1	32	3	2	0	1	0	0	0	38	42
12:15	0	0	0	0	0	0	0	0	0	0	37	4	1	0	1	0	0	0	43	45
12:30	0	0	0	0	0	0	0	0	0	0	30	1	0	0	1	0	0	1	33	33
12:45	0	0	0	0	0	0	0	0	0	0	30	1	1	0	1	1	0	0	34	36
H/TOT	1	0	0	0	0	0	0	0	1	1	129	9	4	0	4	1	0	1	148	156
3H/TOT	2	0	0	0	0	0	0	1	3	2	408	45	13	0	6	1	1	3	477	497
13:00	0	0	0	0	0	0	0	0	0	0	21	3	0	0	0	0	0	0	24	24
13:15	1	0	0	0	0	0	0	0	1	1	33	5	1	0	0	1	0	1	41	42
13:30	0	2	0	0	0	0	0	0	2	2	37	5	0	0	1	0	0	0	43	44
13:45	1	0	0	0	0	0	0	0	1	1	47	4	0	0	1	0	0	0	52	53
H/TOT	2	2	0	0	0	0	0	0	4	4	138	17	1	0	2	1	0	1	160	163
14:00	0	0	0	0	0	0	0	0	0	0	37	6	1	0	0	0	0	0	44	45
14:15	0	0	0	0	0	0	0	0	0	0	47	3	1	0	0	1	0	0	52	53
14:30	0	0	0	0	0	0	0	0	0	0	36	7	0	0	4	0	0	1	48	51
14:45	0	0	0	0	0	0	0	0	0	0	41	3	0	0	1	1	0	0	46	47
H/TOT	0	0	0	0	0	0	0	0	0	0	161	19	2	0	5	2	0	1	190	197
15:00	1	0	0	0	0	0	0	0	1	1	40	6	0	0	0	1	0	0	47	47
15:15	0	0	0	0	0	0	0	0	0	0	33	2	1	0	2	1	0	0	39	42
15:30	0	0	0	0	0	0	0	0	0	0	64	4	0	0	2	0	0	0	70	72
15:45	0	0	0	0	0	0	0	0	0	0	42	3	1	0	2	2	0	0	50	53
H/TOT	1	0	0	0	0	0	0	0	1	1	179	15	2	0	6	4	0	0	206	215
3H/TOT	3	2	0	0	0	0	0	0	5	5	478	51	5	0	13	7	0	2	556	574
16:00	1	0	0	0	0	0	0	0	1	1	49	1	1	0	1	1	1	0	54	56
16:15	0	0	0	0	0	0	0	0	0	0	38	5	1	0	1	0	0	0	45	47
16:30	0	0	0	0	0	0	0	0	0	0	33	3	1	0	0	0	0	0	37	38
16:45	0	0	0	0	0	0	0	0	0	0	27	3	1	0	0	2	0	0	33	34
H/TOT	1	0	0	0	0	0	0	0	1	1	147	12	4	0	2	3	1	0	169	176
17:00	0	0	0	0	0	0	0	0	0	0	33	4	1	0	0	0	0	0	38	39
17:15	0	0	0	0	0	0	0	0	0	0	43	4	1	0	0	1	0	0	49	50
17:30	0	0	0	0	0	0	0	0	0	0	46	4	0	0	0	0	0	0	50	50
17:45	1	0	0	0	0	0	0	0	1	1	27	2	0	0	1	0	0	0	30	31
H/TOT	1	0	0	0	0	0	0	0	1	1	149	14	2	0	1	1	0	0	167	171
18:00	0	0	0	0	0	0	0	0	0	0	39	2	0	0	0	0	0	0	41	41
18:15	0	0	0	0	0	0	0	0	0	0	41	1	1	0	0	0	0	0	43	44
18:30	0	0	0	0	0	0	0	0	0	0	47	1	0	0	0	0	0	0	48	48
18:45	0	0	0	0	0	0	0	0	0	0	38	3	0	0	0	0	0	0	41	41
H/TOT	0	0	0	0	0	0	0	0	0	0	165	7	1	0	0	0	0	0	173	174
3H/TOT	2	0	0	0	0	0	0	0	2	2	461	33	7	0	3	4	1	0	509	521
P/TOT	20	2	0	0	0	0	0	1	23	22	1916	175	40	0	30	14	2	5	2182	2259

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	A to D										A to A									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	6	0	0	0	0	0	0	1	7	6	0	0	0	0	0	0	0	0	0	0
07:15	16	3	1	0	0	0	0	1	21	22	0	0	0	0	0	0	0	0	0	0
07:30	32	5	0	0	0	0	0	0	37	37	1	0	0	0	0	0	0	0	1	1
07:45	53	5	1	0	0	0	0	0	59	60	0	0	0	0	0	0	0	0	0	0
H/TOT	107	13	2	0	0	0	0	2	124	125	1	0	0	0	0	0	0	0	1	1
08:00	54	8	1	0	1	0	0	0	64	66	0	0	0	0	0	0	0	0	0	0
08:15	101	9	2	0	3	0	0	0	115	121	0	0	0	0	0	0	0	0	0	0
08:30	84	3	0	0	0	0	0	0	87	87	0	0	0	0	0	0	0	0	0	0
08:45	61	1	0	0	0	0	0	1	63	62	0	0	0	0	0	0	0	0	0	0
H/TOT	300	21	3	0	4	0	0	1	329	336	0	0	0	0	0	0	0	0	0	0
09:00	88	8	0	0	1	0	0	0	97	98	1	0	0	0	0	0	0	0	1	1
09:15	67	6	2	0	0	0	0	1	76	78	0	0	0	0	0	0	0	0	0	0
09:30	52	5	0	0	0	0	0	1	58	57	0	0	0	0	0	0	0	0	0	0
09:45	46	8	1	0	0	0	1	0	56	57	1	0	0	0	0	0	0	0	1	1
H/TOT	253	27	3	0	1	0	1	2	287	290	2	0	0	0	0	0	0	0	2	2
3H/TOT	660	61	8	0	5	0	1	5	740	751	3	0	0	0	0	0	0	0	3	3
10:00	36	9	3	0	1	1	0	0	50	55	0	0	0	0	0	0	0	0	0	0
10:15	29	3	0	0	0	0	0	0	32	32	0	0	0	0	0	0	0	0	0	0
10:30	38	4	3	0	0	1	0	0	46	50	0	0	0	0	0	0	0	0	0	0
10:45	29	8	3	0	0	0	0	0	40	44	0	0	0	0	0	0	0	0	0	0
H/TOT	132	24	9	0	1	2	0	0	168	181	0	0	0	0	0	0	0	0	0	0
11:00	36	4	2	0	0	2	0	0	44	47	0	0	0	0	0	0	0	0	0	0
11:15	41	2	4	0	0	0	0	0	47	52	2	0	0	0	0	0	0	0	2	2
11:30	40	5	1	0	0	0	0	0	46	47	1	0	1	0	0	0	0	0	2	3
11:45	37	5	2	0	0	2	0	0	46	49	0	0	0	0	0	0	0	0	0	0
H/TOT	154	16	9	0	0	4	0	0	183	195	3	0	1	0	0	0	0	0	4	5
12:00	38	6	2	0	0	0	0	0	46	49	0	0	0	0	0	0	0	0	0	0
12:15	49	8	2	0	0	1	0	0	60	63	0	0	0	0	0	0	0	0	0	0
12:30	48	4	0	0	0	1	0	0	53	53	0	0	0	0	0	0	0	0	0	0
12:45	43	4	3	0	0	1	0	0	51	55	0	0	0	0	0	0	0	0	0	0
H/TOT	178	22	7	0	0	3	0	0	210	219	0	0	0	0	0	0	0	0	0	0
3H/TOT	464	62	25	0	1	9	0	0	561	595	3	0	1	0	0	0	0	0	4	5
13:00	42	4	1	0	0	2	0	0	49	50	0	0	0	0	0	0	0	0	0	0
13:15	58	4	2	0	0	1	0	0	65	68	2	0	0	0	0	0	0	0	2	2
13:30	62	7	3	0	0	2	0	0	74	78	0	0	0	0	0	0	0	0	0	0
13:45	71	6	0	0	0	0	0	0	77	77	0	0	0	0	0	0	0	0	0	0
H/TOT	233	21	6	0	0	5	0	0	265	273	2	0	0	0	0	0	0	0	2	2
14:00	52	4	0	0	1	1	0	0	58	59	0	0	0	0	0	0	0	0	0	0
14:15	80	6	2	0	1	0	0	1	90	93	1	0	0	0	0	0	0	0	1	1
14:30	55	8	5	0	0	1	0	0	69	76	0	0	0	0	0	0	0	0	0	0
14:45	52	2	4	0	0	1	0	0	59	64	1	0	0	0	0	0	0	0	1	1
H/TOT	239	20	11	0	2	3	0	1	276	292	2	0	0	0	0	0	0	0	2	2
15:00	53	6	1	0	0	0	0	0	60	61	0	0	0	0	0	0	0	0	0	0
15:15	48	7	2	0	0	1	0	0	58	61	0	0	0	0	0	0	0	0	0	0
15:30	61	7	0	0	1	1	0	0	70	71	0	0	0	0	0	0	0	0	0	0
15:45	68	7	2	0	0	3	0	0	80	83	0	0	0	0	0	0	0	0	0	0
H/TOT	230	27	5	0	1	5	0	0	268	276	0	0	0	0	0	0	0	0	0	0
3H/TOT	702	68	22	0	3	13	0	1	809	840	4	0	0	0	0	0	0	0	4	4
16:00	35	4	0	0	0	1	0	0	40	40	0	0	0	0	0	0	0	0	0	0
16:15	41	8	2	0	1	1	0	0	53	57	0	0	0	0	0	0	0	0	0	0
16:30	55	2	0	0	0	1	0	0	58	58	0	0	0	0	0	0	0	0	0	0
16:45	58	8	1	0	0	1	0	0	68	69	0	0	0	0	0	0	0	0	0	0
H/TOT	189	22	3	0	1	4	0	0	219	224	0	0	0	0	0	0	0	0	0	0
17:00	45	3	1	0	0	1	0	0	50	51	0	0	0	0	0	0	0	0	0	0
17:15	62	6	1	0	0	0	0	0	69	70	0	0	0	0	0	0	0	0	0	0
17:30	52	5	0	0	1	0	0	0	58	59	0	0	0	0	0	0	0	0	0	0
17:45	47	7	0	0	0	0	0	0	54	54	0	0	0	0	0	0	0	0	0	0
H/TOT	206	21	2	0	1	1	0	0	231	235	0	0	0	0	0	0	0	0	0	0
18:00	48	4	0	0	0	0	0	0	52	52	0	0	0	0	0	0	0	0	0	0
18:15	40	1	0	0	0	0	0	0	41	41	0	0	0	0	0	0	0	0	0	0
18:30	42	3	0	0	0	0	0	2	47	45	0	0	0	0	0	0	0	0	0	0
18:45	34	5	0	0	0	0	0	0	39	39	0	0	0	0	0	0	0	0	0	0
H/TOT	164	13	0	0	0	0	0	2	179	177	0	0	0	0	0	0	0	0	0	0
3H/TOT	559	56	5	0	2	5	0	2	629	636	0	0	0	0	0	0	0	0	0	0
P/TOT	2385	247	60	0	11	27	1	8	2739	2821	10	0	1	0	0	0	0	0	11	12

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	B to C										B to D									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	1
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
08:45	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	6	6	1
09:00	4	0	0	0	0	0	0	0	4	4	2	0	0	0	0	0	0	0	2	2
09:15	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	1	1	0
09:30	5	0	1	0	0	0	0	0	6	7	3	0	0	0	0	0	0	0	3	3
09:45	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0
H/TOT	12	0	1	0	0	0	0	0	13	14	5	0	0	0	0	0	0	2	7	5
3H/TOT	13	0	1	0	0	0	0	0	14	15	5	0	0	0	0	0	0	8	13	7
10:00	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
10:15	3	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
10:30	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1
10:45	3	0	2	0	0	0	0	0	5	8	3	0	0	0	0	0	0	0	3	3
H/TOT	7	0	3	0	0	0	0	0	10	14	4	0	0	0	0	0	0	0	4	4
11:00	4	1	0	0	0	0	0	0	5	5	5	0	0	0	0	0	0	0	5	5
11:15	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
11:30	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	2
11:45	1	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	2	2
H/TOT	5	1	0	0	0	0	0	0	6	6	10	0	0	0	0	0	0	0	10	10
12:00	4	1	0	0	0	0	0	0	5	5	3	0	0	1	0	0	0	0	4	5
12:15	6	1	0	0	0	0	0	0	7	7	1	0	0	0	0	0	0	0	1	1
12:30	13	0	0	0	0	0	1	0	14	13	4	0	0	0	0	0	0	0	4	4
12:45	6	0	0	0	0	0	0	0	6	6	3	1	0	0	0	0	0	0	4	4
H/TOT	29	2	0	0	0	0	1	0	32	31	11	1	0	1	0	0	0	0	13	14
3H/TOT	41	3	3	0	0	0	1	0	48	51	25	1	0	1	0	0	0	0	27	28
13:00	4	0	0	0	0	0	0	0	4	4	2	1	0	0	0	0	0	0	3	3
13:15	1	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	2	2
13:30	2	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0	1	4	3
13:45	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	1
H/TOT	7	1	0	0	0	0	0	0	8	8	7	2	0	0	0	0	0	1	10	9
14:00	2	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	2	2
14:15	4	0	0	0	0	0	0	0	4	4	2	0	0	0	0	0	0	0	2	2
14:30	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
14:45	2	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0	0	3	3
H/TOT	9	0	0	0	0	0	0	0	9	9	7	0	0	0	0	0	0	0	7	7
15:00	1	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
15:15	1	1	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	1	1
15:30	4	0	0	0	0	0	0	0	4	4	1	0	0	0	0	0	0	0	1	1
15:45	2	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0	0	3	3
H/TOT	8	2	0	0	0	0	0	0	10	10	5	0	0	0	0	0	0	0	5	5
3H/TOT	24	3	0	0	0	0	0	0	27	27	19	2	0	0	0	0	0	1	22	21
16:00	4	0	0	0	0	0	0	0	4	4	1	0	0	0	0	0	0	0	1	1
16:15	6	1	0	0	0	0	0	0	7	7	3	0	0	0	0	0	0	0	3	3
16:30	16	0	0	0	0	0	0	0	16	16	8	0	0	0	0	0	0	1	9	8
16:45	4	1	0	0	0	0	0	0	5	5	3	1	0	0	0	0	0	0	4	4
H/TOT	30	2	0	0	0	0	0	0	32	32	15	1	0	0	0	0	0	1	17	16
17:00	4	0	0	0	0	0	0	0	4	4	2	0	1	0	0	0	0	0	3	4
17:15	1	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	5	1	0	0	0	0	0	0	6	6	2	0	1	0	0	0	0	0	3	4
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
3H/TOT	35	3	0	0	0	0	0	0	38	38	17	1	1	0	0	0	0	3	22	21
P/TOT	113	9	4	0	0	0	1	0	127	132	66	4	1	1	0	0	0	12	84	77

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

TIME	B to A Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	B to B Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3H/TOT	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
12:30	2	0	0	0	0	0	0	1	3	2	0	0	0	0	0	0	0	0	0	0
12:45	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
H/TOT	6	0	0	0	0	0	0	1	7	6	0	0	0	0	0	0	0	0	0	0
3H/TOT	7	1	0	0	0	0	0	1	9	8	0	0	0	0	0	0	0	0	0	0
13:00	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
15:00	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
15:15	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
15:30	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
15:45	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
H/TOT	5	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0
3H/TOT	8	0	0	0	0	0	0	0	8	8	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	4	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0
16:30	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	6	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3H/TOT	6	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	0	0
P/TOT	21	1	0	0	0	0	0	2	24	22	0	0	0	0	0	0	0	0	0	0

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	C to D										C to A									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	9	0	1	0	1	0	0	0	11	13	10	2	0	0	0	0	0	0	12	12
07:15	12	0	2	0	0	0	0	0	14	17	15	4	1	0	0	0	0	0	20	21
07:30	15	2	2	0	0	0	0	0	19	22	15	3	2	0	0	0	0	0	20	23
07:45	43	1	5	0	0	0	0	0	49	56	20	3	2	0	0	3	0	0	28	31
H/TOT	79	3	10	0	1	0	0	0	93	107	60	12	5	0	0	3	0	0	80	87
08:00	32	3	3	0	1	0	0	0	39	44	28	0	4	0	1	0	0	0	33	39
08:15	52	3	5	0	0	1	0	0	61	68	52	4	0	0	1	2	0	0	59	60
08:30	32	2	2	0	1	0	0	0	37	41	40	2	2	0	1	1	0	0	46	50
08:45	32	3	5	0	0	3	0	0	43	50	22	6	0	0	0	0	0	0	28	28
H/TOT	148	11	15	0	2	4	0	0	180	202	142	12	6	0	3	3	0	0	166	177
09:00	35	6	3	0	0	1	0	0	45	49	42	2	2	0	3	0	0	0	49	55
09:15	31	9	2	0	0	0	0	0	42	45	26	5	1	0	1	0	0	0	33	35
09:30	29	5	4	0	1	1	0	0	40	46	27	5	0	0	3	0	0	0	35	38
09:45	42	4	1	0	0	0	0	0	47	48	23	4	3	0	0	1	0	0	31	35
H/TOT	137	24	10	0	1	2	0	0	174	188	118	16	6	0	7	1	0	0	148	163
3H/TOT	364	38	35	0	4	6	0	0	447	497	320	40	17	0	10	7	0	0	394	426
10:00	34	6	2	0	1	1	0	0	44	48	15	1	2	0	0	0	0	0	18	21
10:15	40	6	0	0	0	1	0	0	47	47	25	5	1	0	2	0	0	0	33	36
10:30	41	7	4	0	0	2	0	0	54	59	28	3	2	0	0	0	0	0	33	36
10:45	27	8	3	0	0	0	0	0	38	42	25	5	2	0	0	0	0	0	32	35
H/TOT	142	27	9	0	1	4	0	0	183	196	93	14	7	0	2	0	0	0	116	127
11:00	27	9	2	0	0	1	0	0	39	42	27	2	0	0	1	0	0	0	30	31
11:15	47	7	4	0	0	0	0	0	58	63	25	1	4	0	1	0	0	0	31	37
11:30	36	6	7	0	0	1	0	0	50	59	38	5	2	0	1	1	0	0	47	51
11:45	41	8	5	0	2	2	0	0	58	67	27	2	1	0	0	0	0	0	30	31
H/TOT	151	30	18	0	2	4	0	0	205	230	117	10	7	0	3	1	0	0	138	150
12:00	44	4	2	0	0	0	0	0	50	53	40	9	0	0	1	1	0	0	51	52
12:15	35	9	5	0	0	0	0	0	49	56	32	3	0	0	0	1	0	0	36	36
12:30	41	8	6	0	0	1	0	0	56	64	39	1	0	0	0	1	0	0	41	41
12:45	49	6	3	0	1	0	0	0	59	64	48	4	2	0	1	1	0	0	56	60
H/TOT	169	27	16	0	1	1	0	0	214	236	159	17	2	0	2	4	0	0	184	189
3H/TOT	462	84	43	0	4	9	0	0	602	662	369	41	16	0	7	5	0	0	438	466
13:00	40	4	2	0	0	2	0	0	48	51	68	8	0	0	0	0	0	0	76	76
13:15	58	1	3	0	0	1	0	0	63	67	39	6	2	0	0	0	0	0	47	50
13:30	50	6	1	0	0	0	0	0	57	58	51	1	1	0	1	2	0	0	56	58
13:45	44	4	2	0	0	1	0	0	51	54	41	5	1	0	0	0	0	0	47	48
H/TOT	192	15	8	0	0	4	0	0	219	229	199	20	4	0	1	2	0	0	226	232
14:00	45	10	3	0	0	1	0	0	59	63	36	5	0	0	1	0	0	1	43	43
14:15	50	8	2	0	2	0	0	0	62	67	54	3	1	0	0	0	0	0	58	59
14:30	49	4	3	0	0	1	0	0	57	61	37	3	0	0	0	1	0	0	41	41
14:45	45	5	3	0	0	1	0	0	54	58	41	3	0	0	0	2	0	0	46	46
H/TOT	189	27	11	0	2	3	0	0	232	248	168	14	1	0	1	3	0	1	188	190
15:00	37	7	2	0	0	0	0	0	46	49	39	3	1	0	0	0	0	0	43	44
15:15	54	6	3	0	0	0	0	0	63	67	54	3	0	0	1	0	0	0	58	59
15:30	42	7	5	0	1	2	0	0	57	65	47	5	1	0	1	3	0	0	57	59
15:45	41	7	4	0	2	0	0	0	54	61	48	3	0	0	0	0	0	0	51	51
H/TOT	174	27	14	0	3	2	0	0	220	241	188	14	2	0	2	3	0	0	209	214
3H/TOT	555	69	33	0	5	9	0	0	671	719	555	48	7	0	4	8	0	1	623	635
16:00	54	6	1	0	0	0	0	0	61	62	51	7	0	0	0	2	0	0	60	60
16:15	50	6	0	0	0	2	0	0	58	58	54	5	0	0	1	2	0	0	62	63
16:30	49	7	4	0	0	0	0	0	60	65	59	6	2	0	0	0	0	0	67	70
16:45	52	8	6	0	0	1	0	0	67	75	54	5	0	0	0	0	0	0	59	59
H/TOT	205	27	11	0	0	3	0	0	246	260	218	23	2	0	1	4	0	0	248	252
17:00	55	5	2	0	1	1	0	0	64	68	89	2	1	0	0	0	0	0	92	93
17:15	54	3	1	0	0	0	0	0	58	59	72	1	1	0	1	0	0	0	75	77
17:30	66	3	1	0	0	2	0	0	72	73	86	1	0	0	1	0	0	0	88	89
17:45	48	7	0	0	0	0	0	0	55	55	54	4	0	0	0	0	0	0	58	58
H/TOT	223	18	4	0	1	3	0	0	249	255	301	8	2	0	2	0	0	0	313	318
18:00	62	6	0	0	0	1	0	1	70	69	68	3	1	0	1	1	0	0	74	76
18:15	35	5	0	0	0	0	0	0	40	40	80	3	0	0	1	1	0	0	85	86
18:30	30	1	0	0	0	1	0	0	32	32	43	5	1	0	0	0	0	1	50	51
18:45	29	2	1	0	0	1	0	0	33	34	40	6	0	0	1	0	0	0	47	48
H/TOT	156	14	1	0	0	3	0	1	175	176	231	17	2	0	3	2	0	1	256	261
3H/TOT	584	59	16	0	1	9	0	1	670	691	750	48	6	0	6	6	0	1	817	830
P/TOT	1965	250	127	0	14	33	0	1	2390	2568	1994	177	46	0	27	26	0	2	2272	2357

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	C to B										C to C									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL		Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0	0	0	1	2
07:45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0	0	0	1	2
08:00	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
08:15	6	1	0	0	0	0	0	0	7		0	0	0	0	0	0	0	0	0	0
08:30	5	0	0	0	0	0	0	0	5		0	0	0	0	0	0	0	0	0	0
08:45	3	0	0	0	0	0	0	0	3		0	0	0	0	0	0	0	0	0	0
H/TOT	15	1	0	0	0	0	0	0	16		0	0	0	0	0	0	0	0	0	0
09:00	4	0	0	0	0	0	0	0	4		0	0	0	0	0	0	0	0	0	0
09:15	0	0	1	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
09:30	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
09:45	4	0	1	0	0	1	0	0	6		0	0	0	0	0	0	0	0	0	0
H/TOT	9	0	2	0	0	1	0	0	12		0	0	0	0	0	0	0	0	0	0
3H/TOT	24	1	2	0	0	1	0	0	28	31	0	0	0	0	1	0	0	0	1	2
10:00	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
10:15	2	1	0	0	0	0	0	0	3		0	0	0	0	0	0	0	0	0	0
10:30	2	0	1	0	0	0	0	0	3		1	0	0	0	0	0	0	0	1	1
10:45	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	0	0	1	1
H/TOT	5	1	1	0	0	0	0	0	7		2	0	0	0	0	0	0	0	2	2
11:00	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
11:15	2	0	2	0	0	0	0	0	4		0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	0	0	1	1
11:45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
H/TOT	3	0	2	0	0	0	0	0	5		1	0	0	0	0	0	0	0	1	1
12:00	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
12:15	0	1	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
12:30	5	0	0	0	0	0	0	0	5		1	0	0	0	0	0	0	0	1	1
12:45	1	1	0	0	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0
H/TOT	6	2	0	0	0	0	0	0	8		1	0	0	0	0	0	0	0	1	1
3H/TOT	14	3	3	0	0	0	0	0	20	24	4	0	0	0	0	0	0	0	4	4
13:00	2	0	0	0	0	1	0	0	3		1	0	0	0	0	0	0	0	1	1
13:15	4	0	0	0	0	0	0	0	4		0	0	0	0	0	0	0	0	0	0
13:30	5	0	0	0	0	0	0	0	5		0	0	0	0	0	0	0	0	0	0
13:45	2	0	0	0	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0
H/TOT	13	0	0	0	0	1	0	0	14		1	0	0	0	0	0	0	0	1	1
14:00	3	0	0	0	0	0	0	0	3		2	0	0	0	0	0	0	0	2	2
14:15	0	1	0	0	0	0	0	0	1		1	0	0	0	0	0	0	0	1	1
14:30	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
14:45	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
H/TOT	4	1	0	0	0	0	0	0	5		3	0	0	0	0	0	0	0	3	3
15:00	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
15:15	2	0	0	0	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	0	0	1	1
15:45	1	0	0	0	0	0	0	0	1		1	0	0	0	0	0	0	0	1	1
H/TOT	3	0	0	0	0	0	0	0	3		2	0	0	0	0	0	0	0	2	2
3H/TOT	20	1	0	0	0	1	0	0	22	22	6	0	0	0	0	0	0	0	6	6
16:00	2	0	0	0	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	0	0	1	1
17:15	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
17:30	0	1	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
H/TOT	1	1	0	0	0	0	0	0	2		1	0	0	0	0	0	0	0	1	1
18:00	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	0	0	1	1
18:15	0	0	0	0	0	0	0	0	0		0	1	0	0	0	0	0	0	1	1
18:30	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0		1	1	0	0	0	0	0	0	2	2
3H/TOT	3	1	0	0	0	0	0	0	4	4	2	1	0	0	0	0	0	0	3	3
P/TOT	61	6	5	0	0	2	0	0	74		12	1	0	0	1	0	0	0	14	15

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WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	D to A										D to B									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	6	1	1	0	0	0	0	0	8	9	0	0	0	0	0	0	0	0	0	0
07:15	9	2	0	0	0	0	0	0	11	11	0	0	0	0	0	0	0	0	0	0
07:30	14	5	3	0	0	0	0	0	22	26	0	0	0	0	0	0	0	1	1	0
07:45	17	5	1	0	0	0	0	0	23	24	0	0	0	0	0	0	0	0	0	0
H/TOT	46	13	5	0	0	0	0	0	64	71	0	0	0	0	0	0	0	1	1	0
08:00	41	7	1	0	1	0	0	0	50	52	5	0	0	0	0	0	0	0	5	5
08:15	64	2	1	0	2	3	0	0	72	75	13	0	0	0	0	0	0	0	13	13
08:30	68	2	0	0	1	1	0	0	72	73	5	0	0	0	0	0	0	0	5	5
08:45	55	7	1	0	2	5	0	0	70	73	3	0	0	0	0	0	0	0	3	3
H/TOT	228	18	3	0	6	9	0	0	264	274	26	0	0	0	0	0	0	0	26	26
09:00	58	3	1	0	0	1	0	0	63	64	4	1	0	0	0	0	0	0	5	5
09:15	26	5	3	0	0	0	0	1	35	38	4	0	0	0	0	0	0	0	4	4
09:30	26	7	1	0	1	0	0	0	35	37	1	0	0	0	0	0	0	0	1	1
09:45	25	6	1	0	0	0	0	1	33	34	0	0	0	0	0	0	0	0	0	0
H/TOT	135	21	6	0	1	1	0	2	166	173	9	1	0	0	0	0	0	0	10	10
3H/TOT	409	52	14	0	7	10	0	2	494	518	35	1	0	0	0	0	0	1	37	36
10:00	20	4	1	0	0	2	0	0	27	28	0	0	0	0	0	0	0	0	0	0
10:15	30	4	1	0	0	0	0	0	35	36	1	0	0	0	0	0	0	1	2	1
10:30	20	8	3	0	0	0	0	0	31	35	2	0	2	0	0	0	0	0	4	7
10:45	26	4	2	0	0	1	0	0	33	36	0	0	0	0	0	0	0	0	0	0
H/TOT	96	20	7	0	0	3	0	0	126	135	3	0	2	0	0	0	0	1	6	8
11:00	23	5	0	0	0	0	1	0	29	28	0	0	0	0	0	0	0	0	0	0
11:15	21	4	3	0	0	1	0	1	30	33	0	1	0	0	0	1	0	1	3	2
11:30	22	3	2	0	2	1	0	0	30	35	0	0	0	0	0	0	0	2	2	0
11:45	34	8	2	0	1	2	0	0	47	51	0	0	0	0	0	0	0	2	2	0
H/TOT	100	20	7	0	3	4	1	1	136	147	0	1	0	0	0	1	0	5	7	3
12:00	28	3	2	0	0	2	0	0	35	38	1	0	0	0	0	0	0	0	1	1
12:15	38	6	2	0	0	1	0	0	47	50	0	0	0	0	0	0	0	1	1	0
12:30	39	7	1	0	0	0	0	1	48	49	0	0	0	0	0	0	0	0	0	0
12:45	38	6	1	0	1	0	0	0	46	48	1	0	0	0	0	0	0	0	1	1
H/TOT	143	22	6	0	1	3	0	1	176	184	2	0	0	0	0	0	0	1	3	2
3H/TOT	339	62	20	0	4	10	1	2	438	466	5	1	2	0	0	1	0	7	16	13
13:00	47	6	3	0	0	2	0	1	59	62	0	0	0	0	0	0	0	0	0	0
13:15	40	6	1	0	0	1	0	0	48	49	1	0	0	0	0	0	0	0	1	1
13:30	27	5	0	0	0	2	0	0	34	34	4	0	0	0	0	0	0	0	4	4
13:45	59	5	1	0	0	1	0	0	66	67	1	0	0	0	0	0	0	0	1	1
H/TOT	173	22	5	0	0	6	0	1	207	213	6	0	0	0	0	0	0	0	6	6
14:00	64	1	0	0	2	0	0	1	68	69	1	0	0	0	0	0	0	0	1	1
14:15	31	2	1	0	1	2	0	1	38	40	0	0	0	0	0	0	0	0	0	0
14:30	39	5	0	0	0	0	0	0	44	44	0	0	0	0	0	0	0	0	0	0
14:45	54	7	2	0	0	0	0	0	63	66	1	0	0	0	0	0	0	1	2	1
H/TOT	188	15	3	0	3	2	0	2	213	218	2	0	0	0	0	0	0	1	3	2
15:00	60	7	1	0	1	0	0	0	69	71	0	0	0	0	0	0	0	0	0	0
15:15	54	5	3	0	1	0	0	0	63	68	0	0	0	0	0	0	0	0	0	0
15:30	61	6	2	0	1	1	0	0	71	75	1	0	0	0	0	0	0	0	1	1
15:45	49	8	0	0	0	1	0	0	58	58	0	0	0	0	0	0	0	0	0	0
H/TOT	224	26	6	0	3	2	0	0	261	272	1	0	0	0	0	0	0	0	1	1
3H/TOT	585	63	14	0	6	10	0	3	681	703	9	0	0	0	0	0	0	1	10	9
16:00	75	2	1	0	0	1	0	0	79	80	0	0	0	0	0	0	0	0	0	0
16:15	51	8	0	0	3	3	0	0	65	68	0	0	0	0	0	0	0	0	0	0
16:30	48	6	0	0	0	1	1	0	56	55	0	0	0	0	0	0	0	0	0	0
16:45	59	5	2	0	0	2	0	0	68	71	0	0	0	0	0	0	0	0	0	0
H/TOT	233	21	3	0	3	7	1	0	268	274	0	0	0	0	0	0	0	0	0	0
17:00	68	8	0	0	0	1	0	0	77	77	0	0	0	0	0	0	0	0	0	0
17:15	55	4	0	0	0	1	0	0	60	60	1	0	0	0	0	0	0	1	2	1
17:30	72	7	0	0	1	0	0	0	80	81	1	0	0	0	0	0	0	0	1	1
17:45	48	11	0	0	0	0	0	0	59	59	0	0	0	0	0	0	0	0	0	0
H/TOT	243	30	0	0	1	2	0	0	276	277	2	0	0	0	0	0	0	1	3	2
18:00	63	10	0	0	0	0	0	1	74	73	0	0	0	0	0	0	0	0	0	0
18:15	75	8	0	0	0	0	0	0	83	83	0	0	0	0	0	0	0	0	0	0
18:30	49	3	0	0	0	0	0	0	52	52	0	0	0	0	0	0	0	0	0	0
18:45	49	3	0	0	0	0	0	0	52	52	0	0	0	0	0	0	0	0	0	0
H/TOT	236	24	0	0	0	0	0	1	261	260	0	0	0	0	0	0	0	0	0	0
3H/TOT	712	75	3	0	4	9	1	1	805	812	2	0	0	0	0	0	0	1	3	2
P/TOT	2045	252	51	0	21	39	2	8	2418	2498	51	2	2	0	0	1	0	10	66	61

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Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

	D to C										D to D									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	12	1	0	0	0	1	0	0	14	14	0	0	0	0	0	0	0	0	0	0
07:15	16	5	5	0	0	0	0	0	26	33	0	0	0	0	0	0	0	0	0	0
07:30	18	4	0	0	0	0	0	0	22	22	1	0	0	0	0	0	0	0	1	1
07:45	38	10	0	0	0	1	0	0	49	49	1	0	0	0	0	0	0	0	1	1
H/TOT	84	20	5	0	0	2	0	0	111	118	2	0	0	0	0	0	0	0	2	2
08:00	48	8	4	0	1	1	0	0	62	68	0	0	0	0	0	0	0	0	0	0
08:15	62	9	6	0	4	1	0	0	82	94	0	0	0	0	0	0	0	0	0	0
08:30	43	3	4	0	0	1	0	0	51	56	0	0	0	0	0	0	0	0	0	0
08:45	42	9	5	0	0	2	0	0	58	65	0	0	0	0	0	0	0	0	0	0
H/TOT	195	29	19	0	5	5	0	0	253	283	0	0	0	0	0	0	0	0	0	0
09:00	61	10	6	0	0	2	0	0	79	87	1	0	0	0	0	0	0	0	1	1
09:15	50	11	5	0	1	0	0	0	67	75	0	1	0	0	0	0	0	0	1	1
09:30	50	9	2	0	0	1	0	0	62	65	0	0	0	0	0	0	0	0	0	0
09:45	50	10	4	0	0	0	0	0	64	69	1	0	0	0	0	0	0	0	1	1
H/TOT	211	40	17	0	1	3	0	0	272	295	2	1	0	0	0	0	0	0	3	3
3H/TOT	490	89	41	0	6	10	0	0	636	695	4	1	0	0	0	0	0	0	5	5
10:00	33	8	4	0	0	2	0	0	47	52	0	0	0	0	0	0	0	0	0	0
10:15	52	7	5	0	0	0	0	0	64	71	0	0	0	0	0	0	0	0	0	0
10:30	29	8	7	0	3	3	0	0	50	62	0	0	1	0	0	0	0	0	1	2
10:45	57	12	5	0	2	1	0	0	77	86	0	0	0	0	0	0	0	0	0	0
H/TOT	171	35	21	0	5	6	0	0	238	270	0	0	1	0	0	0	0	0	1	2
11:00	37	2	2	0	0	2	0	0	43	46	0	0	0	0	0	0	0	0	0	0
11:15	47	7	5	0	0	2	0	0	61	68	1	0	0	0	0	0	0	0	1	1
11:30	54	8	3	0	0	1	0	0	66	70	1	0	0	0	0	0	0	0	1	1
11:45	59	10	5	0	0	2	0	0	76	83	0	0	0	0	0	0	0	0	0	0
H/TOT	197	27	15	0	0	7	0	0	246	266	2	0	0	0	0	0	0	0	2	2
12:00	52	18	6	0	0	1	0	0	77	85	0	0	0	0	0	0	0	0	0	0
12:15	56	10	2	0	0	2	0	0	70	73	0	0	1	0	0	0	0	0	1	2
12:30	49	14	4	0	0	1	0	0	68	73	1	0	0	0	0	0	0	0	1	1
12:45	59	13	3	0	0	0	0	0	75	79	0	0	0	0	0	0	0	0	0	0
H/TOT	216	55	15	0	0	4	0	0	290	310	1	0	1	0	0	0	0	0	2	3
3H/TOT	584	117	51	0	5	17	0	0	774	845	3	0	2	0	0	0	0	0	5	8
13:00	67	8	3	0	1	0	0	0	79	84	0	0	0	0	0	0	0	0	0	0
13:15	49	10	0	0	0	0	0	0	59	59	0	0	0	0	0	0	0	0	0	0
13:30	64	8	4	0	0	1	0	0	77	82	0	0	0	0	0	0	0	0	0	0
13:45	57	9	3	0	0	3	1	0	73	76	0	0	0	0	0	0	0	0	0	0
H/TOT	237	35	10	0	1	4	1	0	288	301	0	0	0	0	0	0	0	0	0	0
14:00	63	12	5	0	0	2	0	0	82	89	0	0	0	0	0	0	0	0	0	0
14:15	64	10	4	0	0	1	0	0	79	84	0	0	0	0	0	0	0	0	0	0
14:30	45	9	4	0	0	0	0	1	59	63	0	0	0	0	0	0	0	0	0	0
14:45	72	3	4	0	0	2	0	0	81	86	0	0	0	0	0	0	0	0	0	0
H/TOT	244	34	17	0	0	5	0	1	301	322	0	0	0	0	0	0	0	0	0	0
15:00	63	16	2	0	0	2	0	0	83	86	0	0	0	0	0	0	0	0	0	0
15:15	55	8	3	0	0	0	0	0	66	70	1	0	0	0	0	0	0	0	1	1
15:30	47	7	4	0	0	0	0	0	58	63	0	0	0	0	0	0	0	0	0	0
15:45	74	3	2	0	1	2	0	0	82	86	0	0	0	0	0	0	0	0	0	0
H/TOT	239	34	11	0	1	4	0	0	289	304	1	0	0	0	0	0	0	0	1	1
3H/TOT	720	103	38	0	2	13	1	1	878	928	1	0	0	0	0	0	0	0	1	1
16:00	91	13	0	0	0	1	0	0	105	105	0	0	0	0	0	0	0	0	0	0
16:15	66	12	5	0	0	2	0	0	85	92	0	0	0	0	0	0	0	0	0	0
16:30	69	6	3	0	0	0	0	0	78	82	1	0	0	0	0	0	0	0	1	1
16:45	59	7	3	0	0	2	0	0	71	75	0	0	0	0	0	0	0	0	0	0
H/TOT	285	38	11	0	0	5	0	0	339	353	1	0	0	0	0	0	0	0	1	1
17:00	74	11	4	0	2	2	0	0	93	100	1	0	0	0	0	0	0	0	1	1
17:15	59	2	1	0	0	0	0	0	62	63	0	0	0	0	0	0	0	0	0	0
17:30	64	12	2	0	0	1	0	0	79	82	0	1	0	0	0	0	0	0	1	1
17:45	63	4	2	0	1	0	0	0	70	74	0	0	0	0	0	0	0	0	0	0
H/TOT	260	29	9	0	3	3	0	0	304	319	1	1	0	0	0	0	0	0	2	2
18:00	60	1	0	0	0	1	0	0	62	62	0	0	0	0	0	0	0	0	0	0
18:15	66	5	0	0	0	0	0	0	71	71	0	0	0	0	0	0	0	0	0	0
18:30	36	5	1	0	0	2	0	0	44	45	0	0	0	0	0	0	0	0	0	0
18:45	33	2	0	0	0	1	0	0	36	36	1	0	0	0	0	0	0	0	1	1
H/TOT	195	13	1	0	0	4	0	0	213	214	1	0	0	0	0	0	0	0	1	1
3H/TOT	740	80	21	0	3	12	0	0	856	886	3	1	0	0	0	0	0	0	4	4
P/TOT	2534	389	151	0	16	52	1	1	3144	3355	11	2	2	0	0	0	0	0	15	18

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

TIME	TO ARM A									FROM ARM A								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	16	3	1	0	0	0	0	0	20	14	3	0	0	0	0	0	1	18
07:15	24	6	1	0	0	0	0	0	31	39	6	2	0	0	0	0	1	48
07:30	30	8	5	0	0	0	0	0	43	64	9	0	0	0	0	0	0	73
07:45	37	8	3	0	0	3	0	0	51	79	12	4	0	0	0	0	0	95
H/TOT	107	25	10	0	0	3	0	0	145	196	30	6	0	0	0	0	2	234
08:00	69	7	5	0	2	0	0	1	84	96	13	1	0	1	0	0	0	111
08:15	116	6	1	0	3	5	0	0	131	173	16	4	0	5	0	0	0	198
08:30	108	4	2	0	2	2	0	0	118	170	5	2	0	1	0	0	0	178
08:45	77	13	1	0	2	5	0	0	98	152	6	0	0	4	1	0	1	164
H/TOT	370	30	9	0	9	12	0	1	431	591	40	7	0	11	1	0	1	651
09:00	101	5	3	0	3	1	0	0	113	156	9	1	0	1	1	0	0	168
09:15	52	10	4	0	1	0	0	1	68	131	8	5	0	0	0	0	1	145
09:30	53	12	1	0	4	0	0	0	70	84	11	3	0	0	0	0	1	99
09:45	49	10	4	0	0	1	0	1	65	87	9	1	0	1	0	1	0	99
H/TOT	255	37	12	0	8	2	0	2	316	458	37	10	0	2	1	1	2	511
3H/TOT	732	92	31	0	17	17	0	3	892	1245	107	23	0	13	2	1	5	1396
10:00	35	5	3	0	0	2	0	0	45	61	14	3	0	1	1	0	0	80
10:15	55	9	2	0	2	0	0	0	68	78	7	1	0	1	0	0	0	87
10:30	49	11	5	0	0	0	0	0	65	79	8	4	0	0	1	0	0	92
10:45	51	9	4	0	0	1	0	0	65	56	15	5	0	0	0	0	1	77
H/TOT	190	34	14	0	2	3	0	0	243	274	44	13	0	2	2	0	1	336
11:00	50	7	0	0	1	0	1	0	59	74	11	3	0	1	2	0	1	92
11:15	48	5	7	0	1	1	0	1	63	84	5	6	0	0	0	0	0	95
11:30	61	8	5	0	3	2	0	0	79	66	10	3	0	0	0	1	0	80
11:45	61	11	3	0	1	2	0	0	78	71	6	3	0	0	2	0	1	83
H/TOT	220	31	15	0	6	5	1	1	279	295	32	15	0	1	4	1	2	350
12:00	68	12	2	0	1	3	0	0	86	71	9	4	0	1	0	0	0	85
12:15	72	9	2	0	0	2	0	0	85	86	12	3	0	1	1	0	0	103
12:30	80	8	1	0	0	1	0	2	92	78	5	0	0	1	1	0	1	86
12:45	88	10	3	0	2	1	0	0	104	73	5	4	0	1	2	0	0	85
H/TOT	308	39	8	0	3	7	0	2	367	308	31	11	0	4	4	0	1	359
3H/TOT	718	104	37	0	11	15	1	3	889	877	107	39	0	7	10	1	4	1045
13:00	116	14	3	0	0	2	0	1	136	63	7	1	0	0	2	0	0	73
13:15	81	12	3	0	0	1	0	0	97	94	9	3	0	0	2	0	1	109
13:30	78	6	1	0	1	4	0	0	90	99	14	3	0	1	2	0	0	119
13:45	100	10	2	0	0	1	0	0	113	119	10	0	0	1	0	0	0	130
H/TOT	375	42	9	0	1	8	0	1	436	375	40	7	0	2	6	0	1	431
14:00	100	6	0	0	3	0	0	2	111	89	10	1	0	1	1	0	0	102
14:15	87	5	2	0	1	2	0	1	98	128	9	3	0	1	1	0	1	143
14:30	76	8	0	0	0	1	0	0	85	91	15	5	0	4	1	0	1	117
14:45	97	10	2	0	0	2	0	0	111	94	5	4	0	1	2	0	0	106
H/TOT	360	29	4	0	4	5	0	3	405	402	39	13	0	7	5	0	2	468
15:00	100	10	2	0	1	0	0	0	113	94	12	1	0	0	1	0	0	108
15:15	109	8	3	0	2	0	0	0	122	81	9	3	0	2	2	0	0	97
15:30	109	11	3	0	2	4	0	0	129	125	11	0	0	3	1	0	0	140
15:45	99	11	0	0	0	1	0	0	111	110	10	3	0	2	5	0	0	130
H/TOT	417	40	8	0	5	5	0	0	475	410	42	7	0	7	9	0	0	475
3H/TOT	1152	111	21	0	10	18	0	4	1316	1187	121	27	0	16	20	0	3	1374
16:00	126	9	1	0	0	3	0	0	139	85	5	1	0	1	2	1	0	95
16:15	109	13	0	0	4	5	0	0	131	79	13	3	0	2	1	0	0	98
16:30	109	12	2	0	0	1	1	0	125	88	5	1	0	0	1	0	0	95
16:45	113	10	2	0	0	2	0	0	127	85	11	2	0	0	3	0	0	101
H/TOT	457	44	5	0	4	11	1	0	522	337	34	7	0	3	7	1	0	389
17:00	157	10	1	0	0	1	0	0	169	78	7	2	0	0	1	0	0	88
17:15	127	5	1	0	1	1	0	0	135	105	10	2	0	0	1	0	0	118
17:30	158	8	0	0	2	0	0	0	168	98	9	0	0	1	0	0	0	108
17:45	102	15	0	0	0	0	0	0	117	75	9	0	0	1	0	0	0	85
H/TOT	544	38	2	0	3	2	0	0	589	356	35	4	0	2	2	0	0	399
18:00	131	13	1	0	1	1	0	1	148	87	6	0	0	0	0	0	0	93
18:15	155	11	0	0	1	1	0	0	168	81	2	1	0	0	0	0	0	84
18:30	92	8	1	0	0	0	0	1	102	89	4	0	0	0	0	0	2	95
18:45	89	9	0	0	1	0	0	0	99	72	8	0	0	0	0	0	0	80
H/TOT	467	41	2	0	3	2	0	2	517	329	20	1	0	0	0	0	2	352
3H/TOT	1468	123	9	0	10	15	1	2	1628	1022	89	12	0	5	9	1	2	1140
P/TOT	4070	430	98	0	48	65	2	12	4725	4331	424	101	0	41	41	3	14	4955

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

TIME	TO ARM B									FROM ARM B								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
08:00	9	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	4	4
08:15	24	1	0	0	0	0	0	0	25	0	0	0	0	0	0	0	2	2
08:30	12	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	1	1
08:45	8	0	0	0	0	0	0	0	8	1	0	0	0	0	0	0	0	1
H/TOT	53	1	0	0	0	0	0	0	54	1	0	0	0	0	0	0	7	8
09:00	9	1	0	0	0	0	0	0	10	6	0	0	0	0	0	0	0	6
09:15	4	0	1	0	0	0	0	0	5	2	0	0	0	0	0	0	1	3
09:30	2	0	0	0	0	0	0	0	2	8	0	1	0	0	0	0	0	9
09:45	4	0	1	0	0	1	0	0	6	1	0	0	0	0	0	0	1	2
H/TOT	19	1	2	0	0	1	0	0	23	17	0	1	0	0	0	0	2	20
3H/TOT	72	2	2	0	0	1	0	1	78	18	0	1	0	0	0	0	9	28
10:00	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
10:15	3	1	0	0	0	0	0	1	5	3	0	0	0	0	0	0	0	3
10:30	5	0	3	0	0	0	0	0	8	3	0	0	0	0	0	0	0	3
10:45	0	0	0	0	0	0	0	0	0	6	0	2	0	0	0	0	0	8
H/TOT	9	1	3	0	0	0	0	1	14	12	0	3	0	0	0	0	0	15
11:00	1	0	0	0	0	0	0	1	2	9	1	0	0	0	0	0	0	10
11:15	2	1	2	0	0	1	0	1	7	1	0	0	0	0	0	0	0	1
11:30	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	2
11:45	0	0	0	0	0	0	0	2	2	3	1	0	0	0	0	0	0	4
H/TOT	3	1	2	0	0	1	0	6	13	15	2	0	0	0	0	0	0	17
12:00	2	0	0	0	0	0	0	0	2	7	1	0	1	0	0	0	0	9
12:15	0	1	0	0	0	0	0	1	2	9	1	0	0	0	0	0	0	10
12:30	5	0	0	0	0	0	0	0	5	19	0	0	0	0	0	1	1	21
12:45	2	1	0	0	0	0	0	0	3	11	1	0	0	0	0	0	0	12
H/TOT	9	2	0	0	0	0	0	1	12	46	3	0	1	0	0	1	1	52
3H/TOT	21	4	5	0	0	1	0	8	39	73	5	3	1	0	0	1	1	84
13:00	2	0	0	0	0	1	0	0	3	7	1	0	0	0	0	0	0	8
13:15	6	0	0	0	0	0	0	0	6	3	0	0	0	0	0	0	0	3
13:30	9	2	0	0	0	0	0	0	11	5	0	0	0	0	0	0	1	6
13:45	4	0	0	0	0	0	0	0	4	0	2	0	0	0	0	0	0	2
H/TOT	21	2	0	0	0	1	0	0	24	15	3	0	0	0	0	0	1	19
14:00	4	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	4
14:15	0	1	0	0	0	0	0	0	1	7	0	0	0	0	0	0	0	7
14:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
14:45	2	0	0	0	0	0	0	1	3	6	0	0	0	0	0	0	0	6
H/TOT	6	1	0	0	0	0	0	1	8	18	0	0	0	0	0	0	0	18
15:00	1	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	3
15:15	2	0	0	0	0	0	0	0	2	3	1	0	0	0	0	0	0	4
15:30	1	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	6
15:45	1	0	0	0	0	0	0	0	1	7	0	0	0	0	0	0	0	7
H/TOT	5	0	0	0	0	0	0	0	5	18	2	0	0	0	0	0	0	20
3H/TOT	32	3	0	0	0	1	0	1	37	51	5	0	0	0	0	0	1	57
16:00	3	0	0	0	0	0	0	0	3	5	0	0	0	0	0	0	0	5
16:15	0	0	0	0	0	0	0	0	0	13	1	0	0	0	0	0	0	14
16:30	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	1	27
16:45	0	0	0	0	0	0	0	0	0	7	2	0	0	0	0	0	0	9
H/TOT	3	0	0	0	0	0	0	0	3	51	3	0	0	0	0	0	1	55
17:00	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0	7
17:15	2	0	0	0	0	0	0	1	3	1	1	0	0	0	0	0	0	2
17:30	1	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
17:45	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
H/TOT	4	1	0	0	0	0	0	1	6	7	1	1	0	0	0	0	0	9
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
3H/TOT	7	1	0	0	0	0	0	1	9	58	4	1	0	0	0	0	3	66
P/TOT	132	10	7	0	0	3	0	11	163	200	14	5	1	0	0	1	14	235

