F.0 LANDSIM ASSESSMENT

METHODOLOGY

F.1 The impact of the leachate leakage from the existing dilute and disperse landfill on groundwater resources and the effectiveness of the proposed engineered containment and leachate management systems, was examined by a probabilistic risk assessment undertaken using LandSim software. This is a specially designed environmental software package produced by Golder Associates (UK) Ltd under contract from the Environment Agency (England and Wales) and recognised by the Environment Protection Agency (Ireland). LandSim enables the impact of multiple phases of landfill operations to be modelled simultaneously, so that the cumulative impact of the landfill leakage on groundwater resources can be examined at various stages of development. It is based on the prevailing geological conditions determined by the exploratory site investigations, and the design of the engineered containment system.

F.2 The probabilistic risk modelling approach enables uncertainties in input parameters to be represented by specifying maximum/minimum and most likely distribution values, rather than the limited approach of single deterministic input calculations. This facilitates modelling of a range of values to account for variations in incident rainfall, leachate composition, elements of the engineered containment and drainage systems and the prevailing geological and hydrogeological conditions of the site.

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LANDSIM MODEL INPUT PARAMETERS

F.3 The distribution input values and default leachate parameters modelled are presented in Tables E.1 and E.2.

F.4 The input parameters for the LandSim models were entered for three different phases of the Ballynacarrick landfill site identified as the existing dilute and disperse landfill (Phase I), the engineered containment phase of the existing site (Phase II) and the proposed engineered containment system of the extension (Phase III) to which this Environmental Statement applies.

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Table F.1 LandSim Input Parameters

Model Parameter	Unit	Value			Distribution	Justification
		Minimum	Most Likely	Maximum		
Infiltration						
Uncapped Phase	mm/yr	-	687	-	Normal (SD 10%)	Effective Rainfall
Temporary Capped Phase	mm/yr	-	172	-	Normal (SD 10%)	25% Effective Rainfall
Capped Phase	mm/yr	-	68	-	Normal (SD 10%)	10% Effective Rainfall
Phase Dimensions						
Phase 1 (Dilute and Disperse Landfill)						
Landfill top area	Ha	-	5.4	-	Single Value	Phase Dimensions
Landfill base area	Ha	-	5.4	-	Single Value	Phase Dimensions
Number of Cells	Nr	-	1	-	Single Value	Phase Development
Cell Dimensions	m	-	180x300	-	Single Value	Phase Area
Phase 2 (Existing Contained Cell)						
Landfill top area	Ha	-	1.08	-	Single Value	Phase Dimensions
Landfill base area	Ha	-	1.08	-	Single Value	Phase Dimensions
Number of Cells	Nr	-	2	-	Single Value	Engineered Design
Cell Dimensions	m	-	180x30	-	Single Value	Phase Area
Phase 3 (Proposed Contained Extension)						
Landfill top area	Ha	-	3.6	-	Single Value	Phase Dimensions
Landfill base area	Ha	-	3.6	-	Single Value	Phase Dimensions
Number of Cells	Nr	-	4	-	Single Value	Engineered Design
Cell Dimensions	m	-	180x50	-	Single Value	Phase Area
Leachate Source						
Phase 1, 2 & 3						
Final Waste Thickness	m	4	6	8	Uniform	Site Capacity and Area
Field Capacity of Waste	Fraction	0.1	0.2	0.3	Uniform	LandSim Default Values
Leachate Inventory	mg/l	See Table E.2			Log Triangular	LandSim Default leachate inventory
Drainage Information						
Phase 1 (No Leachate Drainage System)						
No Drainage System Present		-	-	-		Leakage calculated for fixed leachate head of 1.0m
Phase 2 & 3 (Drainage Blanket)						
Slope to Sump	Gradient	-	1:50	-	Single Value	Engineered Design
Sump Diameter	m	-	3	-	Single Value	Engineered Design
Blanket Thickness	m	-	0.5	-	Single Value	Engineered Design
Drainage blanket permeability	m/s	1×10^{-3}	1×10^{-2}	1×10^{-1}	Log triangular	Design Specification reduced by 1 order of magnitude to reflect potential clogging
Barrier Information						
Phase 1 (Unlined Landfill)						
No Engineered Barrier Present		-	-	-		Leakage calculated for fixed leachate head of 1.0m

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Table F.1 LandSim Input Parameters (continued)

Phase 2 & 3 (Composite Lining System)						
BES Construction Thickness	m	-	0.5	-	Single Value	Engineered Design
BES Permeability	m/s	$1x10^{-10}$	$1x10^{-9}$	$1x10^{-8}$	Log Triangular	Design Specification
HDPE Membrane Defects						
Pinholes in liner	Nr per Ha	0	5	12	Triangular	Estimated number of defects based on formal CQA with leak detection survey
Holes in liner	Nr per Ha	0	2	2	Triangular	Estimated number of defects based on formal CQA with leak detection survey
Tears in liner	Nr per Ha	0	0.1	2	Triangular	LandSim Default Values
Area of each pinhole	mm^2	0.1	-	5	Uniform	LandSim Default Values
Area of each hole	mm^2	5	-	100	Uniform	LandSim Default Values
Area of each tear	mm^2	100	-	10000	Uniform	LandSim Default Values
Unsaturated Zone (Drift Deposits)						
Phase 1						
Thickness	m	0	0.5	4.5	Triangular	Exploratory Site Investigation
Density	kg/l	1.8	2	2.2	Triangular	Exploratory Site Investigation
Moisture Content	Fraction	0.12	0.16	0.21	Triangular	Exploratory Site Investigation
Permeability	m/s	1.0×10^{-8}	$1.0 x10^{-5}$	$1.0 x10^{-3}$	Log Triangular	Exploratory Site Investigation
Phase 2 & 3						
No Unsaturated zone		-	-	-		Drift cover removed during phased construction of landfill cells
Aquifer Pathway (Fractured Bedrock)						
Hydraulic Gradient		-	0.018	-	Single Value	Hydraulic contours
Hydraulic Conductivity	m/s	1×10^{-9}	1.0×10^{-7}	1.0×10^{-5}	Log Triangular	Exploratory Site Investigation
Pathway Porosity		0	-	0.2	Uniform	Limestone Porosity values listed in Table 5.5 of LandSim Manual
Longitudinal Dispersivity	m	20	-	58	Uniform	Calculated by LandSim
Transverse Dispersivity	m	6	-	17.4	Uniform	Calculated by LandSim
Mixing Zone Thickness	m	1	-	30	Uniform	Assumed Aquifer Thickness
Phase 1						
Pathway Width	m	-	180	-	Single Value	Pathway lengths measured as distance from compliance point to phase boundaries relative to direction of groundwater flow. Pathway widths measured perpendicular to groundwater flow, which equals width of phase
Pathway Length	m	270	-	570	Uniform	
Phase 2						
Pathway Width	m	-	180	-	Single Value	Pathway lengths measured as distance from compliance point to phase boundaries relative to direction of groundwater flow. Pathway widths measured perpendicular to groundwater flow, which equals width of phase
Pathway Length	m	210	-	270	Uniform	

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Table F.1 LandSim Input Parameters (continued)

Phase 3						
Pathway Width	m	-	180	-	Single Value	Pathway lengths measured as distance from compliance point to phase boundaries relative to direction of groundwater flow. Pathway widths measured perpendicular to groundwater flow, which equals width of phase
Pathway Length	m	10	-	210	Uniform	

Table F.2 LandSim Default Leachate Inventory

Model Parameter	Unit	Value			Distribution	Justification
		Minimum	Most Likely	Maximum		
Source Concentration of Leachate Contaminants						
Ammonical Nitrogen	mg/kg	4.37E+00	7.22E+02	3.64E+03	Log Triangular	LandSim defaults from leachates sampled at UK and Irish domestic waste landfills
Arsenic	mg/kg	6.73E-04	4.84E-03	1.31E+00	Log Triangular	
Cadmium	mg/kg	1.90E-03	1.01E-02	1.05E-01	Log Triangular	
Chloride	mg/kg	3.66E+01	2.27E+03	7.76E+03	Log Triangular	
Chromium	mg/kg	8.55E-03	6.47E-02	1.75E+00	Log Triangular	
Copper	mg/kg	4.89E-03	2.43E-02	1.73E+00	Log Triangular	
Lead	mg/kg	9.57E-03	1.30E-01	1.02E+00	Log Triangular	
Mercury	mg/kg	3.94E-05	8.91E-05	1.95E-03	Log Triangular	
Nickel	mg/kg	8.83E-03	1.20E-01	2.21E+00	Log Triangular	
Nitrite	mg/kg	1.00E-02	2.70E-01	6.01E+00	Log Triangular	
Phosphate	mg/kg	1.00E-02	2.54E+00	2.26E+01	Log Triangular	
Potassium	mg/kg	7.55E+00	9.29E+02	3.12E+03	Log Triangular	
Zinc	mg/kg	2.25E-03	1.65E-01	2.08E+02	Log Triangular	
Retardation of Leachate Contaminants for Drift Deposits						
Ammonical Nitrogen	l/kg	0		10	Uniform	LandSim defaults
Arsenic	l/kg	25		250	Uniform	
Cadmium	l/kg	0.9		4500	Uniform	
Chloride	l/kg		0		Single Value	
Chromium	l/kg			4400	Uniform	
Copper	l/kg	40		30000	Uniform	
Lead	l/kg	20		270000	Uniform	
Mercury	l/kg	0.1		4000	Uniform	

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Table F.2 LandSim Default Leachate Inventory

Nickel	l/kg	0.1		8100	Uniform	
Nitrite	l/kg		0		Single Value	
Phosphate	l/kg	0		0.1	Uniform	
Potassium	l/kg		0		Single Value	
Zinc	l/kg	1		160000	Uniform	

F.5 Within LandSim the landfill setting is defined within a domain area that includes the total site area and a downgradient compliance point which can be moved to any location to simulate the impact on a specified receptor point.

F.6 The offsite compliance point was modelled to represent a fictional groundwater abstraction point 10m downgradient of the boundary of the proposed landfill extension, reflecting the worst case condition.

F.7 The model simulations for the final phase of the existing landfill (Phase 2) and ithe proposed extension (Phase 3) included a composite engineered barrier system and a leachate drainage system following the design specifications for the site. The existing dilute and disperse landfill operation (Phase 1) was modelled as an unlined site without any leachate drainage system in accordance with the existing site condition.

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F.8 For the contained phases of the development, leakage of leachate through potential liner defects was calculated by LandSim using in-built equations proposed by Giroud et al, 1992. The model inputs selected were based on the expected size and frequency of defects of various dimensions, given that a formal Construction Quality Assurance (CQA) programme will be implemented. CQA procedures ensure the placement and welding of the liner is carried out under strict quality control requirements, thereby minimising any potential damage to the liner.

F.9 Subsequent to the installation of the containment system, a leak detection survey will be carried out to identify defects in each cell area. The survey uses electrical resistivity techniques, which can detect pinhole (1mm diameter) size defects in the liner. Any defects determined by this survey will be repaired and resurveyed. The number of pinholes and small holes in the liner was reduced to reflect this situation, while the number of tears was unchanged. These input values were agreed with Golder (UK) Associates, the designers of the LandSim software.

F.10 Each phase was modelled as a rectangular area, which was sized to reflect an equivalent area to the physical cell dimensions.

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F. 11 The quantity and quality of leachate generated within each phase of the landfill operations depends on:

- The nature and rate of waste input
- The incident rainfall
- The infiltration rate of the landfill surface during various phases of operation
- The absorptive capacity of the waste
- The effectiveness of the leachate control systems

F.12 The leachate composition at Ballynacarrick was simulated using LandSim default parameters for a typical inventory of contaminants sampled at domestic waste landfills in the United Kingdom and Ireland. Chloride and Ammoniacal nitrogen represent the principal constituents of landfill leachate and are key indicators of contamination. Chloride is not attenuated other than by dilution, while Ammoniacal nitrogen is retarded by ion exchange processes.

F.13 Geological input parameters used in the simulations were largely based on actual data derived from exploratory site investigations and insitu and laboratory tests on subsoils and rock. Where site-specific data could not be determined, conservative LandSim default values or reasoned estimates were used.

LandSim Model Outputs

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F. 14 The main outputs of the analysis used in the risk assessment for the proposed landfill extension are outlined below:

- Head of leachate on the base of the liner;
- Leakage rate through the liner;
- Dilution factor in the groundwater regime;
- Contaminant travel times through the groundwater regime; and
- Contaminant breakthrough concentrations.

F.15 The principals and methodologies involved in the LandSim model determinations are outlined briefly below:

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Leachate Head

F.16 Factors modelled in LandSim which affect the head of leachate on the base of a landfill include the following

- Volume of rainfall over the site
- The nature and rate of the solid waste inputs
- The volume of liquid waste inputs
- The landfill cell geometry and dimensions
- The arrangement and permeability of the leachate drainage system

F.17 To quantify the head of leachate on the basal lining system within the fully engineered phases of the existing and proposed landfill, a number of modelling scenarios were undertaken using LandSim to simulate variations in infiltration rate for typical phases of operation, namely active, temporarily capped and fully restored cell status. These conditions were modelled using three infiltration rates, based on the effective rainfall (ER) data for the area, where:

- 100% ER was assumed for an active phase of operation
- 25% ER for a temporarily capped phase
- 10% ER for a fully restored phase

F.18 For the existing dilute and disperse landfill, a 1m fixed leachate head was assumed in the analysis to simulate worst case conditions.

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Leakage

F.19 The leakage from the existing landfill and its proposed extension was simulated within LandSim based on the leachate head as described above. In the containment phases of the landfill the rate of leakage also depends on the character of the engineered barrier system and integrity of the lining system.

Dilution

F.20 The dilution ratio for predicted leachate leakage entering groundwater was determined for each phase of landfill operation, related to the source concentration of contaminant parameters in the leachate and rate of groundwater flow calculated by LandSim on the basis of the hydrogeological inputs.

Geosphere Travel Time

F.21 To quantify the expected time for leachate leakage to migrate through groundwater to the downgradient compliance point, the total geosphere travel time was calculated. This was determined using hydrogeological factors specific to the site. The groundwater compliance point assumed in the analyses was located 10m downgradient of the proposed landfill extension boundary.

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Contaminant Breakthrough Concentrations

F.22 The breakthrough concentration of contaminant parameters at the compliance point represents the ultimate determination of the LandSim model and forms the basis for the risk assessment. It is based on the predicted travel time and the dilution of leachate leakage from the site during its migration through the groundwater regime. The modelled breakthrough concentration also reflects the biodegradation and retardation of specific contaminants in the unsaturated zone and aquifer.

F.23 The model predicts the breakthrough concentration for specific leachate contaminant parameters within affected groundwater at discrete future time intervals. It is assumed that baseline concentrations of contaminants in groundwater are zero prior to the development of the landfill. The contaminant breakthrough results are interpreted in the context of current guidelines for water quality and related to the baseline groundwater quality.

LANDSIM MODELLING RESULTS

F.24 LandSim model results are plotted statistically as frequency charts which are interpreted in terms of the probability of an event of given magnitude occurring at a specific level of confidence. The most likely scenario is reflected by a 50 percentile probability value, whilst the worst case is generally predicted by a 95 or 5 percentile value as indicated in the following sections.

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F.25 The results of the various LandSim model simulations are considered below.

Leachate Head and Leakage

F.26 The predicted volume of leakage and head of leachate within the lined phases of the existing landfill (Phase 2) and proposed extension (Phase 3) reflects the characteristics of the engineered barrier system and integrity of the liner. For the existing dilute and disperse site the leakage was calculated on the basis of a 1.0m fixed leachate head which was assumed to reflect worst case conditions. The results of the analysis are presented in Table E.3 below.

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Table F.3 LandSim Leakage and Leachate Head Results

Landfill Phase	Leachate Head (m)		Leakage (litres/day)	
	50%	**95%**	**50%**	**95%**
Phase 1: Existing Dilute and Disperse Phase				
Capped Phase Infiltration Rate 68mm/year			10100	11700
Phase 2: Existing Engineered Containment Phase				
Capped Phase Infiltration Rate 68mm/year	0.0318	0.0967	0.201	1.73
Phase 3: Proposed Engineered Containment Extension				
1Nr. Uncapped, 1Nr.Temporary Capped and 2Nr. Capped Cells Mean Infiltration Rate 300mm/year	0.061	0.186	1.32	11.1
Capped Phase Infiltration Rate 68mm/year	0.0256	0.0763	0.619	5.4

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F.27 The volume of leachate leakage from the existing dilute and disperse phase reflects the greatest volume of leakage from the site, where 11700 litres/day (95 percentile) is indicated to be released into the environment. This is caused by the absence of a lining system at the base of the landfill site and by the assumption of a leachate head of 1.0 metre.