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

TIME	TO ARM C									FROM ARM C								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	20	4	0	0	0	1	0	0	25	19	2	1	0	1	0	0	0	23
07:15	39	8	6	0	0	0	0	0	53	27	4	3	0	0	0	0	0	34
07:30	49	8	0	0	1	0	0	0	58	30	5	4	0	1	0	0	0	40
07:45	64	17	3	0	0	1	0	0	85	63	4	7	0	0	3	0	0	77
H/TOT	172	37	9	0	1	2	0	0	221	139	15	15	0	2	3	0	0	174
08:00	87	13	4	0	1	1	0	0	106	61	3	7	0	2	0	0	0	73
08:15	129	16	8	0	6	1	0	0	160	110	8	5	0	1	3	0	0	127
08:30	127	5	6	0	1	1	0	0	140	77	4	4	0	2	1	0	0	88
08:45	132	14	5	0	4	3	0	0	158	57	9	5	0	0	3	0	0	74
H/TOT	475	48	23	0	12	6	0	0	564	305	24	21	0	5	7	0	0	362
09:00	131	11	7	0	0	3	0	0	152	81	8	5	0	3	1	0	0	98
09:15	116	13	8	0	1	0	0	0	138	57	14	4	0	1	0	0	0	76
09:30	87	15	6	0	0	1	0	0	109	57	10	4	0	4	1	0	0	76
09:45	91	11	4	0	1	0	0	0	107	69	8	5	0	0	2	0	0	84
H/TOT	425	50	25	0	2	4	0	0	506	264	40	18	0	8	4	0	0	334
3H/TOT	1072	135	57	0	15	12	0	0	1291	708	79	54	0	15	14	0	0	870
10:00	58	13	5	0	0	2	0	0	78	50	7	4	0	1	1	0	0	63
10:15	104	11	6	0	1	0	0	0	122	67	12	1	0	2	1	0	0	83
10:30	71	12	8	0	3	3	0	0	97	72	10	7	0	0	2	0	0	91
10:45	88	19	9	0	2	1	0	1	120	53	13	5	0	0	0	0	0	71
H/TOT	321	55	28	0	6	6	0	1	417	242	42	17	0	3	4	0	0	308
11:00	79	10	3	0	1	2	0	0	95	55	11	2	0	1	1	0	0	70
11:15	88	10	7	0	0	2	0	0	107	74	8	10	0	1	0	0	0	93
11:30	80	13	4	0	0	1	1	0	99	75	11	9	0	1	2	0	0	98
11:45	94	11	6	0	0	2	0	1	114	68	10	6	0	2	2	0	0	88
H/TOT	341	44	20	0	1	7	1	1	415	272	40	27	0	5	5	0	0	349
12:00	88	22	8	0	1	1	0	0	120	84	13	2	0	1	1	0	0	101
12:15	99	15	3	0	1	2	0	0	120	67	13	5	0	0	1	0	0	86
12:30	93	15	4	0	1	1	1	1	116	86	9	6	0	0	2	0	0	103
12:45	95	14	4	0	1	1	0	0	115	98	11	5	0	2	1	0	0	117
H/TOT	375	66	19	0	4	5	1	1	471	335	46	18	0	3	5	0	0	407
3H/TOT	1037	165	67	0	11	18	2	3	1303	849	128	62	0	11	14	0	0	1064
13:00	93	11	3	0	1	0	0	0	108	111	12	2	0	0	3	0	0	128
13:15	83	15	1	0	0	1	0	1	101	101	7	5	0	0	1	0	0	114
13:30	103	13	4	0	1	1	0	0	122	106	7	2	0	1	2	0	0	118
13:45	104	14	3	0	1	3	1	0	126	87	9	3	0	0	1	0	0	100
H/TOT	383	53	11	0	3	5	1	1	457	405	35	12	0	1	7	0	0	460
14:00	104	18	6	0	0	2	0	0	130	86	15	3	0	1	1	0	1	107
14:15	116	13	5	0	0	2	0	0	136	105	12	3	0	2	0	0	0	122
14:30	82	16	4	0	4	0	0	2	108	86	7	3	0	0	2	0	0	98
14:45	115	6	4	0	1	3	0	0	129	87	8	3	0	0	3	0	0	101
H/TOT	417	53	19	0	5	7	0	2	503	364	42	12	0	3	6	0	1	428
15:00	104	23	2	0	0	3	0	0	132	76	10	3	0	0	0	0	0	89
15:15	89	11	4	0	2	1	0	0	107	110	9	3	0	1	0	0	0	123
15:30	116	11	4	0	2	0	0	0	133	90	12	6	0	2	5	0	0	115
15:45	119	6	3	0	3	4	0	0	135	91	10	4	0	2	0	0	0	107
H/TOT	428	51	13	0	7	8	0	0	507	367	41	16	0	5	5	0	0	434
3H/TOT	1228	157	43	0	15	20	1	3	1467	1136	118	40	0	9	18	0	1	1322
16:00	144	14	1	0	1	2	1	0	163	107	13	1	0	0	2	0	0	123
16:15	110	18	6	0	1	2	0	0	137	104	11	0	0	1	4	0	0	120
16:30	118	9	4	0	0	0	0	0	131	108	13	6	0	0	0	0	0	127
16:45	90	11	4	0	0	4	0	0	109	106	13	6	0	0	1	0	0	126
H/TOT	462	52	15	0	2	8	1	0	540	425	50	13	0	1	7	0	0	496
17:00	112	15	5	0	2	2	0	0	136	145	7	3	0	1	1	0	0	157
17:15	103	7	2	0	0	1	0	0	113	127	4	2	0	1	0	0	0	134
17:30	110	16	2	0	0	1	0	0	129	152	5	1	0	1	2	0	0	161
17:45	90	6	2	0	2	0	0	0	100	102	11	0	0	0	0	0	0	113
H/TOT	415	44	11	0	4	4	0	0	478	526	27	6	0	3	3	0	0	565
18:00	100	3	0	0	0	1	0	0	104	131	9	1	0	1	2	0	1	145
18:15	107	7	1	0	0	0	0	0	115	115	9	0	0	1	1	0	0	126
18:30	83	6	1	0	0	2	0	0	92	73	6	1	0	0	1	0	1	82
18:45	71	5	0	0	0	1	0	0	77	69	8	1	0	1	1	0	0	80
H/TOT	361	21	2	0	0	4	0	0	388	388	32	3	0	3	5	0	2	433
3H/TOT	1238	117	28	0	6	16	1	0	1406	1339	109	22	0	7	15	0	2	1494
P/TOT	4575	574	195	0	47	66	4	6	5467	4032	434	178	0	42	61	0	3	4750

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 2

Location: Castlecomer Road/ Newpark Road/ New Road

TIME	TO ARM D									FROM ARM D								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	15	0	1	0	1	0	0	1	18	18	2	1	0	0	1	0	0	22
07:15	28	3	3	0	0	0	0	1	35	25	7	5	0	0	0	0	0	37
07:30	48	7	2	0	0	0	0	0	57	33	9	3	0	0	0	0	1	46
07:45	97	6	6	0	0	0	0	0	109	56	15	1	0	0	1	0	0	73
H/TOT	188	16	12	0	1	0	0	2	219	132	33	10	0	0	2	0	1	178
08:00	86	11	4	0	2	0	0	3	106	94	15	5	0	2	1	0	0	117
08:15	153	12	7	0	3	1	0	2	178	139	11	7	0	6	4	0	0	167
08:30	116	5	2	0	1	0	0	1	125	116	5	4	0	1	2	0	0	128
08:45	93	4	5	0	0	3	0	1	106	100	16	6	0	2	7	0	0	131
H/TOT	448	32	18	0	6	4	0	7	515	449	47	22	0	11	14	0	0	543
09:00	126	14	3	0	1	1	0	0	145	124	14	7	0	0	3	0	0	148
09:15	98	16	4	0	0	0	0	2	120	80	17	8	0	1	0	0	1	107
09:30	84	10	4	0	1	1	0	1	101	77	16	3	0	1	1	0	0	98
09:45	89	12	2	0	0	0	1	1	105	76	16	5	0	0	0	0	1	98
H/TOT	397	52	13	0	2	2	1	4	471	357	63	23	0	2	4	0	2	451
3H/TOT	1033	100	43	0	9	6	1	13	1205	938	143	55	0	13	20	0	3	1172
10:00	70	15	5	0	2	2	0	0	94	53	12	5	0	0	4	0	0	74
10:15	69	9	0	0	0	1	0	0	79	83	11	6	0	0	0	0	1	101
10:30	80	11	8	0	0	3	0	0	102	51	16	13	0	3	3	0	0	86
10:45	59	16	6	0	0	0	0	0	81	83	16	7	0	2	2	0	0	110
H/TOT	278	51	19	0	2	6	0	0	356	270	55	31	0	5	9	0	1	371
11:00	68	13	4	0	0	3	0	0	88	60	7	2	0	0	2	1	0	72
11:15	90	9	8	0	0	0	0	0	107	69	12	8	0	0	4	0	2	95
11:30	79	11	8	0	0	1	0	0	99	77	11	5	0	2	2	0	2	99
11:45	80	13	7	0	2	4	0	0	106	93	18	7	0	1	4	0	2	125
H/TOT	317	46	27	0	2	8	0	0	400	299	48	22	0	3	12	1	6	391
12:00	85	10	4	1	0	0	0	0	100	81	21	8	0	0	3	0	0	113
12:15	85	17	8	0	0	1	0	0	111	94	16	5	0	0	3	0	1	119
12:30	94	12	6	0	0	2	0	0	114	89	21	5	0	0	1	0	1	117
12:45	95	11	6	0	1	1	0	0	114	98	19	4	0	1	0	0	0	122
H/TOT	359	50	24	1	1	4	0	0	439	362	77	22	0	1	7	0	2	471
3H/TOT	954	147	70	1	5	18	0	0	1195	931	180	75	0	9	28	1	9	1233
13:00	84	9	3	0	0	4	0	0	100	114	14	6	0	1	2	0	1	138
13:15	118	5	5	0	0	2	0	0	130	90	16	1	0	0	1	0	0	108
13:30	115	13	4	0	0	2	0	1	135	95	13	4	0	0	3	0	0	115
13:45	115	11	2	0	0	1	0	0	129	117	14	4	0	0	4	1	0	140
H/TOT	432	38	14	0	0	9	0	1	494	416	57	15	0	1	10	1	1	501
14:00	99	14	3	0	1	2	0	0	119	128	13	5	0	2	2	0	1	151
14:15	132	14	4	0	3	0	0	1	154	95	12	5	0	1	3	0	1	117
14:30	104	12	8	0	0	2	0	0	126	84	14	4	0	0	0	0	1	103
14:45	100	7	7	0	0	2	0	0	116	127	10	6	0	0	2	0	1	146
H/TOT	435	47	22	0	4	6	0	1	515	434	49	20	0	3	7	0	4	517
15:00	90	13	3	0	0	0	0	0	106	123	23	3	0	1	2	0	0	152
15:15	104	13	5	0	0	1	0	0	123	110	13	6	0	1	0	0	0	130
15:30	104	14	5	0	2	3	0	0	128	109	13	6	0	1	1	0	0	130
15:45	112	14	6	0	2	3	0	0	137	123	11	2	0	1	3	0	0	140
H/TOT	410	54	19	0	4	7	0	0	494	465	60	17	0	4	6	0	0	552
3H/TOT	1277	139	55	0	8	22	0	2	1503	1315	166	52	0	8	23	1	5	1570
16:00	90	10	1	0	0	1	0	0	102	166	15	1	0	0	2	0	0	184
16:15	94	14	2	0	1	3	0	0	114	117	20	5	0	3	5	0	0	150
16:30	113	9	4	0	0	1	0	1	128	118	12	3	0	0	1	1	0	135
16:45	113	17	7	0	0	2	0	0	139	118	12	5	0	0	4	0	0	139
H/TOT	410	50	14	0	1	7	0	1	483	519	59	14	0	3	12	1	0	608
17:00	103	8	4	0	1	2	0	0	118	143	19	4	0	2	3	0	0	171
17:15	116	9	2	0	0	0	0	0	127	115	6	1	0	0	1	0	1	124
17:30	118	9	1	0	1	2	0	0	131	137	20	2	0	1	1	0	0	161
17:45	95	14	0	0	0	0	0	0	109	111	15	2	0	1	0	0	0	129
H/TOT	432	40	7	0	2	4	0	0	485	506	60	9	0	4	5	0	1	585
18:00	110	10	0	0	0	1	0	1	122	123	11	0	0	0	1	0	1	136
18:15	75	6	0	0	0	0	0	1	82	141	13	0	0	0	0	0	0	154
18:30	72	4	0	0	0	1	0	2	79	85	8	1	0	0	2	0	0	96
18:45	64	7	1	0	0	1	0	1	74	83	5	0	0	0	1	0	0	89
H/TOT	321	27	1	0	0	3	0	5	357	432	37	1	0	0	4	0	1	475
3H/TOT	1163	117	22	0	3	14	0	6	1325	1457	156	24	0	7	21	1	2	1668
P/TOT	4427	503	190	1	25	60	1	21	5228	4641	645	206	0	37	92	3	19	5643

Site: 3

Location: New Road/ Vicar Street

	A to B										A to C									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	11	1	1	0	0	0	0	0	13	14	5	1	0	0	0	0	0	0	6	6
07:15	17	6	5	0	0	0	0	0	28	35	6	0	1	0	0	0	0	0	7	8
07:30	27	4	2	0	0	0	0	0	33	36	10	1	1	0	0	0	0	0	12	13
07:45	47	5	1	0	0	0	0	0	53	54	21	3	1	0	0	1	0	2	28	28
H/TOT	102	16	9	0	0	0	0	0	127	139	42	5	3	0	0	1	0	2	53	55
08:00	71	9	3	0	3	0	0	0	86	93	13	2	0	0	0	1	0	0	16	16
08:15	101	7	3	0	4	1	0	2	118	124	21	2	1	0	0	1	0	1	26	27
08:30	99	8	4	0	1	0	0	0	112	118	50	2	0	0	0	0	0	1	53	52
08:45	87	11	4	0	1	2	0	0	105	111	48	0	0	0	0	1	0	2	51	49
H/TOT	358	35	14	0	9	3	0	2	421	447	132	6	1	0	0	3	0	4	146	144
09:00	71	13	5	0	0	1	0	0	90	97	34	1	0	0	0	0	0	0	35	35
09:15	49	8	6	0	0	1	0	1	65	72	19	4	1	0	0	0	0	0	24	25
09:30	50	9	4	0	1	1	0	0	65	71	21	4	1	0	0	0	0	0	26	27
09:45	44	9	4	0	0	0	0	0	57	62	23	3	0	0	0	0	0	0	26	26
H/TOT	214	39	19	0	1	3	0	1	277	302	97	12	2	0	0	0	0	0	111	114
3H/TOT	674	90	42	0	10	6	0	3	825	887	271	23	6	0	0	4	0	6	310	313
10:00	37	5	4	0	0	1	0	0	47	52	30	4	1	0	0	0	0	1	36	37
10:15	40	7	3	0	0	0	0	2	52	54	31	2	0	0	0	1	0	1	35	34
10:30	41	8	9	0	4	0	0	0	62	78	22	4	0	0	0	3	0	0	29	29
10:45	45	9	4	0	1	3	0	0	62	68	28	4	1	0	0	0	0	0	33	34
H/TOT	163	29	20	0	5	4	0	2	223	252	111	14	2	0	0	4	0	2	133	134
11:00	34	6	2	0	0	2	0	0	44	47	23	1	0	0	0	1	0	0	25	25
11:15	42	8	5	0	0	3	0	0	58	65	22	4	2	0	0	0	0	0	28	31
11:30	43	5	4	0	2	1	0	1	56	62	18	5	1	0	0	2	0	0	26	27
11:45	56	10	5	0	0	1	0	0	72	79	27	1	1	0	0	1	0	1	31	32
H/TOT	175	29	16	0	2	7	0	1	230	252	90	11	4	0	0	4	0	1	110	114
12:00	46	14	5	0	0	0	0	0	65	72	25	2	0	0	0	1	0	1	29	28
12:15	53	6	6	0	0	1	0	0	66	74	22	1	0	0	0	0	0	0	23	23
12:30	44	17	4	0	0	0	0	0	65	70	26	1	0	0	0	0	0	0	27	27
12:45	50	11	3	0	1	0	0	0	65	70	23	4	2	0	0	1	0	0	30	33
H/TOT	193	48	18	0	1	1	0	0	261	285	96	8	2	0	0	2	0	1	109	111
3H/TOT	531	106	54	0	8	12	0	3	714	790	297	33	8	0	0	10	0	4	352	359
13:00	62	8	5	0	1	1	0	1	78	85	33	4	1	0	0	0	0	0	38	39
13:15	53	4	2	0	0	1	0	0	60	63	25	2	0	0	0	1	0	0	28	28
13:30	41	8	3	0	0	3	0	1	56	59	22	3	0	0	0	2	1	0	28	27
13:45	60	10	4	0	0	1	1	0	76	81	22	2	0	0	0	2	0	0	26	26
H/TOT	216	30	14	0	1	6	1	2	270	287	102	11	1	0	0	5	1	0	120	121
14:00	65	10	3	0	1	1	0	2	82	85	26	4	0	0	0	1	0	0	31	31
14:15	57	8	3	0	0	2	0	0	70	74	24	1	1	0	0	0	0	0	26	27
14:30	42	12	6	0	0	0	0	0	60	68	20	0	0	0	0	0	0	0	20	20
14:45	76	14	4	0	0	3	0	0	97	102	29	4	0	0	0	0	0	0	33	33
H/TOT	240	44	16	0	1	6	0	2	309	329	99	9	1	0	0	1	0	0	110	111
15:00	56	10	2	0	1	1	0	0	70	74	22	5	0	0	0	1	0	0	28	28
15:15	51	10	6	0	0	1	0	1	69	76	17	4	0	0	0	0	0	0	21	21
15:30	54	7	3	0	1	2	0	0	67	72	28	1	1	0	0	2	0	0	32	33
15:45	77	7	2	0	1	0	0	0	87	91	21	2	1	0	0	0	0	1	25	26
H/TOT	238	34	13	0	3	4	0	1	293	312	88	12	2	0	0	3	0	1	106	108
3H/TOT	694	108	43	0	5	16	1	5	872	928	289	32	4	0	0	9	1	1	336	340
16:00	126	7	3	0	0	2	0	0	138	142	23	3	0	0	0	0	0	0	26	26
16:15	75	10	5	0	2	2	0	0	94	103	26	1	0	0	0	1	0	0	28	28
16:30	72	8	3	0	0	1	0	0	84	88	25	2	0	0	0	0	0	1	28	27
16:45	74	5	2	0	0	4	0	0	85	88	10	1	0	0	0	0	0	1	12	11
H/TOT	347	30	13	0	2	9	0	0	401	420	84	7	0	0	0	1	0	2	94	92
17:00	113	13	3	0	0	0	0	0	129	133	24	3	0	0	0	1	0	1	29	28
17:15	58	2	0	0	0	0	0	0	60	60	24	2	0	0	0	0	0	0	26	26
17:30	82	11	2	0	1	0	0	1	97	100	23	3	0	0	0	0	0	0	26	26
17:45	54	4	0	0	1	1	0	0	60	61	14	1	1	0	0	0	0	0	16	17
H/TOT	307	30	5	0	2	1	0	1	346	354	85	9	1	0	0	1	0	1	97	98
18:00	65	3	0	0	0	1	0	0	69	69	20	4	0	0	0	1	0	0	25	25
18:15	65	8	0	0	0	2	0	1	76	75	13	1	0	0	0	0	0	0	14	14
18:30	40	7	1	0	0	0	0	0	48	49	22	0	1	0	0	1	0	1	25	26
18:45	38	2	0	0	0	1	0	0	41	41	29	1	0	0	0	0	0	0	30	30
H/TOT	208	20	1	0	0	4	0	1	234	235	84	6	1	0	0	2	0	1	94	95
3H/TOT	862	80	19	0	4	14	0	2	981	1008	253	22	2	0	0	4	0	4	285	284
P/TOT	2761	384	158	0	27	48	1	13	3392	3613	1110	110	20	0	0	27	1	15	1283	1296

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

	A to A										B to C									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0	9	1	1	0	1	0	0	1	13	15
07:15	0	0	0	0	0	0	0	0	0	0	13	1	3	0	0	0	0	1	18	21
07:30	0	0	0	0	0	0	0	0	0	0	23	4	0	0	0	0	0	0	27	27
07:45	0	0	0	0	0	0	0	0	0	0	39	6	0	0	0	0	0	0	45	45
H/TOT	0	0	0	0	0	0	0	0	0	0	84	12	4	0	1	0	0	2	103	108
08:00	0	0	0	0	0	0	0	0	0	0	36	8	2	0	0	0	0	0	46	49
08:15	0	0	0	0	0	0	0	0	0	0	60	5	1	0	1	0	0	0	67	69
08:30	0	0	0	0	0	0	0	0	0	0	56	3	1	0	0	2	0	0	62	63
08:45	0	0	0	0	0	0	0	0	0	0	74	4	1	0	0	4	0	0	83	84
H/TOT	0	0	0	0	0	0	0	0	0	0	226	20	5	0	1	6	0	0	258	266
09:00	0	0	0	0	0	0	0	0	0	0	112	7	0	0	0	3	0	0	122	122
09:15	0	0	0	0	0	0	0	0	0	0	85	8	1	0	0	1	0	2	97	97
09:30	0	0	0	0	0	0	0	0	0	0	67	7	2	0	0	3	0	1	80	82
09:45	0	0	0	0	0	0	0	0	0	0	55	8	2	0	1	2	1	0	69	72
H/TOT	0	0	0	0	0	0	0	0	0	0	319	30	5	0	1	9	1	3	368	373
3H/TOT	0	0	0	0	0	0	0	0	0	0	629	62	14	0	3	15	1	5	729	746
10:00	0	0	0	0	0	0	0	0	0	0	39	7	0	0	1	1	0	0	48	49
10:15	1	0	0	0	0	0	0	0	1	1	51	5	2	0	0	2	0	0	60	63
10:30	0	0	0	0	0	0	0	0	0	0	56	12	1	0	0	2	0	0	71	72
10:45	0	0	0	0	0	0	0	0	0	0	39	12	0	0	0	2	0	0	53	53
H/TOT	0	0	0	0	0	0	0	0	0	0	185	36	3	0	1	7	0	0	232	237
11:00	0	0	0	0	0	0	0	0	0	0	56	6	2	0	0	1	0	0	65	68
11:15	0	0	0	0	0	0	0	0	0	0	57	6	0	0	0	0	0	0	63	63
11:30	0	0	0	0	0	0	0	0	0	0	47	5	2	0	0	3	0	0	57	60
11:45	0	0	0	0	0	0	0	0	0	0	47	7	1	0	2	2	0	2	61	63
H/TOT	0	0	0	0	0	0	0	0	0	0	207	24	5	0	2	6	0	2	246	253
12:00	0	0	0	0	0	0	0	0	0	0	51	7	4	0	0	1	0	0	63	68
12:15	0	0	0	0	0	0	0	0	0	0	66	10	3	0	0	3	0	0	82	86
12:30	0	0	0	0	0	0	0	0	0	0	54	5	1	0	0	4	0	0	64	65
12:45	0	0	0	0	0	0	0	0	0	0	71	6	1	0	1	1	0	0	80	82
H/TOT	0	0	0	0	0	0	0	0	0	0	242	28	9	0	1	9	0	0	289	302
3H/TOT	0	0	0	0	0	0	0	0	0	0	634	88	17	0	4	22	0	2	767	792
13:00	0	0	0	0	0	0	0	0	0	0	58	7	1	0	0	2	0	0	68	69
13:15	0	0	0	0	0	0	0	0	0	0	69	4	1	0	0	2	0	0	76	77
13:30	1	0	0	0	0	0	0	0	1	1	73	10	0	0	0	0	0	1	84	83
13:45	0	0	0	0	0	0	0	0	0	0	69	4	3	0	0	4	0	0	80	84
H/TOT	0	0	0	0	0	0	0	0	0	0	269	25	5	0	0	8	0	1	308	314
14:00	0	0	0	0	0	0	0	0	0	0	73	6	0	0	0	2	0	1	82	81
14:15	0	0	0	0	0	0	0	0	0	0	61	11	2	0	1	2	0	1	78	81
14:30	0	0	0	0	0	0	0	0	0	0	58	7	4	0	0	1	0	0	70	75
14:45	0	0	0	0	0	0	0	0	0	0	65	6	3	0	0	3	0	0	77	81
H/TOT	0	0	0	0	0	0	0	0	0	0	257	30	9	0	1	8	0	2	307	318
15:00	0	0	0	0	0	0	0	0	0	0	61	9	1	0	0	1	0	0	72	73
15:15	1	0	0	0	0	0	0	0	1	1	63	10	1	0	0	0	0	0	74	75
15:30	0	0	0	0	0	0	0	0	0	0	55	8	3	0	0	2	0	0	68	72
15:45	0	0	0	0	0	0	0	0	0	0	54	8	3	0	1	4	0	1	71	75
H/TOT	0	0	0	0	0	0	0	0	0	0	233	35	8	0	1	7	0	1	285	296
3H/TOT	0	0	0	0	0	0	0	0	0	0	759	90	22	0	2	23	0	4	900	927
16:00	0	0	0	0	0	0	0	0	0	0	56	7	0	0	0	1	0	0	64	64
16:15	0	0	0	0	0	0	0	0	0	0	67	12	2	0	1	3	0	0	85	89
16:30	0	0	0	0	0	0	0	0	0	0	62	8	2	0	0	3	0	1	76	78
16:45	0	0	0	0	0	0	0	0	0	0	64	6	1	0	0	1	0	0	72	73
H/TOT	0	0	0	0	0	0	0	0	0	0	249	33	5	0	1	8	0	1	297	304
17:00	0	0	0	0	0	0	0	0	0	0	51	6	1	0	0	1	0	1	60	61
17:15	1	0	0	0	0	0	0	0	1	1	58	6	1	0	0	0	0	0	65	66
17:30	0	0	0	0	0	0	0	0	0	0	78	2	0	0	1	1	0	0	82	83
17:45	0	0	0	0	0	0	0	0	0	0	55	5	0	0	0	2	0	0	62	62
H/TOT	0	0	0	0	0	0	0	0	0	0	242	19	2	0	1	4	0	1	269	272
18:00	0	0	0	0	0	0	0	0	0	0	60	5	0	0	0	0	0	0	65	65
18:15	0	0	0	0	0	0	0	0	0	0	45	1	0	0	0	1	0	0	47	47
18:30	0	0	0	0	0	0	0	0	0	0	50	3	0	0	0	0	0	2	55	53
18:45	0	0	0	0	0	0	0	0	0	0	52	4	0	0	0	2	0	1	59	58
H/TOT	0	0	0	0	0	0	0	0	0	0	207	13	0	0	0	3	0	3	226	224
3H/TOT	0	0	0	0	0	0	0	0	0	0	698	65	7	0	2	15	0	5	792	799
P/TOT	0	0	0	0	0	0	0	0	0	0	2720	305	60	0	11	75	1	16	3188	3264

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

	B to A										B to B									
TIME	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	11	1	1	0	0	0	0	0	13	14	0	0	0	0	0	0	0	0	0	0
07:15	16	2	0	0	0	0	0	0	18	18	0	0	0	0	0	0	0	0	0	0
07:30	44	5	3	0	0	0	1	0	53	56	0	0	0	0	0	0	0	0	0	0
07:45	86	8	6	0	0	0	0	0	100	108	0	0	0	0	0	0	0	0	0	0
H/TOT	157	16	10	0	0	0	1	0	184	196	0	0	0	0	0	0	0	0	0	0
08:00	58	10	2	0	1	1	1	0	73	76	0	0	0	0	0	0	0	0	0	0
08:15	118	11	4	0	6	1	0	0	140	151	0	0	0	0	0	0	0	0	0	0
08:30	117	9	3	0	1	0	0	1	131	135	0	0	0	0	0	0	0	0	0	0
08:45	109	5	3	0	0	2	0	1	120	123	0	0	0	0	0	0	0	0	0	0
H/TOT	402	35	12	0	8	4	1	2	464	485	0	0	0	0	0	0	0	0	0	0
09:00	81	12	4	0	1	0	0	0	98	104	0	0	0	0	0	0	0	0	0	0
09:15	44	9	5	0	0	1	0	1	60	66	0	0	0	0	0	0	0	0	0	0
09:30	43	8	3	0	0	0	0	0	54	58	0	0	0	0	0	0	0	0	0	0
09:45	59	11	1	0	0	0	0	0	71	72	0	0	0	0	0	0	0	0	0	0
H/TOT	227	40	13	0	1	1	0	1	283	300	0	0	0	0	0	0	0	0	0	0
3H/TOT	786	91	35	0	9	5	2	3	931	982	0	0	0	0	0	0	0	0	0	0
10:00	40	12	5	0	1	1	0	0	59	67	0	0	0	0	0	0	0	0	0	0
10:15	34	6	1	0	0	0	0	0	41	42	0	0	0	0	0	0	0	0	0	0
10:30	41	10	4	0	0	2	0	0	57	62	0	0	1	0	0	0	0	0	1	2
10:45	45	10	5	0	0	2	0	0	62	69	0	0	0	0	0	0	0	0	0	0
H/TOT	160	38	15	0	1	5	0	0	219	240	0	0	0	0	0	0	0	0	0	0
11:00	32	12	4	0	0	2	0	0	50	55	0	0	0	0	0	0	0	0	0	0
11:15	43	12	7	0	0	2	0	0	64	73	0	0	0	0	0	0	0	0	0	0
11:30	39	9	6	0	0	2	0	0	56	64	0	0	0	0	0	0	0	0	0	0
11:45	51	10	8	0	0	5	0	0	74	84	1	0	0	0	0	0	0	0	1	1
H/TOT	165	43	25	0	0	11	0	0	244	277	0	0	0	0	0	0	0	0	0	0
12:00	51	5	3	0	0	1	0	0	60	64	0	0	0	0	0	0	0	0	0	0
12:15	44	10	8	0	0	1	0	0	63	73	0	0	0	0	0	0	0	0	0	0
12:30	53	6	6	0	0	0	0	0	65	73	1	0	0	0	0	0	0	0	1	1
12:45	51	6	4	0	0	3	0	0	64	69	0	0	0	0	0	0	0	0	0	0
H/TOT	199	27	21	0	0	5	0	0	252	279	0	0	0	0	0	0	0	0	0	0
3H/TOT	524	108	61	0	1	21	0	0	715	795	0	0	0	0	0	0	0	0	0	0
13:00	58	8	2	0	0	2	0	0	70	73	0	1	0	0	0	0	0	0	1	1
13:15	57	6	4	0	0	0	0	0	67	72	0	0	0	0	0	0	0	0	0	0
13:30	78	8	3	0	0	2	0	0	91	95	0	0	0	0	0	0	0	0	0	0
13:45	58	9	1	0	0	0	0	0	68	69	0	0	0	0	0	0	0	0	0	0
H/TOT	251	31	10	0	0	4	0	0	296	309	0	0	0	0	0	0	0	0	0	0
14:00	64	17	2	0	1	1	0	1	86	89	0	0	0	0	0	0	0	0	0	0
14:15	74	6	2	0	0	2	0	1	85	87	1	0	0	0	0	0	0	0	1	1
14:30	62	8	3	0	0	1	0	0	74	78	0	0	0	0	0	0	0	0	0	0
14:45	72	4	6	0	0	1	0	0	83	91	0	0	0	0	0	0	0	0	0	0
H/TOT	272	35	13	0	1	5	0	2	328	344	0	0	0	0	0	0	0	0	0	0
15:00	50	13	3	0	0	1	0	0	67	71	0	0	0	0	0	0	0	0	0	0
15:15	70	7	3	0	0	0	0	0	80	84	0	0	0	0	0	0	0	0	0	0
15:30	62	13	4	0	2	4	0	0	85	92	0	0	0	0	0	0	0	0	0	0
15:45	90	7	2	0	1	0	0	0	100	104	0	0	0	0	0	0	0	0	0	0
H/TOT	272	40	12	0	3	5	0	0	332	351	0	0	0	0	0	0	0	0	0	0
3H/TOT	795	106	35	0	4	14	0	2	956	1004	0	0	0	0	0	0	0	0	0	0
16:00	64	7	2	0	0	0	0	2	75	76	0	0	0	0	0	0	0	0	0	0
16:15	49	5	2	0	0	0	0	0	56	59	0	0	0	0	0	0	0	0	0	0
16:30	69	11	3	0	0	0	0	0	83	87	0	0	0	0	0	0	0	0	0	0
16:45	68	8	5	0	0	1	0	1	83	89	0	0	0	0	0	0	0	0	0	0
H/TOT	250	31	12	0	0	1	0	3	297	310	0	0	0	0	0	0	0	0	0	0
17:00	82	7	3	0	0	1	0	0	93	97	0	0	0	0	0	0	0	0	0	0
17:15	98	5	2	0	0	0	0	0	105	108	0	1	0	0	0	0	0	0	1	1
17:30	70	9	1	0	0	1	0	0	81	82	0	0	0	0	0	0	0	0	0	0
17:45	69	7	0	0	0	0	0	0	76	76	0	0	0	0	0	0	0	0	0	0
H/TOT	319	28	6	0	0	2	0	0	355	363	0	0	0	0	0	0	0	0	0	0
18:00	93	8	0	0	0	1	0	0	102	102	0	0	0	0	0	0	0	0	0	0
18:15	51	4	1	0	0	1	0	0	57	58	1	0	0	0	0	0	0	0	1	1
18:30	60	4	0	0	0	0	0	0	64	64	0	0	0	0	0	0	0	0	0	0
18:45	40	4	1	0	0	0	0	0	45	46	0	0	0	0	0	0	0	0	0	0
H/TOT	244	20	2	0	0	2	0	0	268	271	1	0	0	0	0	0	0	0	1	1
3H/TOT	813	79	20	0	0	5	0	3	920	944	1	0	0	0	0	0	0	0	1	1
P/TOT	2918	384	151	0	14	45	2	8	3522	3725	1	0	0	0	0	0	0	0	1	1

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

TIME	C to A Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU	C to B Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	2	2	0	0	0	0	0	0	4	4	9	3	1	0	0	1	0	0	14	15
07:15	12	2	2	0	0	0	0	0	16	19	12	2	1	0	0	0	0	1	16	17
07:30	10	0	0	0	0	0	0	0	10	10	14	4	2	0	0	0	0	0	20	23
07:45	20	4	1	0	0	0	0	0	25	26	19	8	1	0	0	1	0	0	29	30
H/TOT	44	8	3	0	0	0	0	0	55	59	54	17	5	0	0	2	0	1	79	85
08:00	14	1	0	0	0	0	0	0	15	15	36	7	4	0	0	0	0	0	47	52
08:15	25	1	0	0	0	2	0	0	28	28	48	2	1	0	1	3	0	0	55	57
08:30	28	5	0	0	0	0	0	0	33	33	60	0	1	0	1	0	0	0	62	64
08:45	22	4	0	0	0	0	0	0	26	26	60	9	3	0	1	3	0	1	77	81
H/TOT	89	11	0	0	0	2	0	0	102	102	204	18	9	0	3	6	0	1	241	255
09:00	14	1	1	0	0	0	0	0	16	17	62	3	1	0	0	2	0	1	69	70
09:15	13	4	0	0	0	0	0	0	17	17	56	12	3	0	1	0	0	0	72	77
09:30	12	2	0	0	0	0	0	0	14	14	49	6	1	0	1	0	0	0	57	59
09:45	10	0	1	0	0	0	0	0	11	12	43	4	2	0	0	1	0	0	50	53
H/TOT	49	7	2	0	0	0	0	0	58	61	210	25	7	0	2	3	0	1	248	258
3H/TOT	182	26	5	0	0	2	0	0	215	222	468	60	21	0	5	11	0	3	568	598
10:00	21	3	2	0	0	1	0	0	27	30	41	9	2	0	0	2	0	0	54	57
10:15	11	0	0	0	0	1	0	0	12	12	43	7	6	0	0	1	0	0	57	65
10:30	17	5	0	0	0	3	0	0	25	25	36	5	4	0	0	1	0	0	46	51
10:45	20	3	0	0	0	1	0	0	24	24	50	7	1	0	0	2	0	0	60	61
H/TOT	69	11	2	0	0	6	0	0	88	91	170	28	13	0	0	6	0	0	217	234
11:00	22	0	1	0	0	0	0	0	23	24	44	2	2	0	0	1	1	0	50	52
11:15	23	5	0	0	0	0	0	0	28	28	58	7	1	0	0	0	0	0	66	67
11:30	23	4	1	0	0	0	0	1	29	30	49	4	1	0	1	0	0	0	55	57
11:45	22	1	1	0	0	0	0	0	24	25	71	10	3	0	0	0	0	0	84	88
H/TOT	90	10	3	0	0	0	0	1	104	107	222	23	7	0	1	1	1	0	255	265
12:00	27	6	2	0	0	0	0	0	35	38	53	9	5	0	0	0	0	0	67	74
12:15	18	2	0	0	0	0	0	0	20	20	68	14	1	0	0	2	0	1	86	87
12:30	19	0	0	0	0	0	1	0	20	19	59	5	0	0	0	0	0	1	65	64
12:45	18	3	1	0	0	1	0	0	23	24	67	10	0	0	0	1	0	1	79	78
H/TOT	82	11	3	0	0	1	1	0	98	101	247	38	6	0	0	3	0	3	297	302
3H/TOT	241	32	8	0	0	7	1	1	290	299	639	89	26	0	1	10	1	3	769	801
13:00	30	2	0	0	0	0	0	0	32	32	70	5	1	0	0	2	0	0	78	79
13:15	30	3	0	0	0	0	0	0	33	33	72	12	0	0	0	2	0	0	86	86
13:30	24	1	2	0	0	0	0	0	27	30	65	9	2	0	0	2	0	3	81	81
13:45	19	4	0	0	0	1	0	0	24	24	78	6	3	0	0	2	0	0	89	93
H/TOT	103	10	2	0	0	1	0	0	116	119	285	32	6	0	0	8	0	3	334	339
14:00	23	3	2	0	0	0	0	0	28	31	81	3	2	0	1	1	0	0	88	92
14:15	33	3	0	0	0	2	0	0	38	38	69	9	5	0	1	2	0	0	86	94
14:30	30	5	0	0	0	0	0	0	35	35	72	12	2	0	0	1	0	0	87	90
14:45	17	3	0	0	0	0	0	0	20	20	75	2	0	0	0	1	0	0	78	78
H/TOT	103	14	2	0	0	2	0	0	121	124	297	26	9	0	2	5	0	0	339	353
15:00	26	4	3	0	0	1	0	1	35	38	82	14	1	0	0	0	0	0	97	98
15:15	24	3	0	0	0	0	0	2	29	27	70	8	0	0	1	1	0	0	80	81
15:30	22	3	1	0	1	0	0	0	27	29	74	8	4	0	0	0	0	0	86	91
15:45	21	3	0	0	1	0	0	0	25	26	70	8	0	0	0	0	0	0	78	78
H/TOT	93	13	4	0	2	1	0	3	116	121	296	38	5	0	1	1	0	0	341	349
3H/TOT	299	37	8	0	2	4	0	3	353	363	878	96	20	0	3	14	0	3	1014	1041
16:00	24	2	1	0	0	0	0	0	27	28	72	10	3	0	0	1	0	0	86	90
16:15	28	0	0	0	0	1	0	0	29	29	62	6	0	0	1	3	0	0	72	73
16:30	29	4	0	0	0	0	0	1	34	33	68	7	1	0	0	3	0	0	79	80
16:45	30	2	0	0	0	0	0	2	34	32	68	6	2	0	0	1	0	0	77	80
H/TOT	111	8	1	0	0	1	0	3	124	123	270	29	6	0	1	8	0	0	314	323
17:00	36	5	0	0	0	0	0	0	41	41	77	7	1	0	2	3	0	0	90	93
17:15	33	1	0	0	0	0	0	0	34	34	82	3	2	0	0	1	0	0	88	91
17:30	37	0	0	0	0	0	0	0	37	37	102	4	0	0	0	0	0	0	106	106
17:45	34	1	0	0	0	0	0	0	35	35	91	4	1	0	0	0	0	0	96	97
H/TOT	140	7	0	0	0	0	0	0	147	147	352	18	4	0	2	4	0	0	380	387
18:00	31	1	0	0	0	0	0	0	32	32	93	9	0	0	0	1	0	3	106	104
18:15	33	3	0	0	0	0	0	0	36	36	86	7	0	0	0	1	0	1	95	94
18:30	28	1	0	0	0	0	0	0	29	29	66	1	0	0	0	1	0	0	68	68
18:45	27	3	0	0	0	0	0	1	31	30	64	3	0	0	0	0	0	0	67	67
H/TOT	119	8	0	0	0	0	0	1	128	127	309	20	0	0	0	3	0	4	336	333
3H/TOT	370	23	1	0	0	1	0	4	399	397	931	67	10	0	3	15	0	4	1030	1043
P/TOT	1092	118	22	0	2	14	1	8	1257	1281	2916	312	77	0	12	50	1	13	3381	3482

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

TIME	Car	LGV	HGV	C to C Dublin Bus	C to C Other Bus	Taxi	M/C	P/C	TOTAL	PCU
07:00	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
09:00	1	0	0	0	0	0	0	0	1	1
09:15	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0
09:45	1	0	0	0	0	0	0	0	1	1
H/TOT	2	0	0	0	0	0	0	0	2	2
3H/TOT	2	0	0	0	0	0	0	0	2	2
10:00	1	0	0	0	0	0	0	0	1	1
10:15	0	0	0	0	0	0	0	0	0	0
10:30	1	0	0	0	0	0	0	0	1	1
10:45	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	0	2	2
11:00	2	0	0	0	0	0	0	0	2	2
11:15	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0
11:45	1	0	0	0	0	0	0	0	1	1
H/TOT	3	0	0	0	0	0	0	0	3	3
12:00	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0
12:45	1	0	0	0	0	0	0	0	1	1
H/TOT	1	0	0	0	0	0	0	0	1	1
3H/TOT	6	0	0	0	0	0	0	0	6	6
13:00	0	0	0	0	0	0	0	0	0	0
13:15	2	0	0	0	0	0	0	0	2	2
13:30	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	0	2	2
14:00	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0
15:15	1	0	0	0	0	0	0	0	1	1
15:30	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	1
3H/TOT	3	0	0	0	0	0	0	0	3	3
16:00	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
3H/TOT	0	0	0	0	0	0	0	0	0	0
P/TOT	11	0	0	0	0	0	0	0	11	11

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

TIME	TO ARM A									FROM ARM A								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	13	3	1	0	0	0	0	0	17	16	2	1	0	0	0	0	0	19
07:15	28	4	2	0	0	0	0	0	34	23	6	6	0	0	0	0	0	35
07:30	54	5	3	0	0	0	1	0	63	37	5	3	0	0	0	0	0	45
07:45	106	12	7	0	0	0	0	0	125	68	8	2	0	0	1	0	2	81
H/TOT	201	24	13	0	0	0	1	0	239	144	21	12	0	0	1	0	2	180
08:00	72	11	2	0	1	1	1	0	88	84	11	3	0	3	1	0	0	102
08:15	143	12	4	0	6	3	0	0	168	122	9	4	0	4	2	0	3	144
08:30	145	14	3	0	1	0	0	1	164	149	10	4	0	1	0	0	1	165
08:45	131	9	3	0	0	2	0	1	146	135	11	4	0	1	3	0	2	156
H/TOT	491	46	12	0	8	6	1	2	566	490	41	15	0	9	6	0	6	567
09:00	95	13	5	0	1	0	0	0	114	105	14	5	0	0	1	0	0	125
09:15	57	13	5	0	0	1	0	1	77	68	12	7	0	0	1	0	1	89
09:30	55	10	3	0	0	0	0	0	68	71	13	5	0	1	1	0	0	91
09:45	69	11	2	0	0	0	0	0	82	67	12	4	0	0	0	0	0	83
H/TOT	276	47	15	0	1	1	0	1	341	311	51	21	0	1	3	0	1	388
3H/TOT	968	117	40	0	9	7	2	3	1146	945	113	48	0	10	10	0	9	1135
10:00	61	15	7	0	1	2	0	0	86	67	9	5	0	0	1	0	1	83
10:15	46	6	1	0	0	1	0	0	54	72	9	3	0	0	1	0	3	88
10:30	58	15	4	0	0	5	0	0	82	63	12	9	0	4	3	0	0	91
10:45	65	13	5	0	0	3	0	0	86	73	13	5	0	1	3	0	0	95
H/TOT	230	49	17	0	1	11	0	0	308	275	43	22	0	5	8	0	4	357
11:00	54	12	5	0	0	2	0	0	73	57	7	2	0	0	3	0	0	69
11:15	66	17	7	0	0	2	0	0	92	64	12	7	0	0	3	0	0	86
11:30	62	13	7	0	0	2	0	1	85	61	10	5	0	2	3	0	1	82
11:45	73	11	9	0	0	5	0	0	98	83	11	6	0	0	2	0	1	103
H/TOT	255	53	28	0	0	11	0	1	348	265	40	20	0	2	11	0	2	340
12:00	78	11	5	0	0	1	0	0	95	71	16	5	0	0	1	0	1	94
12:15	62	12	8	0	0	1	0	0	83	75	7	6	0	0	1	0	0	89
12:30	72	6	6	0	0	0	1	0	85	70	18	4	0	0	0	0	0	92
12:45	69	9	5	0	0	4	0	0	87	73	15	5	0	1	1	0	0	95
H/TOT	281	38	24	0	0	6	1	0	350	289	56	20	0	1	3	0	1	370
3H/TOT	766	140	69	0	1	28	1	1	1006	829	139	62	0	8	22	0	7	1067
13:00	88	10	2	0	0	2	0	0	102	95	12	6	0	1	1	0	1	116
13:15	87	9	4	0	0	0	0	0	100	78	6	2	0	0	2	0	0	88
13:30	103	9	5	0	0	2	0	0	119	64	11	3	0	0	5	1	1	85
13:45	77	13	1	0	0	1	0	0	92	82	12	4	0	0	3	1	0	102
H/TOT	355	41	12	0	0	5	0	0	413	319	41	15	0	1	11	2	2	391
14:00	87	20	4	0	1	1	0	1	114	91	14	3	0	1	2	0	2	113
14:15	107	9	2	0	0	4	0	1	123	81	9	4	0	0	2	0	0	96
14:30	92	13	3	0	0	1	0	0	109	62	12	6	0	0	0	0	0	80
14:45	89	7	6	0	0	1	0	0	103	105	18	4	0	0	3	0	0	130
H/TOT	375	49	15	0	1	7	0	2	449	339	53	17	0	1	7	0	2	419
15:00	76	17	6	0	0	2	0	1	102	78	15	2	0	1	2	0	0	98
15:15	95	10	3	0	0	0	0	2	110	69	14	6	0	0	1	0	1	91
15:30	84	16	5	0	3	4	0	0	112	82	8	4	0	1	4	0	0	99
15:45	111	10	2	0	2	0	0	0	125	98	9	3	0	1	0	0	1	112
H/TOT	366	53	16	0	5	6	0	3	449	327	46	15	0	3	7	0	2	400
3H/TOT	1096	143	43	0	6	18	0	5	1311	985	140	47	0	5	25	2	6	1210
16:00	88	9	3	0	0	0	0	2	102	149	10	3	0	0	2	0	0	164
16:15	77	5	2	0	0	1	0	0	85	101	11	5	0	2	3	0	0	122
16:30	98	15	3	0	0	0	0	1	117	97	10	3	0	0	1	0	1	112
16:45	98	10	5	0	0	1	0	3	117	84	6	2	0	0	4	0	1	97
H/TOT	361	39	13	0	0	2	0	6	421	431	37	13	0	2	10	0	2	495
17:00	118	12	3	0	0	1	0	0	134	137	16	3	0	0	1	0	1	158
17:15	132	6	2	0	0	0	0	0	140	83	4	0	0	0	0	0	0	87
17:30	107	9	1	0	0	1	0	0	118	105	14	2	0	1	0	0	1	123
17:45	103	8	0	0	0	0	0	0	111	68	5	1	0	1	1	0	0	76
H/TOT	460	35	6	0	0	2	0	0	503	393	39	6	0	2	2	0	2	444
18:00	124	9	0	0	0	1	0	0	134	85	7	0	0	0	2	0	0	94
18:15	84	7	1	0	0	1	0	0	93	78	9	0	0	0	2	0	1	90
18:30	88	5	0	0	0	0	0	0	93	62	7	2	0	0	1	0	1	73
18:45	67	7	1	0	0	0	0	1	76	67	3	0	0	0	1	0	0	71
H/TOT	363	28	2	0	0	2	0	1	396	292	26	2	0	0	6	0	2	328
3H/TOT	1184	102	21	0	0	6	0	7	1320	1116	102	21	0	4	18	0	6	1267
P/TOT	4014	502	173	0	16	59	3	16	4783	3875	494	178	0	27	75	2	28	4679

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

TIME	TO ARM B									FROM ARM B								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	20	4	2	0	0	1	0	0	27	20	2	2	0	1	0	0	1	26
07:15	29	8	6	0	0	0	0	1	44	29	3	3	0	0	0	0	1	36
07:30	41	8	4	0	0	0	0	0	53	67	9	3	0	0	0	1	0	80
07:45	66	13	2	0	0	1	0	0	82	125	14	6	0	0	0	0	0	145
H/TOT	156	33	14	0	0	2	0	1	206	241	28	14	0	1	0	1	2	287
08:00	107	16	7	0	3	0	0	0	133	94	18	4	0	1	1	1	0	119
08:15	149	9	4	0	5	4	0	2	173	178	16	5	0	7	1	0	0	207
08:30	159	8	5	0	2	0	0	0	174	173	12	4	0	1	2	0	1	193
08:45	147	20	7	0	2	5	0	1	182	183	9	4	0	0	6	0	1	203
H/TOT	562	53	23	0	12	9	0	3	662	628	55	17	0	9	10	1	2	722
09:00	133	16	6	0	0	3	0	1	159	193	19	4	0	1	3	0	0	220
09:15	105	20	9	0	1	1	0	1	137	129	17	6	0	0	2	0	3	157
09:30	99	15	5	0	2	1	0	0	122	110	15	5	0	0	3	0	1	134
09:45	87	13	6	0	0	1	0	0	107	114	19	3	0	1	2	1	0	140
H/TOT	424	64	26	0	3	6	0	2	525	546	70	18	0	2	10	1	4	651
3H/TOT	1142	150	63	0	15	17	0	6	1393	1415	153	49	0	12	20	3	8	1660
10:00	78	14	6	0	0	3	0	0	101	79	19	5	0	2	2	0	0	107
10:15	83	14	9	0	0	1	0	2	109	85	11	3	0	0	2	0	0	101
10:30	77	13	14	0	4	1	0	0	109	97	22	6	0	0	4	0	0	129
10:45	95	16	5	0	1	5	0	0	122	84	22	5	0	0	4	0	0	115
H/TOT	333	57	34	0	5	10	0	2	441	345	74	19	0	2	12	0	0	452
11:00	78	8	4	0	0	3	1	0	94	88	18	6	0	0	3	0	0	115
11:15	100	15	6	0	0	3	0	0	124	100	18	7	0	0	2	0	0	127
11:30	92	9	5	0	3	1	0	1	111	86	14	8	0	0	5	0	0	113
11:45	128	20	8	0	0	1	0	0	157	99	17	9	0	2	7	0	2	136
H/TOT	398	52	23	0	3	8	1	1	486	373	67	30	0	2	17	0	2	491
12:00	99	23	10	0	0	0	0	0	132	102	12	7	0	0	2	0	0	123
12:15	121	20	7	0	0	3	0	1	152	110	20	11	0	0	4	0	0	145
12:30	104	22	4	0	0	0	0	1	131	108	11	7	0	0	4	0	0	130
12:45	117	21	3	0	1	1	0	1	144	122	12	5	0	1	4	0	0	144
H/TOT	441	86	24	0	1	4	0	3	559	442	55	30	0	1	14	0	0	542
3H/TOT	1172	195	81	0	9	22	1	6	1486	1160	196	79	0	5	43	0	2	1485
13:00	132	14	6	0	1	3	0	1	157	116	16	3	0	0	4	0	0	139
13:15	125	16	2	0	0	3	0	0	146	126	10	5	0	0	2	0	0	143
13:30	106	17	5	0	0	5	0	4	137	151	18	3	0	0	2	0	1	175
13:45	138	16	7	0	0	3	1	0	165	127	13	4	0	0	4	0	0	148
H/TOT	501	63	20	0	1	14	1	5	605	520	57	15	0	0	12	0	1	605
14:00	146	13	5	0	2	2	0	2	170	137	23	2	0	1	3	0	2	168
14:15	127	17	8	0	1	4	0	0	157	136	17	4	0	1	4	0	2	164
14:30	114	24	8	0	0	1	0	0	147	120	15	7	0	0	2	0	0	144
14:45	151	16	4	0	0	4	0	0	175	137	10	9	0	0	4	0	0	160
H/TOT	538	70	25	0	3	11	0	2	649	530	65	22	0	2	13	0	4	636
15:00	138	24	3	0	1	1	0	0	167	111	22	4	0	0	2	0	0	139
15:15	121	18	6	0	1	2	0	1	149	133	17	4	0	0	0	0	0	154
15:30	128	15	7	0	1	2	0	0	153	117	21	7	0	2	6	0	0	153
15:45	147	15	2	0	1	0	0	0	165	144	15	5	0	2	4	0	1	171
H/TOT	534	72	18	0	4	5	0	1	634	505	75	20	0	4	12	0	1	617
3H/TOT	1573	205	63	0	8	30	1	8	1888	1555	197	57	0	6	37	0	6	1858
16:00	198	17	6	0	0	3	0	0	224	120	14	2	0	0	1	0	2	139
16:15	137	16	5	0	3	5	0	0	166	116	17	4	0	1	3	0	0	141
16:30	140	15	4	0	0	4	0	0	163	131	19	5	0	0	3	0	1	159
16:45	142	11	4	0	0	5	0	0	162	132	14	6	0	0	2	0	1	155
H/TOT	617	59	19	0	3	17	0	0	715	499	64	17	0	1	9	0	4	594
17:00	190	20	4	0	2	3	0	0	219	133	13	4	0	0	2	0	1	153
17:15	140	6	2	0	0	1	0	0	149	156	12	3	0	0	0	0	0	171
17:30	184	15	2	0	1	0	0	1	203	148	11	1	0	1	2	0	0	163
17:45	145	8	1	0	1	1	0	0	156	124	12	0	0	0	2	0	0	138
H/TOT	659	49	9	0	4	5	0	1	727	561	48	8	0	1	6	0	1	625
18:00	158	12	0	0	0	2	0	3	175	153	13	0	0	0	1	0	0	167
18:15	152	15	0	0	0	3	0	2	172	97	5	1	0	0	2	0	0	105
18:30	106	8	1	0	0	1	0	0	116	110	7	0	0	0	0	0	2	119
18:45	102	5	0	0	0	1	0	0	108	92	8	1	0	0	2	0	1	104
H/TOT	518	40	1	0	0	7	0	5	571	452	33	2	0	0	5	0	3	495
3H/TOT	1794	148	29	0	7	29	0	6	2013	1512	145	27	0	2	20	0	8	1714
P/TOT	5681	698	236	0	39	98	2	26	6780	5642	691	212	0	25	120	3	24	6717

Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
JUNCTION TURNING COUNTS

Site: 1

Location: New Road/ Vicar Street

TIME	TO ARM C									FROM ARM C								
	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL	Car	LGV	HGV	Dublin Bus	Other Bus	Taxi	M/C	P/C	TOTAL
07:00	14	2	1	0	1	0	0	1	19	11	5	1	0	0	1	0	0	18
07:15	19	1	4	0	0	0	0	1	25	24	4	3	0	0	0	0	1	32
07:30	33	5	1	0	0	0	0	0	39	24	4	2	0	0	0	0	0	30
07:45	60	9	1	0	0	1	0	2	73	39	12	2	0	0	1	0	0	54
H/TOT	126	17	7	0	1	1	0	4	156	98	25	8	0	0	2	0	1	134
08:00	49	10	2	0	0	1	0	0	62	50	8	4	0	0	0	0	0	62
08:15	81	7	2	0	1	1	0	1	93	73	3	1	0	1	5	0	0	83
08:30	106	5	1	0	0	2	0	1	115	88	5	1	0	1	0	0	0	95
08:45	122	4	1	0	0	5	0	2	134	82	13	3	0	1	3	0	1	103
H/TOT	358	26	6	0	1	9	0	4	404	293	29	9	0	3	8	0	1	343
09:00	147	8	0	0	0	3	0	0	158	77	4	2	0	0	2	0	1	86
09:15	104	12	2	0	0	1	0	2	121	69	16	3	0	1	0	0	0	89
09:30	88	11	3	0	0	3	0	1	106	61	8	1	0	1	0	0	0	71
09:45	79	11	2	0	1	2	1	0	96	54	4	3	0	0	1	0	0	62
H/TOT	418	42	7	0	1	9	1	3	481	261	32	9	0	2	3	0	1	308
3H/TOT	902	85	20	0	3	19	1	11	1041	652	86	26	0	5	13	0	3	785
10:00	70	11	1	0	1	1	0	1	85	63	12	4	0	0	3	0	0	82
10:15	82	7	2	0	0	3	0	1	95	54	7	6	0	0	2	0	0	69
10:30	79	16	1	0	0	5	0	0	101	54	10	4	0	0	4	0	0	72
10:45	67	16	1	0	0	2	0	0	86	70	10	1	0	0	3	0	0	84
H/TOT	298	50	5	0	1	11	0	2	367	241	39	15	0	0	12	0	0	307
11:00	81	7	2	0	0	2	0	0	92	68	2	3	0	0	1	1	0	75
11:15	79	10	2	0	0	0	0	0	91	81	12	1	0	0	0	0	0	94
11:30	65	10	3	0	0	5	0	0	83	72	8	2	0	1	0	0	1	84
11:45	75	8	2	0	2	3	0	3	93	94	11	4	0	0	0	0	0	109
H/TOT	300	35	9	0	2	10	0	3	359	315	33	10	0	1	1	1	1	362
12:00	76	9	4	0	0	2	0	1	92	80	15	7	0	0	0	0	0	102
12:15	88	11	3	0	0	3	0	0	105	86	16	1	0	0	2	0	1	106
12:30	80	6	1	0	0	4	0	0	91	78	5	0	0	0	0	1	1	85
12:45	95	10	3	0	1	2	0	0	111	86	13	1	0	0	2	0	1	103
H/TOT	339	36	11	0	1	11	0	1	399	330	49	9	0	0	4	1	3	396
3H/TOT	937	121	25	0	4	32	0	6	1125	886	121	34	0	1	17	2	4	1065
13:00	91	11	2	0	0	2	0	0	106	100	7	1	0	0	2	0	0	110
13:15	96	6	1	0	0	3	0	0	106	104	15	0	0	0	2	0	0	121
13:30	95	13	0	0	0	2	1	1	112	89	10	4	0	0	2	0	3	108
13:45	91	6	3	0	0	6	0	0	106	97	10	3	0	0	3	0	0	113
H/TOT	373	36	6	0	0	13	1	1	430	390	42	8	0	0	9	0	3	452
14:00	99	10	0	0	0	3	0	1	113	104	6	4	0	1	1	0	0	116
14:15	85	12	3	0	1	2	0	1	104	102	12	5	0	1	4	0	0	124
14:30	78	7	4	0	0	1	0	0	90	102	17	2	0	0	1	0	0	122
14:45	94	10	3	0	0	3	0	0	110	92	5	0	0	0	1	0	0	98
H/TOT	356	39	10	0	1	9	0	2	417	400	40	11	0	2	7	0	0	460
15:00	83	14	1	0	0	2	0	0	100	108	18	4	0	0	1	0	1	132
15:15	81	14	1	0	0	0	0	0	96	95	11	0	0	1	1	0	2	110
15:30	83	9	4	0	0	4	0	0	100	96	11	5	0	1	0	0	0	113
15:45	75	10	4	0	1	4	0	2	96	91	11	0	0	1	0	0	0	103
H/TOT	322	47	10	0	1	10	0	2	392	390	51	9	0	3	2	0	3	458
3H/TOT	1051	122	26	0	2	32	1	5	1239	1180	133	28	0	5	18	0	6	1370
16:00	79	10	0	0	0	1	0	0	90	96	12	4	0	0	1	0	0	113
16:15	93	13	2	0	1	4	0	0	113	90	6	0	0	1	4	0	0	101
16:30	87	10	2	0	0	3	0	2	104	97	11	1	0	0	3	0	1	113
16:45	74	7	1	0	0	1	0	1	84	98	8	2	0	0	1	0	2	111
H/TOT	333	40	5	0	1	9	0	3	391	381	37	7	0	1	9	0	3	438
17:00	75	9	1	0	0	2	0	2	89	113	12	1	0	2	3	0	0	131
17:15	82	8	1	0	0	0	0	0	91	115	4	2	0	0	1	0	0	122
17:30	101	5	0	0	1	1	0	0	108	139	4	0	0	0	0	0	0	143
17:45	69	6	1	0	0	2	0	0	78	125	5	1	0	0	0	0	0	131
H/TOT	327	28	3	0	1	5	0	2	366	492	25	4	0	2	4	0	0	527
18:00	80	9	0	0	0	1	0	0	90	124	10	0	0	0	1	0	3	138
18:15	58	2	0	0	0	1	0	0	61	119	10	0	0	0	1	0	1	131
18:30	72	3	1	0	0	1	0	3	80	94	2	0	0	0	1	0	0	97
18:45	81	5	0	0	0	2	0	1	89	91	6	0	0	0	0	0	1	98
H/TOT	291	19	1	0	0	5	0	4	320	428	28	0	0	0	3	0	5	464
3H/TOT	951	87	9	0	2	19	0	9	1077	1301	90	11	0	3	16	0	8	1429
P/TOT	3841	415	80	0	11	102	2	31	4482	4019	430	99	0	14	64	2	21	4649

Sky High-Count On Us

Job Number: SC1596

Job Title: Kilkenny

Client: Clifton Scannell Emerson Associates

Survey Date: Wed 16/01/13

Survey Period: 07:00-19:00

Survey Type: Pedestrian Crossing

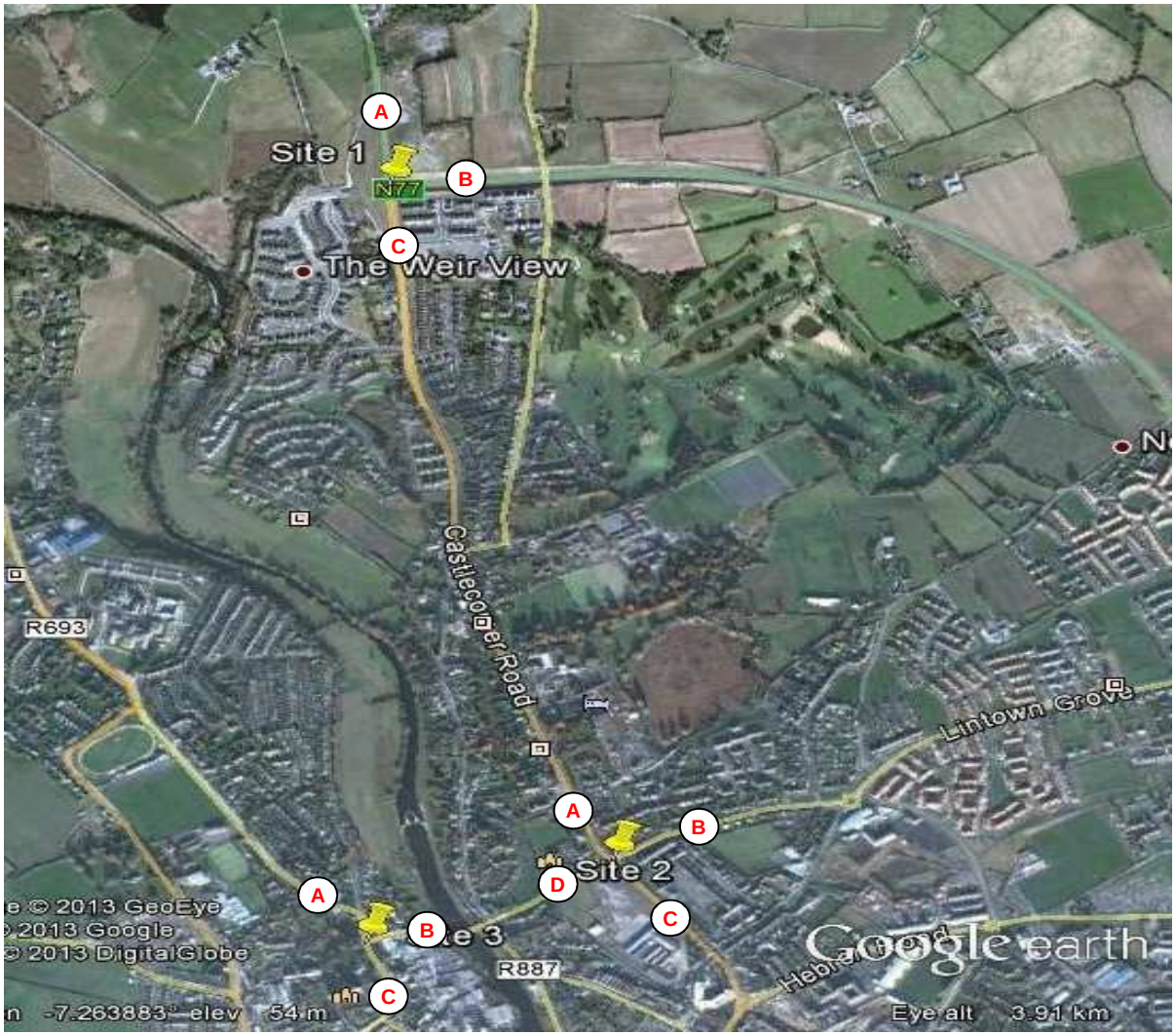
Sky High-Count On Us

KILKENNY / SC1596
WED 16 JANUARY 2013
SITE PLAN

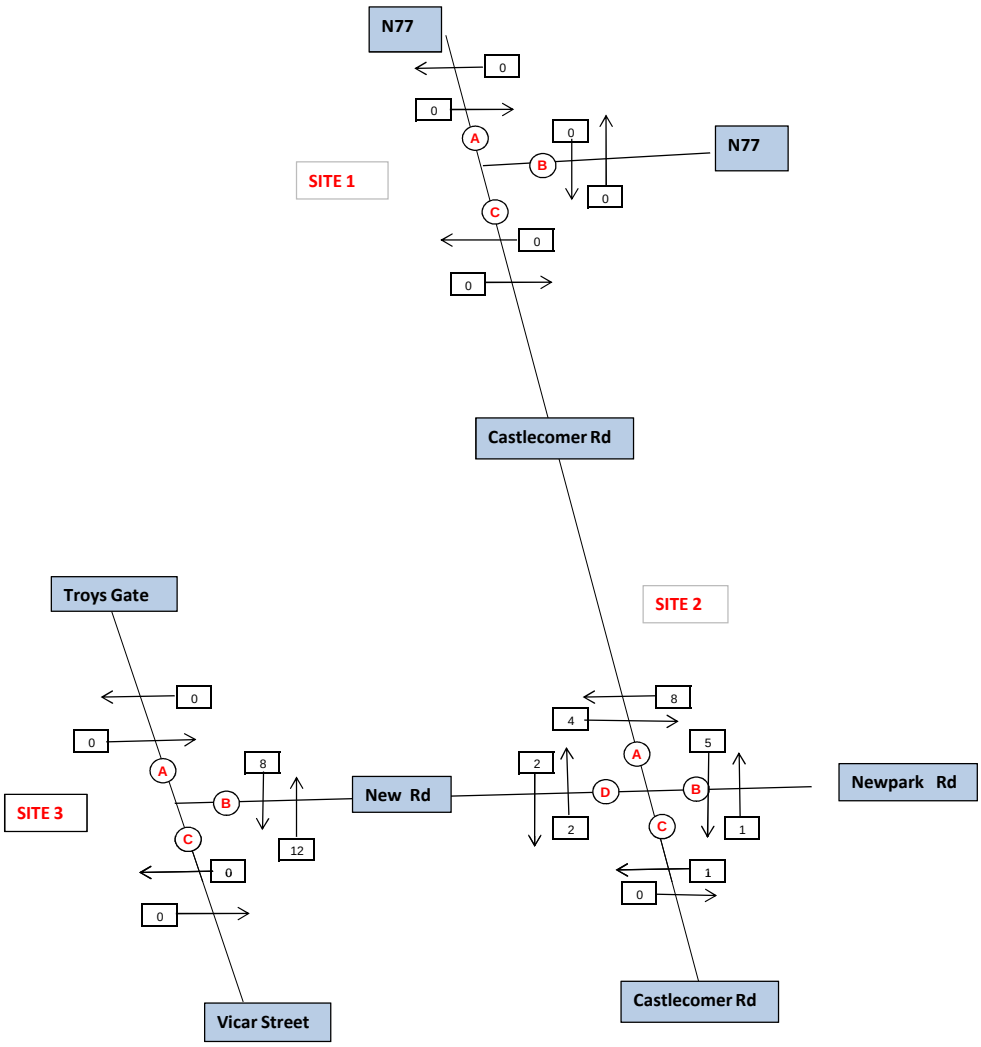
Sites/ Locations: 1 - N77/ Castlecomer Road
2 - Castlecomer Road/ Newpark Road/ New Road
3 - New Road/ Vicar Street

Diagram No: 1

N



Hour 14:00 - 15:00



Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
PEDESTRIAN CROSSING

SITE: 1

LOCATION: N77/ Castlecomer Road

	ARM A						ARM B					
	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
TIME	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL
07:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
07:15	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
07:30	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
07:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	1	**1**	0	1	**1**
08:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
08:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
08:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
08:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
09:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
09:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
09:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
09:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**	0	1	**1**	0	1	**1**
10:00	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
10:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
10:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
10:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
11:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
11:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
11:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
11:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
12:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
12:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
12:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
12:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
13:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
13:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
13:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
13:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
14:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
14:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
14:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
14:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
15:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
15:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
15:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
15:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
16:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
16:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
16:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
16:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
17:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
17:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
17:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
17:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
18:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
18:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
18:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
18:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
TOTAL	0	0	**0**	0	0	**0**	0	1	**1**	0	2	**2**

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
PEDESTRIAN CROSSING

SITE: 1

LOCATION: N77/ Castlecomer Road

	ARM C					
	EASTBOUND			WESTBOUND		
TIME	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL
07:00	0	0	**0**	0	0	**0**
07:15	0	0	**0**	0	0	**0**
07:30	0	0	**0**	0	0	**0**
07:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
08:00	0	0	**0**	0	0	**0**
08:15	0	0	**0**	0	0	**0**
08:30	0	0	**0**	0	0	**0**
08:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
09:00	0	0	**0**	0	0	**0**
09:15	0	0	**0**	0	0	**0**
09:30	0	0	**0**	0	0	**0**
09:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**
10:00	0	0	**0**	0	0	**0**
10:15	0	0	**0**	0	0	**0**
10:30	0	0	**0**	0	0	**0**
10:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
11:00	0	0	**0**	0	0	**0**
11:15	0	0	**0**	0	1	**1**
11:30	0	0	**0**	0	0	**0**
11:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	1	**1**
12:00	0	0	**0**	0	0	**0**
12:15	0	0	**0**	0	0	**0**
12:30	0	0	**0**	0	0	**0**
12:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	1	**1**
13:00	0	0	**0**	0	0	**0**
13:15	0	0	**0**	0	0	**0**
13:30	0	0	**0**	0	0	**0**
13:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
14:00	0	0	**0**	0	0	**0**
14:15	0	0	**0**	0	0	**0**
14:30	0	0	**0**	0	0	**0**
14:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
15:00	0	0	**0**	0	0	**0**
15:15	0	0	**0**	0	0	**0**
15:30	0	0	**0**	0	0	**0**
15:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**
16:00	0	0	**0**	0	0	**0**
16:15	0	0	**0**	0	0	**0**
16:30	0	0	**0**	0	0	**0**
16:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
17:00	0	0	**0**	0	0	**0**
17:15	0	0	**0**	0	0	**0**
17:30	0	0	**0**	0	0	**0**
17:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
18:00	0	0	**0**	0	0	**0**
18:15	0	0	**0**	0	0	**0**
18:30	0	0	**0**	0	1	**1**
18:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	1	**1**
3HR/TOT	0	0	**0**	0	1	**1**
TOTAL	0	0	**0**	0	2	**2**

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
PEDESTRIAN CROSSING

SITE: 2

LOCATION: Castlecomer Road/ Newpark Road/ New Road

	ARM A						ARM B					
	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
TIME	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL
07:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
07:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
07:30	0	0	**0**	0	1	**1**	0	0	**0**	0	0	**0**
07:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	1	**1**	0	0	**0**	0	0	**0**
08:00	0	0	**0**	0	3	**3**	0	0	**0**	0	0	**0**
08:15	0	0	**0**	0	4	**4**	0	1	**1**	0	0	**0**
08:30	0	0	**0**	0	1	**1**	0	1	**1**	0	0	**0**
08:45	0	0	**0**	1	4	**5**	0	1	**1**	0	1	**1**
H/TOT	0	0	**0**	1	12	**13**	0	3	**3**	0	1	**1**
09:00	0	2	**2**	0	1	**1**	0	0	**0**	0	1	**1**
09:15	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
09:30	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
09:45	0	1	**1**	0	0	**0**	0	3	**3**	0	3	**3**
H/TOT	0	3	**3**	0	1	**1**	0	3	**3**	0	6	**6**
3HR/TOT	0	3	**3**	1	14	**15**	0	6	**6**	0	7	**7**
10:00	0	0	**0**	0	1	**1**	0	3	**3**	0	3	**3**
10:15	0	0	**0**	0	1	**1**	0	0	**0**	0	3	**3**
10:30	0	0	**0**	0	1	**1**	0	1	**1**	0	0	**0**
10:45	1	1	**2**	0	0	**0**	0	0	**0**	0	1	**1**
H/TOT	1	1	**2**	0	3	**3**	0	4	**4**	0	7	**7**
11:00	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
11:15	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
11:30	0	0	**0**	0	1	**1**	0	1	**1**	0	2	**2**
11:45	0	0	**0**	0	1	**1**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	2	**2**	0	1	**1**	0	4	**4**
12:00	0	1	**1**	0	0	**0**	0	0	**0**	0	0	**0**
12:15	0	2	**2**	0	0	**0**	0	0	**0**	0	0	**0**
12:30	0	0	**0**	0	1	**1**	0	0	**0**	0	0	**0**
12:45	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
H/TOT	0	3	**3**	0	1	**1**	0	0	**0**	0	1	**1**
3HR/TOT	1	4	**5**	0	6	**6**	0	5	**5**	0	12	**12**
13:00	0	0	**0**	0	0	**0**	0	1	**1**	0	2	**2**
13:15	0	0	**0**	1	2	**3**	0	2	**2**	0	0	**0**
13:30	0	0	**0**	0	2	**2**	0	0	**0**	0	1	**1**
13:45	0	1	**1**	1	3	**4**	0	0	**0**	0	3	**3**
H/TOT	0	1	**1**	2	7	**9**	0	3	**3**	0	6	**6**
14:00	0	1	**1**	1	3	**4**	0	0	**0**	0	3	**3**
14:15	0	0	**0**	0	1	**1**	0	0	**0**	0	1	**1**
14:30	1	2	**3**	0	3	**3**	0	1	**1**	0	1	**1**
14:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	1	3	**4**	1	7	**8**	0	1	**1**	0	5	**5**
15:00	0	2	**2**	0	0	**0**	0	0	**0**	0	3	**3**
15:15	0	0	**0**	0	1	**1**	0	1	**1**	0	2	**2**
15:30	0	1	**1**	0	0	**0**	0	1	**1**	0	0	**0**
15:45	0	0	**0**	0	1	**1**	0	6	**6**	0	0	**0**
H/TOT	0	3	**3**	0	2	**2**	0	8	**8**	0	5	**5**
3HR/TOT	1	7	**8**	3	16	**19**	0	12	**12**	0	16	**16**
16:00	0	4	**4**	0	0	**0**	0	2	**2**	0	5	**5**
16:15	0	1	**1**	0	1	**1**	0	1	**1**	0	3	**3**
16:30	0	1	**1**	0	1	**1**	0	2	**2**	0	0	**0**
16:45	0	2	**2**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	8	**8**	0	2	**2**	0	5	**5**	0	8	**8**
17:00	0	2	**2**	0	0	**0**	0	2	**2**	0	1	**1**
17:15	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
17:30	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
17:45	0	5	**5**	0	0	**0**	0	1	**1**	0	1	**1**
H/TOT	0	7	**7**	0	0	**0**	0	4	**4**	0	3	**3**
18:00	0	3	**3**	0	0	**0**	0	1	**1**	0	0	**0**
18:15	0	1	**1**	0	2	**2**	0	2	**2**	0	0	**0**
18:30	0	1	**1**	0	0	**0**	0	0	**0**	0	2	**2**
18:45	0	2	**2**	0	1	**1**	0	0	**0**	0	0	**0**
H/TOT	0	7	**7**	0	3	**3**	0	3	**3**	0	2	**2**
3HR/TOT	0	22	**22**	0	5	**5**	0	12	**12**	0	13	**13**
TOTAL	2	36	**38**	4	41	**45**	0	35	**35**	0	48	**48**

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
PEDESTRIAN CROSSING

SITE: 2

LOCATION: Castlecomer Road/ Newpark Road/ New Road

	ARM C						ARM D					
	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
TIME	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL
07:00	0	0	**0**	0	1	**1**	0	0	**0**	0	1	**1**
07:15	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
07:30	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
07:45	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
H/TOT	0	0	**0**	0	1	**1**	0	2	**2**	0	2	**2**
08:00	0	0	**0**	0	0	**0**	0	3	**3**	0	2	**2**
08:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
08:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
08:45	0	0	**0**	0	0	**0**	2	1	**3**	0	1	**1**
H/TOT	0	0	**0**	0	0	**0**	2	4	**6**	0	3	**3**
09:00	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
09:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
09:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
09:45	0	1	**1**	0	1	**1**	0	2	**2**	0	2	**2**
H/TOT	0	1	**1**	0	1	**1**	0	2	**2**	0	3	**3**
3HR/TOT	0	1	**1**	0	2	**2**	2	8	**10**	0	8	**8**
10:00	0	3	**3**	0	0	**0**	0	0	**0**	0	1	**1**
10:15	0	2	**2**	0	0	**0**	0	0	**0**	0	2	**2**
10:30	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
10:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	5	**5**	0	0	**0**	0	0	**0**	0	3	**3**
11:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
11:15	0	1	**1**	0	2	**2**	0	2	**2**	0	1	**1**
11:30	0	1	**1**	0	1	**1**	0	0	**0**	0	1	**1**
11:45	0	1	**1**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	3	**3**	0	3	**3**	0	2	**2**	0	2	**2**
12:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
12:15	0	1	**1**	0	1	**1**	0	1	**1**	0	0	**0**
12:30	1	1	**2**	0	1	**1**	0	0	**0**	0	0	**0**
12:45	0	0	**0**	0	6	**6**	1	4	**5**	0	0	**0**
H/TOT	1	2	**3**	0	8	**8**	1	5	**6**	0	0	**0**
3HR/TOT	1	10	**11**	0	11	**11**	1	7	**8**	0	5	**5**
13:00	0	1	**1**	0	0	**0**	0	1	**1**	0	0	**0**
13:15	1	0	**1**	0	0	**0**	0	0	**0**	0	1	**1**
13:30	0	3	**3**	0	3	**3**	0	2	**2**	0	0	**0**
13:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	1	4	**5**	0	3	**3**	0	3	**3**	0	1	**1**
14:00	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
14:15	0	0	**0**	0	1	**1**	0	0	**0**	1	1	**2**
14:30	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
14:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	1	**1**	0	2	**2**	1	1	**2**
15:00	0	0	**0**	0	1	**1**	0	2	**2**	0	0	**0**
15:15	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
15:30	0	0	**0**	0	1	**1**	0	0	**0**	0	2	**2**
15:45	0	4	**4**	0	0	**0**	0	1	**1**	0	0	**0**
H/TOT	0	4	**4**	0	2	**2**	0	3	**3**	0	2	**2**
3HR/TOT	1	8	**9**	0	6	**6**	0	8	**8**	1	4	**5**
16:00	0	0	**0**	0	2	**2**	0	0	**0**	0	0	**0**
16:15	0	1	**1**	0	1	**1**	0	1	**1**	0	0	**0**
16:30	0	0	**0**	0	0	**0**	0	3	**3**	0	0	**0**
16:45	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
H/TOT	0	1	**1**	0	3	**3**	0	4	**4**	0	1	**1**
17:00	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
17:15	0	0	**0**	0	2	**2**	0	1	**1**	0	1	**1**
17:30	0	0	**0**	0	0	**0**	0	2	**2**	0	1	**1**
17:45	0	0	**0**	0	0	**0**	0	2	**2**	0	1	**1**
H/TOT	0	0	**0**	0	2	**2**	0	6	**6**	0	3	**3**
18:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
18:15	0	0	**0**	0	0	**0**	0	3	**3**	0	0	**0**
18:30	0	0	**0**	0	0	**0**	0	2	**2**	0	0	**0**
18:45	0	0	**0**	0	0	**0**	0	2	**2**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**	0	7	**7**	0	0	**0**
3HR/TOT	0	1	**1**	0	5	**5**	0	17	**17**	0	4	**4**
TOTAL	2	20	**22**	0	24	**24**	3	40	**43**	1	21	**22**

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
PEDESTRIAN CROSSING

SITE: 3

LOCATION: New Road/ Vicar Street

	ARM A						ARM B					
	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
TIME	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL
07:00	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
07:15	0	0	**0**	0	0	**0**	0	4	**4**	0	0	**0**
07:30	0	0	**0**	0	1	**1**	0	0	**0**	0	1	**1**
07:45	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	1	**1**	0	4	**4**	0	1	**1**
08:00	0	0	**0**	0	0	**0**	0	1	**1**	0	0	**0**
08:15	0	0	**0**	0	0	**0**	0	3	**3**	0	2	**2**
08:30	0	0	**0**	0	1	**1**	0	7	**7**	0	4	**4**
08:45	0	0	**0**	0	1	**1**	0	4	**4**	0	8	**8**
H/TOT	0	0	**0**	0	2	**2**	0	15	**15**	0	14	**14**
09:00	0	0	**0**	0	1	**1**	0	4	**4**	1	4	**5**
09:15	0	0	**0**	0	1	**1**	0	5	**5**	0	2	**2**
09:30	0	0	**0**	0	1	**1**	0	3	**3**	0	4	**4**
09:45	0	0	**0**	1	1	**2**	0	3	**3**	0	8	**8**
H/TOT	0	0	**0**	1	4	**5**	0	15	**15**	1	18	**19**
3HR/TOT	0	0	**0**	1	7	**8**	0	34	**34**	1	33	**34**
10:00	0	1	**1**	0	1	**1**	1	5	**6**	0	0	**0**
10:15	0	1	**1**	0	0	**0**	0	0	**0**	1	3	**4**
10:30	0	2	**2**	0	0	**0**	0	0	**0**	0	0	**0**
10:45	0	0	**0**	0	0	**0**	1	3	**4**	0	3	**3**
H/TOT	0	4	**4**	0	1	**1**	2	8	**10**	1	6	**7**
11:00	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
11:15	0	0	**0**	0	3	**3**	0	5	**5**	0	1	**1**
11:30	0	1	**1**	0	0	**0**	0	1	**1**	1	2	**3**
11:45	0	0	**0**	0	0	**0**	0	3	**3**	0	2	**2**
H/TOT	0	1	**1**	0	3	**3**	0	9	**9**	1	6	**7**
12:00	0	1	**1**	0	0	**0**	0	2	**2**	0	2	**2**
12:15	1	1	**2**	0	0	**0**	0	2	**2**	10	0	**10**
12:30	0	0	**0**	0	0	**0**	0	2	**2**	0	0	**0**
12:45	0	1	**1**	0	1	**1**	0	0	**0**	0	4	**4**
H/TOT	1	3	**4**	0	1	**1**	0	6	**6**	10	6	**16**
3HR/TOT	1	8	**9**	0	5	**5**	2	23	**25**	12	18	**30**
13:00	0	1	**1**	0	0	**0**	0	3	**3**	0	4	**4**
13:15	0	0	**0**	0	0	**0**	3	2	**5**	0	1	**1**
13:30	0	0	**0**	0	0	**0**	2	6	**8**	0	5	**5**
13:45	0	0	**0**	0	0	**0**	0	7	**7**	0	5	**5**
H/TOT	0	1	**1**	0	0	**0**	5	18	**23**	0	15	**15**
14:00	0	0	**0**	0	0	**0**	0	2	**2**	0	0	**0**
14:15	0	0	**0**	0	0	**0**	0	3	**3**	0	2	**2**
14:30	0	0	**0**	0	0	**0**	1	4	**5**	1	3	**4**
14:45	0	0	**0**	0	0	**0**	0	2	**2**	0	2	**2**
H/TOT	0	0	**0**	0	0	**0**	1	11	**12**	1	7	**8**
15:00	0	2	**2**	0	0	**0**	0	6	**6**	0	2	**2**
15:15	0	0	**0**	0	2	**2**	0	2	**2**	0	2	**2**
15:30	0	3	**3**	0	0	**0**	1	5	**6**	0	2	**2**
15:45	0	0	**0**	0	1	**1**	0	3	**3**	0	2	**2**
H/TOT	0	5	**5**	0	3	**3**	1	16	**17**	0	8	**8**
3HR/TOT	0	6	**6**	0	3	**3**	7	45	**52**	1	30	**31**
16:00	0	0	**0**	0	0	**0**	0	1	**1**	0	4	**4**
16:15	0	1	**1**	0	2	**2**	1	2	**3**	1	5	**6**
16:30	0	1	**1**	0	0	**0**	0	2	**2**	0	1	**1**
16:45	0	0	**0**	0	0	**0**	0	6	**6**	0	2	**2**
H/TOT	0	2	**2**	0	2	**2**	1	11	**12**	1	12	**13**
17:00	0	0	**0**	0	0	**0**	0	4	**4**	0	2	**2**
17:15	0	0	**0**	0	0	**0**	0	4	**4**	0	0	**0**
17:30	0	0	**0**	0	0	**0**	0	2	**2**	0	0	**0**
17:45	0	1	**1**	0	0	**0**	0	6	**6**	0	2	**2**
H/TOT	0	1	**1**	0	0	**0**	0	16	**16**	0	4	**4**
18:00	0	1	**1**	0	1	**1**	0	1	**1**	0	0	**0**
18:15	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
18:30	0	0	**0**	0	0	**0**	0	0	**0**	0	1	**1**
18:45	0	1	**1**	0	0	**0**	0	1	**1**	0	0	**0**
H/TOT	0	2	**2**	0	1	**1**	0	2	**2**	0	2	**2**
3HR/TOT	0	5	**5**	0	3	**3**	1	29	**30**	1	18	**19**
TOTAL	1	19	**20**	1	18	**19**	10	131	**141**	15	99	**114**

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
PEDESTRIAN CROSSING

SITE: 3

LOCATION: New Road/ Vicar Street

	ARM C					
	EASTBOUND			WESTBOUND		
TIME	CHILD	ADULT	TOTAL	CHILD	ADULT	TOTAL
07:00	0	0	**0**	0	0	**0**
07:15	0	0	**0**	0	0	**0**
07:30	0	0	**0**	0	0	**0**
07:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
08:00	0	0	**0**	0	0	**0**
08:15	0	0	**0**	0	0	**0**
08:30	0	0	**0**	0	1	**1**
08:45	0	0	**0**	0	1	**1**
H/TOT	0	0	**0**	0	2	**2**
09:00	0	0	**0**	0	0	**0**
09:15	0	0	**0**	0	0	**0**
09:30	0	0	**0**	0	0	**0**
09:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	2	**2**
10:00	0	0	**0**	0	1	**1**
10:15	0	1	**1**	0	0	**0**
10:30	0	0	**0**	0	0	**0**
10:45	0	1	**1**	0	0	**0**
H/TOT	0	2	**2**	0	1	**1**
11:00	0	1	**1**	0	0	**0**
11:15	0	0	**0**	0	0	**0**
11:30	0	1	**1**	0	0	**0**
11:45	0	0	**0**	0	0	**0**
H/TOT	0	2	**2**	0	0	**0**
12:00	0	0	**0**	0	0	**0**
12:15	0	0	**0**	0	0	**0**
12:30	0	0	**0**	0	0	**0**
12:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
3HR/TOT	0	4	**4**	0	1	**1**
13:00	0	0	**0**	0	1	**1**
13:15	0	0	**0**	0	1	**1**
13:30	0	0	**0**	0	0	**0**
13:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	2	**2**
14:00	0	0	**0**	0	0	**0**
14:15	0	0	**0**	0	0	**0**
14:30	0	0	**0**	0	0	**0**
14:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
15:00	0	1	**1**	0	1	**1**
15:15	0	1	**1**	0	0	**0**
15:30	0	0	**0**	0	0	**0**
15:45	0	0	**0**	0	0	**0**
H/TOT	0	2	**2**	0	1	**1**
3HR/TOT	0	2	**2**	0	3	**3**
16:00	0	0	**0**	0	0	**0**
16:15	0	0	**0**	0	0	**0**
16:30	0	0	**0**	0	0	**0**
16:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
17:00	0	0	**0**	0	0	**0**
17:15	0	0	**0**	0	0	**0**
17:30	0	0	**0**	0	0	**0**
17:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
18:00	0	0	**0**	0	0	**0**
18:15	0	0	**0**	0	0	**0**
18:30	0	0	**0**	0	0	**0**
18:45	0	0	**0**	0	0	**0**
H/TOT	0	0	**0**	0	0	**0**
3HR/TOT	0	0	**0**	0	0	**0**
TOTAL	0	6	**6**	0	6	**6**

Sky High-Count On Us

Job Number: SC1596

Job Title: Kilkenny

Client: Clifton Scannell Emerson Associates

Survey Date: Wed 16/01/13

Survey Period: 07:00-19:00

Survey Type: Queues Length Observations

Sky High-Count On Us

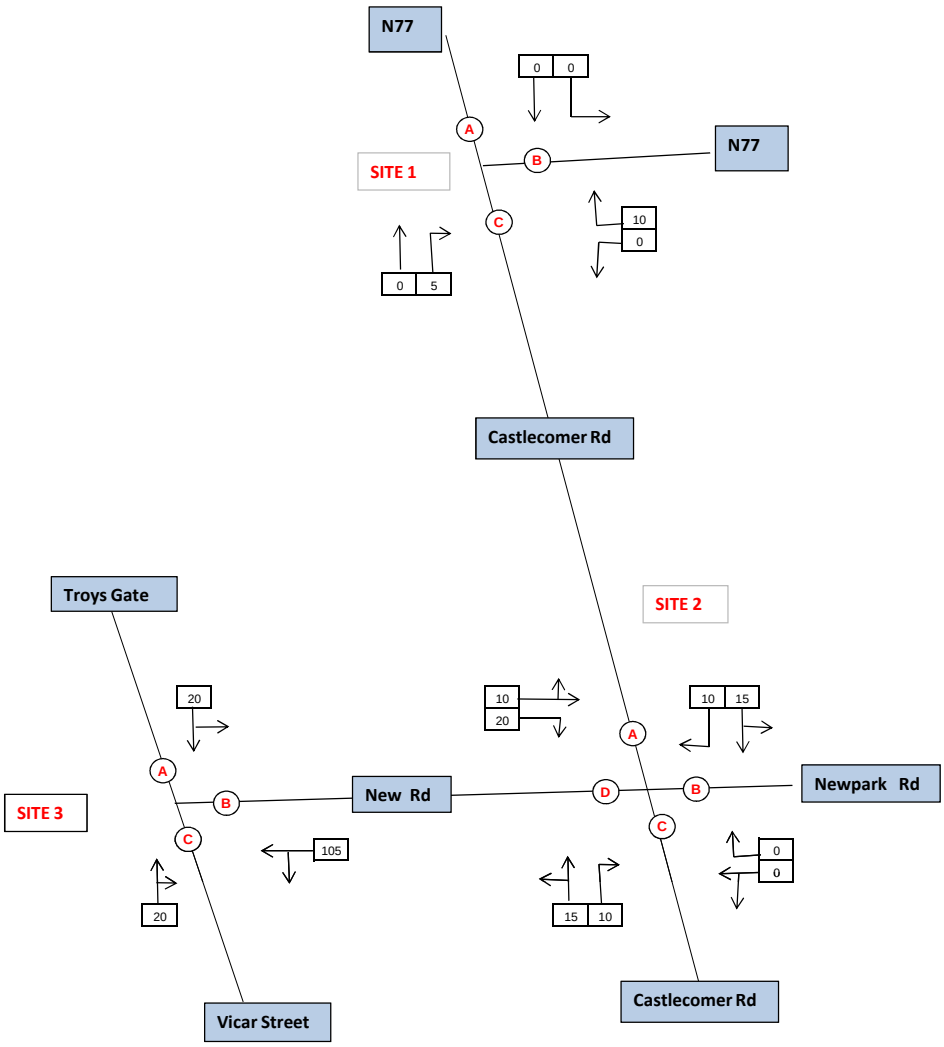
KILKENNY / SC1596
WED 16 JANUARY 2013
SITE PLAN

Sites/ Locations: 1 - N77/ Castlecomer Road
2 - Castlecomer Road/ Newpark Road/ New Road
3 - New Road/ Vicar Street

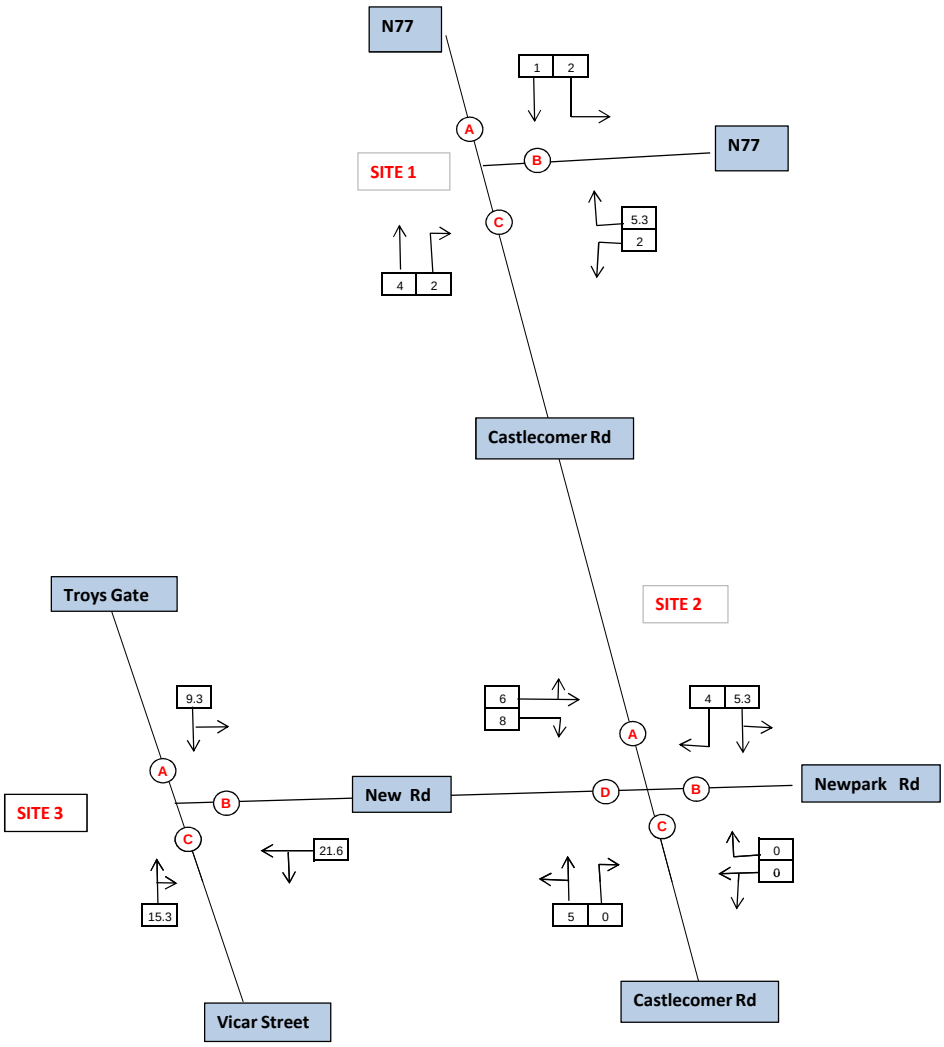
Diagram No: 1

N

Hour 07:00 - 08:00



Hour 17:00 - 18:00



Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
QUEUES LENGTH OBSERVATIONS

SITE: 1

LOCATION: N77/ Castlecomer Road

Time	N77 - SOUTHBOUND				N77 - WESTBOUND			
	NEARSIDE		OFFSIDE		NEARSIDE		OFFSIDE	
	Metres	PCU	Metres	PCU	Metres	PCU	Metres	PCU
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	10	2
H/MAX	0	0	0	0	0	0	10	2
08:00	0	0	5	1	5	1	10	2
08:15	0	0	10	2	5	1	5	1
08:30	10	2	15	3	5	1	40	8.3
08:45	5	1	5	1	5	1	40	8.3
H/MAX	10	2	15	3	5	1	40	8.3
09:00	0	0	0	0	5	1	30	6.6
09:15	5	1	0	0	15	3.3	20	4.3
09:30	0	0	0	0	15	3.3	5	1
09:45	0	0	15	3	5	1	10	2
H/MAX	5	1	15	3	15	3.3	30	6.6
3HR/ MAX	10	2	15	3	15	3.3	40	8.3
10:00	0	0	5	1	10	2	5	1
10:15	0	0	0	0	5	1	5	1
10:30	0	0	0	0	5	1	15	3.3
10:45	0	0	0	0	5	1	10	2
H/MAX	0	0	5	1	10	2	15	3.3
11:00	0	0	5	1	0	0	5	1
11:15	10	2.3	0	0	10	2	15	3.3
11:30	0	0	0	0	0	0	15	3.3
11:45	0	0	0	0	5	1	0	0
H/MAX	10	2.3	5	1	10	2	15	3.3
12:00	5	1	5	1	5	1	0	0
12:15	5	1	0	0	5	1	5	1
12:30	0	0	15	3	10	2.3	0	0
12:45	0	0	0	0	0	0	5	1
H/MAX	5	1	15	3	10	2.3	5	1
3HR/ MAX	10	2.3	15	3	10	2.3	15	3.3
13:00	0	0	0	0	5	1	25	5.3
13:15	0	0	0	0	0	0	15	3
13:30	5	1	0	0	5	1	5	1
13:45	5	1	0	0	5	1	5	1
H/MAX	5	1	0	0	5	1	25	5.3
14:00	0	0	5	1	0	0	25	5.3
14:15	0	0	0	0	5	1	20	4.3
14:30	10	2	0	0	10	2	10	2
14:45	5	1	0	0	0	0	10	2
H/MAX	10	2	5	1	10	2	25	5.3
15:00	10	2	0	0	10	2	20	4
15:15	5	1	5	1	5	1	5	1
15:30	0	0	10	2.3	10	2	10	2
15:45	0	0	10	2	5	1	15	3.3
H/MAX	10	2	10	2.3	10	2	20	4
3HR/ MAX	10	2	10	2.3	10	2	25	5.3
16:00	5	1	0	0	5	1	15	3
16:15	10	2	10	2	10	2	10	2
16:30	0	0	0	0	0	0	5	1
16:45	10	2.3	0	0	5	1	15	3.3
H/MAX	10	2.3	10	2	10	2	15	3.3
17:00	10	2	0	0	5	1	10	2
17:15	5	1	5	1	10	2	25	5.3
17:30	5	1	5	1	5	1	0	0
17:45	0	0	0	0	10	2	15	3
H/MAX	10	2	5	1	10	2	25	5.3
18:00	5	1	5	1	5	1	10	2
18:15	5	1	0	0	10	2	10	2
18:30	5	1	5	1	5	1	10	2
18:45	5	1	0	0	5	1	10	2
H/MAX	5	1	5	1	10	2	10	2
3HR/ MAX	10	2.3	10	2	10	2	25	5.3
P/MAX	10	2.3	15	3	15	3.3	40	8.3

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
QUEUES LENGTH OBSERVATIONS

SITE: 1

LOCATION: N77/ Castlecomer Road

Time	Castlecomer Rd - NORTHBOUND			
	NEARSIDE		OFFSIDE	
	Metres	PCU	Metres	PCU
07:00	0	0	0	0
07:15	0	0	0	0
07:30	0	0	5	1
07:45	0	0	5	1
H/MAX	0	0	5	1
08:00	15	3	5	1
08:15	0	0	15	3
08:30	15	3	5	1
08:45	5	1	5	1
H/MAX	15	3	15	3
09:00	5	1	5	1
09:15	0	0	0	0
09:30	0	0	0	0
09:45	5	1	5	1
H/MAX	5	1	5	1
3HR/ MAX	15	3	15	3
10:00	0	0	5	1
10:15	0	0	5	1
10:30	20	4.3	0	0
10:45	5	1	0	0
H/MAX	20	4.3	5	1
11:00	5	1	5	1
11:15	5	1	0	0
11:30	10	2	0	0
11:45	10	2	0	0
H/MAX	10	2	5	1
12:00	0	0	0	0
12:15	0	0	10	2
12:30	0	0	5	1
12:45	10	2	0	0
H/MAX	10	2	10	2
3HR/ MAX	20	4.3	10	2
13:00	10	2	0	0
13:15	5	1	5	1
13:30	0	0	0	0
13:45	0	0	5	1
H/MAX	10	2	5	1
14:00	10	2	5	1
14:15	0	0	0	0
14:30	0	0	5	1
14:45	10	2	5	1
H/MAX	10	2	5	1
15:00	10	2	5	1
15:15	0	0	0	0
15:30	0	0	5	1
15:45	5	1	0	0
H/MAX	10	2	5	1
3HR/ MAX	10	2	5	1
16:00	0	0	0	0
16:15	5	1	0	0
16:30	0	0	5	1
16:45	5	1	5	1
H/MAX	5	1	5	1
17:00	15	3	5	1
17:15	20	4	5	1
17:30	15	3	10	2
17:45	5	1	5	1
H/MAX	20	4	10	2
18:00	20	4	5	1
18:15	15	3	5	1
18:30	0	0	5	1
18:45	0	0	5	1
H/MAX	20	4	5	1
3HR/ MAX	20	4	10	2
P/MAX	20	4.3	15	3

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
QUEUES LENGTH OBSERVATIONS

SITE: 2

LOCATION: Castlecomer Road/ Newpark Road/ New Road

Time	Castlecomer Rd - SOUTHBOUND				Newpark Rd - WESTBOUND			
	NEARSIDE		OFFSIDE		NEARSIDE		OFFSIDE	
	Metres	PCU	Metres	PCU	Metres	PCU	Metres	PCU
07:00	0	0	0	0	0	0	0	0
07:15	5	1	0	0	0	0	0	0
07:30	0	0	5	1	0	0	0	0
07:45	15	3.3	10	2	0	0	0	0
H/MAX	15	3.3	10	2	0	0	0	0
08:00	15	3	25	5	0	0	0	0
08:15	65	12.9	50	10	0	0	0	0
08:30	50	10.3	60	12	0	0	0	0
08:45	35	6	65	13	0	0	0	0
H/MAX	65	12.9	65	13	0	0	0	0
09:00	20	4	70	14	0	0	0	0
09:15	20	4.3	15	3	0	0	0	0
09:30	5	1	10	2	0	0	0	0
09:45	20	3	30	6	0	0	0	0
H/MAX	20	4.3	70	14	0	0	0	0
3HR/ MAX	65	12.9	70	14	0	0	0	0
10:00	10	2	10	2	0	0	0	0
10:15	10	2	10	2	0	0	0	0
10:30	10	2	25	5.3	0	0	0	0
10:45	20	4.3	10	2	0	0	0	0
H/MAX	20	4.3	25	5.3	0	0	0	0
11:00	10	2	10	2	0	0	0	0
11:15	10	2	15	3	0	0	0	0
11:30	5	1	25	5.3	0	0	0	0
11:45	10	2	25	5.3	0	0	0	0
H/MAX	10	2	25	5.3	0	0	0	0
12:00	10	2	25	5.3	10	2.3	0	0
12:15	10	2	30	6.3	0	0	0	0
12:30	10	2	10	2	0	0	0	0
12:45	5	1	10	2	0	0	0	0
H/MAX	10	2	30	6.3	10	2.3	0	0
3HR/ MAX	20	4.3	30	6.3	10	2.3	0	0
13:00	15	3	15	3	5	1	0	0
13:15	5	1	20	4.3	0	0	0	0
13:30	15	3.3	45	9	0	0	0	0
13:45	10	2	10	2	0	0	0	0
H/MAX	15	3.3	45	9	5	1	0	0
14:00	10	2	20	4	0	0	0	0
14:15	20	4.3	25	5	0	0	0	0
14:30	30	5	30	6	0	0	0	0
14:45	10	2	20	4.3	0	0	0	0
H/MAX	30	5	30	6	0	0	0	0
15:00	15	3	15	3	0	0	0	0
15:15	25	4	20	4.3	0	0	0	0
15:30	25	4	20	4	0	0	0	0
15:45	15	3	30	6	0	0	0	0
H/MAX	25	4	30	6	0	0	0	0
3HR/ MAX	30	5	45	9	5	1	0	0
16:00	20	4	10	2	0	0	0	0
16:15	30	5.3	35	7.3	0	0	0	0
16:30	10	2	30	6	0	0	0	0
16:45	40	8.3	20	4	0	0	0	0
H/MAX	40	8.3	35	7.3	0	0	0	0
17:00	20	4.3	20	4	0	0	0	0
17:15	25	5.3	20	4	0	0	0	0
17:30	15	3	20	4	0	0	0	0
17:45	10	2	15	3	0	0	0	0
H/MAX	25	5.3	20	4	0	0	0	0
18:00	20	4	25	5	0	0	0	0
18:15	10	2	30	6	0	0	0	0
18:30	10	2	10	2	0	0	0	0
18:45	15	3	5	1	0	0	0	0
H/MAX	20	4	30	6	0	0	0	0
3HR/ MAX	40	8.3	35	7.3	0	0	0	0
P/MAX	65	12.9	70	14	10	2.3	0	0