F.28 In comparison, the volumes of leachate escaping from the capped Phase 2 and final operational stage of Phase 3, which are both engineered containment landfills, is predicted to be 1.73 litres/day and 11.1 litres/day (95 percentile) respectively. These volumes are three orders of magnitude less than the volume of leakage predicted for the unlined Phase 1. This reflects the containment of leachate generated within Phases 2 and 3 by the lining system.

F.29 The leakage rate for Phase 3 is reduced to 5.4 litres/day (95 percentile) when the proposed extension is capped and restored as the rate of leakage through liner defects is governed by the head of leachate on the base of a landfill. Head of leachate is greatest in an uncapped phase of operation, when the volume of rainfall infiltration into the waste is greatest.

Dilution Ratios and Geosphere Travel Time

F.30 The dilution ratio and geosphere travel time results are presented in Table E.4 below. The dilution factor represents the ratio of the leachate release rate to the groundwater flow in the aquifer beneath the site. In this table the 5 percentile value represents the worst case situation, whilst the 50 percentile value reflects the scenario most likely to occur.

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Table F.4 LandSim Leakage Dilution Ratios and Aquifer Flow

Landfill Phase	Dilution Ratio		Unretarded Travel Time (years)	
	50%	5%	50%	5%
Phase 1: Existing Dilute and Disperse Phase				
Capped Phase Infiltration Rate 68mm/year	2	1	27.1	4.47
Phase 2: Existing Engineered Containment Phase				
Capped Phase Infiltration Rate 68mm/year	44200	44200	5020	5020
Phase 3: Proposed Engineered Containment Extension				
1Nr. Uncapped, 1Nr.Temporary Capped and 2Nr. Capped Cells Mean Infiltration Rate 377mm/year	8270	8270	5030	5030
Capped Phase Infiltration Rate 68mm/year	21600	21600	5030	5030

F.31 The LandSim results indicate that the uncontrolled leakage from the existing unlined landfill site receives a limited 1:1 dilution ratio (5th percentile) in groundwater circulating through the bedrock aquifer. By comparison, the results indicate that the low volume of leakage through defects in the lined landfill extension receives a substantial dilution of 1:8270 (5th percentile) during the final stage of landfilling operations.

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F.32 Capping of the landfill surface reduces rainfall infiltration and minimises leakage from the site. The reduced volume of leakage therefore receives more dilution when it enters groundwater. This is reflected by a dilution ratio to 1:44200 for Phase 2 and 1:21600 for Phase 3 (5th percentile).

F.33 The unretarded travel time calculated by LandSim is the time taken for the leachate to migrate through the engineered barrier system to the compliance point, located 10m downgradient of the extension boundary. The results indicate that high volumes of leachate leakage from the existing unlined phase impact on groundwater quality at the compliance point in the short term, ranging from 4.47 years (5 percentile) to 27.1 years (50 percentile).

F.34 By comparison the low volume leakage from the lined containment landfill phases breaks through in the long term with a predicted 5020 to 5030 year travel time (5th percentile).

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Contaminant Breakthrough Concentrations

F.35 The breakthrough concentration of leachate parameters at the compliance point quantifies the potential impact from the existing dilute and disperse landfill and the proposed extension on groundwater. As no downgradient groundwater abstractions are located in close proximity to the landfill the impact on groundwater resources was determined for the assumed compliance point 10m from the proposed landfill extension boundary.

F.36 The breakthrough concentration at the compliance point was determined as a worst case (95 percentile) and a most likely (50 percentile) value for future time intervals ranging from 3 years to 10,000 years. The significance of the breakthrough concentration of contaminant parameters was then assessed against European Community drinking water standards (80/778/EEC).

F.37 Four models were undertaken to compare the impact of the leachate leakage from the existing landfill and the proposed extension during its operation and following restoration and closure The models are listed below:

- **Model 1**: Baseline conditions (Phase 1 & 2 Capped)
- **Model 2**: Final phase operations of total landfill site (Phase 1 & 2 capped and Phase 3 with 1 uncapped cell, 1 temporary capped cell and 2 capped cells)
- **Model 3**: Landfill site fully capped and restored (Phase 1, 2 & 3 capped)
- **Model 4**: Proposed extension operating in isolation (Phase 3 only with 1 uncapped cell, 1 temporary capped cell and 2 capped cells) This separates out the breakthrough concentrations that result from Phase 3 operations only.

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F.38 **Model 1: Baseline Conditions (Phase 1 & 2 Capped:** The LandSim results for the existing Phase 1 & Phase 2 capped, listed in Table E.5, indicate that the uncontrolled leakage of high volumes of leachate through the unlined base of Phase 1 gives rise to a slight impact on groundwater quality measured at the compliance point.

F.39 The impact on groundwater quality at the compliance point initially arises when unretarded non-hazardous List II substances break through, particularly chloride, nitrite, and potassium. This occurs at the 10 to 30 year interval when the maximum 95-percentile concentration of chloride is predicted at 481mg/l, nitrite at 0.250mg/l, and potassium at 190mg/l. From this point the concentrations of these contaminants decline progressively, returning to levels below the Drinking Water Standard limits around the 100-year interval (for chloride and nitrite) and 300-year interval (for potassium).

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F.40 The LandSim results also indicate that Ammoniacal Nitrogen, a List II retarded contaminant parameter, breaks through to the compliance point at a concentration elevated above the Drinking Water Standard around the 300-year interval, with a predicted maximum concentration of 7.0 mg/l (95 percentile) , declining below this level thereafter.

F.41 The model also indicates that no impact arises from the remaining trace metal contaminants including the hazardous List I substances, arsenic, cadmium, lead and mercury, where the concentration measured at the compliance point remains significantly below the specified Drinking Water Standard limits across all time intervals.

F.42 **Model 2: Final Phase Operations of Landfill Site (Phase 1 & 2 capped and Phase 3 with 1 uncapped cell, 1 temporary capped cell and 2 capped cells):** The LandSim results for Model 2 are similar to Model 1 with concentrations of non-hazardous List II substances such as ammonia, chloride, nitrite and potassium slightly exceeding the drinking water standards on the short to medium-term period. In addition concentrations of hazardous List I substances remain below the drinking water standards.

F.43 No significant increase in the breakthrough concentration of contaminants is predicted following the development of the containment landfill phases (Phase 2 & 3). This reflects the minimal volume of leakage from the lined landfill phases, compared with that which occurs from the unlined site. The initial impact on groundwater quality is reflected by the leakage from the Phase 1 dilute and disperse site, where the maximum 95 percentile break through concentration of chloride is recorded at 460mg/l, nitrite at 0.210mg/l and potassium at 190mg/l. The concentration of these contaminants falls beyond the 30 year interval as the source concentration declines, returning to levels below the Drinking Water Standard limits around the 100 year interval.

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F.44 **Model 3: Landfill Site Fully Capped and Restored (Phase 1, 2 & 3 capped):** Model 3 represents the post-closure condition of the landfill, when the whole landfill site including the proposed extension has been capped and restored. The results are similar to Model 2 although the leakage rate from the proposed extension is reduced.

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F.45 **Model 4: Proposed Extension Operating in Isolation (Phase 3 only with 1 uncapped cell, 1 temporary capped cell and 2 capped cells):** Model 4 considers the final phase of the proposed extension in isolation from the total landfill site. This only assesses the impact of the proposed site on the groundwater regime downgradient of the site. The model results for all timeslices predict that the breakthrough concentration of leachate contaminants at the compliance point will remain well below the drinking water standards. Therefore, the development of the proposed extension as a fully engineered containment landfill site will not have a significant impact on groundwater quality downgradient the site.

CONCLUSION

F.46 The LandSim analyses indicates that the greatest volume of leachate leakage occurs from the existing dilute and disperse landfill (Phase 1). This is reflected at the compliance point assumed to be located 10m downgradient of the proposed extension boundary. Here the impact on groundwater quality is reflected by the breakthrough of chloride, nitrite and potassium at the 10 to 30 year interval, and by ammonia around the 100 year interval, at concentrations slightly elevated above the levels set by the European Community drinking water standards. The breakthrough concentration of trace metals including List 1 substances remain well below the drinking water standards.