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
QUEUES LENGTH OBSERVATIONS

SITE: 2

LOCATION: Castlecomer Road/ Newpark Road/ New Road

Time	Castlecomer Rd - NORTHBOUND				New Rd - EASTBOUND			
	NEARSIDE		OFFSIDE		NEARSIDE		OFFSIDE	
	Metres	PCU	Metres	PCU	Metres	PCU	Metres	PCU
07:00	0	0	10	2.3	0	0	0	0
07:15	5	1	0	0	5	1	0	0
07:30	0	0	0	0	5	1	5	1
07:45	15	3	0	0	10	2	20	4
H/MAX	15	3	10	2.3	10	2	20	4
08:00	15	3	0	0	20	4	35	7
08:15	25	5	5	1	10	2	40	8.3
08:30	45	9	10	2	10	2	10	2
08:45	85	17.3	25	5.3	15	3	60	12
H/MAX	85	17.3	25	5.3	20	4	60	12
09:00	90	18.3	20	4.3	10	2	35	7
09:15	35	7.3	10	2	10	2	15	3
09:30	20	4	5	1	10	2	5	1
09:45	25	5	5	1	5	1	15	3
H/MAX	90	18.3	20	4.3	10	2	35	7
3HR/ MAX	90	18.3	25	5.3	20	4	60	12
10:00	10	2	0	0	5	1	25	5.6
10:15	5	1	0	0	10	2	20	4
10:30	25	5	0	0	15	3	20	4
10:45	10	2	0	0	15	3.3	10	2
H/MAX	25	5	0	0	15	3.3	25	5.6
11:00	5	1	0	0	10	2	10	2
11:15	10	2	5	1	10	2	25	5.3
11:30	10	2	5	1	10	2	20	4.3
11:45	5	1	0	0	15	3	25	5
H/MAX	10	2	5	1	15	3	25	5.3
12:00	20	4	0	0	20	4.3	35	7
12:15	20	4	0	0	40	8	10	2
12:30	15	3	5	1	10	2	15	3
12:45	15	3	0	0	15	3	15	3
H/MAX	20	4	5	1	40	8	35	7
3HR/ MAX	25	5	5	1	40	8	35	7
13:00	10	2	5	1	15	3	20	4
13:15	25	5	0	0	15	3	20	4
13:30	20	4	5	1	15	3	10	2
13:45	10	2	0	0	10	2	20	4
H/MAX	25	5	5	1	15	3	20	4
14:00	30	6	10	2.3	10	2	20	4
14:15	30	6	5	1	10	2	30	6
14:30	30	6.3	0	0	15	3	15	3
14:45	15	3	0	0	10	2	35	7
H/MAX	30	6.3	10	2.3	15	3	35	7
15:00	20	4	0	0	25	5	15	3
15:15	25	5	0	0	15	3	20	4.3
15:30	15	3	5	1	25	5	20	4
15:45	35	7.3	0	0	15	3	30	6
H/MAX	35	7.3	5	1	25	5	30	6
3HR/ MAX	35	7.3	10	2.3	25	5	35	7
16:00	40	8	0	0	15	3	40	8
16:15	25	5	0	0	15	3	20	4
16:30	30	6	0	0	10	2	25	5
16:45	10	2	0	0	15	3	20	4
H/MAX	40	8	0	0	15	3	40	8
17:00	25	5	0	0	30	6	40	8
17:15	25	5	0	0	15	3	25	5
17:30	20	4	0	0	15	3	30	6.3
17:45	25	5	0	0	20	4	35	7
H/MAX	25	5	0	0	30	6	40	8
18:00	15	3	5	1	35	7	45	9
18:15	10	2	0	0	20	4	25	5
18:30	10	2	0	0	15	3	15	3
18:45	10	2	0	0	20	4	25	5
H/MAX	15	3	5	1	35	7	45	9
3HR/ MAX	40	8	5	1	35	7	45	9
P/MAX	90	18.3	25	5.3	40	8	60	12

Sky High-Count On Us

SC1596 / KILKENNY
WED 16 JANUARY 2013
QUEUES LENGTH OBSERVATIONS

SITE: 3

LOCATION: New Road/ Vicar Street

Time	SOUTHBOUND		WESTBOUND		NORTHBOUND	
	Metres	PCU	Metres	PCU	Metres	PCU
07:00	5	1	5	1	0	0
07:15	20	4.3	25	5.3	5	1
07:30	15	3	15	3	5	1
07:45	10	2	105	21.6	20	4
H/MAX	20	4.3	105	21.6	20	4
08:00	25	5	35	7.3	20	4
08:15	50	10.3	100	20.6	40	8
08:30	70	14	90	18.3	65	13
08:45	60	12	90	18.3	70	14.3
H/MAX	70	14	100	20.6	70	14.3
09:00	60	12	105	21.3	60	12
09:15	45	9.6	85	17.3	40	8.3
09:30	40	8	45	9	25	5.3
09:45	10	2	30	6	45	9.3
H/MAX	60	12	105	21.3	60	12
3HR/ MAX	70	14	105	21.6	70	14.3
10:00	20	4	40	8.3	25	5
10:15	30	6.3	15	3	25	5.3
10:30	20	4	30	6.3	20	4
10:45	25	5	25	5.3	20	4
H/MAX	30	6.3	40	8.3	25	5.3
11:00	10	2	40	8.3	15	3
11:15	15	3.3	35	7.3	40	8
11:30	20	4	75	15.9	30	6
11:45	30	6	70	14.3	45	9
H/MAX	30	6	75	15.9	45	9
12:00	25	5	40	8	25	5
12:15	40	8	115	24.2	35	7
12:30	30	6	60	12.6	20	4
12:45	30	6.3	45	9.3	50	10
H/MAX	40	8	115	24.2	50	10
3HR/ MAX	40	8	115	24.2	50	10
13:00	50	10.6	45	9.3	25	5
13:15	20	4	45	9.6	40	8
13:30	15	3	75	15.3	60	12.6
13:45	15	3	30	6	50	10
H/MAX	50	10.6	75	15.3	60	12.6
14:00	20	4	75	15	65	13.3
14:15	20	4	80	16	70	14.6
14:30	30	6	90	18.6	55	11.3
14:45	35	7	120	24.9	60	12
H/MAX	35	7	120	24.9	70	14.6
15:00	40	8	85	17.3	60	12.3
15:15	20	4	40	8	55	11
15:30	50	10.3	85	17.6	60	12.9
15:45	25	5.3	130	26.9	60	12
H/MAX	50	10.3	130	26.9	60	12.9
3HR/ MAX	50	10.6	130	26.9	70	14.6
16:00	40	8	50	10.3	55	11
16:15	35	7	65	13.3	35	7
16:30	35	7	95	19.6	65	13
16:45	25	5	70	14.6	25	5
H/MAX	40	8	95	19.6	65	13
17:00	45	9.3	65	13	60	12
17:15	30	6	105	21.6	65	13.3
17:30	40	8	40	8	60	12
17:45	30	6	40	8	75	15.3
H/MAX	45	9.3	105	21.6	75	15.3
18:00	25	5	50	10	55	11
18:15	15	3	25	5	50	10
18:30	40	8	25	5	20	4
18:45	20	4	20	4	20	4
H/MAX	40	8	50	10	55	11
3HR/ MAX	45	9.3	105	21.6	75	15.3
P/MAX	70	14	130	26.9	75	15.3

APPENDIX G

Additional Information Relating to Ecology

REFERENCES

1. Fossitt, J.A. 2000 A guide to habitats in Ireland. Heritage Council.

2. Dept of Environment, Heritage and Local Government (2009). Appropriate assessment of plans and projects in Ireland: guidance for planning authorities. Dublin.

3. National Parks & Wildlife Service (2011) Conservation Objectives: River Barrow & River Nore SAC 002162. Dept of Arts, Heritage and the Gaeltacht. Version 1 (website)

Proposed Kilkenny Ring Road extension,

Ecology

Report for Clifton Scannell Emerson

February 2013

Roger Goodwillie & Associates, Lavistown House, Kilkenny. Ph/Fax 056-7765145

1. INTRODUCTION

This report is an ecological assessment of the comparative impacts of eight possible routes for the extension of the Kilkenny Ring Road between the N77 (Castlecomer) and the R693 (Freshford) roads. It follows on from the Constraints and Route option Study and provides information to inform a future Environmental Impact Statement, as required by An Bord Pleanála.

The assessment takes account of the NRA guidelines for road scheme planning (Guidelines for Assessment of Ecological Impacts of National Road Schemes) and relevant Irish and EU legislation, namely the Wildlife Acts 1976 – 2010 and the EU Habitats and Birds Directives and ensuing regulations and statutes.

It is derived from literature study and discussions with the National Parks & Wildlife Service (Lorcan Scott and Jimi Conroy) and with Inland Fisheries Ireland (Patrick Kilfeather). Two main sessions of fieldwork were carried out, one in March (2008) which was related to the constraints study and one in February 2013 for a re-assessment of bat and other habitat. The western part of the area was also visited in 2011 for another project.

2. DESCRIPTION OF AREA

The habitats (following Fossitt 2000) that occur in this section of the floodplain and adjacent river valley are shown in the map below. They are described in detail by the March 2008 study and have not changed appreciably since then. Broadly they comprise a large area of improved agricultural grassland and smaller sections of wet woodland, dry deciduous woodland, lowland river, drainage ditches and treelines/hedgerows. Small areas of buildings and artificial surfaces are provided by the roads and trackways while there is also a little disturbed ground just west of the existing roundabout on the N77. (The more interesting plant and animal species that occur are noted in later sections)

Improved agricultural grassland (GA1)
The fields are intensively managed for grazing and some are also cut for silage. The plant species are restricted by this management and there is little if any influence of the adjacent river as the local gradients ensure that even when flooded the ground drains evenly. A former spring and wetland was drained in recent years and the only lingering effects are in the drains at the sides of the Bleach Road.

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Hedgerows (WL1) and treelines (WL2)
The field boundaries include electric fences, with or without hedgerows of hawthorn, willows and bramble Rubus fruticosus. Two notable hedgerows just north of the Weir estate are the remaining edges of a patch of woodland shown on the O.S. maps and involve a broader selection of trees including oak, and hazel. The hedge along the western side of the Bleach Road is largely of elm.

Wet woodland (WN6)
A small area of wet woodland occurs at the eastern end of the route. Its type wet willow-alder-ash woodland defines the species content which includes three different willows as well as guilder rose *Viburnum opulus*. The ground in open places is covered by a good variety of tall herbs.

Swamps (FS1)
A small stand of tall sedges occurs at the eastern edge of the floodplain on the path of Route 1 where several other depressions occur related to the glacial terrain. There is also swampy ground along the northern edge of the wet woodland.

Mixed broadleaved woodland (WD1)
Deciduous woodland which has a planted origin occurs along the south-west bank of the River Nore below Auteven Hospital but is largely avoided by the routes.
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River (FW2), streams and drains (FW4)
The most important watercourse in the area is the River Nore which is crossed by all routes options. It is here at the western edge of the floodplain so has a low eastern bank of 1m or so but a much higher western bank, up to 4m. An open line of trees grows on both sides of the river with ash, alder and willows.

The other watercourses have been artificially straightened so correspond to drainage ditches. Most of them have tall and nutritionally-enriched marginal vegetation though those along the Bleach Road are less modified and hold some aquatic plants.

Built land and roads (BL3)
Apart from the existing N77 and R693 roads there are a number of laneways and tracks as well as the former Castlecomer railway line at the eastern end. Adjacent buildings consist of a hospital complex, one-off dwellings, derelict/disused cottages, farm buildings and culverts.

Disturbed ground (ED)
Disturbance of sandy material on the western side of the former railway line has provided a site for ruderal, opportunist plants.

2.1 Flora

Pockets of interesting habitat occur along the route with plant species that are uncommon locally, though none of them are rare or protected. Starting from the eastern end, a patch of disturbed ground supports hawkweed ox-tongue *Picris hieracioides*, an introduced, but Kilkenny, speciality. The wet woodland in its clearings and drains has large sedges (*Carex acutiformis*, *C.riparia*, *C.otrubae*) as well as herbs like yellow loosestrife *Lysimachia vulgaris* and the floating liverwort

Riccia fluitans. The large pond sedge *C.riparia* also occurs in the isolated floodplain marsh (touched by Route 1) with the introduced garden angelica *Angelica archangelica*, which is restricted to the Nore in southern Ireland.

Another centre of interest is the drain along the western side of the Bleach Road where creeping jenny *Lysimachia nummularia* is abundant. The Nore banks have patches of creeping yellowcress *Rorippa sylvestris* but this is ubiquitous along the channel, if rare over much of the country.

2.2 Fauna

The only large mammal dependant on the area is the otter and the species is relatively common in that a regular otter path is seen on some of the Nore bank. Feeding activities may take animals into the drains and woodland east of the Bleach Road, especially in spring when looking for frogs. Otters breed in holes in riverbanks, often under fallen trees but there are no especially favourable sites in this section of the Nore.

Badgers are resident or at least regular in the woodland on the southwest bank of the river, visiting the fields north of Auteven. No evidence of them crossing the route was seen but this is likely to happen when feeding demands it.

The bat survey (see Appendix) indicates that at least six species occur in the area with the river channel being the most valuable habitat, followed by the riverside woodland east of Auteven and the wet woodland at the eastern edge. There are no buildings potentially affected by the project that would be suitable as breeding roosts. Temporary roosting does also occur on trees during summer, especially if ivy-covered.

The floodplain of the river attracts wildfowl when flooded and small flocks of whooper swans occur for short periods in some winters. Geese, probably grey-lag, have also been seen but very rarely. Considerable numbers of snipe feed in wetter areas of the floodplain in winter and some are likely to nest in the marshland west of the routes. Little egrets also occur sporadically along the river but do not nest. A species that has nested is the yellowhammer, seen in the hedges along the Bleach Road.

The Nore river supports a wide variety of fish, both salmonids and coarse types like perch and pike. It is a migratory route for salmon and river lamprey and there is some breeding in this section. Lamprey larvae are found in muddy embayments along the bank. Some salmonid fry also penetrate into the drains leading to the river.

3. DESIGNATED CONSERVATION AREAS

The aerial photograph (at end) shows the ecological designations in force at present. It may be seen that the river course is an SPA (vertical hatching – red) and that parts of

the route are SAC's (diagonal hatching – red). These latter, in places, are enclosed or augmented by proposed Natural Heritage Areas (diagonal hatching – blue).

3.1 Special Protection Area – River Nore (Site Code 4233)

The SPA is designated by S.I. No. 193/2012 under the Birds Directive (1979) and later regulations. It includes the river channel and its marginal vegetation and is listed because of the occurrence of a high population of kingfisher, a bird species included in the Annex I of the Birds Directive (see site synopsis below).

The river's banks are suitable for nesting by this species in many places while feeding occurs in the main channel and also inflowing streams and drains.

3.2 Special Area of Conservation– River Barrow & River Nore (Site code 2162)

This river system has considerable European value for rare habitats and species. The site synopsis (see below) indicates that it is selected for a number of habitats in Annex I of the EU Habitats Directive - alluvial wet woodlands and petrifying springs (both priority habitats) and also for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs The site is also selected for the following species listed on Annex II of the same directive - sea lamprey, river lamprey, brook lamprey, freshwater pearl mussel, Nore freshwater pearl mussel, freshwater crayfish, Twaite shad, Atlantic salmon, otter, the snail *Vertigo moulinsiana* and the plant Killarney Fern.

3.3 Dunmore Complex pNHA (Site code 1859)

This area, being a proposed NHA, does not have any statutory protection and has been modified in the years since its mapping by quarry works and agriculture. The particular part near to the eastern end of the route (alongside the old railway line now used as an avenue to a farm) has been totally reclaimed to ryegrass pasture and has no ecological importance. Another section, including the isolated floodplain marsh and westward to the Bleach Road has been partly reclaimed in the same way.

4. DESIGNATED FEATURES PRESENT IN VICINITY

Habitats Directive		Extent
Eutrophic tall herbs	Annex I	Fragments in wet woodland
Otter	Annex II	Frequent along river
Atlantic salmon	Annex II	Frequent in river
River lamprey	Annex II	Frequent in river
Brook lamprey	Annex II	Possible in drains
Freshwater crayfish	Annex II	Frequent in river

Birds Directive		
Whooper swan	Annex I	Occasional on floodplain (winter)
Peregrine	Annex I	Regular feeding (aerial)
Kingfisher	Annex I	Frequent along river
Golden plover	Annex I	Occasional on floodplain (winter)
Wildlife Acts 1976-2010		
Bat species (also in Annex IV, Habitats Directive)		Common & soprano pipistrelle, Leisler's, Daubenton's, brown long-eared, Natterer's, whiskered.
Hedgehog		Eastern end, hedges and dry ground
Badger		Regular on west side of river valley
Stoat		In cover of trees/hedges
Pygmy shrew		In cover hedges, scrub
Common frog		Breeds in drains, feed in wet ground
Common newt		Probable in drains
Birds (except pest species)		

5. IMPACT OF ROAD WORKS

Whichever route is chosen will require a short length of cut at the eastern end followed by an extensive embankment across the floodplain, punctuated by regular openings. At the river channel a freespan bridge on piers set well back from the riverbanks will initiate a long cut most of the way to the Freshford Road.

The potential impacts of a road in such as sensitive situation are many but with current design and planning protocols, the following should be considered the most relevant

Destruction of habitat
The habitats included in the SAC are considered the most important and there is inevitable impact at the eastern end after the route crosses the old railway line. The impact of the routes, in the distance they run through the SAC, increases from north to south. Further west the narrow field on the western side of the Bleach Road is also crossed by four of the possible routes with the same increase in impact from north to south.

The bridge crossing of the River Nore will necessitate some tree felling but can be completed without physical impacts on the river or its banks provided the design leaves 5m of existing ground at each side. Further west three of the routes run through a landward projection of the SAC.

Severance of habitat corridors
Severance is probably most important for mammals which move extensively during feeding such as bats, badgers and otters. Many species of bats are unwilling to cross open spaces due to fear of predation, and may have their feeding territories greatly

reduced by road gaps. Wider gaps are the most serious but bridging trees can often be used in mitigation. Most species can be considered to cross an open space the same length as the height of the adjacent trees.

Lighting also may constitute a barrier particularly to bats as some species will not cross a lighted area. Daubenton's bat on the river is the most sensitive but it applies to all species. Down-lighting will be important in any habitat of value to bats.

Few otter (or badger) movements occur on the floodplain fields but the frequent openings for water flow will facilitate animal movements provided they are not fenced. A study of badger movements in the field around Auteven should be done to allow for an underpass somewhere on this section.

The bridge itself is a potential barrier but this will be much reduced by having the span high enough over the water to allow swans etc to fly underneath and also to have the free space on each bank to allow for continuous vegetation especially of shrub height. Too narrow a gap promotes muddy ground as animals and fishermen create a path.

Culverts can create a significant barrier on streams and drains that are crossed and care must be taken to make them fully passable by fish, particularly as some salmonids are found in drain son the floodplain.

Construction traffic
The effect of site clearance, cut and fill and general traffic movements may be considerable in releasing sediment that can feed into the river to the detriment of most forms of aquatic life and especially salmonid fish. Method statements should be prepared to cover all activities with sufficient settlement and run-off capacity to minimise this risk. Building the embankment progressively from one end to the other will obviously minimise this impact as will the naturally low gradients of the floodplain.

Positive impacts
The extensive embankment will allow for an ecological type of management that could favour plant communities and insect life in places where the current intensive management prohibits them. This will depend on the type of material used but should be considered at an early stage with the aim of offsetting some of the negative effects of the project in the SAC. In addition conditions could probably be created for sand martins (and solitary bees) to nest in the cut at the eastern end and scrub planted in the cut below Auteven.

6. IMPACT MITIGATION

The residual impacts are likely to be habitat removal and severance. Habitat removal in a European site is regarded as Severe Negative by the NRA. Compensation could be considered by habitat creation around an attenuation pond on the floodplain, preferably in contact with the existing SAC. The existing pond in the wet woodland could also be modified to accommodate the rare plant as there is a ready water supply all winter during floods.

Severance can never be totally mitigated and remains an impact for some forms of life.

7. ROUTE SELECTION

The yellow route (2) is preferred because of its short passage through the SAC at the eastern end, its avoidance of the rest of the SAC, its perpendicular bridging of the Nore channel and the distance from the Auteven woods – which include a badger territory.

Thereafter Route 7 (orange) would be chosen for the limited amount of damage it would do at the eastern end, followed by Route 8 (black). These both run close to the Auteven boundary but any effect on badgers could be mitigated.

Route 1 (red) though relatively good at each end would destroy much of the isolated floodplain swamp included in the SAC (and pNHA).

Routes 3,4,5 & 6 would damage the integrity of the wet woodland by dividing it in two and probably drying out a considerable portion

Option	m in SAC	m in SPA	Severance of habitat	Impact on species	Route preference (bats)	Route preference (other)
1 Red	152	15	Medium	Medium	2	4
2 Yellow	114	13	Minor	Minor	1	1
3 Dark blue	151	20	Major	Medium	5	7
4 Light blue	146	20	Major	Medium	6	6
5 Green	270	18	Major	Medium	7	8
6 Purple	93	18	Major	Medium	5	5
7 (then 8) Orange	139	14	Minor	Minor	3	2
8 Black	97	14	Medium	Medium	4	3

SITE SYNOPSES

SITE NAME: RIVER NORE SPA **SITE CODE: 004233**

The River Nore SPA is a long, linear site that includes the following river sections: the River Nore from the bridge at Townparks, (north-west of Borris in Ossory) to Coolnamuck (approximately 3 km south of Inistioge) in Co. Kilkenny; the Delour River from its junction with the River Nore to Derrynaseera bridge (west of Castletown) in Co. Laois; the Erkina River from its junction with the River Nore at Durrow Mills to Boston Bridge in Co. Laois; a 1.5 km stretch of the River Goul upstream of its junction with the Erkina River; the Kings River from its junction with the River Nore to a bridge at Mill Island, Co. Kilkenny. The site includes the river channel and marginal vegetation.

For a large part of its course the River Nore traverses Carboniferous limestone plains; it passes over a narrow band of Old Red Sandstone rocks below Thomastown.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive of special conservation interest for the following species: Kingfisher. A survey in 2010 recorded 22 pairs of Kingfisher (based on 16 probable and 6 possible territories) within the SPA. Other species which occur within the site include Mute Swan (35), Mallard (267), Cormorant (14), Grey Heron (45), Moorhen (14), Snipe (17) and Sand Martin (1,029) – all figures are peak counts recorded during the 2010 survey.

The River Nore SPA is of high ornithological importance as it supports a nationally important population of Kingfisher, a species that is listed on Annex I of the E.U. Birds Directive.

25.11.2010

SITE SYNOPSIS

RIVER BARROW AND RIVER NORE cSAC SITE CODE: 002162

This site consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The site passes through eight counties – Offaly, Kildare, Laois, Carlow, Kilkenny, Tipperary, Wexford and Waterford. Major towns along the edge of the site include Mountmellick, Portarlington, Monasterevin, Stradbally, Athy, Carlow, Leighlinbridge, Graiguenamanagh, New Ross, Inistioge, Thomastown, Callan, Bennettsbridge, Kilkenny and Durrow. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King's Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones. The Nore, for a large part of its course, traverses limestone plains and then Old Red Sandstone for a short stretch below Thomastown. Before joining the Barrow it runs over intrusive rocks poor in silica. The upper reaches of the Barrow also runs through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, like the Nore runs over intrusive rocks poor in silica. Waterford Harbour is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore.

The site is a candidate SAC selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, *Vertigo moulinsiana* and the plant Killarney Fern.

Good examples of Alluvial Forest are seen at Rathsnagadan, Murphy's of the River, in Abbeyleix estate and along other shorter stretches of both the tidal and freshwater elements of the site. Typical species seen include Almond Willow (*Salix triandra*), White Willow (*S. alba*), Grey Willow (*S. cinerea*), Crack Willow (*S. fragilis*), Osier (*S. viminalis*), with Iris (*Iris pseudacorus*), Hemlock Water-dropwort (*Oenanthe crocata*), Angelica (*Angelica sylvestris*), Thin-spiked Wood-sedge (*Carex strigosa*), Pendulous Sedge (*C. pendula*),

Meadowsweet (*Filipendula ulmaria*), Valerian (*Valeriana officinalis*) and the Red Data Book species Nettle-leaved Bellflower (*Campanula trachelium*). Three rare invertebrates have been recorded in this habitat at Murphy's of the River. These are: *Neoascia obliqua* (Diptera: Syrphidae), *Tetanocera freyi* (Diptera: Sciomyzidae) and *Dictya umbrarum* (Diptera: Sciomyzidae).

A good example of petrifying springs with tufa formations occurs at Dysart Wood along the Nore. This is a rare habitat in Ireland and one listed with priority status on Annex I of the EU Habitats Directive. These hard water springs are characterised by lime encrustations, often associated with small waterfalls. A rich bryophyte flora is typical of the habitat and two diagnostic species, *Cratoneuron commutatum* var. *commutatum* and *Eucladium verticillatum*, have been recorded.

The best examples of old Oak woodlands are seen in the ancient Park Hill woodland in the estate at Abbeyleix; at Kyleadohir, on the Delour, Forest Wood House, Kylecorragh and Brownstown Woods on the Nore; and at Cloghristic Wood, Drummond Wood and Borris Demesne on the Barrow, though other patches occur throughout the site. Abbeyleix Woods is a large tract of mixed deciduous woodland which is one of the only remaining true ancient woodlands in Ireland. Historical records show that Park Hill has been continuously wooded since the sixteenth century and has the most complete written record of any woodland in the country. It supports a variety of woodland habitats and an exceptional diversity of species including 22 native trees, 44 bryophytes and 92 lichens. It also contains eight indicator species of ancient woodlands. Park Hill is also the site of two rare plants, Nettle-leaved Bellflower and the moss *Leucodon sciuroides*. It has a typical bird fauna including Jay, Long-eared Owl and Raven. A rare invertebrate, *Mitostoma chrysomelas*, occurs in Abbeyleix and only two other sites in the country. Two flies *Chrysogaster virescens* and *Hybomitra muhlfeldi* also occur. The rare Myxomycete fungus, *Licea minima* has been recorded from woodland at Abbeyleix.

Oak woodland covers parts of the valley side south of Woodstock and is well developed at Brownsford where the Nore takes several sharp bends. The steep valley side is covered by Oak (*Quercus* spp.), Holly (*Ilex aquifolium*), Hazel (*Corylus avellana*) and Birch (*Betula pubescens*) with some Beech (*Fagus sylvatica*) and Ash (*Fraxinus excelsior*). All the trees are regenerating through a cover of Bramble (*Rubus fruticosus* agg.), Foxglove (*Digitalis purpurea*) Wood Rush (*Luzula sylvatica*) and Broad Buckler-fern (*Dryopteris dilatata*).

On the steeply sloping banks of the River Nore about 5 km west of New Ross, in County Kilkenny, Kylecorragh Woods form a prominent feature in the landscape. This is an excellent example of a relatively undisturbed, relict Oak woodland with a very good tree canopy. The wood is quite damp and there is a rich and varied ground flora. At Brownstown a small, mature Oak-dominant woodland occurs on a steep slope. There is younger woodland to the north and east of it. Regeneration throughout is evident. The understorey is similar to the woods at Brownsford. The ground flora of this woodland is developed on acidic, brown earth type soil and comprises a thick carpet of Bilberry (*Vaccinium myrtillus*), Heather (*Calluna vulgaris*), Hard Fern (*Blechnum spicant*), Cow-wheat (*Melampyrum* spp.) and Bracken (*Pteridium aquilinum*).

Borris Demesne contains a very good example of a semi-natural broad-leaved woodland in very good condition. There is quite a high degree of natural re-generation of Oak and Ash through the woodland. At the northern end of the estate Oak species predominate. Drummond Wood, also on the Barrow, consists of three blocks of deciduous woods situated on steep slopes above the river. The deciduous trees are mostly Oak species. The woods have a well established understorey of Holly (*Ilex aquifolium*), and the herb layer is varied, with Brambles abundant. Whitebeam (*Sorbus devoniensis*) has also been recorded.

Eutrophic tall herb vegetation occurs in association with the various areas of alluvial forest and elsewhere where the flood-plain of the river is intact. Characteristic species of the habitat include Meadowsweet (*Filipendula ulmaria*), Purple Loosestrife (*Lythrum salicaria*), Marsh Ragwort (*Senecio aquaticus*), Ground Ivy (*Glechoma hederacea*) and Hedge Bindweed (*Calystegia sepium*). Indian Balsam (*Impatiens glandulifera*), an introduced and invasive species, is abundant in places.

Floating River Vegetation is well represented in the Barrow and in the many tributaries of the site. In the Barrow the species found include Water Starworts (*Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), Bulbous Rush (*Juncus bulbosus*), Milfoil (*Myriophyllum* spp.), *Potamogeton* x *nitens*, Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (*P. pectinatus*), Perfoliated Pondweed (*P. perfoliatus*) and Crowfoots (*Ranunculus* spp.). The water quality of the Barrow has improved since the vegetation survey was carried out (EPA, 1996).

Dry Heath at the site occurs in pockets along the steep valley sides of the rivers especially in the Barrow Valley and along the Barrow tributaries where they occur in the foothills of the Blackstairs Mountains. The dry heath vegetation along the slopes of the river bank consists of Bracken (*Pteridium aquilinum*) and Gorse (*Ulex europaeus*) species with patches of acidic grassland vegetation. Additional typical species include Heath Bedstraw (*Galium saxatile*), Foxglove (*Digitalis purpurea*), Common Sorrel (*Rumex acetosa*) and Bent Grass (*Agrostis stolonifera*). On the steep slopes above New Ross the Red Data Book species Greater Broomrape (*Orobanche rapum-genistae*) has been recorded. Where rocky outcrops are shown on the maps Bilberry (*Vaccinium myrtillus*) and Wood Rush (*Luzula sylvatica*) are present. At Ballyhack a small area of dry heath is interspersed with patches of lowland dry grassland. These support a number of Clover species including the legally protected Clustered Clover (*Trifolium glomeratum*) - a species known from only one other site in Ireland. This grassland community is especially well developed on the west side of the mud-capped walls by the road. On the east of the cliffs a group of rock-dwelling species occur, i.e. English Stonecrop (*Sedum anglicum*), Sheep's-bit (*Jasione montana*) and Wild Madder (*Rubia peregrina*). These rocks also support good lichen and moss assemblages with *Ramalina subfarinacea* and *Hedwigia ciliata*.

Dry Heath at the site generally grades into wet woodland or wet swamp vegetation lower down the slopes on the river bank. Close to the Blackstairs Mountains, in the foothills associated with the Aughnabrisky, Aughavaud and Mountain Rivers there are small patches of wet heath dominated by Purple Moor-grass (*Molinia caerulea*) with Heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Carnation Sedge (*Carex panicea*) and Bell Heather (*Erica cinerea*).

Saltmeadows occur at the southern section of the site in old meadows where the embankment has been breached, along the tidal stretches of in-flowing rivers below Stokestown House, in a narrow band on the channel side of Common Reed (*Phragmites*) beds and in narrow fragmented strips along the open shoreline. In the larger areas of salt meadow, notably at Carrickcloney, Ballinlaw Ferry and Rochestown on the west bank; Fisherstown, Alderton and Great Island to Dunbrody on the east bank, the Atlantic and Mediterranean sub types are generally intermixed. At the upper edge of the salt meadow in the narrow ecotonal areas bordering the grasslands where there is significant percolation of salt water, the legally protected species Borrer's Saltmarsh-grass (*Puccinellia fasciculata*) and Meadow Barley (*Hordeum secalinum*) (Flora Protection Order, 1987) are found. The very rare Divided Sedge (*Carex divisa*) is also found. Sea Rush (*Juncus maritimus*) is also present. Other plants recorded and associated with salt meadows include Sea Aster (*Aster tripolium*), Sea Thrift (*Armeria maritima*), Sea Couch (*Elymus pycnanthus*), Spear-leaved Orache (*Atriplex prostrata*), Lesser Sea-spurrey (*Spergularia marina*), Sea Arrowgrass (*Triglochin maritima*) and Sea Plantain (*Plantago maritima*).

Salicornia and other annuals colonising mud and sand are found in the creeks of the saltmarshes and at the seaward edges of them. The habitat also occurs in small amounts on some stretches of the shore free of stones.

The estuary and the other Habitats Directive Annex I habitats within it form a large component of the site. Extensive areas of intertidal flats, comprised of substrates ranging from fine, silty mud to coarse sand with pebbles/stones are present. Good quality intertidal sand and mudflats have developed on a linear shelf on the western side of Waterford Harbour, extending for over 6 km from north to south between Passage East and Creadaun Head, and in places are over 1 km wide. The sediments are mostly firm sands, though grade into muddy sands towards the upper shore. They have a typical macro-invertebrate fauna, characterised by polychaetes and bivalves. Common species include *Arenicola marina*, *Nephtys hombergii*, *Scoloplos armiger*, *Lanice conchilega* and *Cerastoderma edule*.

The western shore of the harbour is generally stony and backed by low cliffs of glacial drift. At Woodstown there is a sandy beach, now much influenced by recreation pressure and erosion. Behind it a lagoonal marsh has been impounded which runs westwards from Gaultiere Lodge along the course of a slow stream. An extensive reedbed occurs here. At the edges is a tall fen dominated by sedges (*Carex* spp.), Meadowsweet, Willowherb (*Epilobium* spp.) and rushes (*Juncus* spp.). Wet woodland also occurs. This area supports populations of typical waterbirds including Mallard, Snipe, Sedge Warbler and Water Rail.

The dunes which fringe the strand at Duncannon are dominated by Marram grass (*Ammophila arenaria*) towards the sea. Other species present include Wild Sage (*Salvia verbenaca*), a rare Red Data Book species. The rocks around Duncannon ford have a rich flora of seaweeds typical of a moderately exposed shore and the cliffs themselves support a number of coastal species on ledges, including Thrift (*Armeria maritima*), Rock Samphire (*Crithmum maritimum*) and Buck's-horn Plantain (*Plantago coronopus*).

Other habitats which occur throughout the site include wet grassland, marsh, reed swamp, improved grassland, arable land, quarries, coniferous plantations, deciduous woodland, scrub and ponds.

Seventeen Red Data Book plant species have been recorded within the site, most in the recent past. These are Killarney Fern (*Trichomanes speciosum*), Divided Sedge (*Carex divisa*), Clustered Clover (*Trifolium glomeratum*), Basil Thyme (*Acinos arvensis*), Hemp nettle (*Galeopsis angustifolia*), Borrer's Saltmarsh Grass (*Puccinellia fasiculata*), Meadow Barley (*Hordeum secalinum*), Opposite-leaved Pondweed (*Groenlandia densa*), Autumn Crocus (*Colchicum autumnale*), Wild Sage (*Salvia verbenaca*), Nettle-leaved Bellflower (*Campanula trachelium*), Saw-wort (*Serratula tinctoria*), Bird Cherry (*Prunus padus*), Blue Fleabane (*Erigeron acer*), Fly Orchid (*Ophrys insectifera*), Broomrape (*Orobanche hederae*) and Greater Broomrape (*Orobanche rapum-genistae*). Of these the first nine are protected under the Flora Protection Order 1999. Divided Sedge (*Carex divisa*) was thought to be extinct but has been found in a few locations in the site since 1990. In addition plants which do not have a very wide distribution in the country are found in the site including Thin-spiked Wood-sedge (*Carex strigosa*), Field Garlic (*Allium oleraceum*) and Summer Snowflake (*Leucojum aestivum*). Six rare lichens, indicators of ancient woodland, are found including *Lobaria laetevirens* and *L. pulmonaria*. The rare moss *Leucodon sciuroides* also occurs.

The site is very important for the presence of a number of EU Habitats Directive Annex II animal species including Freshwater Pearl Mussel (*Margaritifera margaritifera* and *M. m. durrovensis*), Freshwater Crayfish (*Austropotamobius pallipes*), Salmon (*Salmo salar*), Twaite Shad (*Alosa fallax fallax*), three Lamprey species - Sea (*Petromyzon marinus*), Brook (*Lampetra planeri*) and River (*Lampetra fluviatilis*), the marsh snail *Vertigo moulinsiana* and

Otter (*Lutra lutra*). This is the only site in the world for the hard water form of the Pearl Mussel *M. m. durrovensis* and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning.

The site supports many other important animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (*Myotis daubentoni*), Badger (*Meles meles*), Irish Hare (*Lepus timidus hibernicus*) and Frog (*Rana temporaria*). The rare Red Data Book fish species Smelt (*Osmerus eperlanus*) occurs in estuarine stretches of the site. In addition to the Freshwater Pearl Mussel, the site also supports two other freshwater Mussel species, *Anodonta anatina* and *A. cygnea*.

The site is of ornithological importance for a number of E.U. Birds Directive Annex I species including Greenland White-fronted Goose, Whooper Swan, Bewick's Swan, Bar-tailed Godwit, Peregrine and Kingfisher. Nationally important numbers of Golden Plover and Bar-tailed Godwit are found during the winter. Wintering flocks of migratory birds are seen in Shanahoe Marsh and the Curragh and Goul Marsh, both in Co. Laois and also along the Barrow Estuary in Waterford Harbour. There is also an extensive autumnal roosting site in the reedbeds of the Barrow Estuary used by Swallows before they leave the country.

Landuse at the site consists mainly of agricultural activities – many intensive, principally grazing and silage production. Slurry is spread over much of this area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of the salmonid river and to the populations of Habitats Directive Annex II animal species within the site. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs. Fishing is a main tourist attraction along stretches of the main rivers and their tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. There is net fishing in the estuary and a mussel bed also. Other recreational activities such as boating, golfing and walking, particularly along the Barrow towpath are also popular. There is a golf course on the banks of the Nore at Mount Juliet and GAA pitches on the banks at Inistioge and Thomastown. There are active and disused sand and gravel pits throughout the site. Several industrial developments, which discharge into the river, border the site. New Ross is an important shipping port. Shipping to and from Waterford and Belview ports also passes through the estuary.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, overgrazing within the woodland areas, and invasion by non-native species, for example Cherry Laurel and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above. Good quality is dependent on controlling fertilisation of the grasslands, particularly along the Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods which can damage the many Annex II species present. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book

plant species including three rare plants in the salt meadows and the population of the hard water form of the Pearl Mussel which is limited to a 10 km stretch of the Nore, add further interest to this site.

16.1.03

DUNMORE COMPLEX pNHA SITE CODE: 01859

A series of natural depressions in the gravels and boulder clays of the northern outskirts of Kilkenny city supports an interesting diversity of wetland and woodland and old meadow habitats. Although now much affected by development, seven fragments of the former ecological unit have been defined that represent the range of habitats of interest in this locality. In addition, in places the secondary vegetation of abandoned gravel workings is of interest and included within the site.

These seven fragments between them make up the Natural Heritage Area named the Dunmore Complex. To the north of Dunmore house and alongside the railway one of the largest blocks included in the site is itself a complex including areas of wet Alder (Alnus glutinosa) and Willow (Salix cinerea) woodland with an understorey dominated by Greater tussock-sedge (Carex paniculata) and Common reed (Phragmites australis), areas of nutrient poor acidic mire, typified by Purple moor-grass (Molinia caerulea) and Carnation sedge (Carex panicea), areas of more nutrient rich and more species rich freshwater marsh with Meadowsweet (Filipendula ulmaria) and Brown sedge (Carex disticha) and locally, wetter areas with swamp species such as Reedmace (Typha latifolia), Bottle sedge (Carex rostrata), Water horsetail (Equisetum fluviatile) Marsh cinquefoil (Potentilla palustris) and Bogbean (Menyanthes trifoliata). The whole complex is developed partly in a disused sand pit.

By contrast to the north of this block, the smallest block to be designated is a much modified dry embankment, colonised by calcium demanding species such as Kidney vetch (Anthyllis vulneraria), Carline thistle (Carlina vulgaris) and Fairy flax (Linum catharticum). This area's special qualification in the NHA is the common occurrence of the legally protected plant, Basil thyme (Acinos arvensis).

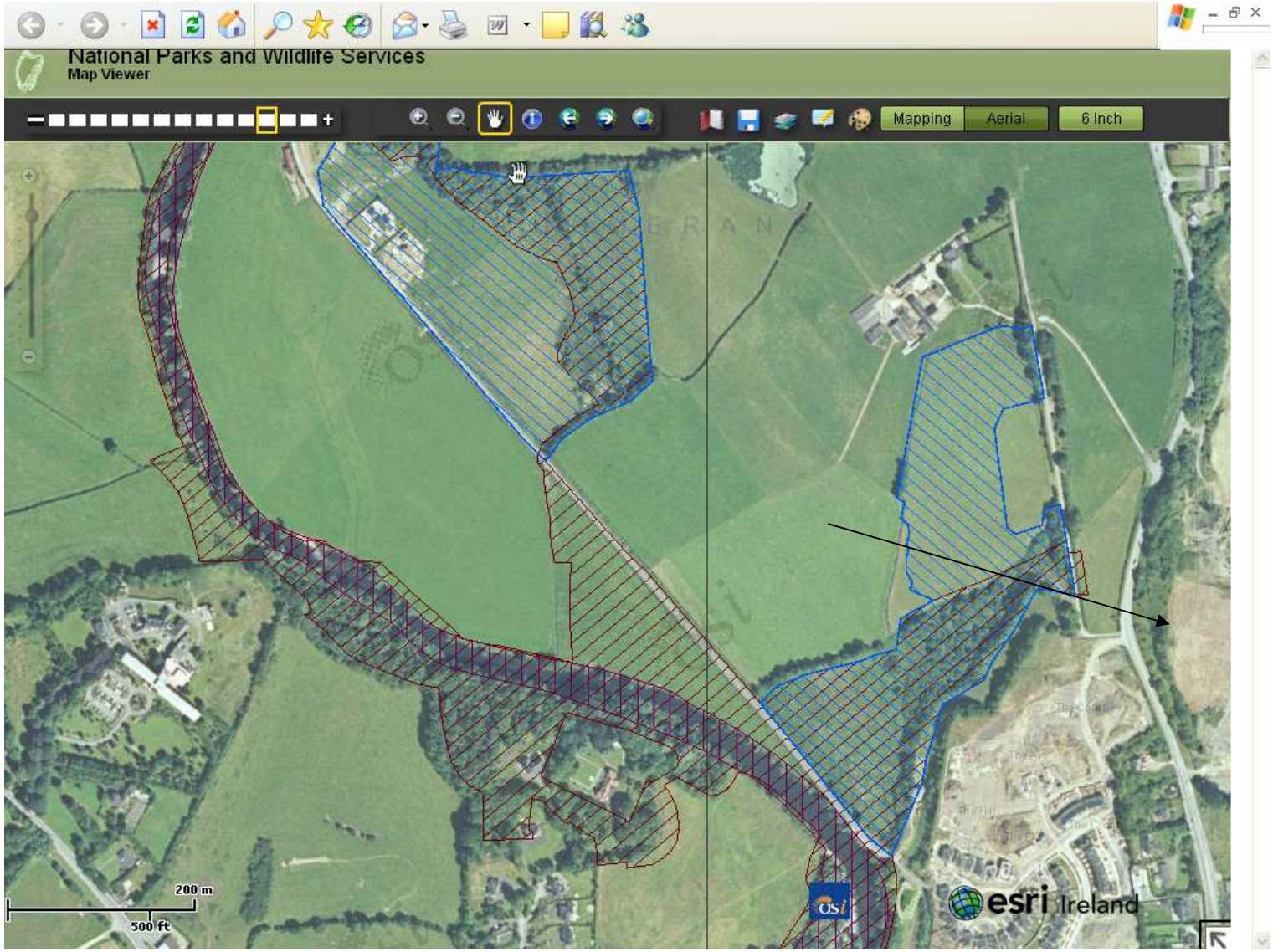
West of these blocks lie two blocks, both wooded ridges. The woods are mainly well drained although they do have wet marginal areas. They tend to be scrubby, the tree species Ash (Fraxinus excelsior), Rowan (Sorbus aucuparia), Sycamore (Acer pseudoplatanus) and occasional Oak (Quercus robur), joined by Blackthorn (Prunus spinosa), Hawthorn (Crataegus monogyna) and Gorse (Ulex europaeus).

The legally protected Nettle-leaved bellflower (Campanula trachelium) grows commonly in both of these woods along with a range of more common woodland herbs. The area around the River Nore is the national headquarters for this extremely rare species.

Three further blocks to the south continue the theme of wetlands developing in depressions with some nutrient poor areas. Notable species include Greater spearwort (Ranunculus lingua) which grows in local profusion, Fen bedstraw (Galium uliginosum) which is widespread, and Great water dock (Rumex hydrolapathum).

Although each block is small, overall they form a highly diverse site which supports an impressive array of rare plant species mentioned above, plus a rare liverwort species (Ricciocarpus fluitans). The wetland basins are vulnerable to infilling, as has happened extensively already, such as at the Rich View block which is the southern most of the seven blocks. Nutrient poor areas are particularly unusual to find in this sort of situation, exactly because of their vulnerability to pollution (nutrient enrichment). A large area in the centre of the cluster has been infilled and now accommodates a concrete works, careless disposal of waste water from this industry also threatens the site.

A further wetland site to the south again, Newpark marsh, has also been designated an NHA and complements the Dunmore complex NHA.



Area for the potential route showing designations (SAC diagonal hatching, SPA vertical hatching). Origin arrowed

APPENDIX H

Natura Impact Statement

Kilkenny Northern Ring Road

N77 to R693 (Freshford Road)

Co Kilkenny

Natura Impact Statement

Report prepared for Kilkenny County Council

May 2013

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1. INTRODUCTION

The purpose of this report is to examine the possible ecological impacts of the proposed extension of the Kilkenny northern ring road through two Natura 2000 sites – the candidate SAC of the River Barrow & River Nore (Site Code 2162) and the Special Protection Area of the River Nore (Site Code 4233).

The report is written after field examinations in February and May 2013 but makes use of information from preceding EIS studies.

The site and possible impacts were discussed with the National Parks and Wildlife Service (Lorcan Scott & Jimi Conroy).

The report is part of the appropriate assessment procedure following the outline of the NPWS Guidance document (DoEHLG 2009). It begins with a short description of the site though this is covered in more detail in the EIS and route selection reports.

2. DESCRIPTION OF SITE

The habitats (following Fossitt 2000) that occur in this section of the floodplain and adjacent river valley are described in detail by the March 2008 study and have not changed appreciably since then. Broadly they comprise a large area of improved agricultural grassland and smaller sections of wet woodland, dry deciduous woodland, lowland river, drainage ditches and treelines/hedgerows. Small areas of buildings and artificial surfaces are provided by the roads and trackways while there is also a little disturbed ground just west of the existing roundabout on the N77. The more interesting plant and animal species that occur are noted below.

2.1 Flora

Pockets of interesting habitat occur along the route with plant species that are uncommon locally, though none of them are rare or protected. Starting from the eastern end, a patch of disturbed ground supports hawkweed ox-tongue *Picris hieracioides*, an introduced, but Kilkenny, speciality. The wet woodland in its clearings and drains has large sedges (*Carex acutiformis*, *C.riparia*, *C.otrubae*) as well as herbs like yellow loosestrife *Lysimachia vulgaris* and the floating liverwort *Riccia fluitans*.

Another centre of interest is the drain along the western side of the Bleach Road where creeping jenny *Lysimachia nummularia* is abundant. The Nore banks have patches of creeping yellowcress *Rorippa sylvestris* but this is ubiquitous along the channel, if rare over much of the country.

2.2 Fauna

The only large mammal dependant on the area is the otter and the species is relatively common in that a regular otter path is seen on some of the Nore bank. Feeding activities may take animals into the drains and woodland east of the Bleach Road, especially in spring when looking for frogs. Otters breed in holes in riverbanks, often under fallen trees but there are no especially favourable sites in this section of the Nore.

Badgers are resident or at least regular in the woodland on the southwest bank of the river, visiting the fields north of Auteven. No evidence of them crossing the route was seen but this is likely to happen when feeding demands it.

A bat survey indicates that at least six species occur in the area with the river channel being the most valuable habitat, followed by the riverside woodland east of Auteven and the wet woodland at the eastern edge. There are no buildings potentially affected by the project that would be suitable as breeding roosts. Temporary roosting does also occur on trees during summer, especially if ivy-covered.

The floodplain of the river attracts wildfowl when flooded and small flocks of whooper swans occur for short periods in some winters. Geese, probably grey-lag, have also been seen but very rarely. Considerable numbers of snipe feed in wetter areas of the floodplain in winter and some are likely to nest in the marshland west of the routes. Little egrets also occur sporadically along the river but do not nest. A species that has nested is the yellowhammer, seen in the hedges along the Bleach Road.

The Nore river supports a wide variety of fish, both salmonids and coarse types like perch and pike. It is a migratory route for salmon and river lamprey and there is some breeding in this section. Lamprey larvae are found in muddy embayments along the bank. Some salmonid fry also penetrate into the drains leading to the river.

3. APPROPRIATE ASSESSMENT

3.1 Introduction

Appropriate assessment was introduced by the EU Habitats Directive as a way of determining during the planning process whether a project is likely to have a significant effect on one of the Natura 2000 sites so far designated (i.e. the candidate SAC's and SPA's), or their conservation objectives. In this case the sites are the River Barrow and River Nore cSAC (Site Code 2162) and the River Nore SPA (Site Code 4233).

Article 6(3) states
Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in

combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives….

In the Irish context this has been interpreted as a four stage process. Firstly a screening exercise (Stage 1) determines if a project could have significant effects on a Natura site. If it does or the situation is unclear a Natura Impact Statement (Stage 2, this document) is provided to the planning or regulatory authority which then conducts an Assessment of the information supplied. Examples of significant effects are loss of habitat area, fragmentation of the habitat, disturbance to species using the site and changes in water resources or quality. If such negative effects come to light in the assessment, alternative solutions are investigated by the proponent (Stage 3) and modifications made unless the project is deemed to be driven by 'imperative reasons of overriding public interest' in its current form. If this is the case Stage 4 then deals with compensatory action.

3.2 Project description

The road is planned as a single carriageway similar to the existing sections of the Ring Road and will be 25.25m wide including verges. It sets off from the N77 roundabout on a north-westerly line but curves to cross the floodplain of the River Nore almost E-W. It runs mostly on embankment though there is a short section of cut on the western side of the river where the land rises abruptly. The embankment over the floodplain will be punctuated regularly by 12 culverts, 3.5m high x10m wide so as not to affect the behaviour of floods, while the bridge will be of traditional design with a steel girder below the carriageway. The clearance over normal waterlevel will be 3.2m while the supporting piers are set back from the riverbank by 14m on the east and 6.5m on the west.

The total length of the road will be 1.5km.

3.3 Natura sites

River Barrow and River Nore cSAC

The site synopsis (see end) lists the qualifying interests of the site in terms of the Annex I habitats and Annex II species included in the EU Habitats Directive. The qualifying interests of the SAC have been brought together by NPWS (2011), along with supporting survey information and specific conservation objectives. These interests are

1016 Desmoulin's whorl snail *Vertigo moulinsiana*
1029 Freshwater pearl mussel *Margaritifera margaritifera*
1092 White-clawed crayfish *Austropotamobius pallipes*
1095 Sea lamprey *Petromyzon marinus*
1096 Brook lamprey *Lampetra planeri*
1099 River lamprey *Lampetra fluviatilis*
1103 Twaite shad *Alosa fallax*
1106 Atlantic salmon (*Salmo salar*) (only in fresh water)
1130 Estuaries

1140 Mudflats and sandflats not covered by seawater at low tide
1310 *Salicornia* and other annuals colonizing mud and sand
1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1355 Otter *Lutra lutra*
1410 Mediterranean salt meadows (*Juncetalia maritimi*)
1421 Killarney fern *Trichomanes speciosum*
1990 Nore freshwater pearl mussel *Margaritifera durrovensis*
3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
4030 European dry heaths
6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
7220 * Petrifying springs with tufa formation (*Cratoneurion*)
91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

* indicates priority habitat

River Nore SPA

The SPA is based on the kingfisher, an Annex I species under the Birds Directive and therefore a species of special conservation interest. A high density of territories was found by a National survey for the bird on the Nore from Borris-in-Ossory to Inistioge. Other species noted to occur are mute swan, cormorant, mallard, snipe and sand martin (site synopsis at end).

3.4 Conservation objectives

The organisms and habitats that occur in this section of the cSAC are

1092 White-clawed crayfish *Austropotamobius pallipes*
1096 Brook lamprey *Lampetra planeri*
1099 River lamprey *Lampetra fluviatilis*
1106 Atlantic salmon (*Salmo salar*) (only in fresh water)
1355 Otter *Lutra lutra*

[3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation]

A few plants of water crowfoot *Ranunculus peltatus* were seen higher up the river but none in the vicinity of the crossing place

[91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)]

Swamp woodland occurs to the SW of the route that could be construed as Salicion albae. However the route runs through a small area of tall sedge with willow bushes at one end of this and does not impinge on the annexed habitat.

3.4.1 River Barrow & River Nore cSAC

Each of the above interests has conservation objectives listed in NPWS (2011), as below. Potential impacts from the project are noted below each table

1092 White-clawed crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed crayfish in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	The crayfish is present almost throughout this SAC. The records extend as far downstream as Thomastown on the Nore and Graiguenamanagh on the Barrow
Population structure: recruitment	Percentage occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in at least 50% of positive samples	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as major direct threat to this species and as disease vector. See Reynolds (1998) for further details
Disease	Occurrence	No instances of disease	Disease is identified as major threat and has occurred in Ireland even in the absence of alien vectors. See Reynolds (1998) for further details
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds(2002). Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)
Habitat quality: heterogeneity	Occurrence of positive habitat features	No decline in heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree□roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus such as leaf litter. These conditions must be available on the whole length of occupied habitat

Impacts: The river channel is unaffected by works and the only potential impact is on water quality during construction or operation. The species is not overly sensitive to water quality as it requires only Q3-4. Currently the river is Q4 (see Appendix I). However it could be affected by oil or chemical residues produced by setting concrete.

1096 Brook lamprey *Lampetra planeri*

To restore the favourable conservation condition of Brook lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	% of river accessible	Access to all watercourses down to first order streams	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King(2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland(IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

Impacts: The river channel is unaffected by the works so that there will be no interference with adult movements. Increased sediment could improve the larval habitat at edges of channel. Oil or chemical inputs are a potential negative impact.

1099 River lamprey *Lampetra fluviatilis*

To restore the favourable conservation condition of River lamprey in the River Barrow and RiverNore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible down to second order	Greater than 75% of main stem and major tributaries accessible from estuary	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

			on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland(IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

Impacts: The river channel is unaffected by the works so that there will be no interference with adult movements. Increased sediment could improve the larval habitat at edges of channel. Oil or chemical inputs are a potential negative impact.

1106 Atlantic salmon (*Salmo salar*) (only in fresh water)

To restore the favourable conservation condition of Salmon in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Adult spawning fish	Number	Conservation Limit (CL) for each system consistently exceeded	A conservation limit is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee of the National Salmon Commission's annual model output of CL attainment levels. See SSC (2010). Stock estimates are either derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance

			counts. The Nore is currently exceeding its CL, while the Barrow is below its CL
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	Target is threshold value for rivers currently exceeding their conservation limit (CL)
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice(*Lepeophtheirus salmonis*)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are currently preventing salmon from accessing suitable spawning habitat
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency

Impact. The river channel is unaffected by the works so that there will be no effect on upstream migration by adults. Water pollution, either by sediment or oils etc, would be an adverse impact, especially on the eggs and younger stages of the fish.

1355 Otter *Lutra lutra*

To restore the favourable conservation condition of Otter in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range in south-east estimated at 73%(Bailey and Rochford, 2006)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as122.8ha above high water mark (HWM); 1136.0ha along river banks / around ponds	No field survey. Areas mapped to include10m terrestrial buffer along shoreline(above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as857.7ha	No field survey. Area mapped based on evidence that otters tend to forage within80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as616.6km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters(Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as2.6ha	No field survey. Area mapped based on evidence that otters tend to forage within80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in

			particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006) and wrasse and rockling in coastal waters

Impacts: The channel and bankside paths will not be affected and there are no suitable resting sites at the river crossing. The only potential impact would be on food, either salmonids or crayfish. Lying up places in the woodland to the south of the bridge are possible but are far enough away to avoid disturbance.

3.4.2 River Nore SPA

The conservation objective in this case is

To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA: kingfisher

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Impacts. The channel will be unaffected by the bridge works and there was no nest in this section during 2013, although parts of the bank nearby are suitableKingfishers will pass under the bridge without difficulty and are not likely to fly into the structure.
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4. EFFECTS OF DEVELOPMENT

The only unavoidable consequences of the project are the covering up of habitat inside a Natura 2000 site and the creating of noise and a level of air pollution that has not been present before. All other effects may be mitigated by attention to detail in design and construction (Section 5).

4.1 Habitat loss

The road will run for 173m through the cSAC, made up of 67m at the eastern end, 44m beside the Bleach Road and 62m in crossing the river. The comparable distance through the SPA is 22m, the width of the river channel itself.

The section at the eastern end consists first of a drain beside the old railway embankment, then the embankment itself which carries a farm access, then a section

of fill which is grassed on the slope down to the stream at the base. Here there is a broad drain which floods back from the river during high water conditions. Two young crack willow *Salix fragilis* and a few grey willow *Salix cinerea* grow in and around a stand of pond sedge *Carex riparia* in the deeper water. Meadowsweet *Filipendula ulmaria* and marsh valerian *Valeriana officinalis* grow in the vicinity. The northern side of this drain is now improved grassland though it was included in a proposed Natural Heritage Area (see map at end).

At the Bleach Road the route enters the tip of a triangular grassland field which is cut for silage, At the northern end there is a mixed stand of rough-stalked meadowgrass *Poa trivialis* and ryegrass *Lolium perenne* which include a lot of meadow foxtail *Alopecurus pratensis* towards the river.

Improved grassland extends almost to the riverbank at the bridge crossing point except for a line of osier *Salix viminalis* and one white willow *Salix alba* with a scatter of. cow parsley *Anthriscus sylvestris* and celandine *Ranunculus ficaria* in between. The river channel is deep though stony with some algae. The western bank is higher (4-5m) than the east and fenced off from animals so has an intact, scrubby fringe including bramble *Rubus fruticosus*, gorse *Ulex europaeus*, blackthorn *Prunus spinosa*, privet *Ligustrum vulgare* and a little guelder rose *Viburnum opulus* with trees growing above it. On this side English elm *Ulmus procera*, white willow *Salix alba* and sycamore are noticeable and the herbs include false brome *Brachypodium sylvaticum* and lords-and-ladies *Arum maculatum*. A small patch of gorse scrub also covers the valley side in the cSAC adding hard rush *Juncus inflexus*, primrose *Primula vulgaris* and barren strawberry *Potentilla sterilis*.

None of these areas has significant ecological interest and the plant species are widespread in the river valley. In particular there are no areas of Annexed habitat and no protected plants under national legislation.

4.2 Other impacts

These impacts are general to road projects and are not specific to the Natura 2000 sites.

Severance
This is probably most important for mammals which move extensively during feeding such as bats, badgers and otters. Many species of bats are unwilling to cross open spaces due to fear of predation, and may have their feeding territories greatly reduced by road gaps. Wider gaps are the most serious but bridging trees can often be used in mitigation. Most species can be considered to cross an open space the same length as the height of the adjacent trees.

Lighting also may constitute a barrier particularly to bats as some species will not cross a lighted area. Daubenton's bat on the river is the most sensitive but it applies to all species. Down-lighting will be important in any habitat of value to bats.

Few otter (or badger) movements occur on the floodplain fields but the frequent openings for water flow will facilitate animal movements provided they are not

fenced. A study of badger movements in the field around Auteven should be done to allow for an underpass somewhere on this section.

The bridge itself is a potential barrier but this will be much reduced by having the span high enough over the water to allow swans etc to fly underneath and also to have the free space on each bank to allow for continuous vegetation especially of shrub height. Too narrow a gap promotes muddy ground as animals and fishermen create a path.
Culverts can create a significant barrier on streams and drains that are crossed and care must be taken to make them fully passable by fish, particularly as some salmonids are found in drain son the floodplain.

Disturbance
Disturbance in terms of noise seems seldom to be an issue for wildlife and is much more noticed by people. Four of the species of importance are aquatic so cannot be affected by noise. Otters and kingfishers are tolerant and much more controlled by the presence of food and shelter. Both species are seen in towns quite frequently if water quality is good.

The main disturbance during the construction phase is site clearance and the removal of tree or bush cover. The movement of machinery on the embankment or at the river side will not be significant although it may alter the daily behaviour of some species.

Air pollution
Raised levels of nitrogen oxides are experienced by all road verges with a reasonable amount of traffic and these might be considered to impact on the vegetation of the SAC (see Air quality and climate section of EIS). However a floodplain is a nutrient-rich habitat, a situation produced by river flooding and, in this case, intensive management of the grassland over most of the adjoining area. Additional nitrate input will not be significant in this case.

Positive impacts
The extensive embankment will allow for an ecological type of management that could favour plant communities and insect life in places where the current intensive agriculture prohibits them. This will depend on the type of material used but should be considered at an early stage with the aim of offsetting some of the negative effects of the project in the SAC.

5. MITIGATION MEASURES

The effect of site clearance, cut and fill and general traffic movements are recognised as major factors in releasing sediment that can feed into the river to the detriment of most forms of aquatic life and especially salmonid fish. Method statements will be prepared by the contractors to cover all activities, with sufficient settlement and run-off capacity to minimise this risk. Building the embankment progressively from one

end to the other will minimise this potential impact as will the naturally low gradients of the floodplain.

5.1 Water quality

In designing appropriate mitigation measures to safeguard water quality in the river the requirements of Inland Fisheries Ireland (see Appendix 2) will be met, i.e.

* Silt traps/settlement ponds or other forms of containment and treatment shall be constructed at locations that will intercept run-off to streams. Traps shall not be constructed immediately adjacent to natural watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact. Alternatively, imported materials such as terram, straw bales, coarse to fine gravel should be used either separately or in combination as appropriate to remove suspended matter from discharges.

* The level of suspended solids in any discharges to fisheries waters as a consequence of construction works shall not exceed 25 mg/l, nor result in the deposition of silts on gravels or any element of the aquatic flora or fauna.

* When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete.

* No direct discharges be made to waters where there is potential for cement or residues in discharges.

* Designated impermeable cement washout areas must be provided.

* The pH of any and all discharges made from and during construction works shall be in the range 6.0 - 9.0 units and not alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units.

* All oils and fuels shall be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular attention shall be paid to gradient and ground conditions which could increase the risk of discharge to waters.

* Temporary oil interceptor facilities shall be installed and maintained where site works involve the discharge of drainage water to receiving rivers and streams.

* There shall be no visible oil film in any discharges from construction works to waters.

* That all containment and treatment facilities are regularly inspected and maintained.

* Waterproofing and other chemical treatment to structures in close proximity to waters shall be applied by hand.

* Hydroseeding shall not be carried out in close proximity to water. These areas shall be seeded by hand.

5.2 Disturbance

The river banks will be checked in case of nesting kingfishers prior to construction and the bridge works timed to avoid any impact.

5.3 Other mitigation

Tall growing trees will be planted close the road edge on the old railway embankment so that a flight bridge may be established with trees there. The significance of this is small as the major feeding area occurs to the south-west. However there could be some roosting by bats in the farm buildings on the northern side.

Mature trees will be left as close as practicable to the bridge on the river bank and willows will be allowed to grow under the bridge itself. This will lessen any severance effect of the bridge for bats.

4. CONCLUSION

The project can be completed without significant effect on the Natura 2000 sites provided the mitigation measures are effective. Local impacts will occur but these will not endanger the special features of the sites or their conservation objectives.

The project will not add cumulatively to others to create any significant impacts on the Natura 2000 sites.

References

Fossitt, J.A. 2000 *A guide to habitats in Ireland*. Heritage Council.

Dept of Environment, Heritage and Local Government (2009). *Appropriate assessment of plans and projects in Ireland: guidance for planning authorities.* Dublin.

National Parks & Wildlife Service (2011) Conservation Objectives: River Barrow & River Nore SAC 002162. Dept of Arts, Heritage and the Gaeltacht. Version 1 (website)

Appendix 1. Water quality data from the River Nore (EPA Data)

1450	Ballyragget Br	244528	170813	60	KK
1500	1.5 km d/s Ballyragget	244009	169382	60	WD
1600	Lismaine Br	244102	166118	60	KK
1700	Threecastles Br	245811	162687	60	KK
1750	ENE of Troyswood House	249539	159374	67	KK
1800	1 km u/s Green's Br, Kilkenny	250457	157314	67	KK
1900	St John's Br, Kilkenny	251080	155819	67	KK

1450	5	4-5	4	4	4	3-4	3-4	3-4	4	3-4	3-4	3-4	-	4
1500	-	4	3-4	4	3-4	3-4	3-4	-	-	-	-	-	-	-
1600	5	5	3-4	4	3-4	4	4	3-4	4	4	4	-	-	-
1700	-	-	4	-	4	4	4	4	4	4	4	4	-	4
1750	-	-	-	-	-	4	4	-	-	-	-	-	-	-
1800	5	4-5	5	-	5	5	4	4	4-5	4	4	4	-	4
1900	-	-	-	-	2-3	4-5	4	3-4	-	-	-	-	-	-

Appendix 2. Consultation from Inland Fisheries Ireland

From: Patrick Kilfeather [mailto:pkilfeather@fisheriesireland.ie]
Sent: 27 February 2013 17:17
To: Pat Groves
Subject: RE: Inland Fisheries Ireland - Re Scoping comments for Kilkenny Northern Ring Road EIS report

RIVER AND STREAM PERMANENT CROSSING STRUCTURES.

Structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage. Design and choice of structure should be based on its technical and economic feasibility to pass fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over-wintering areas, provision in certain areas of angling and commercial fishing access including boat access and prevention of erosion and sedimentation.

Culverts are the most frequently used river/stream crossing structures and are associated with some of the most common fish passage problems. The culverting of long stretches of fisheries water is extremely undesirable and can result in significant loss of valuable habitat. In the case of crossing structures over fishery waters, the preferred position is for clear span structures (bridges), so as not to interfere in any way with the bed or bank of the watercourses in question.

Bridge foundations should be designed and positioned at least 2.5 metres from the river bank so as not to impact on the riparian habitat.

Generally, bridges and bottomless culverts are the best option for maintaining natural stream channel characteristics and have the least impact on habitat. However, because of design and load bearing considerations, bottomless culverts may not always be suitable for installation particularly on narrow river channels, as foundations may encroach on the channel itself and possibly result in future scouring or erosion.

Taking account of recent advances and investigations in the area of climate change and flood studies, designs should be such as to verifiably have carrying capacity for a 1 in 100 year fluvial flood flow whilst maintaining a minimum freeboard of 300 mm.

The Office of Public Works (OPW) is the lead agency for flood risk management in the Republic of Ireland. Design and capacity of structures must also be in accordance with their requirements. IFI strongly recommends that contact be made with OPW at the earliest stage in the planning and design process. (www.opw.iehttp://www.opw.ie>)

Clear span designs maintain channel profile, do not alter gradients, readily pass sediment and debris and provide unrestricted passage for all size classes of fish by retaining the natural stream bed and gradient. Water velocity is not changed and they can be designed to maintain the normal stream width. Foundations should be positioned at least 2.5 metres from waters.

Embedded box and pipe culverts are less preferable to bridges and bottomless culverts. Embedded culverts must maintain the natural channel gradient, width and substrate configuration. They should be buried to a minimum of 500 mm. below the stream bed at the natural gradient. Box and pipe culverts must be sized to maintain the natural stream channel width. The gradient should not exceed 3%. The availability of suitably sized material (depending on hydraulic conditions) to initiate "simulation" of the stream bed is the most preferable approach to establish fish and faunal passage through culverts.

Culverts should be positioned where the watercourse is straightest and aligned with its bed.

In the case of bridges and bottomless culverts, structures should be designed and installed so as to:

* Allow for the maintenance of channel profile and existing gradient.

* Be capable of passing such debris as might arise during flood flow conditions.

* Ensure adequate light penetration to minimise loss in primary productivity.

* Not result in damage to the riparian habitat or necessitate construction within 2.5 metres of waters.

* Provide at locations specified by IFI, angling access and/or access for commercial fishing purposes.

IFI is prepared in certain circumstances to consider proposals for the installation of box or pipe culverts on fisheries waters. These may be installed subject to structures being sized so as to meet the requirements above in terms of channel profile, gradient, flood debris capacity, light, access and:

* Be positioned such that both the upstream and downstream invert shall be 500 mm. below the upstream and downstream river bed invert levels respectively.

* Never exceed a slope of 5%, in which circumstances baffles generally are required, and preferably not exceed a slope of 3%.

* As baffles can reduce the hydraulic efficiency of culverts, appropriate capacity provision must be included in the overall design.

* In the case of box culverts on angling waters, be 3 meters in height.

Pipe culverts are not generally considered acceptable on fisheries waters. They are normally only appropriate for use on minor watercourses and drainage ditches where these can be demonstrated as not being significant in terms of fisheries habitat

Bank protection works are often required upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs. In carrying out bank protection works, it is essential that large enough boulders are selected and strategically positioned, to ensure they cannot be undercut. Normally this entails part burying boulders up to one third of their depth below stream bed level and securing them into their final position. In areas of high water energy, to ensure stability, boulders size should be a minimum of 0.5 ton. To facilitate revegetation, each course of boulders laid should be back filled with a layer of top soil. Selection of boulders in terms of shape to facilitate their placement and stability is a major consideration. Irregularly shaped boulders are very difficult to work with in terms of building multiple stable courses. The height to which rock armour is built must take account not only of the riparian zone requiring protection, but also in certain circumstances of the need to protect e.g. kingfisher and sand martin habitat. In many instances, one or two layers of armour will be sufficient to protect and stabilise the toe of embankments while allowing nesting.

Gabions are not a preferred option when it comes to bank protection. They can easily be vandalised and once the mesh is cut or broken, baskets can collapse. Gabion baskets can be unsightly and it is difficult to successfully establish and maintain vegetation on side walls. Gabion baskets are normally only acceptable at locations where due to access constraints it is not possible to install rock armour.

CONSTRUCTION IMPACTS.

Uncured concrete can kill fish, plant life and macroinvertebrates by altering the pH of the water. Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life.

Discharge of silt-laden waters to fisheries streams is of particular concern. Silt can clog fish spawning beds and juvenile fish species are particularly sensitive. Plant and macroinvertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat. It is important to incorporate best practices into construction methods to minimise discharges of silt/suspended solids to waters.

Discharges of fuels and oils can be directly toxic to aquatic life and at sub lethal levels lead to tainting of fish tissues, rendering fish inedible. Oil films on water can seriously interfere with the diffusion of oxygen from the atmosphere into waters and in extreme cases result in oxygen depletion.

IFI require that:

* When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete.

* No direct discharges be made to waters where there is potential for cement or residues in discharges.

* Designated impermeable cement washout areas must be provided.

* The pH of any and all discharges made from and during construction works shall be in the range 6.0 - 9.0 units and not alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units.

* Silt traps/settlement ponds or other forms of containment and treatment shall be constructed at locations that will intercept run-off to streams. Traps shall not be constructed immediately adjacent to natural watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact. Alternatively, imported materials such as terram, straw bales, coarse to fine gravel should be used either separately or in

combination as appropriate to remove suspended matter from discharges.

* The level of suspended solids in any discharges to fisheries waters as a consequence of construction works shall not exceed 25 mg/l, nor result in the deposition of silts on gravels or any element of the aquatic flora or fauna.

* All oils and fuels shall be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular attention shall be paid to gradient and ground conditions which could increase the risk of discharge to waters.

* Temporary oil interceptor facilities shall be installed and maintained where site works involve the discharge of drainage water to receiving rivers and streams.

* There shall be no visible oil film in any discharges from construction works to waters.

* That all containment and treatment facilities are regularly inspected and maintained.

* Waterproofing and other chemical treatment to structures in close proximity to waters shall be applied by hand.

* Hydroseeding shall not be carried out in close proximity to water. These areas shall be seeded by hand.

ANGLING AND COMMERCIAL FISHING ACCESS.

In circumstances where crossings of important angling waters are concerned, it will often be necessary to provide for angling access to and from stretches of water during the construction phase of projects. It is important to note that fishing rights are property rights and that it is a legal right for anglers to access fisheries. Additionally, certain commercial fishing activities may have entry and access requirements. In such site specific circumstances, IFI will issue project and location specific requirements

IFI require:

* In the case of permanent crossing structures on waters recognised as of angling importance, that a minimum walkway through or under the structure 1.5 meters in width and 2.5 meters in height be provided. The walkway shall be self-draining and have a non-slip finish.

* In the case of a bridge spanning a specific salmon angling site, up to 7 meters clearance above water level and in the case of trout angling, up to 4 metres clearance to allow casting.

TEMPORARY CROSSING STRUCTURES ON WATERS.

All watercourses which have to be traversed during construction projects should be effectively bridged prior to commencement of works. There is sometimes a serious misconception that in installing temporary crossing structures, the only issue is keeping water flowing from above a temporary crossing to below it. Design and choice of temporary crossing structures must provide for passage of fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over wintering areas, as well as preventing erosion and sedimentation. In certain circumstances, access for angling or commercial fishing purposes may also be required.

No temporary crossing on any watercourse shall be installed without the approval of IFI as regards sizing, location, duration and timing.

The preferred option is for clear span 'bridge type' structures on fisheries waters.

The crossing of watercourses at natural fords is not permitted because of the amount of uncontrolled sedimentation that can be generated.

The creation of fords on streams and rivers through the introduction of stone is prohibited.

Where circumstances such as space or access difficulties preclude use of clear span structures, temporary crossings structures shall:

* Comprise one or more metal or concrete pipes, prefabricated culverts or such other material as IFI may permit of minimum diameter 900 mm. Pipes or culverts may be vertically stacked.

* Be laid in such manner as to maintain the existing stream profile.

* Ensure no significant alteration in current speed or hydraulic characteristics, in particular not result in scouring, deposition or erosion upstream or downstream the temporary crossing location.

* Have capacity to convey the full range of flows including flood flows likely to be encountered without the crossing being overtopped.

* Be covered with clean inert material such as to allow for the safe crossing of the widest items of plant and equipment without cover material being dislodged and entering waters.

The approach and departure routes to temporary crossing structures should be designed and installed so that drainage will fall away from the watercourse being crossed. In the event that the fall of ground does not permit sufficient control on drainage, additional earthworks settlement areas shall be provided.

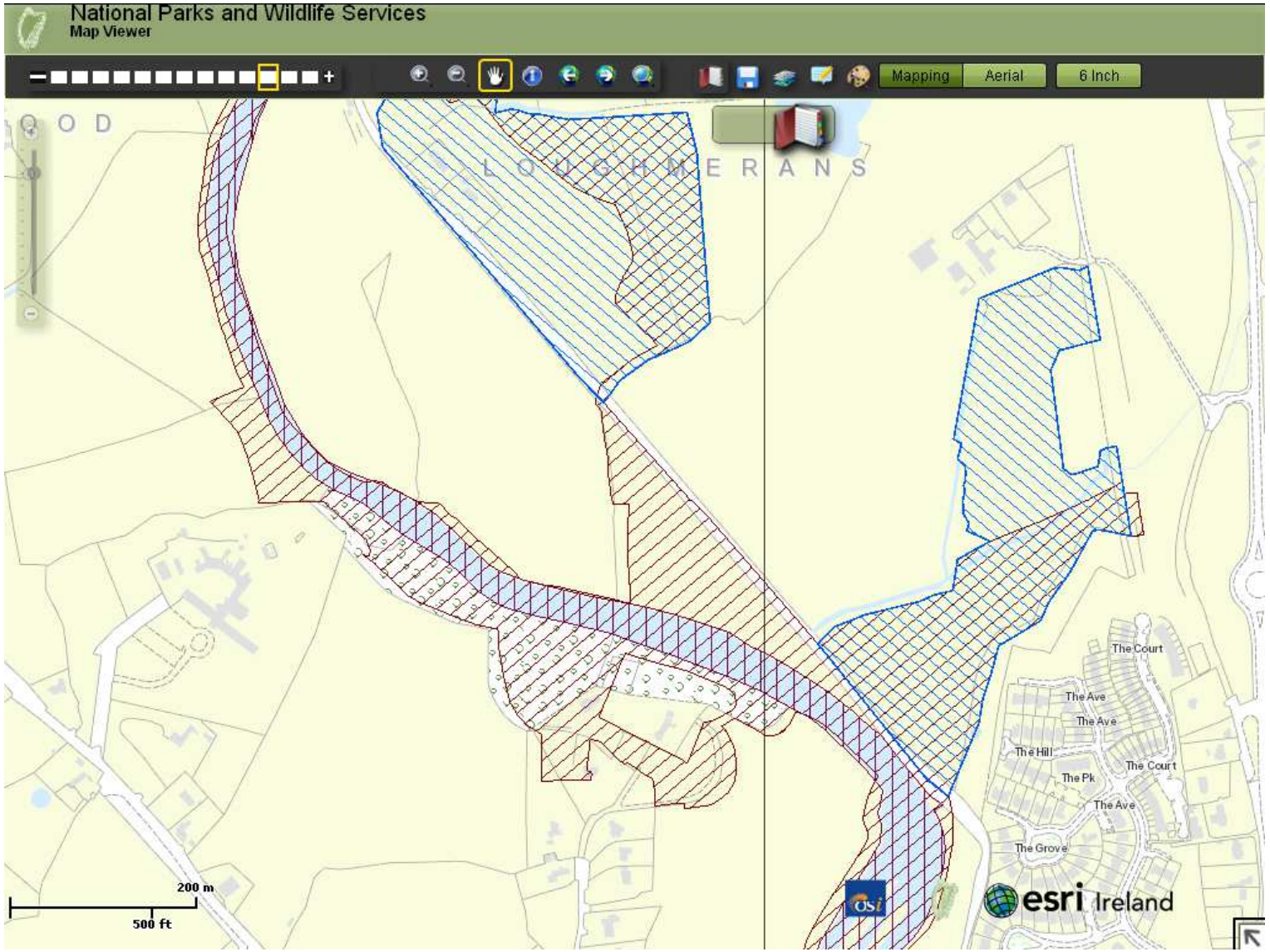
Temporary crossing structures should be fenced with terram or similar material to prevent wind blow carrying dusts and other potentially polluting matter to waters.

Side armour (e.g. reinforced concrete traffic barriers) should be provided on temporary crossing structures to ensure machinery cannot drive over its edge, or force the discharge of material from the bridge deck to waters.

IFI wish to emphasise that site selection for temporary crossings should have regard to all access and construction needs ranging from those of fencing contractors vehicles to the longest wheelbase of multi-axle cranes.

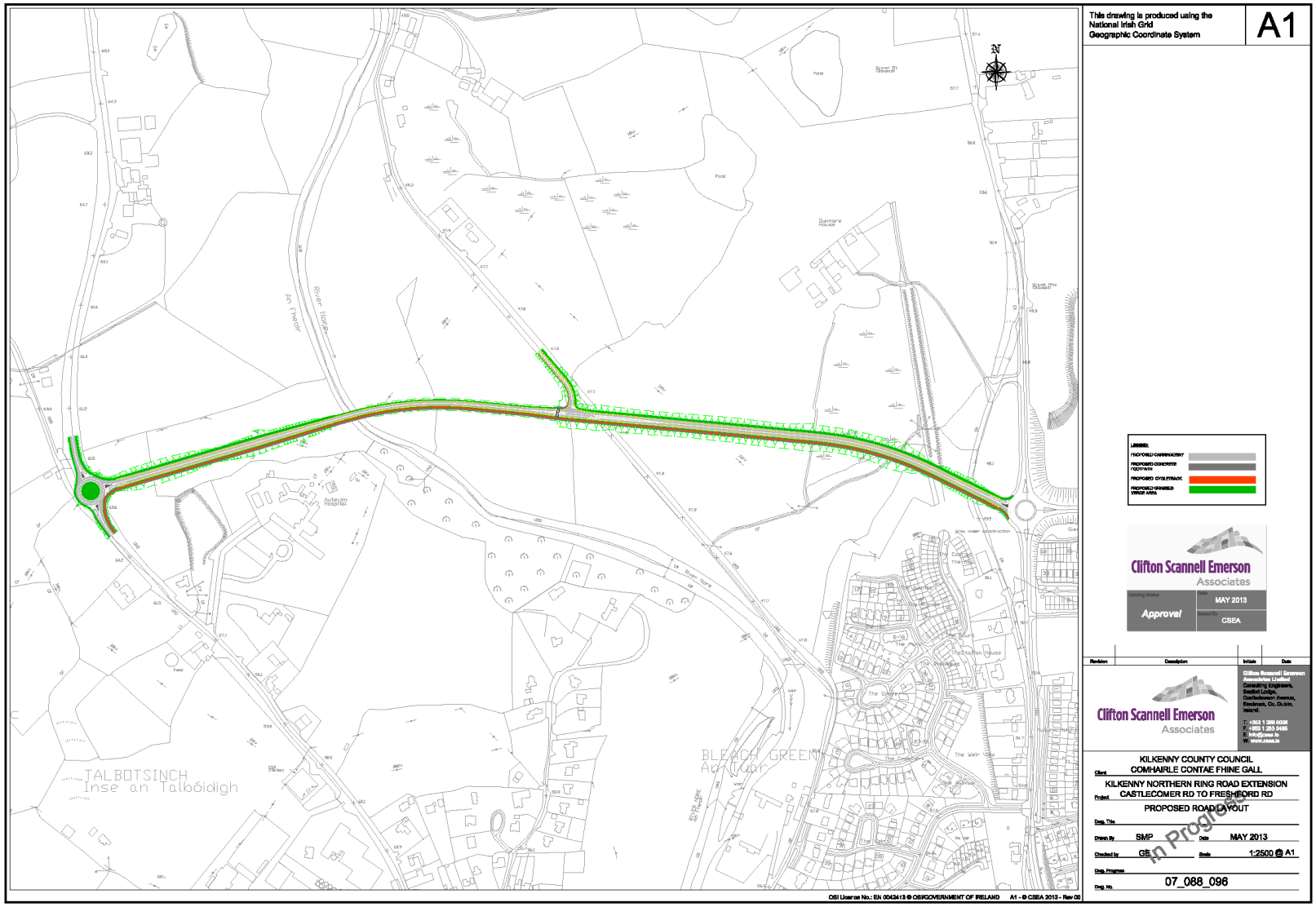
It is not permissible, except in exceptional circumstances, to reposition temporary crossing structures where these are not of a clear span type.

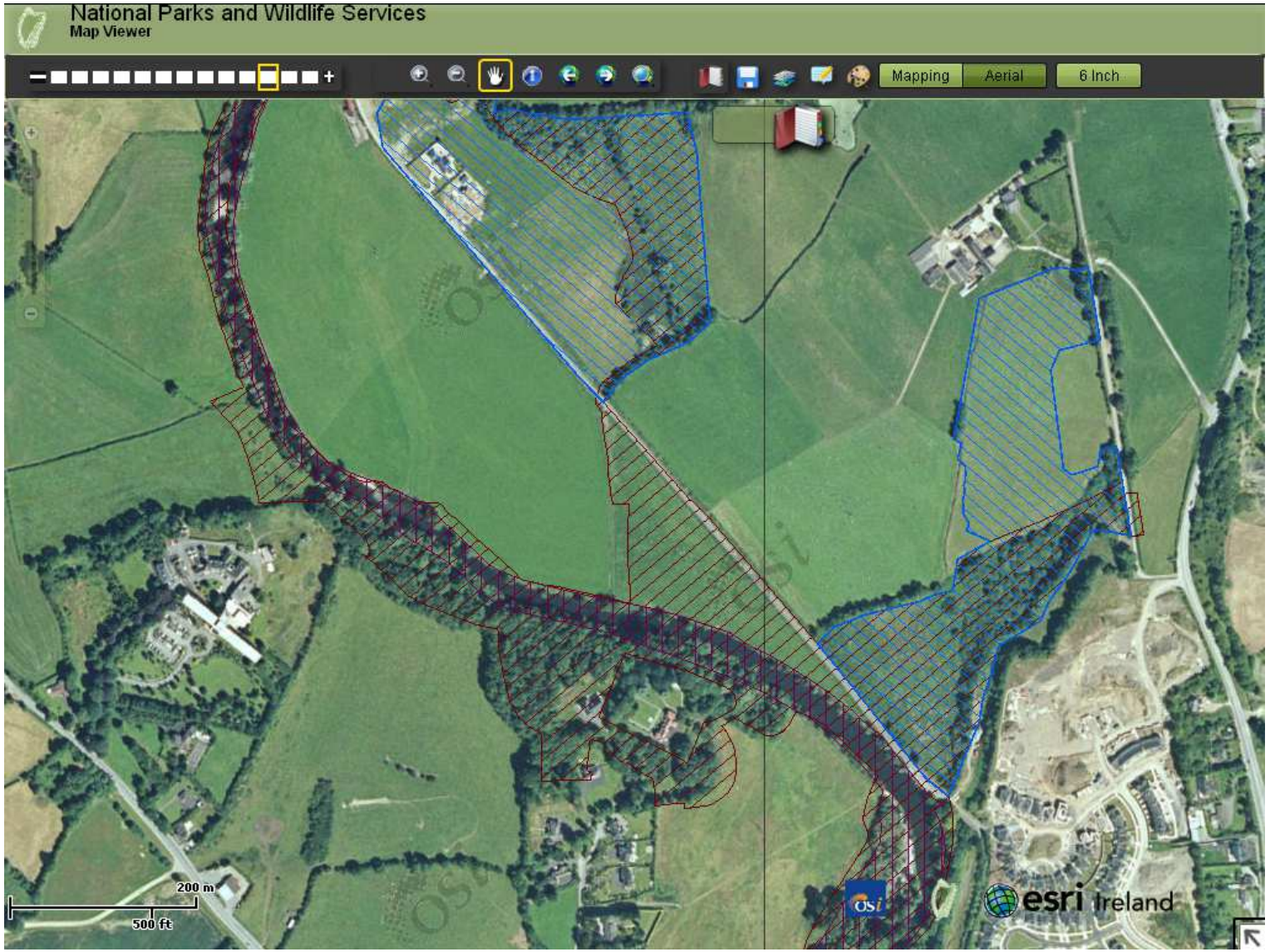
Patrick Kilfeather
Senior Fisheries Environmental Officer - Inland Fisheries Ireland - Clonmel



Map to show location of SPA (vertical hatching), cSAC (diagonal red) and pNHA (diagonal blue)

Proposed route of Ring Road





Aerial photograph with designations, illustrating habitat types crossed by route

APPENDIX I

Bat Assessment

R77 RING ROAD EXTENSION, KILKENNY

BAT FAUNA ASSESSMENT OF PROPOSED ROUTES CONDUCTED FOR EIS

Prepared for

Roger Goodwillie, Applications Ecologist

By

Conor Kelleher AIEEM, ACQI

4th February 2013

Aardwolf Wildlife Surveys

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Page no.

TERRESTRIAL FAUNA

1. RECEIVING ENVIRONMENT

1.1 Introduction

Aardwolf Wildlife Surveys was commissioned by Roger Goodwillie, Applications Ecologist, of Lavistown House, Kilkenny, to carry out a specific assessment of bat fauna within the area of the proposed route options of the R77 Ring Road Extension in Kilkenny for an Environmental Impact Statement (EIS) on the proposal.

The construction of a new road may adversely affect bats in a number of ways. For instance, construction often entails the removal of vegetation that was previously used by bats. This may impact bats through the creation of an open space barrier that bats may be unwilling to cross eventually resulting in a local population decline as bats are prevented from reaching preferred foraging areas. Vehicles using the new corridor may also kill bats. Bat roosts in trees or buildings within or immediately adjacent to the road route corridor may have to be removed or avoided. The removal of hedgerows and treelines and the loss of mature trees, draining of wet areas and provision of artificial lighting all affect the availability of invertebrate prey and feeding areas. It is essential therefore that a comprehensive study of bat activity at sites of such development be undertaken to identify any conflict zones and hence to avoid or reduce impacts through mitigation to safeguard these protected animals.

To comprehensively research and so understand the existing behaviour of bats in the area of the eight route options and the preferred route, once chosen, the approach detailed in the *National Roads Authority's* (NRA) *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* (NRA 2006a) is being followed. These guidelines recommend that the impacts on bats of a proposed road development is assessed seasonally in order to take into consideration the affect the road will have on both their nightly and seasonal behaviour including post hibernation spring re-emergence, peak summer activity and autumnal mating behaviour.

This report details a desk top study of bat occurrence in the area of the routes, an assessment of the existing on-site habitats, reviews each of the route options in relation to potential impacts on bats, lists the route options in adjudged order of preference to avoid/reduce impacts on these animals and proposes probable recommendations for mitigation measures on the chosen preferred route.

1.2 Description of the road route options

The eight route options, numbered 1 to 8 and coloured Red, Yellow, Dark Blue, Light Blue, Green, Purple, Orange and Black respectively, for the R77 Ring Road Extension are within the townlands of Oakpark, Loughmerans, Dunmore and Glendine within National Grid Reference squares S4958 and S5058 (Ordnance Survey Discovery Series Map 67) northwest of Kilkenny City. Access to the route option area is from local roads, tracks and across open countryside.

All route options begin at the same point within the townland of Glendine to the east of the existing N77 Kilkenny to Ballyragget/Castlecomer road and all run west across agricultural farmland, crossing farm tracks, Bleech Road and the River Nore. Route options 1, 2, 5 and 8 end at the R693 Kilkenny to Freshford road while route options 3, 4 and 6 continue across the R693

for various distances through the townland of Oakpark. Route Option 7, the shortest of the eight, is a slight variation of Route Option 8 at the east.

1.3 Bat assessment

This report presents the results of an assessment of the habitats present along each of the proposed route options. The known and expected bat fauna occurring within the study area is described and the likely impacts of the development on bat species discussed.

The general format of this report is in accordance with guidelines recommended by the EPA (2002) - *Guidelines on the Information to be contained in Environmental Impact Statements*. Recommendations and evaluation techniques utilised are in general accordance with *Guidelines for Baseline Ecological Assessment* (Institute of Environmental Assessment, UK 1995), *Wildlife Impact: the treatment of nature conservation in environmental assessment* (RSPB 1995) and *Guidelines for ecological evaluation and impact assessment* (Regini 2000).

In 2006, the NRA published guidelines for bats and these have been referred to:

- *Best practice guidelines for the conservation of bats in the planning of National Road Schemes (NRA, 2006a)*.
- *Guidelines for the treatment of bats during the construction of National Road Schemes (NRA, 2006b)*.

1.3.1 Assessment methodology

Areas likely to be of interest for bats within the area of the routes and in the wider landscape were identified and selected from mapping and aerial photography and also assessed on the ground. The nature and type of habitats present are indicative of the species likely to be present and these were assessed in general accordance with techniques adopted for the Badger & Habitat Survey of Ireland (Smal 1995). Habitats listed by Fossitt (2000) and by the UK *Nature Conservancy Council* (1990) were referred to. The habitat survey is not intended to serve as a botanical study.

The field assessment was supplemented by evaluation of relevant literature and reviews of the *National Parks and Wildlife Service* (NPWS) National Lesser Horseshoe Bat Roost Database and *Bat Conservation Ireland's* (BCIreland) National Bat Records Database.

1.3.2 Assessment constraints

As the assessment was undertaken outside of the active bat period (March to October) it was not possible to include a bat detector survey of the study area. Also the examination of built structures and mature trees with potential for bat roosts was not undertaken as part of this assessment as permission to access lands was not available.

1.4 General description of the area

The area, adjacent to the city of Kilkenny, is located in the low-lying flood plain of the River Nore with an elevation of *c*. 45m to *c*. 50m asl.

The principal agricultural land use in the area is for permanent, high quality improved grassland pasture grazed by cattle. Field boundaries are of wire, hedgerow and treelines. At the east is an area of wet woodland and deciduous occurs on the southern river bank. Areas of scrub also

occur. Several ponds and pools are present and watercourses include streams, drainage ditches and the River Nore.

1.5 Brief description of habitats present

The following habitats are the main ones found within or adjacent to the potential corridors of the proposed route options with classifications based on Fossitt 2000.

1.5.1 Improved agricultural grassland (GA1)

The on-site grasslands are mostly improved, high quality pastures, being predominantly used for grazing but also for silage.

1.5.2 Hedgerows (WL1) and treelines (WL2)

The structure of field boundaries varies in the area from electric fences to hedgerows of hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus* agg. with emergent willow *Salix* spp. and ash *Fraxinus excelsior* which form treelines in places.

1.5.3 Wet woodland (WN6)

A small area of wet woodland occurs at the east where all the route options begin.

1.5.4 Mixed broadleaved woodland (WD1)

Deciduous woodland occurs along the southern bank of the River Nore and extends northwest to border the hospital grounds.

1.5.5 Scrub (WS1)

A few areas of encroaching scrub occur in the area in association with field boundaries, flooded areas and the eastern wet woodland.

1.5.6 River (FW2), streams and drains (FW4)

The most important watercourse in the area is the River Nore which is crossed by all but one of the proposed route options. Various streams and drainage channels are also present which drain into the River Nore.

1.5.7 Built land and roads (BL3)

Apart from the existing major N77 road, many other roads including the R693 and several minor roads and lanes are present and some are met and/or crossed by the potential routes. There are also several tracks that serve as access to farms and houses and a disused railway line within the survey area. Other structures along or adjacent to the routes include a hospital complex, one-off dwellings, derelict/disused cottages, farm buildings and culverts.

1.6 Designated site of conservation interest

Seven of the potential routes of the proposed Ring Road Extension cross the River Nore which is part of the protected River Barrow and River Nore Special Area of Conservation (SAC), Site Code: 002162. The site synopsis is given in Appendix 4.

2. BAT FAUNA ASSESSMENT

The key locations of importance for bats for commuting and foraging within the study area are the River Nore, woodlands, treelines and hedgerows. Additional habitats include areas of scrub and scattered trees. The mature trees in the area also offer roosting opportunities for bats as some are quite old and show storm damage or have hollows and crevices through decay. Some of these and indeed younger trees also have ivy *Hedera helix* cover that may be used for roosting by bats on occasion.

Many of the area's structures offer potential for roosting bats as farm buildings and disused/derelict buildings have open access for these animals through dilapidated doors and windows, holed roofing, gaps at eaves etc. and modern dwellings allow bats access beneath tiles and lead flashing and gaps between walls and soffits.

2.1 Bat fauna – desk study findings

The review of existing records of bat species in the area of the proposed Ring Road Extension routes reveals that six of the ten known Irish species have been observed in the immediate area. These include common *Pipistrellus pipistrellus* and soprano *P. pygmaeus* pipistrelle, Leisler's *Nyctalus leisleri*, brown long-eared *Plecotus auritus,* Daubenton's *Myotis daubentonii* and Natterer's *M. nattereri* bats as shown in Table 1 below. Roosts of common and soprano pipistrelle, brown long-eared and Natterer's bats have also been identified in the area.

The known records were sourced from both the NPWS National Lesser Horseshoe Bat Roost Database and BCIreland's National Bat Records Database.

Table 1: Adjudged status of bat species within the study area

Common name	**Scientific name**	**Occurrence**	**Source**
Common pipistrelle	*Pipistrellus pipistrellus*	Present	BCIreland
Soprano pipistrelle	*Pipistrellus pygmaeus*	Present	BCIreland
Nathusius' pipistrelle	*Pipistrellus nathusii*	Potential – rare	BCIreland
Leisler's bat	*Nyctalus leisleri*	Present	BCIreland
Brown long-eared bat	*Plecotus auritus*	Present	BCIreland
Lesser horseshoe bat	*Rhinolophus hipposideros*	Absent	NPWS
Daubenton's bat	*Myotis daubentonii*	Present	BCIreland
Natterer's bat	*Myotis nattereri*	Present	BCIreland
Whiskered bat	*Myotis mystacinus*	Certain	BCIreland
Brandt's bat	*Myotis brandtii*	Potential – rare	BCIreland

Although unrecorded in the local area to date, the whiskered bat *M. mystacinus* is expected to occur in local deciduous woodland so is certain to occur on-site occasionally while Brandt's bat *M. brandtii*, the most recent bat species to be found in Ireland, being only discovered in 2003 (Mullen 2007), may potentially occur in the area but records of the species are few to date countrywide and, since it cannot be distinguished from the whiskered bat by detector, it is probably often misidentified or overlooked.

The lesser horseshoe bat *Rhinolophus hipposideros* is not expected on-site as it only occurs in the west of the country so is absent from Co. Kilkenny. The distribution range of this species is restricted to the west of Ireland and it is only known from Counties Mayo, Galway, Clare, Limerick, Kerry and West Cork (Kelleher 2004). However, single specimens have recently been discovered

in Lough Key, near Boyle, Co. Roscommon in 2004 (B. Keeley, pers. comm.) and in Tubbercurry, Co. Sligo in 2008 (pers. obs.), two counties where their low numbers may have caused their presence to be overlooked until now.

The remaining Irish bat species, Nathusius' pipistrelle *P. nathusii*, a rare bat, may occur in the area, however, to date, it has not been recorded locally and its known roosts are restricted to north-east Ireland but it is being recorded more often, probably as a result of climate change, with more animals of this highly migratory species arriving from the continent and with the increased use of bat detectors.

Further information on the Irish bat fauna is given in Appendix 1 and 2.

3. ADJUDGED SCIENTIFIC INTEREST OF THE STUDY AREA

The principal areas of ecological interest in relation to bats on or near the potential routes of the proposed road include:

3.1 Agricultural areas and associated hedgerows, treelines and scrub

Most of the agricultural areas may be considered as of low or negligible interest from a bat perspective. These habitats are ecologically of low-grade and widespread. However, many of the hedgerows and treelines offer shelter for commuting and foraging bats and are therefore considered as being of medium local value.

3.2 Wet woodland

The area of wet woodland at the east of the study area is of interest to bats as it provides good hunting habitat in which insects can breed and sheltered areas in which flying insects can swarm. It may also, in time, provide bat roosting opportunities in its trees. The wet woodland is considered as being of medium local value.

3.3 Deciduous woodland

This area, which extends along the southern bank of the River Nore, is outside each of the proposed route corridors but is of interest to bats as it is certain to provide good hunting habitat as well as bat roosting opportunities so is considered as being of medium local value.

3.4 River Nore

The River Nore, a designated site, with its associated riparian habitats provides an important corridor for bats and other wildlife and the quality of the watercourse should be maintained. The watercourse is considered as providing a refuge for a range of bat and other species and is of high local value.

4. LEGAL STATUS – BATS

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 & 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna

and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

The current status and legal protection of the known bat species occurring in Ireland is given in Table 2 below.

Table 2: Legal status and protection of the Irish bat fauna

Common and scientific name	Wildlife Act 1976 & Wildlife (Amendment) Acts 2000 & 2010	Irish Red List status	Habitats Directive	Bern & Bonn Conventions
Common pipistrelle *Pipistrellus pipistrellus*	Yes	Least Concern	Annex IV	Appendix II
Soprano pipistrelle *P. pygmaeus*	Yes	Least Concern	Annex IV	Appendix II
Nathusius' pipistrelle *P. nathusii*	Yes	Least Concern	Annex IV	Appendix II
Leisler's bat *Nyctalus leisleri*	Yes	Near Threatened	Annex IV	Appendix II
Brown long-eared bat *Plecotus auritus*	Yes	Least Concern	Annex IV	Appendix II
Lesser horseshoe bat *Rhinolophus hipposideros*	Yes	Least Concern	Annex II Annex IV	Appendix II
Daubenton's bat *Myotis daubentonii*	Yes	Least Concern	Annex IV	Appendix II
Natterer's bat *M. nattereri*	Yes	Least Concern	Annex IV	Appendix II
Whiskered bat *M. mystacinus*	Yes	Least Concern	Annex IV	Appendix II
Brandt's bat *M. brandtii*	Yes	Data Deficient	Annex IV	Appendix II

All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat is further listed under Annex II.

NB: Destruction, alteration or evacuation of a known bat roost is a notifiable action under current legislation and a derogation licence **has** *to be obtained from the* National Parks and Wildlife Service **before** *works can commence.*

It should be noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS. The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07 "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 - strict protection of certain species/applications for derogation licences*" issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007 - reproduced in Appendix 3.

Furthermore, on 21st September 2011, the Irish Government published the European Communities (Birds and Natural Habitats) Regulations 2011 which include the protection of the Irish bat fauna and further outline derogation licensing requirements re: European Protected Species.

5. POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

Bat species within the survey area will be affected by both the construction phase and subsequent existence of the new road corridor across the existing landscape. Loss of roosting and foraging sites and commuting habitat may displace certain species.

5.1 Potential impacts on bat fauna

The findings of the present assessment indicate that a diverse range of bat species use the landscape surrounding the potential routes and the key impacts on these animals arise through roost loss, loss of feeding areas and disruption of commuting routes.

The on-site habitats vary in their importance for bats. The loss of areas of improved agricultural grassland within the preferred route corridor will have a negligible or minor negative impact on these animals. Apart from pollution incidents, watercourses, including the River Nore, should not be significantly impacted by the proposed development and thus bats are likely to continue using them. The main impact on bats arises through the loss and/or severance of hedgerows, treelines and woodland along the chosen route that are certain to be in wide use by these animals during the late spring and summer months.

In general, the proposed development is expected to have negligible impact on bats in surrounding areas providing that measures are taken to minimise sedimentation and pollution of watercourses during construction and operation phases.

Bats are often faithful to a particular roost site from year to year and buildings occupied by bats are typically maternity roosts where females congregate to give birth. The loss of such sites can have serious implications for a colony as there may be no other suitable sites in the area. The loss of roosts is believed to be one of the major factors contributing to declines in bat populations throughout Europe. The assessment of potential impacts on bats if buildings and other built structures are to be removed as part of the development will require a survey of the structures to determine if these animals are present.

Large deciduous trees on or adjacent to the scheme may harbour bats occasionally especially if ivy-covered. The assessment of potential impacts from the removal of such trees along the preferred route will require a survey of the trees to determine the presence of bats.

6. REVIEW OF ROUTE OPTIONS IN RELATION TO BATS

Each of the proposed route options vary in their potential impacts on the area's bat populations as each impacts different habitats and landscape features to greater or lesser degrees. An assessment of each option follows.

<u>Red Route Option 1</u>
This route option runs close to the northern end of the area of wet woodland and as such is one of two proposed routes (the other being Yellow Route Option 2) which have a minimal impact on this important bat habitat. This route also crosses the River Nore almost perpendicularly which

reduces the land take and disturbance of the river banks. This route does however take out some trees north of Bleach Road.

Yellow Route Option 2
This route option begins at the same location as Red Route Option 1 and similarly has a minimal impact on the area of wet woodland. This route also crosses the River Nore at a near perpendicular angle reducing the impact on the river banks. This route has less of an impact on the trees north of Bleach Road than Red Route Option 1.