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F. 47 In comparison with the leachate emissions for Phase 1, the leakage from the lined phases of the existing landfill and proposed extension is minimal, being three orders of magnitude less. The additional contaminant loading caused by the low volumes of leakage from the lined phases is insignificant compared with the emissions from the unlined site. Indeed it does not give rise to an increased contaminant breakthrough concentration at the compliance point. This indicates that the proposed extension, engineered as a lined containment landfill with a full range of leachate control and management systems, does not impact on groundwater quality. On this basis the proposed extension is considered acceptable.

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Table F.5 Baseline Scenario (Phase 1 and 2 capped) LandSim Contaminant Breakthrough Results (Model Reference PICPIIC.sim)

CONTAMINANT PARAMETER	Contaminant Breakthrough Concentration (mg/litre) with Time (Years)																80/778/EEC Drinking Water Standard (MAC) (mg/l)
	3 Year		10 Year		30 Year		100 Year		300 Year		1000 Year		3000 Year		10000 Year		
	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	
Ammoniacal Nitrogen	1.0E1-3	1.0E-13	3.1E-13	3.1E-13	3.3E-06	3.3E-06	3.9E-01	3.9E-01	2.3E-01	7.0E+0	1.7E-1	4.3E+0	4.9E-2	8.3E-1	3.1E-3	3.1E-3	**5.0E-01**
Arsenic	0	0	0	0	1.1E-31	1.1E-31	6.3E-28	6.3E-28	6.8E-16	6.8E-16	8.2E-13	8.2E-13	1.6E-11	1.6E-11	3.3E-07	3.3E-07	**5.0E-02**
Cadmium	0	0	0	0	2.5E-22	2.5E-22	6.8E-13	6.8E-13	5.1E-15	5.1E-15	9.8E-15	9.8E-15	9.5E-12	9.5E-12	1.6E-11	1.6E-11	**5.0E-03**
Chloride	1.5E+1	1.5E+1	1.1E+1	3.4E+2	4.9E+1	4.8E+2	3.1E+0	1.4E+2	5.3E-01	2.6E+0	1.4E-2	1.4E-2	9.9E-10	9.9E-10	1.2E-8	2.1E-7	**4.0E+02**
Chromium	0	0	0	0	3.2E-24	3.2E-24	6.1E-17	6.1E-17	7.0E-11	7.0E-11	6.8E-12	6.8E-12	5.5E-12	5.5E-12	8.3E-11	8.3E-11	**5.0E-02**
Copper	0	0	0	0	0	0	0	0	2.3E-32	2.3E-32	2.0E-29	2.0E-29	1.6E-17	1.6E-17	5.1E-13	5.1E-13	**3.0E+00**
Lead	0	0	0	0	0	0	0	0	0	0	3.7E-30	3.7E-30	4.8E-19	4.8E-19	1.3E-12	1.3E-12	**5.0E-02**
Mercury	0	0	0	0	0	0	0	0	0	0	0	0	4.7E-25	4.7E-25	1.2E-16	1.2E-16	**1.2**
Nickel	0	0	0	0	7.1E-28	7.1E-28	4.5E-23	4.5E-23	6.3E-17	6.3E-17	8.8E-12	8.8E-12	1.4E-10	1.4E-10	4.1E-11	1.2E-10	**5.0E-02**
Nitrite	4.2E-3	4.2E-3	4.6E-3	1.4E-1	1.9E-2	2.5E-1	1.9E-3	4.7E-2	1.2E-4	8.5E-4	8.5E-7	8.5E-7	4.8E-13	4.8E-13	4.6E-12	7.8E-11	**1.0E-01**
Phosphate	3.4E-2	3.4E-2	2.9E-2	3.9E-1	6.9E-2	9.5E-1	9.1E-3	2.3E-1	2.2E-3	6.6E-3	2.0E-6	2.0E-6	1.8E-13	1.8E-13	2.1E-11	2.7E-10	**2.2E+00**
Potassium	3.3E+0	3.3E+0	3.4E+0	1.1E+2	1.9E+1	1.9E+2	1.2E+0	4.5E+1	1.4E-1	9.7E-1	1.9E-4	1.9E-4	4.5E-9	4.5E-9	1.4E-8	1.4E-8	**1.2E+01**
Zinc	0	0	0	0	8.5E-21	8.5E-21	6.9E-12	6.9E-12	2.8E-10	2.8E-10	9.4E-9	9.4E-9	1.5E-9	1.5E-9	3.8E-9	3.8E-9	**5.0E+00**

Indicates: Exceeds drinking water standard

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Table F.6 **Existing Landfill site and proposed operational extension Contaminant Breakthrough Results (Model Reference PIIIUT2CPICPIIC.sim)**

CONTAMINANT PARAMETER	Contaminant Breakthrough Concentration (mg/litre) with Time (Years)																80/778/EEC Drinking Water Standard (MAC) (mg/l)
	3 Year		10 Year		30 Year		100 Year		300 Year		1000 Year		3000 Year		10000 Year		
	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	
Ammoniacal Nitrogen	1.5E-15	1.5E-15	3.8E-15	3.8E-15	1.3E-3	3.9E-3	7.4E-2	7.4E-2	2.0E-01	4.6E+00	1.2E-01	5.9E+00	4.0E-02	2.0E-01	1.4E-04	1.4E-04	**5.0E-01**
Arsenic	0	0	0	0	5.2E-12	5.2E-12	1.3E-9	1.3E-9	5.1E-10	5.1E-10	9.5E-10	2.9E-09	3.3E-08	3.3E-08	2.7E-06	2.7E-06	**5.0E-02**
Cadmium	0	0	0	0	7.1E-15	7.1E-15	9.7E-11	9.7E-11	6.8E-12	6.8E-12	2.3E-11	1.6E-10	2.1E-11	1.9E-10	6.2E-09	6.2E-09	**5.0E-03**
Chloride	6.0E+00	6.0E+00	9.4E+00	4.1E+02	6.4E+01	4.6E+02	3.1E+00	1.3E+02	3.7E-01	1.1E+00	1.4E-04	1.4E-04	2.6E-09	2.6E-09	1.9E-11	2.4E-10	**4.0E+02**
Chromium	0	0	0	0	6.0E-22	6.0E-22	4.1E-11	4.1E-11	4.4E-10	4.4E-10	2.4E-10	2.4E-10	2.7E-10	2.7E-10	1.3E-10	1.1E-09	**5.0E-02**
Copper	0	0	0	0	7.5E-22	7.5E-22	6.8E-11	6.8E-11	5.5E-11	5.5E-11	1.6E-11	1.6E-11	6.2E-12	6.2E-12	2.9E-11	2.9E-11	**3.0E+00**
Lead	0	0	0	0	0	0	2.7E-22	2.7E-22	7.1E-25	7.1E-25	7.4E-12	7.4E-12	8.4E-16	8.4E-16	2.6E-12	2.6E-12	**5.0E-02**
Mercury	0	0	0	0	3.2E-26	3.2E-26	1.7E-15	1.7E-15	6.4E-16	6.4E-16	1.6E-13	1.6E-13	3.3E-13	3.3E-13	3.0E-13	1.5E-12	**1.0E-03**
Nickel	0	0	0	0	8.0E-15	8.0E-15	1.6E-09	1.6E-09	1.0E-09	1.0E-09	1.9E-09	5.8E-09	4.1E-10	4.5E-09	1.5E-07	1.5E-07	**5.0E-02**
Nitrite	1.8E-03	1.8E-03	3.1E-03	1.2E-01	1.5E-02	2.1E-01	1.9E-03	4.1E-02	1.9E-04	5.6E-04	1.4E-08	1.4E-08	1.1E-11	1.1E-11	4.2E-15	8.9E-14	**1.0E-01**
Phosphate	1.8E-02	1.8E-02	1.6E-02	4.7E-01	6.6E-02	9.4E-01	4.3E-03	1.8E-01	7.1E-04	2.1E-03	2.3E-06	2.3E-06	5.1E-11	5.1E-11	3.0E-14	5.8E-13	**2.2E+00**
Potassium	6.1E+00	6.1E+00	4.6E+00	1.6E+02	1.7E+01	1.9E+02	1.6E+00	4.3E+00	9.7E-02	4.9E-01	1.2E-05	1.2E-05	8.2E-11	8.2E-11	6.4E-12	1.1E-10	**1.2E+01**
Zinc	0	0	0	0	4.0E-14	4.0E-14	6.4E-07	6.4E-07	1.7E-08	1.7E-08	5.8E-08	5.8E-08	8.4E-08	8.4E-08	7.6E-08	7.6E-08	**5.0E+00**