Dark Blue Route Option 3
This route option crosses the wet woodland further south and at a wider point than either of the two previous options and consequently has a larger impact on this habitat resulting in greater tree loss. This option also crosses the River Nore at an acute angle which will have a larger impact on the river banks than would a crossing at or close to a 90° angle.

Light Blue Route Option 4
This route option would have a similar impact on the wet woodland as Dark Blue Option 3 as it crosses it at the same location. This option also runs close to the strip of woodland bordering the hospital grounds south of the river and may impact bats along this woodland edge habitat. This route also crosses the River Nore at a near perpendicular angle so reducing impacts to its banks.

Green Route Option 5
This route option severs the area of wet woodland at the same location as both Dark Blue Route Option 3 and Light Blue Route Option 4 so will have the same negative impacts on this habitat. It also crosses the River Nore at an acute angle and runs close to the woodland bordering the hospital grounds with potential negative impacts on both.

Purple Route Option 6
This route option has a similar large impact on the wet woodland as the previous three options as it crosses it at the same point. It also takes an acute angle in crossing the River Nore. This is also the longest of the eight proposed routes.

Orange Route Option 7
This route option is the shortest of the eight routes proposed being a variation on the eastern section of Black Route Option 8. Its benefit from a bat perspective is that it would cross the wet woodland near its northern end where the wood is narrower.

Black Route Option 8
This route option is different to the others as it is raised throughout its length. If not taking the variation of Orange Route Option 7, this route will cross the wet woodland at a slightly wider point than either Red Route Option 1 or Yellow Route Option 2 but not at the wood's widest point as with the other options. This route also crosses the River Nore almost perpendicularly but it does come close to the woodland bordering the hospital south of the river.

7. ROUTE OPTIONS IN ORDER OF PREFERENCE FOR BATS

Based on the overview of each of the route options as given in the previous section, the options, in order of their adjudged preference in relation to bats, are as follows:

1) Yellow Route Option 2
2) Red Route Option 1
3) Black Route Option 8 + Orange Route Option 7
4) Black Route Option 8
5) Dark Blue Route Option 3/Purple Route Option 6
6) Light Blue Route Option 4

7) Green Route Option 5

8. PROBABLE MITIGATION MEASURES ON THE CHOSEN ROUTE

Standard mitigation measures, as would apply to any large-scale development, shall be adopted in the construction of the carriageway. These include limiting season of disturbance to trees and vegetation so as to reduce impacts on breeding species, to provide for habitat replacement and to implement measures to avoid and/or control pollution and sedimentation into watercourses during construction and operation phases. Specific measures will be required to protect bats and any roosts that may be present along the preferred route corridor, once decided, and preliminary recommendations are given below. Pro-active enhancement measures are also suggested in relation to improvement of bat and bird habitats along the chosen route.

The following mitigation measures are in line with the NRA guidelines on provisions for the conservation of bats during the planning and construction of roads as published in 2006.

Buildings

Structures that are scheduled for removal, whether previously surveyed for bats or not, should be surveyed by a suitably qualified bat specialist immediately prior to demolition to determine if any bats are present as, due to the passage of time between survey and construction of the road, bats may move into previously inspected buildings. If a roost is discovered in a building to be removed then a sufficient number of bat boxes should be erected adjacent to the site one month prior to works to provide alternative roost sites for the bats.

If a roost is found, a derogation licence for its removal shall be obtained from the *National Parks and Wildlife Service* prior to works.

Any work or demolition of buildings or structures identified as bat roosts or having the greatest potential for bat use should preferably be undertaken within the winter months - November to March – as bat numbers are then known to be fewer in buildings. This would reduce impact to bats present on-site.

Demolition of a roost should be done carefully with the expectation that bats may be found. The roof of the structure should be carefully removed by hand to protect any animals which may be beneath. If discovered, bats should be retained in a box until dusk then released on-site.

New bridge over the River Nore

Crevices should be provided in the new structure spanning the River Nore according to best practice bat mitigation measures for bridge works (see Billington and Norman 1997, Shiel 1999, Highways Agency 2001 and Joint Nature Conservation Committee 2004). Access points and roosting areas for bats could be included within the bridge at no extra cost and without affecting the integrity of the structure. Studies have shown that bats use a variety of crevice sizes in bridges from 13mm to 70mm in width to 350mm to 1000mm in depth for summer roosts and deeper for winter hibernation sites. Ready-made artificial roost units are also available for inclusion in such situations. These units can be mounted in maintenance-free areas of the structure to avoid future disturbance from any necessary works.

The minimum height of any new bridge spanning the River Nore should be 4m above the normal water level to allow unrestricted bat flight beneath. The new bridge should also span the entire width of the water course and, where practicable, incorporate at least 2m of bank and bankside vegetation on each side of the waterway. Where practicable, the height of the bridge should also be 2m above the bankside vegetation. Where bankside vegetation is not present, such should be provided using native vegetation.

Native hedgerows should be planted to connect the new bridge to hedgerows dissected by the proposed route. Newly planted hedgerows adjacent to the bridge should be at a height and density to ensure that commuting bats will not cross the road but continue to commute safely under the bridge.

Potential bat roosts in trees

Where possible, treelines and mature trees that are located immediately adjacent to the line of the final route or are not directly impacted should be avoided and retained intact. Overall impacts on these sites should be reduced through modified design and sensitivity during construction. Any existing mature trees adjacent to the corridor or construction sites to be retained should be protected from root damage by machinery by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees should be fenced off by adequate temporary fencing prior to other works commencing.

Mature trees, which are to be removed, should ideally be felled in the period late August to late October, or early November, in order to avoid the disturbance of any roosting bats as per NRA guidelines. Tree felling should be completed by Mid-November at the latest because bats roosting in trees are very vulnerable to disturbance during their hibernation period (November – April). Ivy-covered trees, once felled, should be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight.

Landowners should be advised that the timber from felled trees will remain for their use. This should prevent trees being felled prematurely.

Lighting restrictions

In general, artificial light creates a barrier to commuting bats so lighting should be minimised along the chosen route especially at areas of interest for bats. Lighting should especially be avoided beneath the new bridge as this would impact on bat foraging and commuting especially that of Daubenton's bats that currently hunt over the river (pers. obs.) and it may also prevent use of the bridge as a roosting site. Where lighting is required, directional lighting (i.e. lighting which only shines on the road surface and not nearby countryside) should be used to prevent overspill. This may be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvres and shields to direct the light to the intended area only.

Severance of commuting routes

Linear features such as hedgerows, treelines and woodland edge serve as commuting corridors for bats (and other wildlife) and the severance of the wet woodland at the east, which is certain to be a favoured foraging and commuting area, should be rectified by the provision of a flyover as depicted in Figure 1, Appendix 5. Such a measure will prevent bat collisions with traffic on the new road and enable the animals to continue to reach favoured foraging and roosting areas to the north and continue to move between these and the river to the south. During construction, this flyover area should be maintained by temporary netting erected high over the road until tall trees are planted.

In general and where possible, hedgerows and treelines shall be reconnected using semi-mature trees under-planted with hedgerow species. The exact locations of such planting should be designed at detailed landscaping stage. Native species shall be used as they support more insect life than non-native varieties. These would also serve to screen the road.

Existing vegetation at the crossing point over the River Nore should be retained as close as possible to the new bridge in order to maintain a corridor and encourage bats to cross beneath the bridge and utilise feeding habitat on both sides. The area could also be enhanced by the planting of native shrubs along one or both banks. The planting of shrubs in such areas provides shelter in which insect numbers can accumulate and also a corridor along which bats can commute. These measures would also enhance this area for wildlife in general. Native species

should be used to provide a vegetation belt of greater than three metres to act as shelter for foraging bats.

All planting should preferably be completed during the pre-construction phase to provide hedgerow/tree growth prior to completion of the road to ensure that bats commuting in the area have prior knowledge of newly planted landscape features as well as ensuring the newly planted hedgerows/treelines are well established prior to completion of construction.

Habitat retention, replacement and landscaping
Habitat replacement and landscaping could compensate for or add to the wildlife value of the area, is necessary to minimise visual intrusion of the development into the landscape and also to provide areas of aesthetic as well as wildlife interest.

In general, best practice design should aim to retain the quality of the landscape where possible and ensure its protection within the landscaping programme. Existing hedgerows and treelines, semi-natural scrub, semi-natural woodland or semi-natural grasslands should be retained where possible and incorporated into the landscaping programme.

The overall design of the project should also include habitat replacement or enhancement of existing scrub habitat on-site. For example, planting of native trees along the route should also be carried out in order to provide visual screening of the development. Native species should be chosen in all landscaping schemes. Planting schemes should attempt to link in with existing hedgerows and treelines to provide continuity of wildlife corridors.

Additional measures: monitoring
The success of the mitigation measures for bats should be monitored for a period of three years after construction and appropriate measures taken to enhance these if and where required. Bat boxes and tubes will need some maintenance to ensure their continued usefulness for bats e.g. old droppings or bird nesting material will need to be removed and any unused boxes may need to be relocated. A recommended schedule for such monitoring is given in Table 3 below.

Table 3: Monitoring schedule recommended for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Newly planted hedgerows and treelines	Ensure viable growth of planting	Planted material should be checked periodically over the growing season to remove dead material. Any dead material should be replaced within the same season with viable stock according to age/height restrictions already specified in mitigation.	From time of planting to 1 year post road construction
Bat boxes and tubes	Assess bat usage	Bat boxes and tubes should be examined by a licensed bat specialist and findings should be reported to the NPWS. Records should also be submitted to *Bat Conservation Ireland* for inclusion in their bat distribution database.	3 years post road construction

9. RESIDUAL IMPACT OF THE PROPOSED DEVELOPMENT

Although the loss of habitats favourable to bats is expected to displace certain species through disruption of commuting routes, due to the widespread nature of hedgerows, treelines and scrub in the area and following the implementation of recommended mitigation measures to safeguard these animals, all bat species recorded in the area are expected to persist. The proposed

development is expected to result in minor negative impacts on bats and the favourable conservation status of all species should not be affected.

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11. APPENDICES

11.1 APPENDIX 1: bat ecology

Introduction
The bat is the only mammal that is capable of true flight using modified hands and arms which are covered by a supple membrane of skin. This ability has allowed bats to exploit aerial insect prey and avoid predation. As the largest mammalian group after the rodents (to which they are not related), bats are very successful and have diversified into over 1,200 species worldwide, representing almost a quarter of all mammal species. Within such diversification, they have evolved a range of hunting strategies, means of reproduction, roosting behaviours and social interactions (Kunz 1982). They are found throughout the world and in every continent apart from Antarctica.

Bats are classified within the Order Chiroptera (meaning 'Hand-wing') and this is further divided into two Superfamilies: the Megachiroptera and Microchiroptera. The former are mainly fruit-eaters while the latter are predominantly insectivorous. Of these, 52 bat species are currently known in Europe.

Irish bat species
In Ireland, ten species of bat are currently known to be resident. These are classified into two Families: the Rhinolophidae (Horseshoe bats) and the Vespertilionidae (Common bats). The lesser horseshoe bat *Rhinolophus hipposideros* is the only representative of the former Family in Ireland. All the other Irish bat species are of the latter Family and these include three pipistrelle species: common *Pipistrellus pipistrellus*, soprano *P. pygmaeus* and Nathusius' *P. nathusii*, four *Myotids*: Natterer's *Myotis nattereri*, Daubenton's *M. daubentonii*, whiskered *M. mystacinus*, Brandt's *M. brandtii*, the brown long-eared *Plecotus auritus* and Leisler's *Nyctalus leisleri* bats.

Individual species accounts with distribution maps are given in Appendix 2.

Hunting with sound
The microbats are unique as they use a type of sonar, called echolocation, by which they hunt their prey. This is a stream of sound produced at high frequencies which allows the animal to build-up a complete 'sound picture' of their surroundings. These sounds are produced well beyond the range of human hearing. Using these sounds, the bats are able to detect the clutter of nearby leaves, hear an insect, know how fast it is travelling, how fast its wings are beating, whether it is hard or soft bodied etc. before closing in for the catch. Although bats use this method to find their way around, they also use their eyes to see in low light levels.

All the European bat species feed exclusively on insects and/or spiders and a pipistrelle, weighing only 4 to 8 grams, will eat up to 3,500 insects every night. This allows the bat to increase its body weight by 50% each night but this is immediately burned off through calorie consumption while flying. Such feeding ensures a build up of fat in the form of brown adipose tissue between the shoulder blades of the bat which acts as a winter fuel store to keep the animal alive while in hibernation.

Roosting behaviour
Bats naturally roost in caves and trees but some species have recently adapted to using man-made structures for roosting. Being social animals, these roosts can reach substantial numbers in the peak period of bat activity in mid-summer and especially if the roost has been selected as a maternity site. These nursery roosts are mainly composed of breeding females but often they include some non-breeding females and males that may be the previous season's young still with their mother. Males are more solitary and form smaller roosts apart from the females.

For summer roosts, bats seek warm temperatures but, for hibernation in winter, they require constant temperatures of only 5° or 6°C and humid surroundings to keep from dehydrating. In mild winters, bats will emerge from such sites to hunt should insects be on the wing.

Breeding and longevity
In autumn, male bats attract females by song flights and form harems with up to 20 females being defended by a male. After mating, the males take no further part in the rearing of the young.

Irish bats can produce one young per year but, more usually, only one young is born in spring every two years (Boyd and Stebbings 1989). There is no fixed pregnancy period and gestation is governed by ambient temperature. The slow rate of reproduction by bats inhibits repopulation in areas of rapid decline. Although bats have been known to live for twenty or more years, this is rare as most die in their first and the average lifespan, in the wild, is four years. The survival of the young is closely linked to climate and poor weather in spring and summer can result in high infant mortality.

Threats
All bat species are in decline as they face many threats to their highly developed and specialised lifestyles. Many bats succumb to poisons used as woodworm treatments within their roosting sites (Racey and Swift 1986). Agricultural intensification, with the loss of hedgerows, treelines, woodlands and species-rich grasslands have impacted bat species also. Habitual roosting or hibernation sites in caves, mines, trees and disused buildings are also often lost to development. Summer roosts are prone to disturbance from vandals. Agricultural pesticides accumulate in their prey, reaching lethal doses (Jefferies 1972). Chemical treatments in cattle production sterilise dung thus ensuring that no insects can breed within it to be fed upon by bats. Likewise, river pollution, from agricultural runoff, reduces the abundance of aquatic insects. Road building, with the resultant loss of foraging and roosting sites is a significant cause in the reduction of bat populations across Europe.

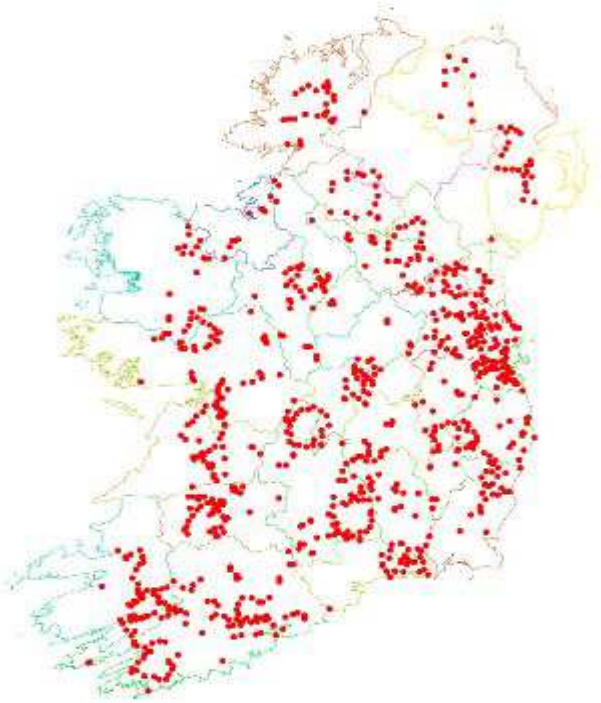
Extinction
As recently as 1992, the greater mouse-eared bat *Myotis myotis* became the first mammal to become extinct in Britain since the wolf in the 18th century.

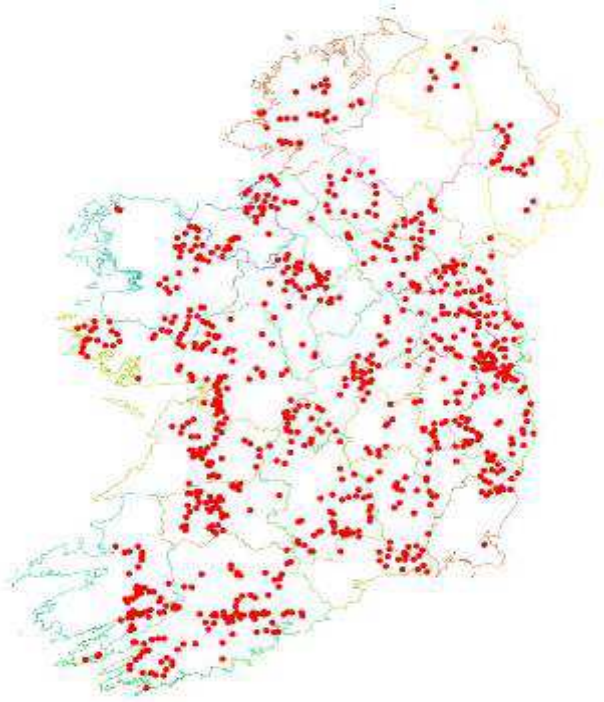
11.2 APPENDIX 2: overview of the Irish bat fauna

Brief species accounts and current known distribution (maps from *Bat Conservation Ireland*)

Common pipistrelle *Pipistrellus pipistrellus*

This species was only recently separated from its sibling, the soprano or brown pipistrelle *Pipistrellus pygmaeus*, which is detailed below (Barratt *et al* 1997). The common pipistrelle's echolocation calls peak at 45 kHz. The species forages along linear landscape features such as hedgerows and treelines as well as within woodland.



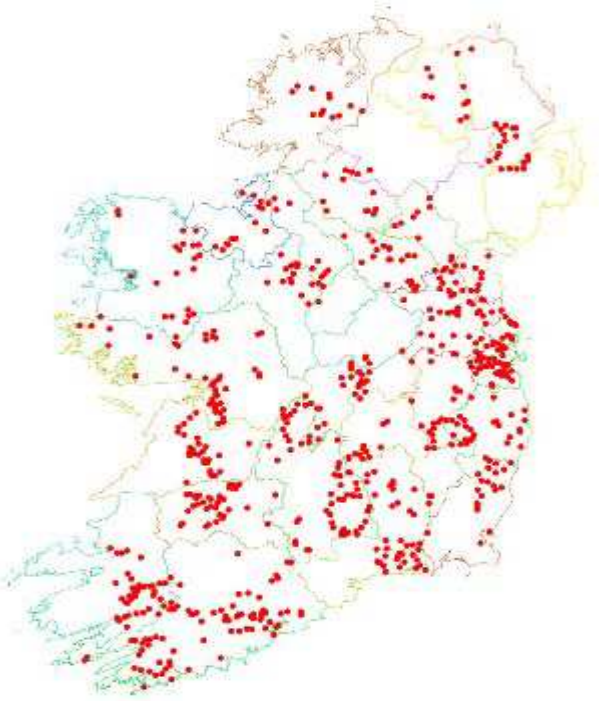


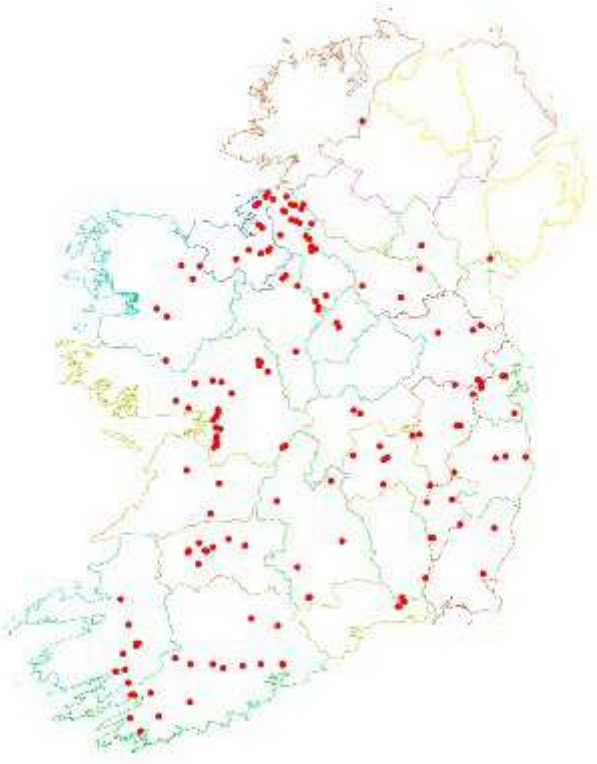
Soprano pipistrelle *Pipistrellus pygmaeus*

The soprano pipistrelle's echolocation calls peak at 55 kHz, which distinguishes it readily from the common pipistrelle. The pipistrelles are the smallest and most often seen of our bats, flying at head height and taking small prey such as midges and small moths. Summer roost sites are usually in buildings but tree holes and heavy ivy are also used. Roost numbers can exceed 1500 animals in mid-summer.

Leisler's bat *Nyctalus leisleri*

This species is Ireland's largest bat, with a wingspan of up to 320mm; it is also the third most common bat, preferring to roost in buildings, although it is sometimes found in trees and bat boxes. It is the earliest bat to emerge in the evening, flying fast and high with occasional steep dives to ground level, feeding on moths, caddis-flies, and beetles. The echolocation calls are sometimes audible to the human ear being around 15 kHz at their lowest. The audible chatter from their roost on hot summer days is sometimes an aid to location. This species is uncommon in Europe and Ireland holds the largest national population. The species is considered as *Internationally Important*.



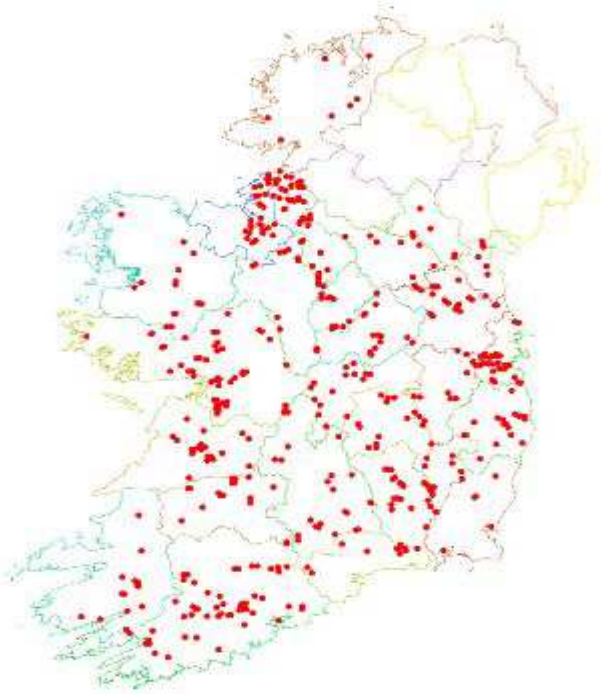


Natterer's bat *Myotis nattereri*

This species has a slow to medium flight, usually over trees but sometimes over water. They follow hedges and treelines to their feeding sites, consuming flies, moths and caddis-flies. Natterer's bats are frequently recorded in hibernation sites in winter but there are few records of summer roosts. Those that are known are usually in old stone buildings but they have been found in trees and bat boxes. The status of the Natterer's bat has not been determined but it is classed as *Threatened* and is listed in the *Irish Red Data Book* (Whilde 1993).

Daubenton's bat *Myotis daubentonii*

This bat species feeds close to the surface of water, either over rivers, canals, ponds, lakes or reservoirs, but can also be found foraging in woodlands. Flying at 15 kilometres per hour, it gaffs insects with its over-sized feet as they emerge from the surface of the water - feeding on caddis flies, moths, mosquitoes, midges etc. It is often found roosting beneath bridges or in tunnels and also makes use of hollows in trees.

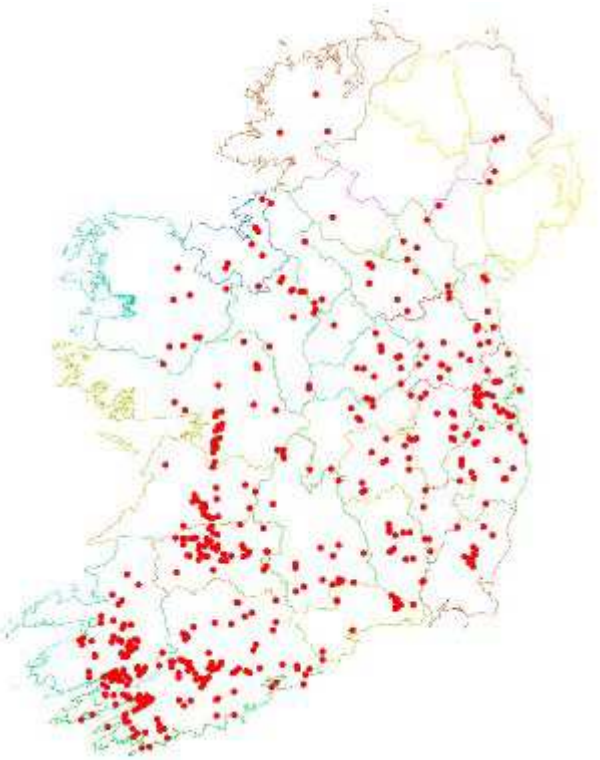


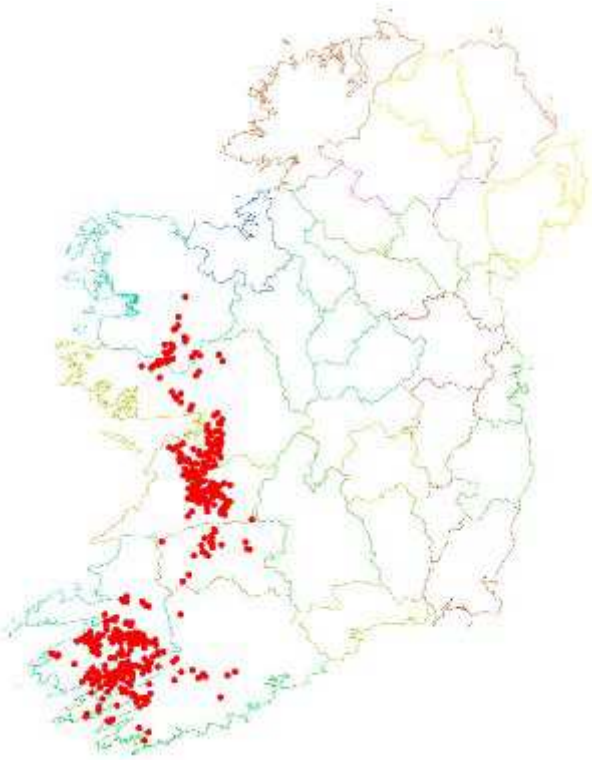
Whiskered bat *Myotis mystacinus*

This species, although widely distributed, has been rarely recorded in Ireland. It is often found in woodland, frequently near water. Flying high, near the canopy, it maintains a steady beat and sometimes glides as it hunts. It also gleans spiders from the foliage of trees. Whiskered bats prefer to roost in buildings, under slates, lead flashing or exposed beneath the ridge beam within attics. However, they also use cracks and holes in trees and sometimes bat boxes. The status of the species has not been determined but it is classed as *Threatened* and is listed in the *Irish Red Data Book* (Whilde 1993).

Brown long-eared bat *Plecotus auritus*

This species of bat is a 'gleaner', hunting amongst the foliage of trees and shrubs, and hovering briefly to pick a moth or spider off a leaf, which it then takes to a sheltered perch to consume. They often land on the ground to capture their prey. Using its nose to emit its echolocation, the long-eared bat 'whispers' its calls so that the insects, upon which it preys, cannot hear its approach (and hence, it needs oversize ears to hear the returning echoes). As this is a whispering species, it is extremely difficult to monitor in the field as it is seldom heard on a bat detector. Furthermore, keeping within the foliage, as it does, it is easily overlooked.



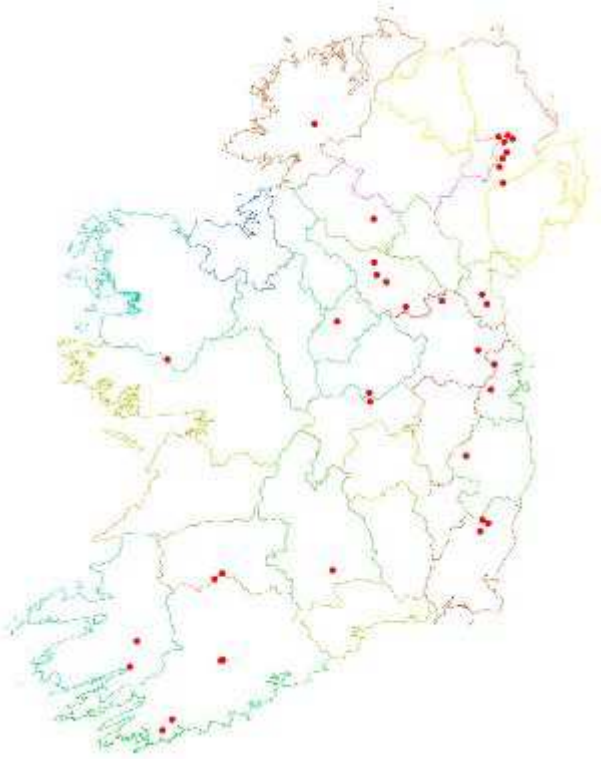


Lesser horseshoe bat *Rhinolophus hipposideros*

This species is the only representative of the Rhinolophidae family in Ireland. It differs from our other species in both habits and looks, having a unique nose leaf with which it projects its echolocation calls. It is also quite small and, at rest, wraps its wings around its body. Lesser horseshoe bats feed close to the ground, gleaning their prey from branches and stones. They often carry their prey to a perch to consume, leaving the remains beneath as an indication of their presence. The echolocation call of this species is of constant frequency and, on a bat detector, sounds like a melodious warble. Its distribution is restricted to the western Atlantic seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork (Kelleher 2004). However, single specimens have recently been discovered in Lough Key, near Boyle, Co. Roscommon in 2004 (B. Keeley, pers. comm.) and in Tubbercurry, Co. Sligo in 2008 (C. Kelleher, pers. obs.), two counties where their low numbers may have caused their presence to be overlooked in the past. This species is considered as *Internationally Important* and it is an Annex II species under the *EC Habitats Directive 1992*.

Nathusius' pipistrelle *Pipistrellus nathusii*

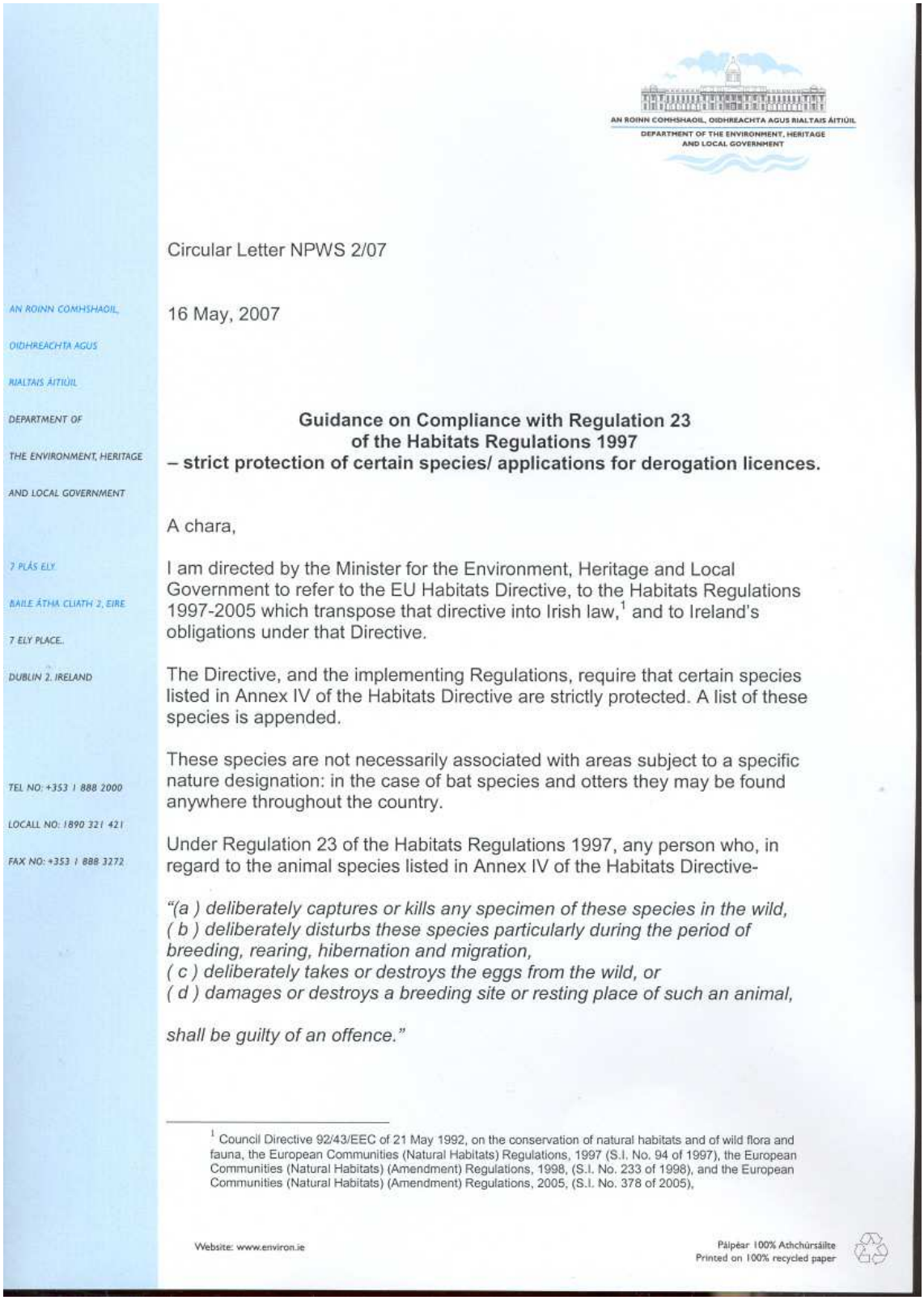
Nathusius' pipistrelle is a recent addition to the Irish fauna and, so far, has only been recorded from the north of the island in Cos. Antrim, Down and Longford (Richardson 2000) but is assumed to be spreading as the known resident population is enhanced in the autumn months by an influx of animals from Scandinavian countries. There is a likelihood, therefore, that this species may occur in the area as a vagrant especially in the autumn months. However, it was not observed during the present survey. The status of the species has not been determined.



Brandt's bat *Myotis brandtii* (No map)

This sibling species to the whiskered bat is known from four specimens found to date in Cos. Wicklow (Mullen 2007), Cavan, Clare (B. Keeley, pers. comm.) and Tipperary (Kelleher 2006b). A fifth specimen was identified in Killarney National Park, Co. Kerry in August 2005 (Kelleher 2005 & 2006a). Its status is unknown.

11.3 APPENDIX 3: NPWS Circular Letter 2/07



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

Circular Letter NPWS 2/07

16 May, 2007

Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/ applications for derogation licences.

A chara,

I am directed by the Minister for the Environment, Heritage and Local Government to refer to the EU Habitats Directive, to the Habitats Regulations 1997-2005 which transpose that directive into Irish law,[1] and to Ireland's obligations under that Directive.

The Directive, and the implementing Regulations, require that certain species listed in Annex IV of the Habitats Directive are strictly protected. A list of these species is appended.

These species are not necessarily associated with areas subject to a specific nature designation: in the case of bat species and otters they may be found anywhere throughout the country.

Under Regulation 23 of the Habitats Regulations 1997, any person who, in regard to the animal species listed in Annex IV of the Habitats Directive-

"(a) deliberately captures or kills any specimen of these species in the wild,
(b) deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,
(c) deliberately takes or destroys the eggs from the wild, or
(d) damages or destroys a breeding site or resting place of such an animal,

shall be guilty of an offence."

[1] Council Directive 92/43/EEC of 21 May 1992, on the conservation of natural habitats and of wild flora and fauna, the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997), the European Communities (Natural Habitats) (Amendment) Regulations, 1998, (S.I. No. 233 of 1998), and the European Communities (Natural Habitats) (Amendment) Regulations, 2005, (S.I. No. 378 of 2005),

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Regulation 21 provides corresponding protection for Annex IV plant species.

The carrying out of any work that has the potential to disturb these species, and for which a derogation licence has not been granted, may constitute an offence under Regulation 21 or 23 of the Habitats Regulations.

It should be noted that in the case of Regulation 23 (d), it is not necessary that the action should be deliberate for an offence to occur. This places an onus of due diligence on anyone proposing to carry out an action or project that might result in such damage or destruction.

A particular concern arises regarding works carried out by or on behalf of local authorities themselves, including works of maintenance or repair.

Examples of cases that are likely to require assessment are the removal of trees and other habitat during the construction of roads or other infrastructure, the modification of the courses of rivers, drainage and discharge of water, and even the re-pointing or replacement of masonry in bridges, walls and other structures where bats are likely to roost, etc.

Procedure to be followed

Local authorities must ensure that they, their staff and their agents comply fully with the requirements of the Directive and the Regulations as follows:

1. In advance of any works, an appropriate initial assessment should be carried out by a person competent to identify where a risk of damage or disturbance to an Annex IV species may exist (e.g. by an appropriately qualified ecologist). The fact that such an assessment has been carried out should be recorded and kept with the papers associated with the project.

2. Projects where a risk is identified should be subject to an appropriate scientific assessment. It will be necessary to identify alternatives or modifications that will avoid that risk.

3. Where it is not possible to identify a means of avoiding the risk completely, the question of seeking a derogation licence from the Minister under Regulation 23 of the Habitats Regulations should be considered if it is desired, notwithstanding, to proceed with the action or project.

4. The Minister is empowered, within strict parameters, to grant a license for derogation from complying with the requirements of the provisions of section 21 of the Wildlife Act 1976 and Regulations 23 and 24 of the Habitats Regulations. The scope of the Minister's powers to grant derogation licences is set out in Regulation 23, as follows:

Where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range, the Minister may, in respect of those species, grant a licence to one or more persons permitting a

derogation from complying with the requirements of the provisions of section 21 of the Principal Act and Regulations 23 and 24 where it is—

(a) in the interests of protecting wild fauna and flora and conserving natural habitats, or

(b) to prevent serious damage, in particular to crops, livestock, forests, fisheries and water and other types of property, or

(c) in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment, or

(d) for the purpose of research and education, of repopulating and re-introducing these species and for the breeding operations necessary for these purposes, including the artificial propagation of plants,

(e) to allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of certain specimens of the species to the extent (if any) specified therein, which are set out in the First Schedule.

6. Any application for a derogation licence (to be submitted to Mr Jamie Mulleady of this Department at: Species and Regulations Unit, National Parks and Wildlife Service, 7 Ely Place, Dublin 2 email: Jamie.mulleady@environ.ie) should address the criteria referred to in the above paragraph as well as proposed scientifically-based mitigation measures to address any potential impact on the identified Annex IV species. A decision on an application will be made on the basis of the information and proposals submitted and best scientific knowledge.

7. An application for such a derogation licence should be made in advance of seeking approval under Part 8 or 10 of the Planning and Development Regulations, 2001, as amended, or seeking planning permission for works. This will ensure that full consideration can be given to the impacts of the proposed project on the species and to avoid the possibility of delay to the proposed project or of a refusal of a derogation licence which would prevent the works being carried out as planned.

8. The obligation to obtain a derogation licence is additional to the requirement to notify the Minister of a proposed development which may have an impact on nature conservation to the Minister under article 82(3)(n) and others of the Planning and Development Regulations, 2001 (as amended). Local authorities should notify the Minister (Development Applications Unit) in any case where it appears that a proposed development may pose a risk to Annex IV species.

9. Should a problem be identified regarding Annex IV species in the course of works, this should be reported immediately to the National Parks and Wildlife Service. No further work that might impact on such species should take place unless a derogation licence has been obtained.

Applications for planning permission
Issues concerning damage or disturbance to Annex IV species also arise in the context of applications for planning permission for proposed development, e.g. proposals to renovate older houses. The responsibility of avoiding disturbance or damage to Annex IV species, or of obtaining an appropriate derogation licence, rests with the developer.

However, planning authorities should note that in any case where it appears that a proposal may pose a risk to Annex IV species, the planning application should be referred to the Minister under article 27(1)(n) of the Planning and Development Regulations 2001 (as amended). This referral should be done in the appropriate manner for applications having impacts on nature conservation sites. Planning authorities could also take the opportunity afforded by any pre-application discussions to alert prospective applicants to the requirements in relation to Annex IV species.

Further information
Species Action Plans, which set out specific measures for the monitoring and protection of these species, have been or are being prepared. They are published on www.npsw.ie or can be obtained from Species Unit (Tel: 01 888 3212). Guidelines in regard to bats are available at www.npsw.ie.

General questions in relation to the protection of Annex IV species or require any further information on an application for a derogation licence should be referred to Species Unit (01 8883214). Specific queries regarding a proposed project, location or species should be referred to the appropriate National Parks and Wildlife Service Divisional Ecologist or to the Regional Manager (contact details http://www.npws.ie/media/Media,4976,en.pdf).

If you have any questions in relation to the referral of a planning application, please contact Development Applications Unit (Tel: 01 8883181)

Is mise le meas,

Peter Carvill,
Assistant Principal Officer.

To: all County and City Managers, Directors of Services for Planning, Town Clerks

11.4 APPENDIX 4: designated area site synopsis

Site Name: River Barrow and River Nore

Site Code: 002162

From: www.npws.ie

This site consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The site passes through eight counties – Offaly, Kildare, Laois, Carlow, Kilkenny, Tipperary, Wexford and Waterford. Major towns along the edge of the site include Mountmellick, Portarlington, Monasterevin, Stradbally, Athy, Carlow, Leighlinbridge, Graiguenamanagh, New Ross, Inistioge, Thomastown, Callan, Bennettsbridge, Kilkenny and Durrow. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King's Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones. The Nore, for a large part of its course, traverses limestone plains and then Old Red Sandstone for a short stretch below Thomastown. Before joining the Barrow it runs over intrusive rocks poor in silica. The upper reaches of the Barrow also runs through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, like the Nore runs over intrusive rocks poor in silica. Waterford Harbour is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore.

The site is a candidate SAC selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, Desmoulin's Whorl Snail *Vertigo moulinsiana* and the Killarney Fern.

Good examples of Alluvial Forest are seen at Rathsnagadan, Murphy's of the River, in Abbeyleix estate and along other shorter stretches of both the tidal and freshwater elements of the site. Typical species seen include Almond Willow (*Salix triandra*), White Willow (*S. alba*), Grey Willow (*S. cinerea*), Crack Willow (*S. fragilis*), Osier (*S. viminalis*), with Iris (*Iris pseudacorus*), Hemlock Water-dropwort (*Oenanthe crocata*), Angelica (*Angelica sylvestris*), Thin-spiked Wood-sedge (*Carex strigosa*), Pendulous Sedge (*C. pendula*), Meadowsweet (*Filipendula ulmaria*), Valerian (*Valeriana officinalis*) and the Red Data Book species Nettle-leaved Bellflower (*Campanula trachelium*). Three rare invertebrates have been recorded in this habitat at Murphy's of the River. These are: *Neoascia obliqua* (Diptera: Syrphidae), *Tetanocera freyi* (Diptera: Sciomyzidae) and *Dictya umbrarum* (Diptera: Sciomyzidae).

A good example of petrifying springs with tufa formations occurs at Dysart Wood along the Nore. This is a rare habitat in Ireland and one listed with priority status on Annex I of the EU Habitats Directive. These hard water springs are characterised by lime encrustations, often associated with small waterfalls. A rich bryophyte flora is typical of the habitat and two diagnostic species, *Cratoneuron commutatum* var. *commutatum* and *Eucladium verticillatum*, have been recorded.

The best examples of old Oak woodlands are seen in the ancient Park Hill woodland in the

estate at Abbeyleix; at Kyleadohir, on the Delour, Forest Wood House, Kylecorragh and Brownstown Woods on the Nore; and at Cloghristic Wood, Drummond Wood and Borris Demesne on the Barrow, though other patches occur throughout the site. Abbeyleix Woods is a large tract of mixed deciduous woodland which is one of the only remaining true ancient woodlands in Ireland. Historical records show that Park Hill has been continuously wooded since the sixteenth century and has the most complete written record of any woodland in the country. It supports a variety of woodland habitats and an exceptional diversity of species including 22 native trees, 44 bryophytes and 92 lichens. It also contains eight indicator species of ancient woodlands. Park Hill is also the site of two rare plants, Nettle-leaved Bellflower and the moss *Leucodon sciuroides.* It has a typical bird fauna including Jay, Long-eared Owl and Raven. A rare invertebrate, *Mitostoma chrysomelas,* occurs in Abbeyleix and only two other sites in the country. Two flies *Chrysogaster virescens* and *Hybomitra muhlfeldi* also occur. The rare Myxomycete fungus, *Licea minima* has been recorded from woodland at Abbeyleix.

Oak woodland covers parts of the valley side south of Woodstock and is well developed at Brownsford where the Nore takes several sharp bends. The steep valley side is covered by Oak (*Quercus* spp.), Holly (*Ilex aquifolium*), Hazel (*Corylus avellana*) and Birch (*Betula pubescens*) with some Beech (*Fagus sylvatica*) and Ash (*Fraxinus excelsior*). All the trees are regenerating through a cover of Bramble (*Rubus fruticosus* agg.), Foxglove (*Digitalis purpurea*) Wood Rush (*Luzula sylvatica*) and Broad Buckler-fern (*Dryopteris dilatata*).

On the steeply sloping banks of the River Nore about 5 km west of New Ross, in County Kilkenny, Kylecorragh Woods form a prominent feature in the landscape. This is an excellent example of a relatively undisturbed, relict Oak woodland with a very good tree canopy. The wood is quite damp and there is a rich and varied ground flora. At Brownstown a small, mature Oak-dominant woodland occurs on a steep slope. There is younger woodland to the north and east of it. Regeneration throughout is evident. The understorey is similar to the woods at Brownsford. The ground flora of this woodland is developed on acidic, brown earth type soil and comprises a thick carpet of Bilberry (*Vaccinium myrtillus*), Heather (*Calluna vulgaris*), Hard Fern (*Blechnum spicant*), Cow-wheat (*Melampyrum* spp.) and Bracken (*Pteridium aquilinum*).

Borris Demesne contains a very good example of a semi-natural broad-leaved woodland in very good condition. There is quite a high degree of natural re-generation of Oak and Ash through the woodland. At the northern end of the estate Oak species predominate. Drummond Wood, also on the Barrow, consists of three blocks of deciduous woods situated on steep slopes above the river. The deciduous trees are mostly Oak species. The woods have a well established understorey of Holly (*Ilex aquifolium*), and the herb layer is varied, with Brambles abundant. Whitebeam (*Sorbus devoniensis*) has also been recorded.

Eutrophic tall herb vegetation occurs in association with the various areas of alluvial forest and elsewhere where the flood-plain of the river is intact. Characteristic species of the habitat include Meadowsweet (*Filipendula ulmaria*), Purple Loosestrife (*Lythrum salicaria*), Marsh Ragwort (*Senecio aquaticus*), Ground Ivy (*Glechoma hederacea*) and Hedge Bindweed (*Calystegia sepium*). Indian Balsam (*Impatiens glandulifera*), an introduced and invasive species, is abundant in places.

Floating River Vegetation is well represented in the Barrow and in the many tributaries of the site. In the Barrow the species found include Water Starworts (*Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), Bulbous Rush (*Juncus bulbosus*), Milfoil (*Myriophyllum* spp.), *Potamogeton* x *nitens,* Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (*P. pectinatus*), Perfoliated Pondweed (*P. perfoliatus*) and Crowfoots (*Ranunculus* spp.). The water quality of the Barrow has improved since the vegetation survey was carried out (EPA, 1996).

Dry Heath at the site occurs in pockets along the steep valley sides of the rivers especially in the Barrow Valley and along the Barrow tributaries where they occur in the foothills of the Blackstairs Mountains. The dry heath vegetation along the slopes of the river bank consists of Bracken

(*Pteridium aquilinum*) and Gorse (*Ulex europaeus*) species with patches of acidic grassland vegetation. Additional typical species include Heath Bedstraw (*Galium saxatile*), Foxglove (*Digitalis purpurea*), Common Sorrel (*Rumex acetosa*) and Bent Grass (*Agrostis stolonifera*). On the steep slopes above New Ross the Red Data Book species Greater Broomrape (*Orobanche rapum-genistae*) has been recorded. Where rocky outcrops are shown on the maps Bilberry (*Vaccinium myrtillus*) and Wood Rush (*Luzula sylvatica*) are present. At Ballyhack a small area of dry heath is interspersed with patches of lowland dry grassland. These support a number of Clover species including the legally protected Clustered Clover (*Trifolium glomeratum*) - a species known from only one other site in Ireland. This grassland community is especially well developed on the west side of the mud-capped walls by the road. On the east of the cliffs a group of rock-dwelling species occur, i.e. English Stonecrop (*Sedum anglicum*), Sheep's-bit (*Jasione montana*) and Wild Madder (*Rubia peregrina*). These rocks also support good lichen and moss assemblages with *Ramalina subfarinacea* and *Hedwigia ciliata*.

Dry Heath at the site generally grades into wet woodland or wet swamp vegetation lower down the slopes on the river bank. Close to the Blackstairs Mountains, in the foothills associated with the Aughnabrisky, Aughavaud and Mountain Rivers there are small patches of wet heath dominated by Purple Moor-grass (*Molinia caerulea*) with Heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Carnation Sedge (*Carex panicea*) and Bell Heather (*Erica cinerea*).

Saltmeadows occur at the southern section of the site in old meadows where the embankment has been breached, along the tidal stretches of in-flowing rivers below Stokestown House, in a narrow band on the channel side of Common Reed (*Phragmites*) beds and in narrow fragmented strips along the open shoreline. In the larger areas of salt meadow, notably at Carrickcloney, Ballinlaw Ferry and Rochestown on the west bank; Fisherstown, Alderton and Great Island to Dunbrody on the east bank, the Atlantic and Mediterranean sub types are generally intermixed. At the upper edge of the salt meadow in the narrow ecotonal areas bordering the grasslands where there is significant percolation of salt water, the legally protected species Borrer's Saltmarsh-grass (*Puccinellia fasciculata*) and Meadow Barley (*Hordeum secalinum*) (Flora Protection Order, 1987) are found. The very rare Divided Sedge (*Carex divisa*) is also found. Sea Rush (*Juncus maritimus*) is also present. Other plants recorded and associated with salt meadows include Sea Aster (*Aster tripolium*), Sea Thrift (*Armeria maritima*), Sea Couch (*Elymus pycnanthus*), Spear-leaved Orache (*Atriplex prostrata*), Lesser Sea-spurrey (*Spergularia marina*), Sea Arrowgrass (*Triglochin maritima*) and Sea Plantain (*Plantago maritima*).

Salicornia and other annuals colonising mud and sand are found in the creeks of the salt marshes and at the seaward edges of them. The habitat also occurs in small amounts on some stretches of the shore free of stones.

The estuary and the other Habitats Directive Annex I habitats within it form a large component of the site. Extensive areas of intertidal flats, comprised of substrates ranging from fine, silty mud to coarse sand with pebbles/stones are present. Good quality intertidal sand and mudflats have developed on a linear shelf on the western side of Waterford Harbour, extending for over 6 km from north to south between Passage East and Creadaun Head, and in places are over 1 km wide. The sediments are mostly firm sands, though grade into muddy sands towards the upper shore. They have a typical macro-invertebrate fauna, characterised by polychaetes and bivalves. Common species include *Arenicola marina*, *Nephtys hombergii*, *Scoloplos armiger*, *Lanice conchilega* and *Cerastoderma edule*.

The western shore of the harbour is generally stony and backed by low cliffs of glacial drift. At Woodstown there is a sandy beach, now much influenced by recreation pressure and erosion. Behind it a lagoonal marsh has been impounded which runs westwards from Gaultiere Lodge along the course of a slow stream. An extensive reed bed occurs here. At the edges is a tall fen dominated by sedges (*Carex* spp.), Meadowsweet, Willowherb (*Epilobium* spp.) and rushes (*Juncus* spp.). Wet woodland also occurs. This area supports populations of typical waterbirds

including Mallard, Snipe, Sedge Warbler and Water Rail.