Indicates: Exceeds drinking water standard

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Table F.7 Proposed Landfill Site Capped LandSim Contaminant Breakthrough Results (Model Reference PIIICPIICPIC.sim)

CONTAMINANT PARAMETER	Contaminant Breakthrough Concentration (mg/litre) with Time (Years)																80/778/EEC Drinking Water Standard (MAC) (mg/l)
	3 Year		10 Year		30 Year		100 Year		300 Year		1000 Year		3000 Year		10000 Year		
	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	
Ammoniacal Nitrogen	1.5E-15	1.5E-15	3.8E-15	3.8E-15	8.8E-4	2.6E-3	7.4E-2	7.4E-2	2.0E-1	**4.6E0**	1.2E-1	**5.8E0**	4.0E-2	2.0E-1	1.4E-4	1.4E-4	**5.0E-01**
Arsenic	0	0	0	0	2.6E-12	2.6E-12	1.9E-9	1.9E-9	2.6E-9	7.8E-9	1.6E-9	4.9E-9	3.3E-8	3.3E-8	2.7E-6	2.7E-6	**5.0E-02**
Cadmium	0	0	0	0	3.4E-15	3.4E-15	1.4E-10	1.4E-10	5.5E-11	5.5E-11	4.1E-11	3.7E-10	5.1E-11	1.5E-10	6.2E-9	6.2E-9	**5.0E-03**
Chloride	6.0E0	6.0E0	9.4E0	**4.0E2**	6.3E1	**4.6E2**	3.1E0	1.3E2	3.7E-1	1.1E0	1.4E-4	1.4E-4	2.8E-9	2.8E-9	1.9E-11	2.5E-10	**4.0E+02**
Chromium	0	0	0	0	7.8E-22	7.8E-22	4.9E-11	4.9E-11	7.5E-10	7.5E-10	3.8E-10	3.8E-10	6.5E-10	6.5E-10	2.2E-10	1.1E-9	**5.0E-02**
Copper	0	0	0	0	1.1E-21	1.1E-21	9.1E-11	9.1E-11	9.4E-11	9.4E-11	2.6E-11	2.6E-11	3.4E-11	3.4E-11	5.0E-11	5.0E-11	**3.0E+00**
Lead	0	0	0	0	0	0	4.4E-22	4.4E-22	4.4E-19	4.4E-19	1.2E-11	1.2E-11	2.9E-10	2.9E-10	1.1E-12	1.1E-12	**5.0E-02**
Mercury	0	0	0	0	3.3E-26	3.3E-26	1.6E-15	1.6E-15	6.1E-14	6.1E-14	1.5E-13	1.5E-13	1.0E-12	1.0E-12	3.8E-13	1.9E-12	**1.0E-03**
Nickel	0	0	0	0	3.9E-15	3.9E-15	2.6E-9	2.6E-9	1.1E-8	1.1E-8	3.3E-9	9.9E-9	1.3E-9	9.3E-9	1.5E-7	1.5E-7	**5.0E-02**
Nitrite	1.8E-3	1.8E-3	3.1E-3	**1.2E-1**	1.5E-2	**2.1E-1**	1.9E-3	4.1E-2	1.9E-4	5.6E-4	1.4E-8	1.4E-8	1.1E-11	1.1E-11	4.2E-15	8.9E-14	**1.0E-01**
Phosphate	1.8E-2	1.8E-2	1.6E-2	4.7E-1	6.6E-2	9.4E-1	4.3E-3	1.8E-1	7.1E-4	2.1E-3	2.2E-6	2.2E-6	5.1E-11	5.1E-11	3.1E-14	5.8E-13	**2.2E+00**
Potassium	6.1E0	6.1E0	4.6E0	**1.6E2**	**1.7E1**	**1.9E2**	1.6E0	**4.3E1**	9.7E-2	4.9E-1	1.2E-5	1.2E-5	1.4E-10	1.4E-10	6.4E-12	1.1E-10	**1.2E+01**
Zinc	0	0	0	0	1.9E-14	1.9E-14	1.0E-6	1.0E-6	9.2E-7	9.2E-7	7.6E-7	7.6E-7	1.2E-7	1.2E-7	1.4E-8	1.7E-7	**5.0E+00**

[Pink box] Indicates: Exceeds drinking water standard

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Table F.8 Proposed Operational Extension (Model Reference PIIIUT2C.sim)

CONTAMINANT PARAMETER	Contaminant Breakthrough Concentration (mg/litre) with Time (Years)																80/778/EEC Drinking Water Standard (MAC) (mg/l)
	3 Year		10 Year		30 Year		100 Year		300 Year		1000 Year		3000 Year		10000 Year		
	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	50%	95%	
Ammoniacal Nitrogen	0	0	0	0	1.9E-3	1.9E-3	2.8E-3	1.4E-2	1.0E-4	9.1E-4	4.3E-5	3.0E-4	3.0E-5	3.0E-5	1.7E-5	1.7E-5	**5.0E-01**
Arsenic	0	0	0	0	3.3E-13	3.3E-13	4.7E-9	4.7E-9	2.2E-8	2.2E-8	2.6E-9	2.6E-9	1.8E-9	1.8E-9	8.6E-10	2.6E-9	**5.0E-02**
Cadmium	0	0	0	0	6.0E-18	6.0E-18	2.6E-10	2.6E-10	1.5E-10	1.5E-10	4.1E-10	4.1E-10	2.1E-10	2.1E-10	7.9E-11	2.4E-10	**5.0E-03**
Chloride	0	0	0	0	1.4E-1	4.2E-1	6.4E-3	1.9E-2	2.0E-5	2.0E-5	1.4E-5	1.4E-5	1.6E-5	1.6E-5	3.8E-10	3.8E-10	**4.0E+02**
Chromium	0	0	0	0	3.2E-16	3.2E-16	5.0E-9	5.0E-9	8.6E-11	8.6E-11	1.3E-9	1.3E-9	3.4E-10	3.4E-10	3.6E-10	3.6E-10	**5.0E-02**
Copper	0	0	0	0	5.6E-29	5.6E-29	3.7E-19	3.7E-19	7.4E-11	7.4E-11	2.9E-11	2.9E-11	1.8E-12	1.8E-12	2.5E-11	2.5E-11	**3.0E+00**
Lead	0	0	0	0	0	0	1.3E-24	1.3E-24	1.6E-23	1.6E-23	4.2E-16	4.2E-16	6.4E-13	6.4E-13	6.3E-12	6.3E-12	**5.0E-02**
Mercury	0	0	0	0	3.4E-28	3.4E-28	7.1E-18	7.1E-18	3.2E-13	3.2E-13	4.7E-13	4.7E-13	1.3E-12	1.3E-12	3.9E-13	1.2E-12	**1.0E-03**
Nickel	0	0	0	0	2.6E-12	2.6E-12	4.9E-9	4.9E-9	4.8E-9	4.8E-9	4.1E-9	4.1E-9	2.5E-9	7.5E-9	8.6E-9	8.6E-9	**5.0E-02**
Nitrite	0	0	0	0	5.7E-5	1.7E-4	1.1E-5	1.1E-5	1.2E-7	1.2E-7	4.1E-8	4.1E-8	9.2E-10	9.2E-10	2.2E-14	2.2E-14	**1.0E-01**
Phosphate	0	0	0	0	2.6E-4	7.8E-4	9.3E-6	2.8E-5	5.5E-7	5.5E-7	1.7E-6	1.7E-6	2.6E-12	2.6E-12	5.9E-17	5.9E-17	**2.2E+00**
Potassium	0	0	0	0	2.0E-2	1.8E-1	4.6E-3	1.4E-2	6.7E-4	6.7E-4	1.9E-4	1.9E-4	1.7E-11	1.7E-11	1.0E-10	1.0E-10	**1.2E+01**
Zinc	0	0	0	0	7.7E-14	7.7E-14	2.2E-6	2.2E-6	2.5E-8	2.5E-8	7.1E-8	7.1E-8	2.2E-8	6.5E-8	8.3E-8	8.3E-8	**5.0E+00**

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G.0 EXPLANATION OF NOISE TERMS

G.1 Definitions of environmental noise terms are detailed in ISO1996 (BS7445), *Description and Measurement of Environmental Noise*.