The dunes which fringe the strand at Duncannon are dominated by Marram grass (*Ammophila arenaria*) towards the sea. Other species present include Wild Sage (*Salvia verbenaca*), a rare Red Data Book species. The rocks around Duncannon ford have a rich flora of seaweeds typical of a moderately exposed shore and the cliffs themselves support a number of coastal species on ledges, including Thrift (*Armeria maritima*), Rock Samphire (*Crithmum maritimum*) and Buck's-horn Plantain (*Plantago coronopus*).

Other habitats which occur throughout the site include wet grassland, marsh, reed swamp, improved grassland, arable land, quarries, coniferous plantations, deciduous woodland, scrub and ponds.

Seventeen Red Data Book plant species have been recorded within the site, most in the recent past. These are Killarney Fern (*Trichomanes speciosum*), Divided Sedge (*Carex divisa*), Clustered Clover (*Trifolium glomeratum*), Basil Thyme (*Acinos arvensis*), Hemp nettle (*Galeopsis angustifolia*), Borrer's Saltmarsh Grass (*Puccinellia fasiculata*), Meadow Barley (*Hordeum secalinum*), Opposite-leaved Pondweed (*Groenlandia densa*), Autumn Crocus (*Colchicum autumnale*), Wild Sage (*Salvia verbenaca*), Nettle-leaved Bellflower (*Campanula trachelium*), Saw-wort (*Serratula tinctoria*), Bird Cherry (*Prunus padus*), Blue Fleabane (*Erigeron acer*), Fly Orchid (*Ophrys insectifera*), Broomrape (*Orobanche hederae*) and Greater Broomrape (*Orobanche rapum-genistae*). Of these the first nine are protected under the Flora Protection Order 1999. Divided Sedge (*Carex divisa*) was thought to be extinct but has been found in a few locations in the site since 1990. In addition plants which do not have a very wide distribution in the country are found in the site including Thin-spiked Wood-sedge (*Carex strigosa*), Field Garlic (*Allium oleraceum*) and Summer Snowflake (*Leucojum aestivum*). Six rare lichens, indicators of ancient woodland, are found including *Lobaria laetevirens* and *L. pulmonaria.* The rare moss *Leucodon sciuroides* also occurs.

The site is very important for the presence of a number of EU Habitats Directive Annex II animal species including Freshwater Pearl Mussel (*Margaritifera margaritifera* and *M. m. durrovensis*), Freshwater Crayfish (*Austropotamobius pallipes*), Salmon (*Salmo salar*), Twaite Shad (*Alosa fallax fallax*), three Lamprey species - Sea (*Petromyzon marinus*), Brook (*Lampetra planeri*) and River (*Lampetra fluviatilis*), the marsh snail *Vertigo moulinsiana* and Otter (*Lutra lutra*). This is the only site in the world for the hard water form of the Pearl Mussel *M. m. durrovensis* and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning.

The site supports many other important animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (*Myotis daubentonii*), Badger (*Meles meles*), Irish Hare (*Lepus timidus hibernicus*) and Frog (*Rana temporaria*). The rare Red Data Book fish species Smelt (*Osmerus eperlanus*) occurs in estuarine stretches of the site. In addition to the Freshwater Pearl Mussel, the site also supports two other freshwater Mussel species, *Anodonta anatina* and *A. cygnea*.

The site is of ornithological importance for a number of E.U. Birds Directive Annex I species including Greenland White-fronted Goose, Whooper Swan, Bewick's Swan, Bar-tailed Godwit, Peregrine and Kingfisher. Nationally important numbers of Golden Plover and Bar-tailed Godwit are found during the winter. Wintering flocks of migratory birds are seen in Shanahoe Marsh and the Curragh and Goul Marsh, both in Co. Laois and also along the Barrow Estuary in Waterford Harbour. There is also an extensive autumnal roosting site in the reed beds of the Barrow Estuary used by Swallows before they leave the country.

Landuse at the site consists mainly of agricultural activities – many intensive, principally grazing and silage production. Slurry is spread over much of this area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of the salmonid river and to the populations of Habitats Directive Annex II animal species within the site. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs. Fishing is a main tourist attraction along stretches of the main rivers and their tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. There is net fishing in the estuary and a mussel bed also. Other recreational activities such as boating, golfing and walking, particularly along the Barrow towpath are also popular. There is a golf course on the banks of the Nore at Mount Juliet and GAA pitches on the banks at Inistioge and Thomastown. There are active and disused sand and gravel pits throughout the site. Several industrial developments, which discharge into the river, border the site. New Ross is an important shipping port. Shipping to and from Waterford and Belview ports also passes through the estuary.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, overgrazing within the woodland areas, and invasion by non-native species, for example Cherry Laurel and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above. Good quality is dependent on controlling fertilisation of the grasslands, particularly along the Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods which can damage the many Annex II species present. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book plant species including three rare plants in the salt meadows and the population of the hard water form of the Pearl Mussel which is limited to a 10 km stretch of the Nore, add further interest to this site.

11.5 APPENDIX 5: flyover as part of bat mitigation

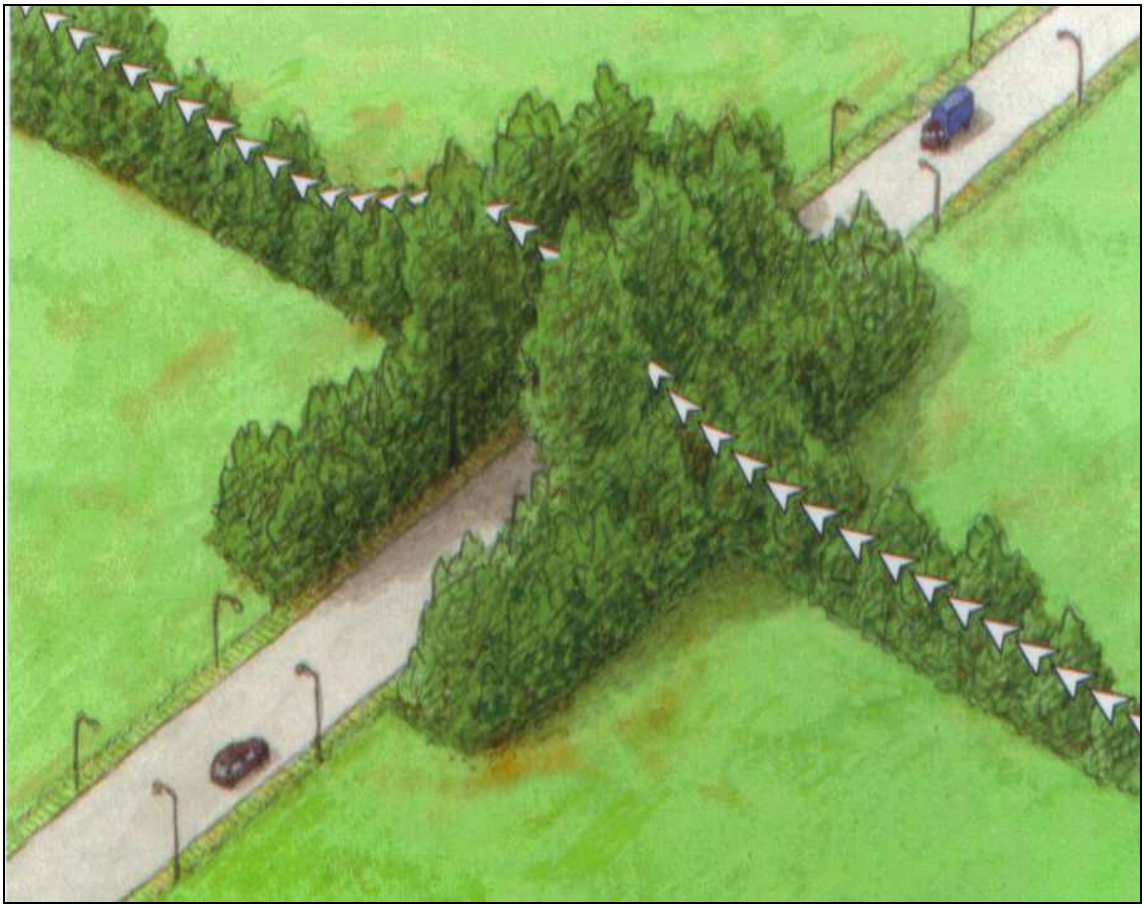

Figure 1: Bat flyover recommended at the wet woodland to allow bats to safely cross the road

APPENDIX J

Additional Information Relating to Hydrology

REFERENCES

NERC (Natural Environment Research Council), 1975. Flood Studies Report. Vol. I Hydrological Studies. Vol II Meteorological Studies. Vol III Flood Routing Studies. Vol IV Hydrological Data. Vol V Maps, London.

APPENDIX K

Additional Information Relating to Soils, Geology and Hydrogeology

REFERENCES

1. National Roads Authority (NRA) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*

2. National Roads Authority (NRA) *Environmental Impact Assessment of National Road Schemes – A Practical Guide* (2008)

3. National Roads Authority (NRA) *Guidelines for the Management of Waste from Road Construction Projects* (2008)

4. EPA *Guidelines on the Information to be Contained in Environmental Impact Statements*, Environmental Publications, 17 Duke Street, Dublin 2, 2002

5. EPA *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements*), Environmental Publications, 17 Duke Street, Dublin 2, 2003

6. GSI, Geological Survey of Ireland, on-line databases; Available on-line at http://www.dcenr.gov.ie/Spatial+Data/Geological+Survey+of+Ireland/GSI+Spatial+Data+Downloads.htm

7. Geological Survey of Ireland, Online groundwater Body Descriptions; Available on-line at: http://www.gsi.ie/

8. EPA (2006) *Water Framework Directive Monitoring Programme*

9. Institute of Geologists of Ireland (IGI); *Geology in Environmental Impact Statements - A Guide*

10. CIRIA, (2001), *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors.*

WELLS ACCURACY within 10m to 50m

GSI Code	Well Type	Original Name	Owner Name	Depth (meters)	Depth to Rock Confidence	Drill Date	Easting	Northing	Locational Accuracy (meters)	Townland	County	Six Inch Sheet No.	Well Use	Yield Class	Yield m3d	General Comments	Casing Comments	Buffer (meters)	GSISPATIAL GROUNDWATER WELLS_10to50 IG DPTH_RCK_M	GSISPATIAL GROUNDWATER WELLS_10to50 IG TOWN	GSISPATIAL GROUNDWATER WELLS_10to50 IG PRODCLASS	GSISPATIAL GROUNDWATER WELLS_10to50 IG ABSTR_M3D	GSISPATIAL GROUNDWATER WELLS_10to50 IG OVRFLW_M3D	GSISPATIAL GROUNDWATER WELLS_10to50 IG ABSTRDDM	GSISPATIAL GROUNDWATER WELLS_10to50 IG SC_M3DM	GSISPATIAL GROUNDWATER WELLS_10to50 IG CASIDIA_MM	GSISPATIAL GROUNDWATER WELLS_10to50 IG WTRSTRK1_M	GSISPATIAL GROUNDWATER WELLS_10to50 IG WTRSTRK2_M	GSISPATIAL GROUNDWATER WELLS_10to50 IG WTRSTRK3_M	GSISPATIAL GROUNDWATER WELLS_10to50 IG WTRSTRK4_M	GSISPATIAL GROUNDWATER WELLS_10to50 IG WTRLOSS1_M	GSISPATIAL GROUNDWATER WELLS_10to50 IG DRILLCOMMS	SHAPE.AREA	SHAPE.LEN
2315NEW114	Dug well			3	DTB Unknown	########	247550	160050	to 20m	KEATINGSTOWN	Kilkenny	14	Agri & domestic use					0	1													DtB approx: rock near surface	0	0
2315NEW118	Borehole			28.4	Bedrock Met	########	248040	160310	to 20m	TROYSWOOD	Kilkenny	14	Agri & domestic use					0	4														0	0
2315NEW119	Borehole			12	DTB Unknown	########	248600	160200	to 20m	TROYSWOOD	Kilkenny	14	Agri & domestic use					0															0	0
2315NEW122	Borehole			25.9	Bedrock Met	########	250140	160210	to 50m	LOUGHMERANS	Kilkenny	14	Agri & domestic use			site from well survey		0	12.8							203						Drilled by Fogarty Bros, Gowran, 1978	0	0
2315NEW199	Borehole	Monitoring BH 1		18.5	Bedrock Not Met	15-Dec-87	249630	160410	to 20m	DUNMORE	Kilkenny	14	Industrial use					0														EIS 829 Dunmore landfill,EPA have C+B analysis	0	0
2315NEW200	Borehole	Monitoring BH 2		18.5	Bedrock Not Met	15-Dec-87	249770	160330	to 20m	DUNMORE	Kilkenny	14	Industrial use					0														EIS 829, Dunmore Landfill,EPA have C+B analysi	0	0
2315NEW203	Borehole	Monitoring BH 5		18.5	Bedrock Not Met	15-Jan-88	249300	160210	to 20m	DUNMORE	Kilkenny	14	Industrial use					0								110						EIS 829, Dunmore landfillEPA have C+B analysis	0	0
2315NEW204	Borehole	MW 1		15.3	Bedrock Not Met	13-Dec-95	249620	160350	to 20m	DUNMORE	Kilkenny	14	Industrial use					0														ref EIS 528,KTC, recovery good	0	0
2315NEW205	Borehole	BH 1/95		12.5	Bedrock Not Met	15-Mar-95	249690	160300	to 20m	DUNMORE	Kilkenny	14	Industrial use					0														EIS 528, F L BensonDrilled by IGSL by shell/auger	0	0
2315NEW206	Borehole	BH 2/95		20.5	Bedrock Not Met	15-Mar-95	249530	160180	to 20m	DUNMORE	Kilkenny	14	Industrial use					0									9.8	11.9				EIS 528, FL Benson, Drilled by IGSL by shell/auger	0	0
2315NEW207	Borehole	BH 5/95		19.5	Bedrock Not Met	15-Mar-95	249760	160210	to 20m	DUNMORE	Kilkenny	14	Industrial use					0									15					EIS 528, FL Benson; Drilled by IGSL by shell/auger; abandoned, blowing sand	0	0
2315NEW208	Borehole	BH 6/95		17.5	Bedrock Not Met	15-Mar-95	249590	160310	to 20m	DUNMORE	Kilkenny	14	Industrial use					0														EIS 528, FLBenson, Drilled by IGSL by shell/auger	0	0
2315NEW241	Borehole			35	Bedrock Met	########	248010	160020	to 20m	TROYSWOOD	Kilkenny	14	Agri & domestic use	Poor				0	3														0	0
2315SEW009	Borehole			45.4	DTB Unknown	########	248340	159760	to 20m	KEATINGSTOWN	Kilkenny	14	Agri & domestic use	Poor				0															0	0
2315SEW010	Borehole			48.8	Bedrock Not Met	########	248360	159920	to 20m	TROYSWOOD	Kilkenny	14	Domestic use only			site from well survey		0	1.5							152						Drilled by Fogarty Bros, Gowran, 1975/6good quality	0	0
2315SEW011	Borehole			20	DTB Unknown	########	248620	159400	to 20m	KEATINGSTOWN	Kilkenny	14	Agri & domestic use					0															0	0
2315SEW012	Borehole			61	Bedrock Not Met	########	248880	159230	to 20m	TROYSWOOD	Kilkenny	14	Agri & domestic use	Moderate	54.5	site from well survey		0	9.1							152	30.5					Drilled by Fogarty Bros, Gowran, 1974/5o/b sand & gravel/limey	0	0
2315SEW013	Borehole			25	Bedrock Met	########	249000	159940	to 20m	TROYSWOOD	Kilkenny	14	Domestic use only	Moderate				0	15													o/b sands	0	0
2315SEW014	Borehole			31	DTB Unknown	########	249050	159970	to 20m	TROYSWOOD	Kilkenny	14	Domestic use only					0														o/b sand	0	0
2315SEW015	Borehole			33	Bedrock Met	########	249150	159120	to 20m	TROYSWOOD	Kilkenny	14	Agri & domestic use	Moderate				0	10														0	0
2315SEW016	Borehole			26.5	Bedrock Not Met	########	249700	159290	to 20m	LOUGHMERANS	Kilkenny	14	Agri & domestic use	Moderate		site from well survey		0								152						Drilled by Sean Flood, Clonroche, 1968iron problem &	0	0
2315SEW017	Dug well			11.2	DTB Unknown	########	249950	159560	to 20m	LOUGHMERANS	Kilkenny	14	Agri & domestic use					0														o/b sand	0	0
2315SEW018	Dug well			4	DTB Unknown	########	250220	159010	to 20m	LOUGHMERANS	Kilkenny	14	Agri & domestic use					0														o/b sand v limey excell supply	0	0
2315SEW019	Dug well		Kilkenny Co Co (Longsgate)	16.3	DTB Unknown	########	250340	159900	to 20m	BAUN	Kilkenny	14	Other					0															0	0
2315SEW020	Borehole			24.4	Bedrock Not Met	########	250400	159300	to 20m	LOUGHMERANS	Kilkenny	14	Agri & domestic use			site from well survey		0								203						o/b sand limey pollutedDrilled by Fogarty Bros, 1971	0	0
2315SEW021	Dug well			6.1	DTB Unknown	########	250550	159100	to 20m	BAUN	Kilkenny	14	Domestic use only			site from well survey		0														limey	0	0
2315SEW022	Borehole			28.1	Bedrock Met	########	250650	159950	to 20m	BAUN	Kilkenny	14	Agri & domestic use	Moderate				0	0													rock at surface	0	0
2315SEW023	Dug well			6.1	Bedrock Met	15-Aug-62	250700	159900	to 20m	BAUN	Kilkenny	14	Agri & domestic use					0	1.2													poor supply in	0	0
2315SEW024	Spring		KILKENNY CO COUNCIL	1.8	DTB Unknown	########	250880	159230	to 20m	BONNETSRATH	Kilkenny	14	Public supply (Co Co)			site from well survey		0															0	0
2315SEW025	Unknown					########	250920	159520	to 20m	RADESTOWN NORTH	Kilkenny	14	Unknown					0															0	0
2315SEW026	Borehole			39.6	Bedrock Met	########	251840	159200	to 20m	BONNETSRATH	Kilkenny	14	Agri & domestic use			site from well survey		0	0.9								33.5					Drilled by Fogarty Bros, Gowran, c.	0	0
2315SEW027	Dug well			15.9	DTB Unknown	########	252200	159020	to 20m	KYLEROE	Kilkenny	14	Domestic use only					0															0	0
2315SEW028	Borehole			44.2	DTB Unknown	########	252240	159140	to 20m	KYLEROE	Kilkenny	14	Agri & domestic use					0														v.limey	0	0
2315SEW029	Borehole			36.6	DTB Unknown	########	252400	159860	to 20m	RADESTOWN SOUTH	Kilkenny	14		Failure				0															0	0
2315SEW030	Borehole			28.9	DTB Unknown	########	252540	158920	to 20m	BROWNSTOWN	Kilkenny	14	Agri & domestic use			site from well survey	went dry in summer; polluted by silage pit beside	0									13.7	27.4				failed: silage pollution	0	0
2315SEW031	Borehole			41.1	Bedrock Met	########	252540	158990	to 20m	BROWNSTOWN	Kilkenny	14	Agri & domestic use	Poor		site from well survey		0	6.1								9.1					contaminated once	0	0
2315SEW032	Borehole			76.2	Bedrock Met	########	252600	159000	to 20m	BROWNSTOWN	Kilkenny	14	Agri & domestic use	Moderate	99	site from well survey		0	7.6								9.1					Drilled by Fogarty Bros, Gowran, c. 1971swallowholes nearby	0	0
2315SEW033	Dug well			4.4	DTB Unknown	########	252620	159840	to 20m	BROWNSTOWN	Kilkenny	14	Agri & domestic use					0															0	0
2315SEW069	Unknown					########	247490	158660	to 20m	KEATINGSTOWN	Kilkenny	19	Other			site from well survey		0															0	0
2315SEW074	Borehole			38.7	Bedrock Met	########	248440	158020	to 20m	DEERPARK	Kilkenny	19	Agri & domestic use	Moderate	43.6	site from well survey		0	8.2					44		152	18.3	38.7				Drilled by Fogarty, Gowran, 1968IRON & LIME	0	0
2315SEW075	Borehole		Group Scheme	22.5	DTB Unknown	########	248140	158440	to 20m	DEERPARK	Kilkenny	19				site from well survey	No longer used (1973)	0														NO LONGER USED	0	0
2315SEW082	Spring					########	249040	158280	to 20m	TALBOTSINCH	Kilkenny	19				site from well survey		0														O/B - S & G; WATER -	0	0
2315SEW083	Spring			1.5	DTB Unknown	########	249120	157760	to 20m	COOLGRANGE	Kilkenny	19				site from well survey		0															0	0
2315SEW084	Borehole			36	Bedrock Not Met	15-Mar-64	249060	157290	to 20m	RAHEENNAGUN	Kilkenny	19	Agri & domestic use	Good	87	site from well survey		0														Drilled by Sean FloodO/B-SAND & GRAVEL	0	0
2315SEW089	Borehole			35.4	Bedrock Met	15-May-63	249470	157900	to 20m	TALBOTSINCH	Kilkenny	19	Agri & domestic use	Moderate	82	site from well survey		0	34.5													Drilled by Sean Flood, Clonroche	0	0
2315SEW091	Borehole			19	Bedrock Not Met	15-Jul-70	249900	157150	to 20m	JAMESPARK	Kilkenny	19	Agri & domestic use	Moderate	76	site from well survey		0								152						Drilled by Sean Flood, Clonroche	0	0
2315SEW092	Borehole		Kilkenny County Hospital	62.2	Bedrock Met	15-Mar-60	249950	157500	to 20m	TALBOTSINCH	Kilkenny	19	Public supply (Co Co)	Poor	16.4	site from well survey		0	11.9								16.5					O/B-SAND & GRAVEL	0	0
2315SEW093	Borehole			30.5	Bedrock Met	########	249860	158330	to 20m	TALBOTSINCH	Kilkenny	19				site from well survey		0	0							152						Drilled by Fogarty, Gowran, 1978WELL IN BASE OF	0	0
2315SEW094	Borehole			26.5	Bedrock Not Met	15-Jun-68	250080	158700	to 20m	LOUGHMERANS	Kilkenny	19	Agri & domestic use	Poor	87	site from well survey		0														Drilled by Sean Flood, Clonrochehigh iron	0	0
2315SEW102	Borehole			25.9	Bedrock Not Met	15-Feb-69	250900	157800	to 20m	GLENDINE	Kilkenny	19	Agri & domestic use	Good	202	site from well survey		0						61									0	0
2315SEW104	Borehole			38.4	Bedrock Presumed	15-May-67	251850	157940	to 20m	NEWORCHARD	Kilkenny	19	Agri & domestic use	Poor	27	site from well survey		0	38.1													Drilled by Fogarty, Gowran(yield:21.8-32.7m3/d)	0	0
2315SEW105	Borehole		Kilkenny Co Co	31	DTB Unknown	########	252000	157860	to 20m	NEWORCHARD	Kilkenny	19	Public supply (Co Co)			site from well survey		0															0	0
2315SEW110	Dug well			9.4	DTB Unknown	########	252380	158010	to 20m	NEWORCHARD	Kilkenny	19	Agri & domestic use			site from well survey		0															0	0
2315SEW111	Borehole			21.3	Bedrock Met	########	252500	158400	to 20m	BROWNSTOWN	Kilkenny	19	Agri & domestic use			site from well survey		0	5.8													Drilled by Doran, BorrisO/B-CLAY	0	0
2315SEW343	Borehole	MW2		6.3	DTB Unknown	15-Dec-95	249470	159810	to 20m	LOUGHMERANS	Kilkenny	14	Industrial use					0														EIS 528, KTC monit.well, recovery good	0	0
2315SEW344	Borehole	MW3		11.4	DTB Unknown	16-Dec-95	249840	159650	to 20m	LOUGHMERANS	Kilkenny	14	Industrial use					0														EIS528, KTCmonit well rep, recovery	0	0
2315SEW345	Borehole	BH 3/95		20	Bedrock Not Met	15-Mar-95	249550	159950	to 20m	DUNMORE	Kilkenny	14	Industrial use					0									12.5					EIS 528, FL BensonDrilled by IGSL by shell/auger	0	0

GROUNDWATER WELLS within 1km RADIUS

GSINAME	number	ORIGNAME	SRCNAME	TYPE	DEPTH_M	DPTH_RCK_M	DTRCONFID	DRILLDATE	EASTING	NORTHING	LOC_ACC	TOWNLAND	TOWN	COUNTY	SIXINSHTNO	SOURCEUSE	YLDCLASS	PRODCLASS	YIELD_M3D	ABSTR_M3D	OVRFLW_M3D	ABSTRDDM	SC_M3DM	CAS1DIA_MM	WTRSTRK1_M	WTRSTRK2_M	WTRSTRK3_M	WTRSTRK4_M	WTRLOSS1_M	GENCOMMS	DRILLCOMMS	CASINGCOMS	BUFFER
2315SEW094	1			Borehole	26.5		Bedrock Not Met	15/06/1968 00:00	250080	158700	to 20m	LOUGHMERANS		Kilkenny	19	Agri & domestic use	Poor		87											site from well survey	Drilled by Sean Flood, Clonroche		
2315SEW015	2			Borehole	33	10	Bedrock Met	30/12/1899 00:00:00	249150	159120	to 20m	TROYSWOOD		Kilkenny	14	Agri & domestic use	Moderate															0
2315SEW018	3			Dug well	4		DTB Unknown	30/12/1899 00:00:00	250220	159010	to 20m	LOUGHMERANS		Kilkenny	14	Agri & domestic use															o/b sand v limey excell supply		0
2315SEW012	4			Borehole	61	9.1	Bedrock Not Met	30/12/1899 00:00:00	248880	159230	to 20m	TROYSWOOD		Kilkenny	14	Agri & domestic use	Moderate		54.5					152	30.5					site from well survey	Drilled by Fogarty Bros, Gowran, 1974/5		
2315SEW093	7			Borehole	30.5	0	Bedrock Met	30/12/1899 00:00:00	249860	158330	to 20m	TALBOTSINCH		Kilkenny	19									152						site from well survey	Drilled by Fogarty, Gowran, 1978		
2315SEW082	5	6		Spring				30/12/1899 00:00:00	249040	158280	to 20m	TALBOTSINCH		Kilkenny	19														site from well survey	O/B - S & G; WATER - EXCELLENT		0
2315SEW017	13			Dug well	11.2		DTB Unknown	30/12/1899 00:00:00	249950	159560	to 20m	LOUGHMERANS		Kilkenny	14	Agri & domestic use															o/b sand		0
2315SEW021	8			Dug well	6.1		DTB Unknown	30/12/1899 00:00:00	250550	159100	to 20m	BAUN		Kilkenny	14	Domestic use only														site from well survey	limey		0
2315SEW011	9			Borehole	20		DTB Unknown	30/12/1899 00:00:00	248620	159400	to 20m	KEATINGSTOWN		Kilkenny	14	Agri & domestic use																	0
2315SEW020	10			Borehole	24.4		Bedrock Not Met	30/12/1899 00:00:00	250400	159300	to 20m	LOUGHMERANS		Kilkenny	14	Agri & domestic use								203						site from well survey	o/b sand limey polluted		
2315SEW074	11			Borehole	38.7	8.2	Bedrock Met	30/12/1899 00:00:00	248440	158020	to 20m	DEERPARK		Kilkenny	19	Agri & domestic use	Moderate		43.6	44				152	18.3	38.7				site from well survey	Drilled by Fogarty, Gowran, 1968		
2315SEW075	12		Group Scheme	Borehole	22.5		DTB Unknown	30/12/1899 00:00:00	248140	158440	to 20m	DEERPARK		Kilkenny	19															site from well survey	NO LONGER USED	No longer used (1973)	0
2315SEW344	14	MW3		Borehole	11.4		DTB Unknown	16/12/1995 00:00	249840	159650	to 20m	LOUGHMERANS		Kilkenny	14	Industrial use															EISS28, KTCmonit well rep, recovery good		
2315SEW343	16	MW2		Borehole	6.3		DTB Unknown	15/12/1995 00:00	249470	159810	to 20m	LOUGHMERANS		Kilkenny	14	Industrial use															EIS 528, KTC monit.well, recovery good		0
2315SEW024	15		KILKENNY CO COUNCIL	Spring	1.8		DTB Unknown	30/12/1899 00:00:00	250880	159230	to 20m	BONNETSRATH		Kilkenny	14	Public supply (Co Co)														site from well survey			0
2315SEW089	17			Borehole	35.4	34.5	Bedrock Met	15/05/1963 00:00	249470	157900	to 20m	TALBOTSINCH		Kilkenny	19	Agri & domestic use	Moderate		82											site from well survey	Drilled by Sean Flood, Clonroche		0
2315SEW083	18			Spring	1.5		DTB Unknown	30/12/1899 00:00:00	249120	157760	to 20m	COOLGRANGE		Kilkenny	19															site from well survey			0
2315SEW013	19			Borehole	25	15	Bedrock Met	30/12/1899 00:00:00	249000	159940	to 20m	TROYSWOOD		Kilkenny	14	Domestic use only	Moderate														o/b sands		0
2315SEW014	20			Borehole	31		DTB Unknown	30/12/1899 00:00:00	249050	159970	to 20m	TROYSWOOD		Kilkenny	14	Domestic use only															o/b sand		0
2315SEW009	21			Borehole	45.4		DTB Unknown	30/12/1899 00:00:00	248340	159760	to 20m	KEATINGSTOWN		Kilkenny	14	Agri & domestic use	Poor																0
2315SEW102	22			Borehole	25.9		Bedrock Not Met	15/02/1969 00:00	250900	157800	to 20m	GLENDINE		Kilkenny	19	Agri & domestic use	Good		202	61										site from well survey			0
2315SEW025	23			Unknown				30/12/1899 00:00:00	250920	159520	to 20m	RADESTOWN NORTH		Kilkenny	14	Unknown																	0
2315SEW345	24	BH 3/95		Borehole	20		Bedrock Not Met	15/03/1995 00:00	249550	159950	to 20m	DUNMORE		Kilkenny	14	Industrial use									12.5						EIS 528, FL Benson		
2315SEW019	25		Kilkenny Co Co (Longsgate)	Dug well	16.3		DTB Unknown	30/12/1899 00:00:00	250340	159900	to 20m	BAUN		Kilkenny	14	Other																	0
2315SEW010	26			Borehole	48.8	1.5	Bedrock Not Met	30/12/1899 00:00:00	248360	159920	to 20m	TROYSWOOD		Kilkenny	14	Domestic use only								152						site from well survey	Drilled by Fogarty Bros, Gowran, 1975/6		
2315SEW023	27			Dug well	6.1	1.2	Bedrock Met	15/08/1962 00:00	250700	159900	to 20m	BAUN		Kilkenny	14	Agri & domestic use															poor supply in summer		0
2315SEW022	28			Borehole	28.1	0	Bedrock Met	30/12/1899 00:00:00	250650	159950	to 20m	BAUN		Kilkenny	14	Agri & domestic use	Moderate														rock at surface		0
2315SEW092	29		Kilkenny County Hospital	Borehole	62.2	11.9	Bedrock Met	15/03/1960 00:00	249950	157500	to 20m	TALBOTSINCH		Kilkenny	19	Public supply (Co Co)	Poor		16.4						16.5					site from well survey	O/B-SAND & GRAVEL		0
2315SEW016	6			Borehole	26.5		Bedrock Not Met	30/12/1899 00:00:00	249700	159290	to 20m	LOUGHMERANS		Kilkenny	14	Agri & domestic use	Moderate							152						site from well survey	Drilled by Sean Flood, Clonroche, 1968		

SOILS, GEOLOGY AND HYDROGEOLOGY

8.1 Introduction

This section of the Route Selection Study describes the existing soils, geology and hydrogeology environment along the proposed routes and in the immediately surrounding area, in addition to its sensitivity to potential impacts that may be encountered during the construction and operational phases of the proposed N77 Kilkenny Road Extension. Figure 8.1 shows the subject site and the eight proposed routes.

8.2 Methodology

The route selection study for the soils, geology and hydrogeology environment along the eight proposed alignments involved the review of desktop information. In addition, the desktop study was supplemented by a site visit, in order to further establish the overall hydrogeological regime within the study area.

The route selection has been carried out in accordance with the NRA guidance Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. The study area encompasses an overall width of 500m i.e. 250m from the centre line of each route corridor, in accordance with the NRA guidance.

An assessment of likely impacts is undertaken and a summary of the associated impacts is presented in tabular format.

The quality, magnitude and duration of potential impacts is defined in accordance with the assessment criteria provided in the EPA publication 'Guidelines on the Information to be contained in Environmental Impact Statements' (2002), outlined in Tables 8.1, 8.2 and 8.3.

Quality of Impacts	Description
Positive Impact	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or removing nuisances or improving amenities).
Neutral Impact	A change which does not affect the quality of the environment.
Negative Impact	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Table 8.1 Impact Assessment Criteria (Quality)

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An impact which obliterates all previous sensitive characteristics

Table 8.2 Impact Assessment Criteria (Magnitude)

Duration of Impact	Description
Short-term Impact	Impact lasting one to seven years.
Medium-term Impact	Impact lasting seven to fifteen years.
Long-term Impact	Impact lasting fifteen to sixty years.
Permanent Impact	Impact lasting over sixty years.
Temporary Impact	Impact lasting for one year or less.

Table 8.3 Impact Assessment Criteria (Duration)

8.3 Route Selection Options

Eight route options have been considered in this instance. A brief description of soils, geology and hydrogeology baseline environmental of each route is set out below.

The proposed route would connect the existing N77 Ring Road Extension roundabout on the Castlecomer Road to the Freshford Road north of the Aut Even Hospital.

8 route corridor options were initially developed for consideration in this scheme, namely; Red (Route 1), Yellow (Route 2), Blue (Route 3), Cyan (Route 4), Green (Route 5), Magenta (Route 6), Orange (Route 7) and Black (Route 8) as indicated on drawing 07_088_032. All eight route corridors connect with the existing N77 Ring Road Extension roundabout and traverse west to the R693, crossing the Nore River at various locations.

The bridge will be located from CH 390 and will consist of an arched culvert with concrete piles to competent ground. The bridge will be constructed with reinforced earth walls and culverts on pile caps on driven piles. The piles will be driven and it is not anticipated that there will much dewatering required. However, there may be dig-and-replacement of 3m-5m of poor subsoil. Piles for the bridge and culverts will be driven 0.5m-1.0m into the rock.

8.4 Description of Baseline Environment

8.4.1 Bedrock Geology

The bedrock geology underlying the route options is shown on Figure 8.1.

Killeshin Siltstone Formation

Options 1, 3 and 6 are entirely underlain by the Killeshin Siltstone Formation, which consists of muddy siltstone and silty mudstone. The majority of the other route options are also underlain by this formation.

Luggacurren Shale Formation

Luggacurren Shale Formation is described as mudstone and shale with chert & limestone.

Route options 2, 4, 5, 7 and 8 are underlain by the Luggacurran Shale Formation to the east. Route options 2 and 5 are underlain by the formation to the far east of the route only.

The impact level on the bedrock geology for all routes is **minor negative to neutral**.

8.4.2 Drift Geology

The drift geology underlying the route options is shown in Figure 8.2.

Limestone Sands and Gravels (GLs)

The majority of all the route options are underlain by Carboniferous limestone sands and gravels (GLs).

Gravelly Alluvium (A)

All route options cross undifferentiated gravelly alluvium (A) around the River Nore area.

Tills Derived from Namurian Rocks (TNSS)

Route options 3, 4 and 6 are underlain by tills derived from Namurian rocks (TNSS) to the west of the route.

Lake Sediments (L)

Route options 1 and 2 are underlain by a small area of undifferentiated lake sediments towards the east of the route options.

Bedrock at Surface

A small area of bedrock at surface is present beneath route options 3 and 6, to the west of the route options.

The impact level on the drift geology for all routes is **minor negative**.

8.4.3 Soils

The soil types underlying the route options are shown in Figure 8.3.

Basic Mineral Soils (BminSW)

The majority of all route options are underlain by basic mineral soil (BminSW). The soils are described as shallow well drained mineral soils, which are mainly basic.

Mineral Alluvium (AlluvMIN)

All routes cross a section of mineral alluvium where the route passes over the River Nore.

Acidic Mineral Soils (AminDW and AminSW)

Routes 4, 6 and a small section of 3 are underlain by deep well drained mainly acidic mineral soils to the west (AminDW). Routes 3 and 6 are underlain by shallow well drained mainly acidic mineral soils to the west (AminSW).

Lacustrine-type Soils

Route Options 1 and 2 are underlain by lacustrine–type alluvium soils towards the east of the routes.

The impact level on the soils for all routes is **minor negative**.

8.4.4 Aquifer Classification

Poor Aquifer (PI)

The entire of route options 1, 3 and 6 and the majority of the other routes are underlain by an aquifer which is classified by the GSI as a poor aquifer (PI), a bedrock aquifer which is generally unproductive except for local zones.

Poor Aquifer (Pu)

The eastern section of route options 4, 7 and 8 and a small section of route options 2 and 5 are underlain by a poor aquifer (PU), a bedrock aquifer which is generally unproductive. Route options 5, 7 and 8 terminate close to the boundary with the adjacent regionally important aquifer (Rkd).

The impact level on the aquifer classification for all routes is **minor negative to neutral**.

8.4.5 Gravel Aquifer

All of the routes are underlain by a gravel aquifer which is classified by the GSI as Rg - Regionally Important extensive sand/gravel aquifer. The gravel aquifer is part of the Nore Gravels Group, and the extent of the gravel aquifer is shown in Figure 8.4.

The impact level on the gravel aquifer for all routes is **minor negative**.

8.4.6 Aquifer Vulnerability

The aquifer vulnerability is shown in Figure 8.5.

All route options other than options 3 and 6 are underlain by high vulnerability aquifers. Short sections of both route options 3 and 6 are underlain by extreme vulnerability aquifer and rock at near surface.

The impact level on all routes options other than options 3 and 6 is **minor negative**.

The impact level on options 3 and 6 is **moderate to minor negative**.

8.4.7 Groundwater Supply Wells

The GSI Well Card Data search found a number of groundwater wells within a 1km radius of the route options, as shown in Figure 8.6. A table showing the well details is presented in Appendix 1.

GSI well reference 2315SEW094, marked on Figure 8.6 as 1, is located on route option 3 and 5, and is shown directly adjacent to route option 4. Information available from the GSI indicates that the borehole extends to a depth of 26.5m and does not extend into bedrock, which gives an indication of the depth of gravel at this location. The borehole is for agricultural and domestic use and has a poor yield.

GSI well reference 2315SEW015, marked as 2, is located approximately 150m north of route option 6. The well extends to a depth of 33m, is used for agricultural and domestic use and has a moderate yield.

GSI well reference 2315SEW018, marked as 3, is located approximately 200m north of route option 2. The well is recorded as being only 4m deep and is used for agricultural and domestic use.

All other groundwater supply wells are located outside the 250m route corridor radius for all options.

The impact level on options 3 and 5 is **moderate to minor negative**.

The impact level on route options 2, 4 and 6 is **minor negative**.

The impact level on all routes options other than options is **neutral**.

8.5 Route Selection

Similar construction and operational procedures and processes are anticipated for each of the eight proposed routes, and for the bridge structure and bridge foundations. Each of the proposed routes was assessed in terms of the sensitivity of the existing soils, geology and hydrogeology environment and potential impacts during the construction and operational phase of the route. The level of impact for each attribute is summarised in Table 8.1 below. Based on this information, the routes are ranked in Table 8.2 in terms of their preference.

Table 8.2 shows that the preferred routes, in terms of soils, geology and hydrogeology are **Routes 1, 7 and 8**.

Attribute	Level of Impact	Routes	Comments
Bedrock Geology	Minor negative to neutral	All routes.	All routes underlain either entirely or mostly by Killeshin Siltstone Formation.
Drift Geology	Minor negative	All routes.	The majority of all routes underlain by limestone sand and gravels
Soils	Minor negative	All routes.	The majority of all routes underlain by basic mineral soil
Aquifer Classification (bedrock)	Minor negative to neutral	All routes.	All routes underlain by a poor bedrock aquifer.
Aquifer Classification (sands and gravel)	Minor negative	All routes.	All routes underlain by a regionally important sand and gravel aquifer.
Aquifer Vulnerability	Minor negative	All routes other than options 3 and 6	Routes are underlain by high vulnerability aquifers.
	Moderate to minor negative	Route options 3 and 6	Short sections of route options 3 and 6 underlain by extreme vulnerability aquifer and rock at near surface
Groundwater Supply Wells	Neutral	Routes 1, 7 and 8.	Groundwater supply wells are located outside the 250m route corridor radius.
	Minor negative	Options 2, 4 and 6	Water supply wells

			located adjacent to and within 250m of proposed routes.
	Moderate to minor negative	Options 3 and 5	Water supply well located on route. The well appears to abstract from gravels for domestic and agricultural use.

Table 8.1 – Assessment of Level of Impact

Impact Level	Route Corridor 2	Route Corridor 3	Route Corridor 4	Route Corridor 5	Route Corridor 6	Routes 1, 7 and 8
Neutral	0	0	0	0	0	1
Minor negative to neutral	3	3	3	3	3	3
Minor negative	4	2	4	3	3	3
Moderate to minor negative	0	2	0	1	1	0
Order of Preference	2nd	4th	2nd	3rd	3rd	1st

Table 8.2 – Route Selection (Soils, Geology and Hydrogeology)

APPENDIX L

Additional Information Relating to Air Quality and Climate

Additional References for Air Quality Standards

Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, was passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and does so every 12 months by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, details limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. This has also been passed into Irish Law under the Air Quality Standards Regulations 2011 (S.I. 180 of 2011). Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The

approach for $PM_{2.5}$ is to establish a target value of 25 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m^3, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3. Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008-2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m^3 has been set to be complied with by 2015, again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 2008/50/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 2008/50/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 2008/50/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 2008/50/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_x (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_x such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive 2008/50/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway;
- 5 km from the nearest major industrial installation;
- 20 km from a major urban conurbation.

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the

Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 21 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations[(A1)]. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB underwent an extensive validation exercise[(A2)] as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK DEFRAs national air quality monitoring network. The validation exercise was carried out for NO_x, NO_2 and PM_{10}, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations[(A2)].

In relation to NO_2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO_2 mirrors that of NO_x showing that the over-prediction is due to NO_x calculations rather than the NO_x:NO_2 conversion. Within most urban situations, the model overestimates annual mean NO_2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict $PM_{10.}$ Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable[(A2)].

References

(A1) UK DEFRA (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 - HA207/07 (Document & Calculation Spreadsheet)

(A2) UK DEFRA (2001) DMRB Model Validation for the Purposes of Review and Assessment

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DEHLG (2006) Ireland's Pathway to Kyoto Compliance - Review of the National Climate Change Strategy

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APPENDIX M

Additional Information Relating to Noise and Vibration

Results of Unattended Baseline Noise Monitoring

Date	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)		
		L_{Aeq}	L_{AF10}	L_{AF90}
14 February 2013	16:00	50	53	46
	17:00	51	53	47
	18:00	47	50	43
	19:00	43	44	40
	20:00	44	46	41
	21:00	44	47	40
	22:00	44	47	39
	23:00	43	45	40
15 February 2013	00:00	41	43	40
	01:00	41	43	40
	02:00	45	49	39
	03:00	44	47	40
	04:00	45	49	40
	05:00	46	49	40
	06:00	46	48	42
	07:00	51	54	45
	08:00	50	53	46
	09:00	50	53	45
	10:00	49	52	43
	11:00	48	51	43
	12:00	47	51	41
	13:00	47	50	41
	14:00	48	51	42
	15:00	48	50	41
L_{den}	52			

APPENDIX N

Additional Information Relating to Archaeology, Architecture and Cultural Heritage

Standards and Guidelines

EC (EIA) (Amendment) Regulations, 1999

The EIA Amendment Regulations, S.I.93 of 1999, specify in Section 2(b) of the Second Schedule, ' Information to be contained in an Environmental Impact Statement', that further information is to be provided on:

> *Material assets, including the architectural and archaeological heritage, and the cultural heritage.*

Environmental Protection Agency (EPA)

The following advice notes and guidelines were consulted during the course of the study.

Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (2003) and Guidelines on the information to be contained in Environmental Impact Statements (2002).

Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000

The Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act provides for the establishment of a national inventory of architectural heritage and historic monuments.

Section 1 of the act defines "architectural heritage" as:

(a) all structures and buildings together with their settings and attendant grounds, fixtures and fittings,

(b) groups of such structures and buildings, and,

(c) sites, which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

The Local Government (Planning and Development) Act, 1999, which came into force on 1st January 2000, provides for the inclusion of protected structures into the planning authorities' development plans and sets out statutory regulations regarding works affecting such structures, thereby giving greater statutory protection to buildings. All structures listed in the development plan are now referred to as Protected Structures and enjoy equal statutory protection. Under the 1999 Act the entire structure is protected, including a structures interior, exterior, the land lying within the curtilage of the protected structure and other structures within that curtilage. This Act was subsequently repealed and replaced by the Planning and Development Act, 2000, where the conditions relating to the protection of architectural heritage are set out in Part IV of the Act.

National Monuments Legislation (1930-2004)

All archaeological sites have the full protection of the national monuments legislation (Principal Act 1930; Amendments 1954, 1987, 1994 and 2004). In the 1987 Amendment of Section 2 of the Principal Act (1930), the definition of a national monument is specified as:

> *any artificial or partly artificial building, structure or erection or group of such buildings, structures or erections;*
>
> *any artificial cave, stone or natural product, whether forming part of the ground, that has been artificially carved, sculptured or worked upon or which (where it does not form part of the place where it is) appears to have been purposely put or arranged in position;*
>
> *any, or any part of any, prehistoric or ancient tomb, grave or burial deposit, or*
>
> *(ii) ritual, industrial or habitation site*
>
> *and*
>
> *any place comprising the remains or traces of any such building, structure or erection, any cave, stone or natural product or any such tomb, grave, burial deposit or ritual, industrial or habitation site...*

Under Section 14 of the Principal Act (1930):

It shall be unlawful...

> *to demolish or remove wholly or in part or to disfigure, deface, alter, or in any manner injure or interfere with any such national monument without or otherwise than in accordance with the consent hereinafter mentioned (a licence issued by the Office of Public Works National Monuments Branch),*
>
> *or*
>
> *to excavate, dig, plough or otherwise disturb the ground within, around, or in the proximity to any such national monument without or otherwise than in accordance...*

Under Amendment to Section 23 of the Principal Act (1930),

> *A person who finds an archaeological object shall, within four days after the finding, make a report of it to a member of the Garda Síochána...or the Director of the National Museum...*

The latter is of relevance to any finds made during a watching brief.

In the 1994 Amendment of Section 12 of the Principal Act (1930), all the sites and 'places' recorded by the Sites and Monuments Record of the Office of Public Works are provided with a new status in law. This new status provides a level of protection to the listed sites that is equivalent to that accorded to 'registered' sites [Section 8(1), National Monuments Amendment Act 1954] as follows:

The Commissioners shall establish and maintain a record of monuments and places where they believe there are monuments and the record shall be comprised of a list of monuments and such places and a map or maps showing each monument and such place in respect of each county in the State.

The Commissioners shall cause to be exhibited in a prescribed manner in each county the list and map or maps of the county drawn up and publish in a prescribed manner information about when and where the lists and maps may be consulted.

In addition, when the owner or occupier (not being the Commissioners) of a monument or place which has been recorded, or any person proposes to carry out, or to cause or permit the carrying

out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Commissioners and shall not, except in the case of urgent necessity and with the consent of the Commissioners, commence the work for a period of two months after having given the notice.

The National Monuments Amendment Act enacted in 2004 provides clarification in relation to the division of responsibilities between the Minister of Environment, Heritage and Local Government, Finance and Arts, Sports and Tourism together with the Commissioners of Public Works. The Minister of Environment, Heritage and Local Government will issue directions relating to archaeological works and will be advised by the National Monuments Section and the National Museum of Ireland. The Act gives discretion to the Minister of Environment, Heritage and Local Government to grant consent or issue directions in relation to road developments (Section 49 and 51) approved by An Bord Pleanála and/or in relation to the discovery of National Monuments

14A. (1) The consent of the Minister under section 14 of this Act and any further consent or licence under any other provision of the National Monuments Acts 1930 to 2004 shall not be required where the works involved are connected with an approved road development.

(2) Any works of an archaeological nature that are carried out in respect of an approved road development shall be carried out in accordance with the directions of the Minister, which directions shall be issued following consultation by the minister with the Director of the National Museum of Ireland.

Subsection 14A (4) Where a national monument has been discovered to which subsection (3) of this section relates, then

(a) the road authority carrying out the road development shall report the discovery to the Minister

(b) subject to subsection (7) of this section, and pending any directions by the minister under paragraph (d) of this subsection, no works which would interfere with the monument shall be carried out, except works urgently required to secure its preservation carried out in accordance with such measures as may be specified by the Minister

The Minister will consult with the Director of the National Museum of Ireland for a period not longer than 14 days before issuing further directions in relation to the national monument.

The Minister will not be restricted to archaeological considerations alone, but will also consider the wider public interest.

Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999

This Act provides for the establishment of a national inventory of architectural heritage and historic monuments.

Section 1 of the act defines “architectural heritage” as:

(a) all structures and buildings together with their settings and attendant grounds, fixtures and fittings,

(b) groups of such structures and buildings, and,

(c) sites

which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

Section 2 of the Act states that the Minister (for Arts, Heritage, Gaeltacht and the Islands) shall establish the NIAH, determining its form and content, defining the categories of architectural heritage, and specifying to which category each entry belongs. The information contained within the inventory will be made available to planning authorities, having regard to the security and privacy of both property and persons involved.

Section 3 of the Act states that the minister may appoint officers, who may in turn request access to premises listed in the inventory from the occupiers of these buildings. The officer is required to inform the occupier of the building why entry is necessary, and in the event of a refusal, can apply for a warrant to enter the premises.

Section 4 of the Act states that obstruction of an officer or a refusal to comply with requirements of entry will result in the owner or occupier being guilty of an offence.

Section 5 of the Act states that sanitary authorities who carry out works on a monument covered by this Act will as far as possible preserve the monument with the proviso that its condition is not a danger to any person or property, and that the sanitation authority will inform the Minister that the works have been carried out.

The provisions in the Act are in addition to and not a substitution for provisions of the National Monument Act (1930–94), and the protection of monuments in the National Monuments Act is extended to the monuments covered by the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act (1999).

Significance Table (NRA Guidelines 2006)

The significance criteria table is not presented in any ranking order and can be used to evaluate the significance of an archaeological site, monument or complex. It should not, however, be regarded as definitive, rather it is an indicator which contributes to a wider judgment based on the individual circumstances of each feature. Different monument types lend themselves more easily to assessment and it should be borne in mind that this can create a bias in the record, for example an upstanding stone monument such as a fortified house is easier to examine with a view to significance than a degraded enclosure site.

Criteria	*Explanation*
Existing Status	The level of protection associated with a monument or complex is an important consideration.
Condition /Preservation	The survival of a monument's archaeological potential both above and below ground is an important consideration and should be assessed in relation to its present condition and surviving features. Well-preserved sites should be highighted, this assessment can only be based on a field inspection.
Documentation /Historical Significance	The significance of a monument may be enhanced by the existence of records of previous investigations or contemporary documentation supported by written evidence or historic maps. Sites with a definite historical association or an example of a notable event or person should be highlighted.
Group Value	The value of a single monument may be greatly enhanced by its association with related contemporary monuments or with monuments from different periods indicating an extended time presence in any specific area. In some cases it may be preferable to protect the complete group, including associated and adjacent land, rather than to protect isolated monuments within that group.
Rarity	The rarity of some monument types can be a central factor affecting response strategies for development, whatever the condition of the individual feature. It is important to recognise sites that have a limited distribution.
Visibility in the landscape	Monuments that are highly visible in the landscape have a heightened physical presence. The inter-visibility between monuments may also be explored in this category.
Fragility/ Vulnerability	It is important to assess the level of threat to archaeological monuments from erosion, natural degradation, agricultural activity, land clearance, neglect, careless treatment or development. The nature of the archaeological evidence cannot always be specified precisely but it may still be possible to document reasons to justify the significance of the feature. This category relates to the probability of monuments producing material of archaeological significance as a result of future investigative work.
Amenity Value	Regard should be taken of the existing and potential amenity value of a monument.

Assessment of material assets, as defined by the EPA:

Context	Describe the location and extent of the asset. Does it extend beyond the site boundary?
Character	Describe the nature and use of the asset. It is exploited, used or accessible? Is it renewable or non-renewable and if so over what period?
Significance	Describe the significance of the asset. Is the material asset unique, scarce or common in the region? Is its use controlled by known plans, priorities or policies? What trends are evident or may reasonably be inferred?
Sensitivity	Describe the changes in the existing environment which could limit the access to, or the use of, the material asset.

Glossary of Impacts as defined by the EPA:

Impacts are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact:

- A **direct impact** occurs when an item of archaeological heritage is located within the proposed development area and entails the removal of part, or all of the monument.

- **Indirect impacts** may be caused due to the close proximity of a development to an archaeological feature. Mitigation strategies and knowledge of detail design can often ameliorate any adverse indirect impact.

- **No predicted** impact occurs when the proposed development does not adversely or positively affect an archaeological site.

The impacts of the proposed development on the archaeological environment are first assessed in terms of their quality i.e. positive, negative, neutral (or direct and indirect):

- **Negative Impact** A change that will detract from or permanently remove an archaeological monument from the landscape.

- **Neutral Impact** A change that does not affect the archaeological heritage.

- **Positive Impact** A change that improves or enhances the setting of an archaeological monument.

A significance rating for these impacts is then given i.e. slight, moderate, significant or profound:

- **Profound** Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed by a proposed development.

- **Significant** An impact which, by its magnitude, duration or intensity alters an important aspect of the environment. An impact like this would be where the part of a site would be permanently impacted upon leading to a loss of character, integrity and data about the archaeological feature/site.

- **Moderate** A moderate direct impact arises where a change to the site is proposed which though noticeable, is not such that the archaeological integrity of the site is compromised and which is reversible. This arises where an archaeological feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible.

- **Slight** An impact which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument.

- **Imperceptible** An impact capable of measurement but without noticeable consequences.

Duration of Impacts

- **Temporary Impact** Impact lasting for one year or less.
- **Short-term Impacts** Impact lasting one to seven years.
- **Medium-term Impact** Impact lasting seven to fifteen years.
- **Long-term Impact** Impact lasting fifteen to sixty years.
- **Permanent Impact** Impact lasting over sixty years.

Types of Impacts

- **Cumulative Impact** The addition of many small impacts to create one larger, more significant, impact.
- **Do Nothing Impact** The environment as it would be in the future should no development of any kind be carried out.
- **Indeterminable Impact** When the full consequences of a change in the environment cannot be described.
- **Irreversible Impact** When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
- **Residual Impact** The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
- **'Worst case' Impact** The impacts arising from a development in the case where mitigation measures substantially fail.

Recorded Archaeological Monuments in the vicinity of the study area

The RMP was established under Section 12 of the National Monuments Act, 1994. It holds the name, location and brief descriptions of historical monuments or archaeological complexes throughout the country, at the discretion of the Minister. This provides legal protection for all monuments listed and mapped under Section 12 of the 1994 Amendment Act. The record consists of a list of monuments and places and a map showing each monument and place in respect of each county in the State. Two months notice must be given to the Minister for the Arts, Heritage and the Gaeltacht of any proposed works affecting a monument, place or archaeological area included in the Record of Monuments and Places or the Register of Historical Monuments (Section 5, National Monuments Amendment Act 1987).

RMP No: KK014-065 **Townland:** Loughmerans
Site Type: Enclosure site **NGR:** 25008/15884
Distance: c.65m north of the proposed route
Description: Marked on 1st edition OS map as a circular enclosure surrounded by mature trees. General situation as for KK019-064. The site is located on southeast end of a northwest/southeast ridge or hillock in a reclaimed field. There is no visible trace and the owner remembers the small wood and banks known locally as a 'rath'.

RMP No: KK014-064 **Townland:** Loughmerans
Site Type: Enclosure site **NGR:** 24999/15904
Distance: c.235m north of the proposed route
Description: Marked on 1st edition OS map as a circular enclosure. Situated on the east margin of the Nore valley, with the flat valley floor to the west. This is rolling glacial terrain consisting of many small north-south ridges and hillocks (lateral morraines). Land rises gently to east. Good views in all directions from top of ridges and hillocks. The area consists of mostly reclaimed or cultivated grassland. This site is situated on the eastern edge of one of these small ridges. There is no visible trace. Field has been reclaimed. There is a reference to a rath in Loughmerans (possible KK014-065?) that has been levelled, possibly 25 yards diameter based on 'marks on the ground' (Doyle 1981, source NMI Topographical Files).

RMP No: KK019-010 **Townland:** Baun
Site Type: Enclosure site **NGR:** 25055/15865
Distance: N/A
Description: Marked on 1st edition OS map as a circular enclosure. This site was excavated in advance of the N77 Ringroad extension in 2003 by Robert O'Hara (Licence No.03E1720, testing). No archaeological material was found at the site of this hilltop enclosure. A letter from Martin Reid (National Monuments Section, DAHG) in file: O'Hara recommended that the original identification was erroneous and the site should be struck from the RMP (seconded by M. Reid).

RMP No: KK019-011 **Townland:** Glendine
Site Type: Enclosure **NGR:** 250690/ 158280
Distance: c. 355m southeast of the proposed route
Description: Marked on 1st edition OS map. No file description. Doyle 1981: 'Part of the rath in Glendine is removed. It is on the brow of a steep hill. Its entrance, which faced south, is approached from level ground at the top of a steep hill. Measures 30 yards across its centre. Situated c.1/4 mile from the rath in Loughmeran.'

RMP No: KK019-063 **Townland:** Loughmerans
Site Type: Crannóg **NGR:**
Distance: c. 840m north of the proposed route
Description: OPW 1986: Bordered by dykes of River Nore to west, quarries to south where ground rises sharply, modern concrete works to east. Situated in an almost impassable field of 'red bog'. A low man-made platform, c.25m diameter, rising c.1m above the surrounding bog. No visible traces of habitation remains. Definitely not a natural feature.
OPW 1987: Situated in very low-lying bog, the bed of an old lake. Low hills to north, south and east and fairly low-level land of Nore valley to west. Not possible to visit the site as it was too wet and marshy. Visible from the edge of the bog as a low circular grassy mound. Possibly a crannóg or natural island. Farmer says it has always been explained as the spoil from old drainage schemes.

RMP No: KK019-006 **Townland:** Raheenagun
Site Type: Ringfort **NGR:** 248760/ 157660
Distance: c.1.5km southwest of the proposed route
Description: Marked on 1st edition OS map and 1945-6 edition. O'Kelly (1969, 24) names this as 'Ráithín na gcon', little rath of the hounds, and describes it as a small partly demolished rath at 210 feet. No file description.

RMP No: KK019-008 **Townland:** Talbotsinch
Site Type: Enclosure **NGR:** 249850/ 157630
Distance: c.1km south of the proposed route
Description: Marked on 1st edition OS map and 1945-6 edition. No file description.

Detailed methodology

Record of Monuments and Places (RMP) and Sites and Monuments Record (SMR)
The primary source of information for the desk study is the Record of Monuments and Places (RMP) of the DAHG. The Sites and Monuments Record (SMR), as revised in the light of fieldwork, formed the basis for the establishment of the statutory RMP pursuant to Section 12 of the National Monuments (Amendment) Act, 1994. The RMP records known upstanding archaeological monuments, their original location (in cases of destroyed monuments) and the position of possible sites identified as cropmarks on vertical aerial photographs. It is based on a comprehensive range of published and publicly available documentary and cartographic sources. The information held in the RMP files is read in conjunction with constraint maps (published at reduced six-inch scale). The RMP is constantly updated and is the first stage in the preparation of a national archaeological survey; inventories are published at an interim stage.

The RMP number consists of two parts: the number of the six-inch sheet on which the site is located, followed by the number of the individual monument. A county code, such as KK for Kilkenny, is included, e.g. KK014-064.

The topographical files of the National Museum of Ireland
The topographical files of the National Museum of Ireland (NMI) identify recorded stray finds held in the museum's archive. The files, which are donated to the state in accordance with national monuments legislation, are provenanced to townland and sometimes include reports on excavations undertaken by NMI archaeologists earlier in the twentieth century.

Documentary and cartographic sources
The documentary sources used are detailed in the bibliography below. Cartographic sources consulted for this report include William Petty's Down Survey map of the Barony of Gowran in County Kilkenny, dated *c*. 1656; the first and revised edition maps of the OS six-inch series for Kilkenny (1839 & 1900).

Excavations Bulletins and Excavations Database
'Excavations' is an annual bulletin that contains summary accounts of all excavations carried out annually in Ireland. The bulletins range from 1970 to 2009, and most can now be accessed on the web at www.Excavations.ie. Compiled from the published excavation bulletins the online database contains summary accounts of all excavations carried out from 1985 to 2009. The bulletins and database were consulted to establish the results of excavations that may previously have been undertaken at sites or as a consequence of development in the environs of the scheme.

County Council Development Plan 2008–2014
The primary source of architectural information is the Kilkenny County Development Plan (2008–2014) which was consulted for Protected Structures and Architectural Conservation Areas within the study area.

National Inventory of Architectural Heritage (NIAH)
The Survey of the Architectural Heritage of Kilkenny (2004/5) is one of a series of surveys published by the National Inventory of Architectural Heritage (NIAH). Compiled by the Department of the Environment Heritage & Local Government (DAHG), the NIAH is an extensive evaluated record of the

architectural heritage of Ireland, concentrating on the post-medieval period. The inventory was formally established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. The inventory will provide the basis for the recommendations of the Minister of the Environment and Local Government to planning authorities to include structures, generally given ratings of regional, national or international significance, in the RPS.

Built Heritage Inventory of the Heritage Audit of the Northern River Nore (Kilkenny County Council 2009)

This constitutes an inventory of the built heritage of the northern River Nore, with accompanying images and mapping. This project represented the first systematic, integrated and comprehensive survey of the northern River Nore's heritage in Kilkenny. The inventory contains a sequential list of the 161 built heritage sites. Each entry has a unique identifier number (KN-#) followed by the townland and site name, which is replicated in the accompanying mapping.

Irish Architectural Archive

11.4.1.1.1 The Irish Architectural Archive on Merrion Square, Dublin 2, was established in 1976 to collect and preserve records of Irish architectural heritage, and since then it has established itself as the principal source of records and information concerning architecture and architects in Ireland during all periods. In addition to an extensive reference library, the archive's collection includes a significant body of historical Irish architectural drawings and one of the largest collections of photographs in the country.

Aerial photographs

Colour aerial photographs of the lands proposed for the route were examined online for any evidence for cropmarks or earthworks in the vicinity of the study area (www.archaeology.ie). Further analysis was undertaken of colour aerial photographs taken of the area in 2007, supplied by Clifton Scannell Emerson.

Field inspection

The land within the proposed route was inspected on 24th January 2013. The field inspection was undertaken to assess current and previous land use, access to the site, local topography and any additional environmental information relevant to the site's appraisal. It also sought to identify any low-visibility archaeological features with little surface expression and to identify properties, structures or features considered to be of architectural or cultural heritage merit.

Geophysical Survey

A geophysical survey was carried out by J. M. Leigh Surveys in April 2013 along the route of the proposed N77 ring road extension (Licence No. 13R41). The aim of the geophysical survey was to identify and locate the nature and extent of any potential below-ground archaeological sites and remains. Geophysical survey is a non-invasive method of examining the below-ground archaeological potential without disturbing the surface of the fields. The benefits of availing of this technique are that it can cover a large amount of ground rapidly and provide definition on the nature, extent and often plan layout of below-ground sites. A summary of the survey results is incorporated into this report and is accompanied by summary greyscale and interpretation drawings (Figures 7-10). The complete geophysical survey report is provided as a separate report.

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APPENDIX O

Geophysical Survey Report

GEOPHYSICAL SURVEY REPORT

N77 NORTHERN RING ROAD EXTENSION,

KILKENNY

COUNTY KILKENNY

LICENCE NUMBER: 13R41

30/04/2013

CLIENT:

CLIFTON SCANNELL EMERSON & ASSOCIATES
&
COURTNERY DEERY HERITAGE CONSULTANCY

J.M.Leigh surveys

124 Oaklawn West, Leixlip, County Kildare Tel: 0879062729. info@jmlsurveys.com

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GEOPHYSICAL SURVEY SUMMARY SHEET
N77 NORTHERN RING ROAD EXTENSION, KILKENNY.

Site Name	N77 Northern Ring Road Extension, Kilkenny	**Ref No.**	13007
Townland	Loughmerans, Troyswood	**Licence No.**	13-R-41
County	Kilkenny	**Licence Holder**	Joanna Leigh
Area NGR (centre)	E649773 / N658821	**Purpose**	Proposed road
Clients	Clifton Scannell Emerson Associates		

Closest RMP	KK014:065	**Classification**	Enclosure
NGR	E650019 / N658887	**Distance**	c.65m to the north of the road scheme
Townland	Loughmerans		

Current land use	Eight fields within application area. Some consisting of pasture and crop.

Survey Type 1	Gradiometer Scanning	**Method**	Scanning mode @ 10m intervals
Instrument	Bartington Grad 601-2	**Survey Area**	1.5 km in length. Typically 40m corridor

Survey Type 2	Detailed Gradiometer	**Method**	Zig-Zag traverses
Instrument	Bartington Grad 601-2	**Grid size**	40m
Sample Int.	0.25m	**Orientation**	NW-NE
Traverse Int.	1.00m	**Survey Area**	3 areas totalling 1.7 hectares

Summary of Results

Detailed gradiometer survey was conducted in three areas (Areas A to C) to investigate anomalies identified in the gradiometer scanning. Although responses of magnetic strength have been identified in the detailed surveys, no clear archaeological patterns are evident, and natural features, representing variations in the sub-soil are most likely represented.

In Area A, a faint curvilinear trend and an area of increased background response were identified. It is possible that plough damaged archaeology is represented here. However, archaeological interpretation is cautious as it is equally likely that natural features are represented here.

Area B has numerous amorphous responses, indicative of natural features in the sub-soil.

Negative linear trends in Area C correlate with the location of a former field boundary. Further parallel linear trends are indicative of ploughing activity. Isolated responses and an area of increased background response have also been identified in Area C. However, interpretation is tentative as there is no clear archaeological pattern. It is likely that natural variations have been identified here.

Report Date	30/04/2013	**Report Author**	Joanna Leigh

Geophysical Survey Report

N77 Northern Ring Road Extension, Kilkenny, County Kilkenny

1 Introduction

1.1 A geophysical survey has been conducted along the proposed N77 northern ring road extension, Kilkenny, County Kilkenny. The proposed road will connect the R693 Freshford Road with the N77 Castlecomer Road, travelling through the townland of Troyswood, crossing the River Nore, and finishing in the townlands of Loughmerans and Dunmore. The proposed road is c.1.6km in length. A location diagram is presented in Figure 1.

1.2 The geophysical survey forms part of a wider archaeological study, undertaken by Courtney Deery Heritage Consultancy, on behalf of Clifton Scannell Emerson & Associates. Survey fieldwork was conducted under licence 13-R-41, issued by the Department of Arts, Heritage and the Gaeltacht.

1.3 There are no recorded archaeological sites located along the proposed route of the ring road extension. An enclosure site (KK014:065) is recorded c.65m north of the proposed route in Loughmerans townland. The enclosure is located on a natural topographical hill and ridge running to the north, where a second enclosure site (KK014:064) is recorded. The proposed road is situated to the south of the natural hill and the enclosure (Figure 1).

1.4 Another enclosure (KK019:10) has been recorded at the location of the Castlecomer Roundabout, where the proposed scheme meets the N77 Castlecomer Road.

1.5 The main aim of the geophysical survey was to identify any potential archaeological remains along the corridor of the proposed road scheme. A preliminary gradiometer scan and targeted detailed survey were conducted.

2 Survey Methodology

2.1 A preliminary gradiometer scan of the road corridor, totalling c.4.8 hectares along the 1.6km route, was undertaken to identify magnetic anomalies of potential archaeological origin. Fields 1 to 8 were subject to gradiometer scanning. Anomalies identified were subject to detailed recorded gradiometer survey, and three areas (Areas A, B and C) were positioned to investigate the results of the gradiometer scanning. The location of the detailed survey areas and scanning notes are presented in Figure 2, at a scale of 1:4,000.

Preliminary Gradiometer Scanning

2.2 Gradiometer scanning is a fast and effective technique for identifying areas of potential archaeological interest. Scanning is used in conjunction with targeted detailed survey, and is effective when assessing large sites.

2.3 The gradiometer instrument is set to scanning mode. 10m traverses of the application area are undertaken. The magnetic fluctuations on the instrument display panel are monitored and any anomalies of potential interest observed are marked in the field for further investigation through detailed gradiometer survey.

Detailed Gradiometer Survey

2.4 A detailed gradiometer survey detects subtle variations in the local magnetic field and measurements are recorded in nano-Tesla (nT). Some archaeological features such as ditches, large pits and fired features have an enhanced magnetic signal and can be detected through recorded survey.

2.5 Data was collected with a sample interval of 0.25m and a traverse interval of 1m, providing 6400 readings per 40m x 40m grid. The instrument was calibrated as recommended by the manufacturers' guidelines.

2.6 Detailed survey areas were set out and tied in to features on the ground with a total station instrument. Detailed tie in information is available on request.

3 Data Display

3.1 Summary diagrams (Figures 3 to 6) present the results of detailed survey in Areas A, B and C. The summary diagrams display greyscale images of the data with and accompanying interpretation drawings. All the summary diagrams are displayed at a scale of 1:1,500.

3.2 Numbers in parentheses in the text of the report refer to specific responses highlighted in the detailed gradiometer survey interpretation diagrams.

3.3 The raw gradiometer data is displayed as a series of archive diagrams in Figures 7 to 9 and present the data as a series of xy-trace plots, greyscale images and interpretation drawings, all at a scale of 1:625.

3.4 The display formats referred to above, and the interpretation categories are discussed in the summary technical information section at the end of this report.

4 Gradiometer Scanning Results (Figure 2)

4.1 Gradiometer scanning was undertaken in all areas available (Fields 1to 8) along the proposed road corridor. In general, background magnetic variation along the proposed route varied, with areas of broad magnetic variations noted in the gradiometer scanning.

Fields 1 & 2

4.2 Gradiometer scanning in Field 1 identified a broad area of magnetic disturbance at the western extent of the field. This is modern in origin, resulting from the adjacent road, fencing and field gate. No anomalies of interest were identified in Field 1.

4.3 Isolated anomalies were identified in Field 2, but were of unclear archaeological potential. The anomalies were of indeterminate origin. Detailed survey Area (A) was positioned in Field 2 to investigate the isolated anomalies.

Fields 3, 4 and 5

4.4 Scanning in Fields 3 and 4 identified numerous broad anomalies of potential interest. The anomalies were detected throughout the fields, and extent of the responses could not be determined. Detailed survey Area B was positioned in Field 3 to investigate the broad scanning anomalies.

4.5 In Field 5, isolated anomalies were detected. Field 5 was considered to be of interest due to the proximity of the recorded enclosure site (KK014:065). Detailed survey Area C was positioned here to investigate any archaeological potential.

Fields 6, 7 and 8

4.6 Gradiometer scanning in Field 6 identified significant magnetic disturbance throughout. It was noted at the time of survey that the ground level in Field 6 was higher than that in the adjacent Field 5. It is likely that Field 6 comprises of made ground, perhaps with the addition of gravel material to improve drainage. Regardless, this field is magnetically disturbed and no archaeological interpretation can be provided. It must be noted that any responses of potential archaeological interest may be masked by the significant disturbance, and remain undetected.

4.7 To the immediate east of Field 6 an area of mature vegetation and trees was not suitable for survey.

4.8 Fields 7 and 8 were magnetically disturbed from modern activity. No further survey could be undertaken due to the magnetic disturbance.

5 Detailed Gradiometer Survey Results

Area A (Figures 3 & 4)

5.1 Numerous ferrous responses scatter the data set. These are most likely modern in origin, and are not of archaeological interest.

5.2 A curvilinear trend and increased magnetic response (1) have been identified in the east of the data set. It is possible that a spread of burnt material of archaeological interest is located here. However, the responses are magnetically weak and barely discernable in the data set. It is equally likely that natural variations in the sub-soil have been detected. Archaeological interpretation is tentative.

Areas B & C (Figures 5 & 6)

5.3 Area B is dominated by broad magnetic responses. Although the magnetic strength of the responses is typical of archaeological features, there is no archaeological pattern evident. The responses are amorphous and indicative of natural features. No archaeological interpretation can be provided, and the natural responses may mask any archaeology present.

5.4 A broad response (2) is evident in the south-western corner of Area C. Although it is possible that a large pit-type feature is located here, the response is similar in strength and form to the natural responses identified in Area B. Response (2) is interpreted as of most likely natural origin.

5.5 Negative linear trends (3) in Area C are suggestive of ditched features and correlate with the location of a former field boundary. Within (3) is an area of magnetic disturbance resulting from the electricity pole. Parallel linear trends, indicative of ploughing activity are perpendicular to the probable former field boundary.

5.6 Numerous isolated responses and linear responses (4) may be of interest. Although it is possible that further agricultural features are located here, plough damaged boundary feature are equally likely. Archaeological interpretation is tentative as there is no clear archaeological pattern or form.

5.7 A linear trend and several broad responses (5) may be of interest, perhaps representing another former boundary feature. However, the responses have no clear archaeological pattern and it is likely that a natural feature is represented here.

5.8 An area of increased response (6) may represent a spread of burnt material although variations in the sub-soil are equally possible. A natural interpretation is preferred as there is no clear archaeological pattern.

6 Discussion and Conclusion

6.1 The gradiometer scanning identified several anomalies and areas presenting increased background response. Detailed survey Areas A, B, and C were positioned to investigate.

6.2 In Area A, may of the isolated responses present as modern ferrous responses. A curvilinear trend and area of increased responses may be of interest, perhaps representing an area of burning or a burnt spread of material. However, there are no clear responses indicative of archaeology, and it is possible that natural variations in the sub-soil have been detected.

6.3 Area B is littered with amorphous responses indicative of natural variations. No archaeological interpretation can be provided.

6.4 In Area C, parallel negative trends correspond with the location of a former field boundary. Parallel linear trends perpendicular to this are indicative of ploughing activity. There are some linear trends and broad responses, however, there is no clear archaeological pattern, and these responses are interpreted as of most likely natural origin.

6.5 Although the geophysical survey identified responses of potential interest, there are no clear archaeological patterns evident in the data sets and it is equally likely that natural variations and agricultural practices have been detected. An archaeological interpretation of the results is cautious.

6.6 Consultation with a licensed archaeologist and with the Department of Arts, Heritage and the Gaeltacht is recommended to establish if any additional archaeological works are required.

Technical Information Section

Instrumentation & Methodology

Fluxgate Gradiometer Survey

Gradiometer survey is the most frequently applied survey instrument as it can be used in 'Scanning' or detailed survey mode.

Scanning

This is a fast and effective reconnaissance technique. The instrument is set in scanning mode and regular traverses of the investigation area are made, usually at 10m intervals. This allows a fast and effective scan of the application area, looking for any responses which may be of archaeological potential. As the traverses are made, the operator observes the instrument readout, and any responses of interest are marked for further investigation.

Detailed Gradiometer Survey

This is conducted to clearly define any responses detected during scanning, or can be applied as a stand alone methodology. Detailed survey is often applied with a sample interval of 0.25m and a traverse interval of 1m. This allows detection of potential archaeological responses. Data is collected in grids 20m x 20m, and data is displayed accordingly. A more detailed survey methodology may be applied where archaeological remains are thought likely. A survey with a grid size of 10m x 10m and a traverse interval of 0.5m will provide a data set with high resolution.

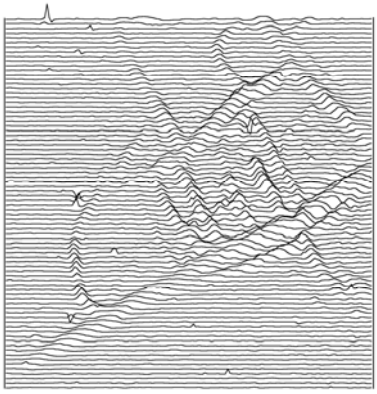
Bartington GRAD 601-2

The Bartington Grad 601-2 instrument is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey very fast and effective. The sensors have a separation of 1m allowing greater sensitivity.

Frequent realignment of the instruments and zero drift correction; ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.1nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

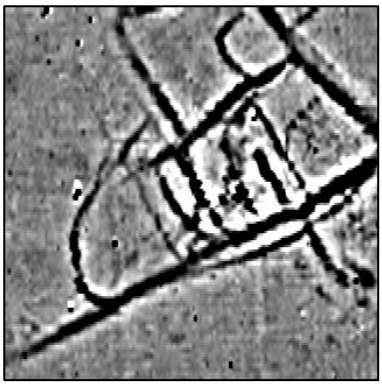
Gradiometer Data Display & Presentation

XY Trace



The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.

*Greyscale**



As with dot density plots, the greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection. In the summary diagrams processed, interpolated data is presented. Raw un-interpolated data is presented in the archive drawings along with the xy-trace plots.

Interpretation

An interpretation of the data is made using many of the plots presented in the final report, in addition to examination of the raw and processed data. The project managers' knowledge and experience allows a detailed interpretation of the survey results with respect to archaeological potential.

**XY Trace and raw greyscale plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation.*

Glossary of Interpretation Terms

Archaeology

This category refers to responses which are interpreted as of clear archaeological potential, and are supported by further archaeological evidence such as aerial photography or excavation. The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, storage pits and associated features.

? Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

? Industrial

Such anomalies generally possess a strong magnetic response and may equate with archaeological features such as kilns, furnaces, concentrations of fired debris and associated industrial material.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent or archaeological cultivation activity.

? Natural

A broad response resulting from localised natural variations in the magnetic background of the subsoil; presenting as broad amorphous responses most likely resulting from geological features.

Ferrous Response

These anomalies exhibit a typically strong magnetic response, often referred to as ‘iron spikes,’ and are the result of modern metal debris located within the topsoil.

Area of Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.

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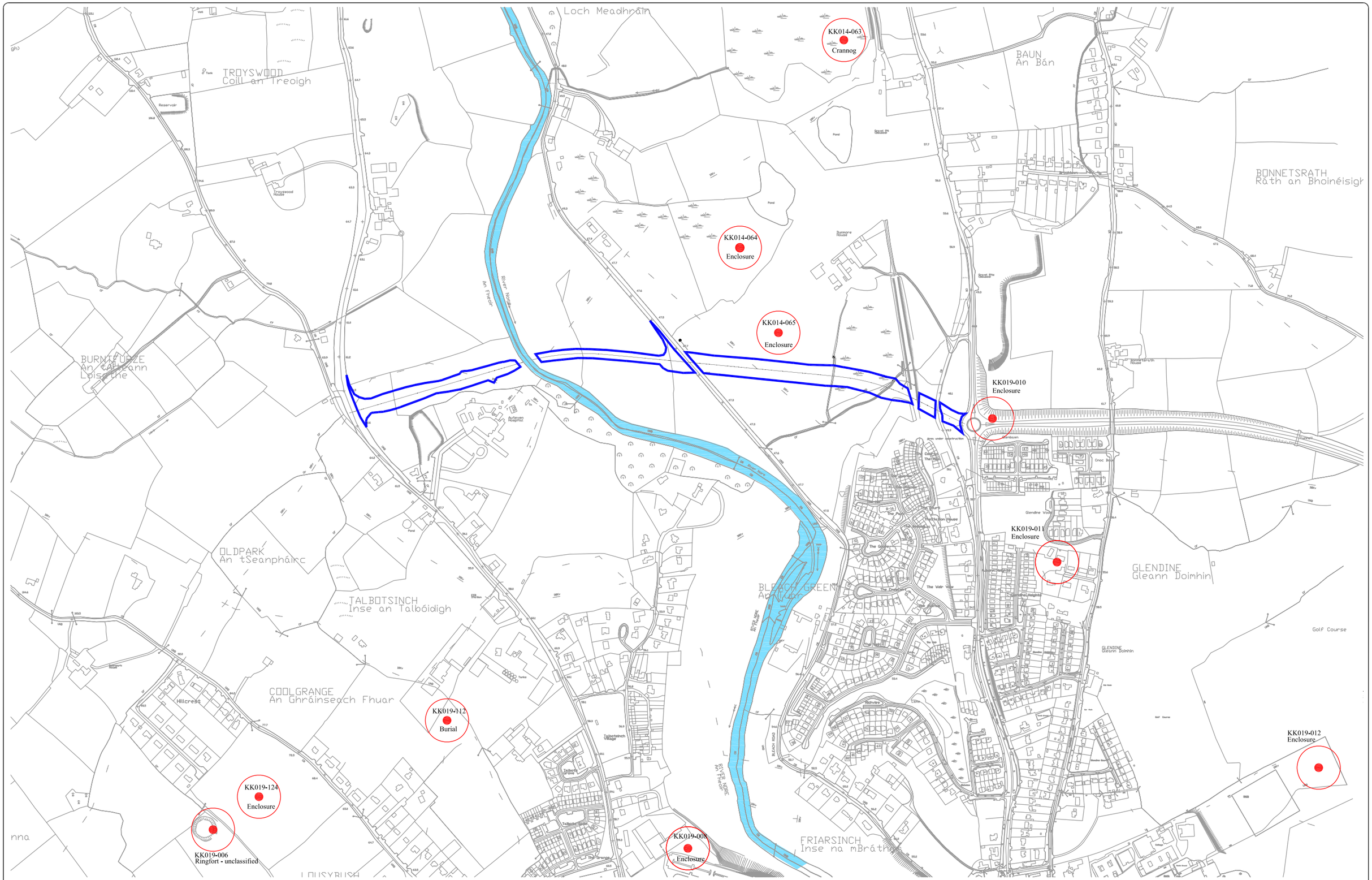
List of Figures



0 metres 320

Client: CLIFTON SCANNELL EMERSON ASSOCIATES

Project: GEOPHYSICAL SURVEY: N77 NORTHERN RING ROAD EXTENSION, KILKENNY

Title: SITE LOCATION DIAGRAM

J.M.Leigh surveys
www.jmlsurveys.com

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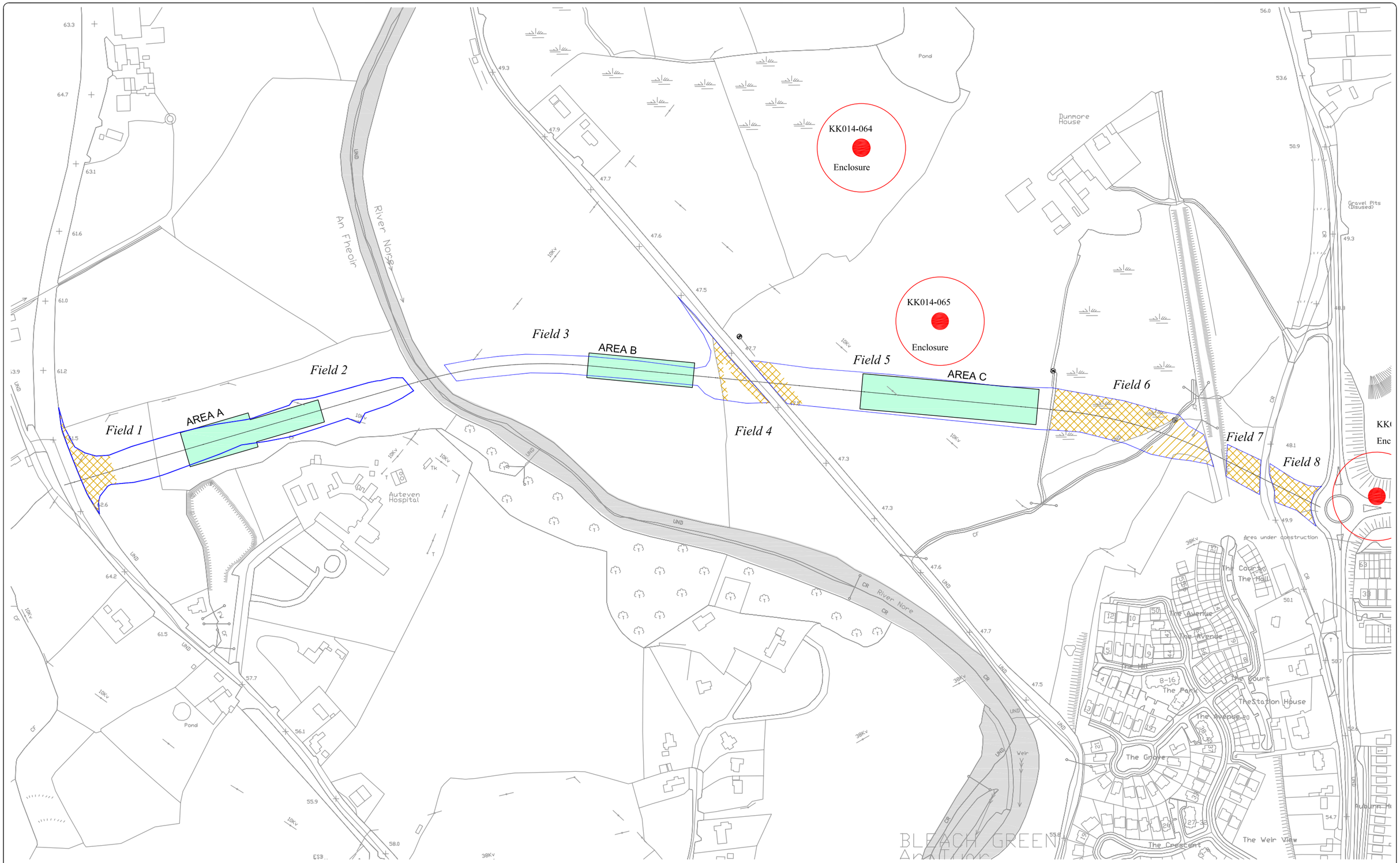
Issue Date:	30.04.2013



Proposed road corridor
Gradiometer scanning

Scanned area
of magnetic disturbance

Not suitable for survey - trees

Detailed gradiometer survey

0 metres 160

Client: CLIFTON SCANNELL EMERSON ASSOCIATES

Project: GEOPHYSICAL SURVEY: N77 NORTHERN RING ROAD EXTENSION, KILKENNY

Title: GRADIOMETER SURVEY SURVEY LOCATION DIAGRAM

J.M.Leigh surveys
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Scale @ A3:	1:4,000
Figure:	2
Licence No.:	13 - R - 41
Issue Date:	30.04.2013

0 metres 60

Client:	Project:	Title:		
CLIFTON SCANNELL EMERSON ASSOCIATES	GEOPHYSICAL SURVEY: N77 NORTHERN RING ROAD EXTENSION, KILKENNY	GRADIOMETER SURVEY AREA A: GREYSCALE IMAGE	J.M.Leigh surveys www.jmlsurveys.com	Scale @ A4: 1:1,500 Figure: 3 Licence No.: 13-R-41 Issue Date: 30.04.2013

? Archaeology | Trend | Area of increased response | Modern ferrous response

0 metres 60

Client: CLIFTON SCANNELL EMERSON ASSOCIATES	Project: GEOPHYSICAL SURVEY: N77 NORTHERN RING ROAD EXTENSION, KILKENNY	Title: GRADIOMETER SURVEY AREA A: GREYSCALE IMAGE	J.M.Leigh surveys www.jmlsurveys.com	Scale @ A4: 1:1,500 Figure: 4 Licence No.: 13-R-41 Issue Date: 30.04.2013

KK014-065
Enclosure

Field 3

Field 4

Field 5

Field 6

AREA B

AREA C

47.5

47.7

47.5

47.3

47.3

47.6

10KV

10KV

UND

UND

CF

3.5

nT

-2.5

Magnetic Disturbance

0 metres 80

Client:
CLIFTON SCANNELL EMERSON ASSOCIATES

Project:
GEOPHYSICAL SURVEY:
N77 NORTHERN RING ROAD EXTENSION, KILKENNY

Title:
GRADIOMETER SURVEY
AREAS B & C: GREYSCALE IMAGE

J.M.Leigh surveys
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Scale @ A3:	1:1,500
Figure:	5
Licence No.:	13 - R - 41
Issue Date:	30.04.2013

KK014-065
Enclosure

Field 3

Field 4

Field 5

Field 6

AREA B

AREA C

47.5

47.7

47.5

47.3

47.3

47.6

10KV

10KV

UND

UND

CF

? Archaeology / ? Natural

Trend

Negative trend

Ploughing

Area of increased response

Magnetic Disturbance

Modern ferrous response

0 metres 80

Client: CLIFTON SCANNELL EMERSON ASSOCIATES

Project: GEOPHYSICAL SURVEY: N77 NORTHERN RING ROAD EXTENSION, KILKENNY

Title: GRADIOMETER SURVEY AREAS B & C: INTERPRETATION

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Issue Date: 30.04.2013

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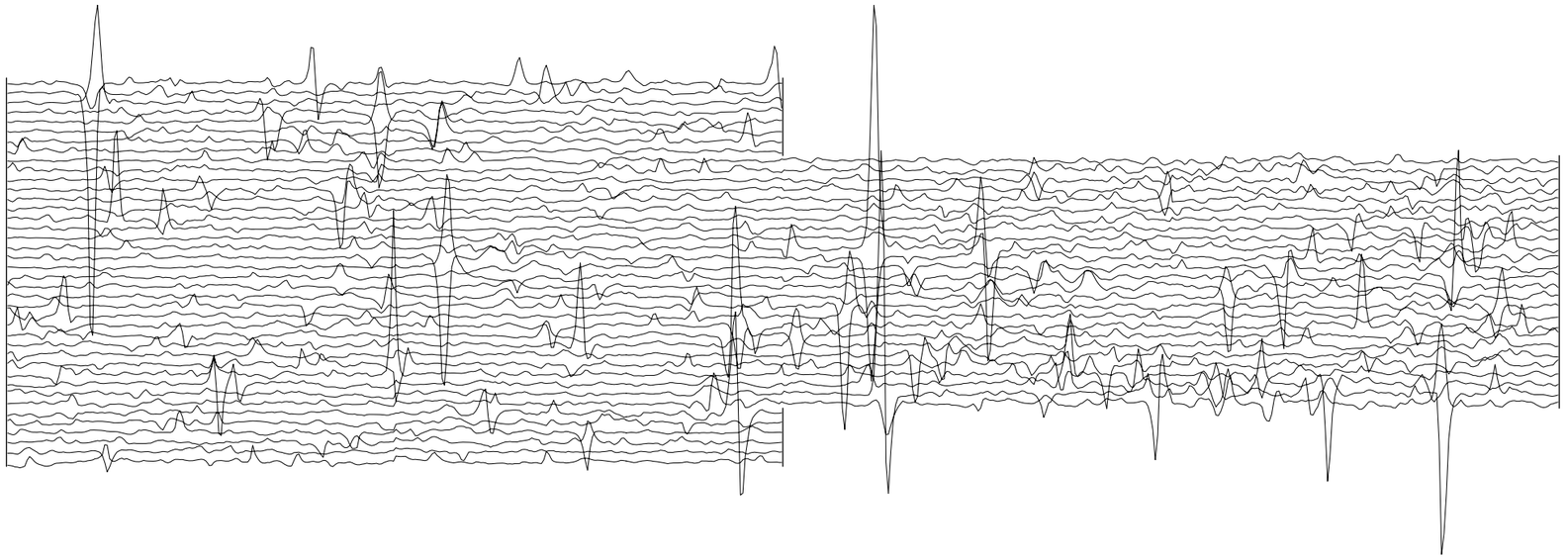
AREA A



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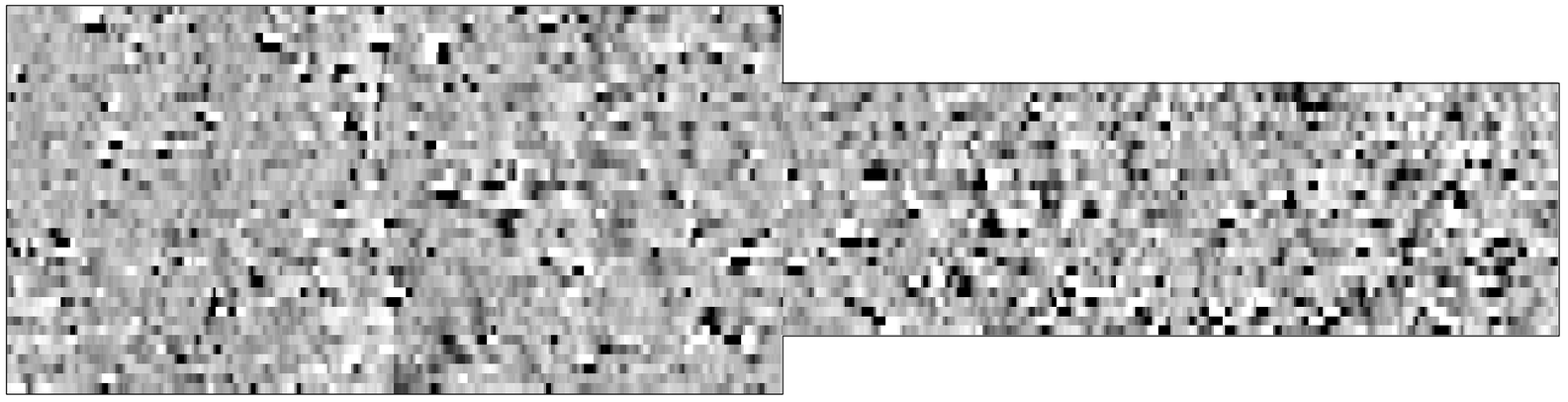

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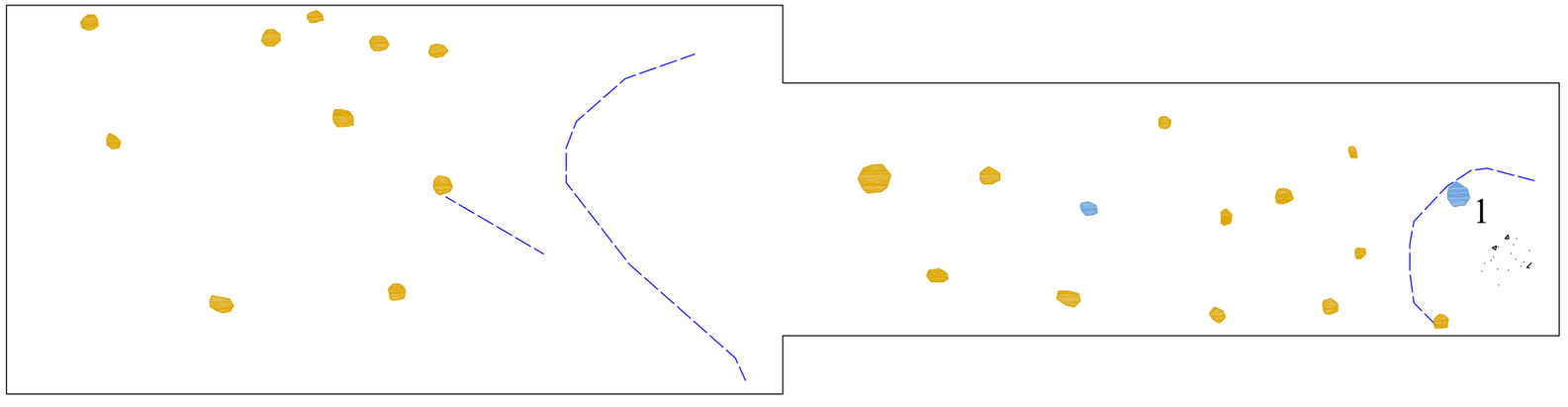
nT
-2.5



? Archaeology

Trend

Area of increased response

Modern ferrous response

0 metres 25

Client:
CLIFTON SCANNELL EMERSON ASSOCIATES

Project:
GEOPHYSICAL SURVEY:
N77 NORTHERN RING ROAD EXTENSION, KILKENNY

Title:
GRADIOMETER SURVEY
AREA A ARCHIVE PLOT:
XY TRACE, GREYSCALE
IMAGE & INTERPRETATION

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Issue Date:	30.04.2013

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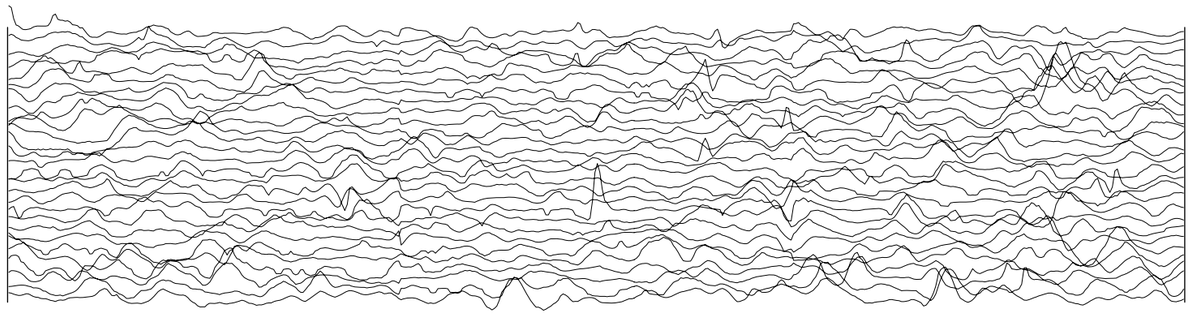
AREA B



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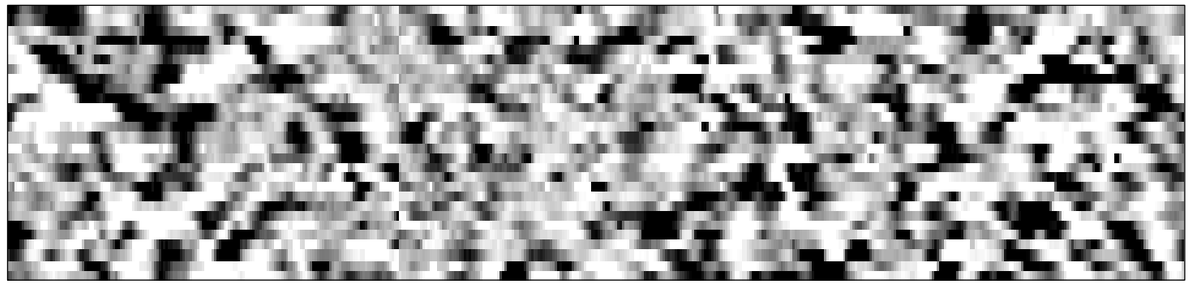

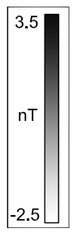

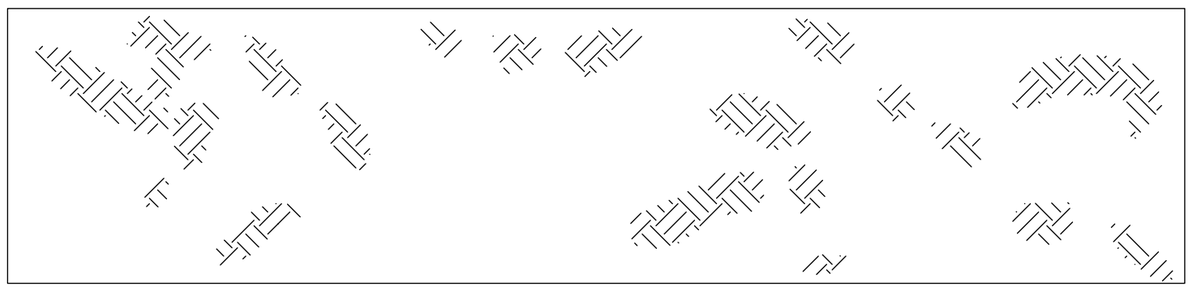

Natural Response

0 metres 25

Client:
CLIFTON SCANNELL EMERSON ASSOCIATES

Project:
GEOPHYSICAL SURVEY:
N77 NORTHERN RING ROAD EXTENSION, KILKENNY

Title:
GRADIOMETER SURVEY
AREA B ARCHIVE PLOT:
XY TRACE, GREYSCALE
IMAGE & INTERPRETATION

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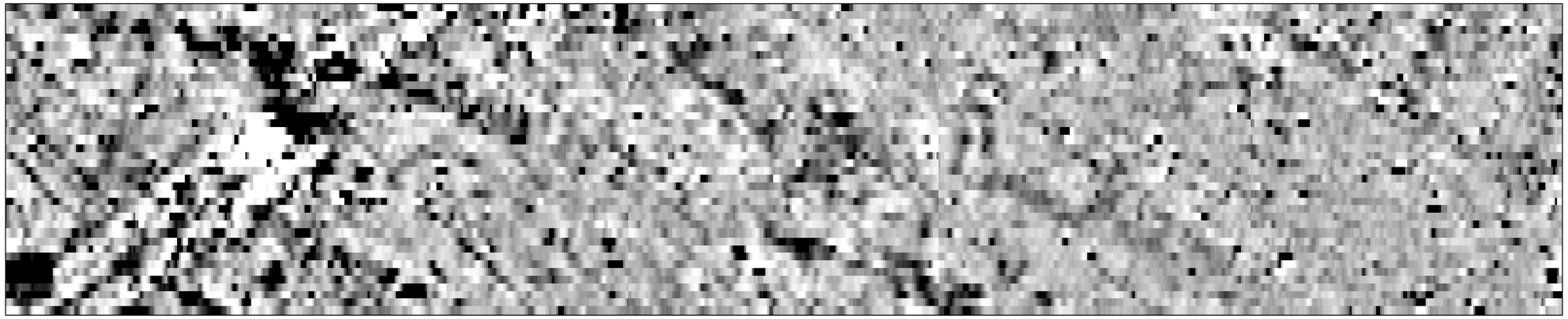
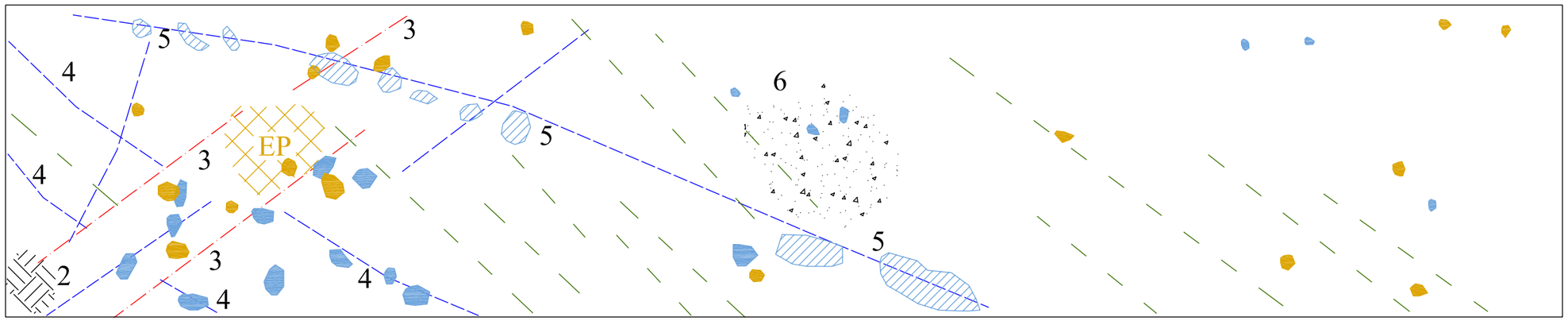
Issue Date:	30.04.2013

ARCHIVE
AREA C

20 nT



3.5
nT
-2.5



? Archaeology /
? Natural

Trend

Negative trend

Ploughing

Area of increased response

Magnetic Disturbance

Modern ferrous response

0 metres 25

Client:
CLIFTON SCANNELL EMERSON
ASSOCIATES

Project:
GEOPHYSICAL SURVEY:
N77 NORTHERN RING ROAD EXTENSION,
KILKENNY

Title:
GRADIOMETER SURVEY
AREA C ARCHIVE PLOT:
XY TRACE, GREYSCALE
IMAGE & INTERPRETATION

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Figure:	9
Licence No.:	13 - R - 41
Issue Date:	30.04.2013

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