G.2 The following explanations of the terms used in this assessment are meant to clarify the nature and use of each term and are made with reference to the glossary of terms in PPG24.

L_A A-weighted sound pressure level (in decibels, dB)
The measured sound level incorporating a logarithmic base and weighting system to approximate the manner in which humans perceive sound. An increase in 10 dB is approximately equivalent to a perceived doubling of loudness.

$L_{Aeq,T}$ Equivalent continuous A-weighted sound pressure level (in decibels, dB), over a given time interval
An average of the energy associated with the noise at a location over a given time interval. Where a time interval is not given it is typically considered as a continuous level.
Indicates the activity noise level of a source. Typical source descriptions include "ambient noise", "specific noise" and "residual noise" as defined in BS4142.

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$L_{A10,T}$ A-weighted sound pressure level (in decibels, dB) obtained using "Fast" time-weighting that is exceeded for 10% of the given time interval.
Indicates the upper limit of a fluctuating noise source such as that from road traffic. For road traffic, it is typically expressed for peak hour, or as the arithmetic average of hourly L_{A10} values over an 18 hour day (06:00-24:00).

$L_{A90,T}$ A-weighted sound pressure level (in decibels, dB) obtained using "Fast" time-weighting that is exceeded for 90% of the given time interval.
Defined as the background noise level at a location in BS4142.

L_{Amax} The highest A-weighted sound pressure level (in decibels, dB) recorded during a measurement event.
May be obtained using either "Slow" time-weighting (as incorporated in PPG24) or "Fast" time-weighting (as incorporated in WHO *Guidelines for Community Noise* and BS8233)

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NOISE MEASUREMENT RESULTS

Table G.1 Daytime Measurement Results

Location	GPS	Time	L_{Aeq}	L_{10}	L_{90}	L_{Amax}
1	E19959 N40889	08.30	35.1	36.8	32.4	41.9
2	E20035 N40983	09:12	36.6	38.9	32.3	45.2
3	E19996 N40932	09:58	34.3	35.4	32.1	39.6
4	E19951 N40936	10:45	34.8	36.3	30.6	43.6

Table G.2 Night-time Measurement Results

Location	GPS	Time	L_{Aeq}	L_{10}	L_{90}	L_{Amax}
1	E19959 N40889	01:12	30.8	32.4	29.5	38
2	E20035 N40983	01:19	31.4	33.5	29.7	39.7
3	E19996 N40932	01:45	32.6	33.6	31.4	40.9
4	E19951 N40936	02:10	33.3	34.2	32.3	36.4

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Table G.3 Octave Analysis of Equipment on Site

Source	Distance	L_{Aeq}	Octave band (Hz) Sound Pressure Analysis							
			31.5	63	125	250	500	1k	2k	4k
Hanomag Dozer	10 mts	82.7	75.9	70.5	89	76.7	78.2	74	65.9	61.2
Hitachi Digger	10 mts	72.3	69	72.5	80	68.5	69.4	65.4	57.2	53.4

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H.0 TRANSPORT

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TIA APPENDIX H.1

EXISTING TRAFFIC

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Ballynacarrick Landfill Site Classified Count

[ ] = Peak Hour

	1		2		3		4		5		6		7		8		9		10		11		12		Quarter Hourly And Hourly Total	
	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Other	HGV	Q	H
0845-0900		2						2			1		1												6	23
0900-0915											1												1		2	21
0915-0930		2											1								1				4	25
0930-0945		1			3		1			1				1			3		1						11	26
0945-1000				1		1												1		1					4	17
1000-1015		1		1			1		2											1					6	18
1015-1030	1										1		3												5	22
1030-1045					1														1						2	28
1045-1100	1				1						1		1						1						5	37
1100-1115			1		2		1		1			1	1				1		1					1	10	32
1115-1130		1			1			3	1			1	1				1		1					1	11	25
1130-1145		2	1	1	1			1			1		1						2	1					11	15
1145-1200																										5
1200-1215											1				1								1		3	10
1215-1230													1												1	14
1230-1245																			1						1	15
1245-1300										1			1	1							2				5	19
1300-1315	1			1	1		1						1				1			1					7	21
1315-1330								2																	2	21
1330-1345		1			1			1						1					1						5	21
1345-1400		1							2				1		1						1		1		7	18
1400-1415			2		1	1		1										1	1						7	11
1415-1430				1																1					2	12
1430-1445									1				1												2	14
1445-1500																										16
1500-1515					2			3			1								2						8	18
1515-1530		3											1												4	
1530-1545												1		1								1		1	4	
1545-1600									1				1												2	

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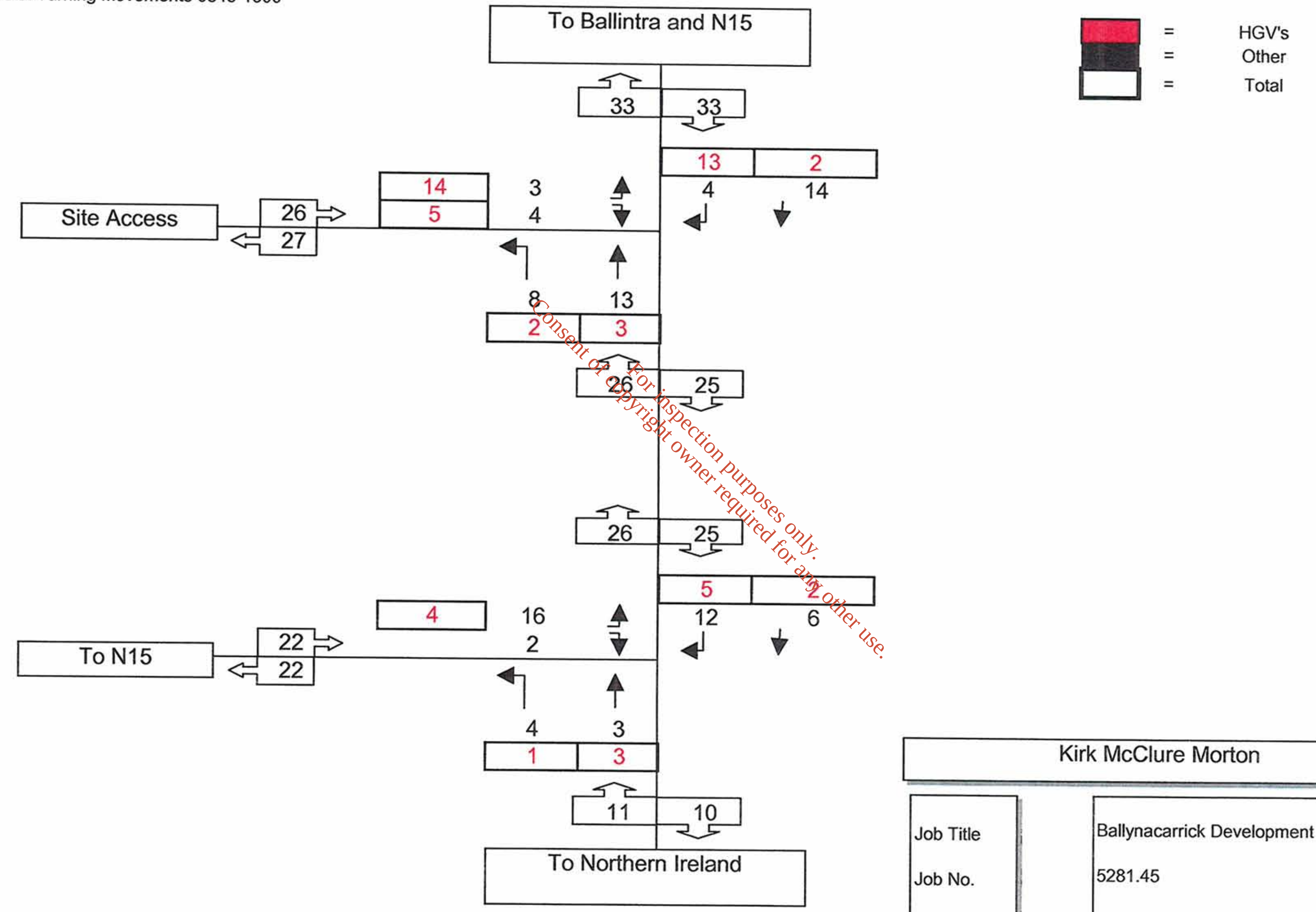
Total Turning Movements 0845-1600



Kirk McClure Morton

Job Title	Ballynacarrick Development
Job No.	5281.45
Dwg Title	Existing Daily Traffic 2002 (0845:1600)

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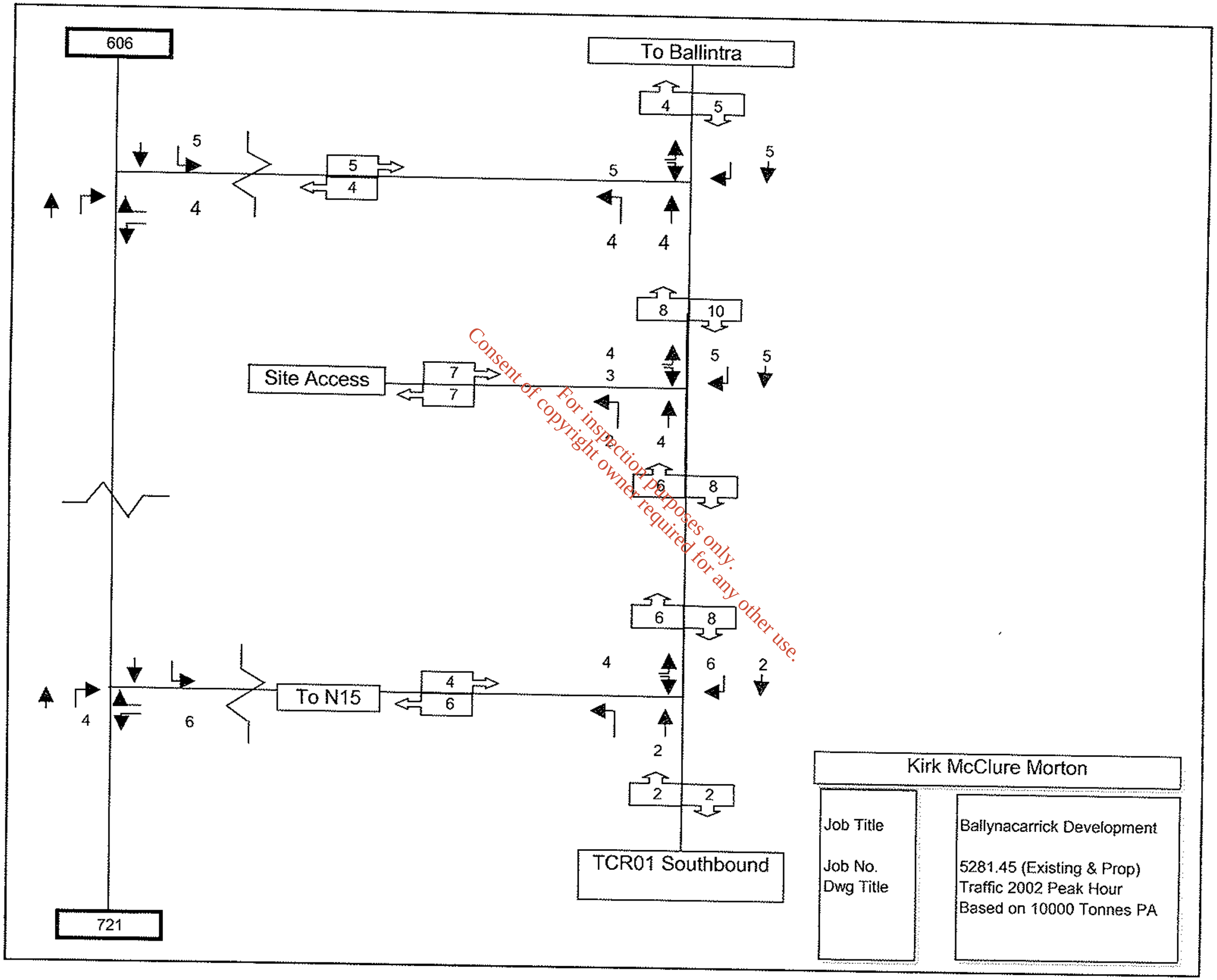

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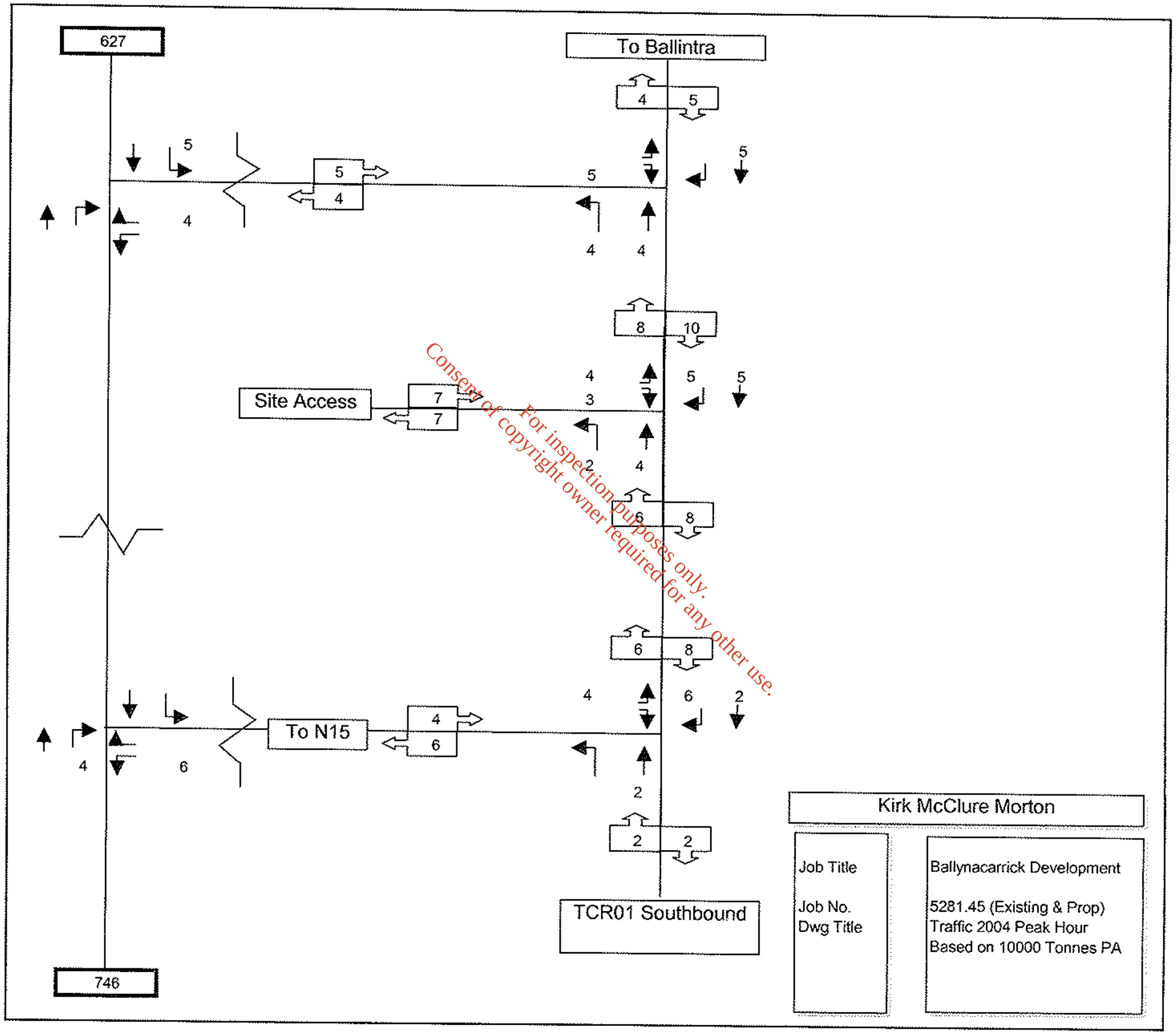
EPA Export 25-07-2013:22:28:56



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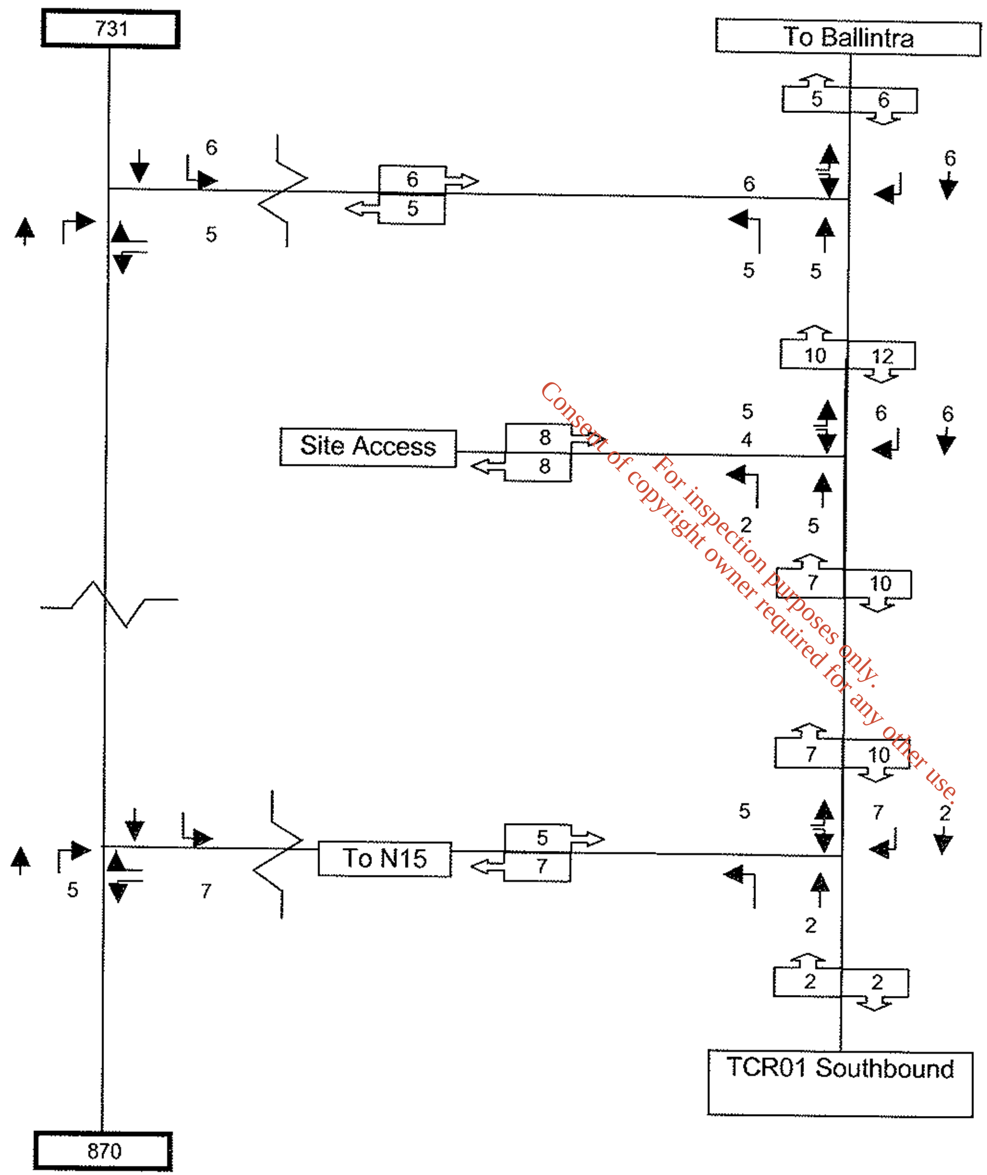

Kirk McClure Morton	
Job Title	Ballynacarrick Development
Job No.	5281.45 (Existing & Prop)
Dwg Title	Traffic 2014 Peak Hour Based on 10000 Tonnes PA

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TIA APPENDIX H.2

TRIP GENERATION AND DISTRIBUTION

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ROAD LOCAL SECTN MILES DESCRIPTION OF ESTIMATE A
SEC- AUTH- LENTH UP TO STARTING POINT 1999 % G
TION ORITY MILES THIS OF THE SECTION AADT HCV E

****

ROUTE N 15
LIFFORD - DONEGAL - SLIGO

START OF ROUTE IN LIFFORD
1/1 *DONEG 5.80 0.00 LIFFORD BRIDGE 4285 13% 1
END LIFFORD
ENTER CASTLEFIN
2/1 *DONEG 7.28 5.80 YJN LHS L16 CASTLEDERG 4897 11% 3
END CASTLEFIN
ENTER BALLYBOFEY
3/1 *DONEG 0.73 13.08 TJN RHS N56 TO LTRKENNY 13066 9% 2
4/1 *DONEG10.82 13.81 YJN RHS L75 TO GLENTIES 4988 18%
END BALLYBOFEY
5/1 DONEG 4.76 24.63 S END BRIDGE SHOULDER ST 2287 15% 3
7/1 DONEG 2.38 29.39 S JN N56 TO KILLYBEGS 4254 13%
8/1 DONEG 0.78 31.77 JN TO DONEGAL R267 7488 12%
ENTER LAGHY BYPASS
END LAGHY BYPASS
9/1A DONEG 3.57 32.55 YJN R232 TO L DERG 6912 11% 2
10/1A DONEG 6.55 36.12 JN R231 TO ROSSNOWLAGH 9350 12% 5
ENTER BALLYSHANNON
11A1 *DONEG 0.26 42.67 BEGIN 1-WAY @ MARKET ST 14724 8%
11B1 *DONEG-0.22 42.93 JN MAIN/CASTLE ST (NB) 14737 7% 5
12/1 *DONEG 0.82 42.93 ROUNDABOUT AT L24 JN 12632 15% 2
END BALLYSHANNON
13/1A DONEG 2.51 43.75 TJN LHS TO KINLOUGH 7279 14% 2
ENTER BUNDORAN
14/1 *DONEG 0.82 46.26 END SL N OF BUNDORAN 7665 9% 2
15/1 *DONEG 0.66 47.08 TJN LHS TO KINLOUGH 9864 07% 1
END BUNDORAN
16/1A DONEG 6.39 47.74 END SL SOUTH OF BUNDORAN 5438 13%
17/1 SLIGO 5.00 54.13 CR TO MULLAGHMORE TV STN 6010 9%
ENTER GRANGE
18/1 *SLIGO 4.78 59.13 TJN RHS TO STREEDAGH 7078 9% 1
END GRANGE
19/1 SLIGO 1.61 63.91 YJN RHS TO CARNEY 9781 8% 1
20/1A SLIGO 2.86 65.52 TJN RHS TO CREGGS HOSP 11107 7%
ENTER SLIGO
21/ *SLIGO 0.40 68.38 30SL N OF SLIGO 12377 8% 1
END OF ROUTE : JN WITH N4,N16 @ CARTRON

****

ROUTE N 16
BORDER - MANORHAMILTON - SLIGO

START OF ROUTE IN BLACKLION
1/1 *CAVAN 2.48 0.00 BORDER AT BELCOO 2513 15% 1
END BLACKLION

ROAD LOCAL SECTN MILES DESCRIPTION OF ESTIMATE A
SEC- AUTH- LENTH UP TO STARTING POINT 1999 % G
TION ORITY MILES THIS OF THE SECTION AADT HCV E

****

ROUTE N 16 (CONTINUED)

2/1A CAVAN 2.67 2.48 JN WITH L43 TO DOWRA 2211 18%
3/1 LETRM 8.66 5.15 JN AT RAINBOW BALLROOM 2699 15% 2
ENTER MANORHAMILTON
4/1 *LETRM 2.41 13.81 CR WITH T54 TO KINLOUGH 1775 19% 1
END MANORHAMILTON
5/1 LETRM12.70 16.22 JN WITH L16 TO DROMAHAIR 3229 20%
ENTER SLIGO
6/ *SLIGO 0.81 28.92 40SL E OF SLIGO 8232 10%
END OF ROUTE : JN WITH N4,N15 @ CARTRON

****

ROUTE N 17
SLIGO/COLLOONEY - CLAREMORRIS - TUAM - GALWAY

START OF ROUTE : BEGN ROUTE: JN WITH N4
1/1 SLIGO 2.25 0.00 JN WITH N4 6692 12% 2
2/1A SLIGO11.70 2.25 JN TO BALLYMOTE R293 4821 12% 1
ENTER TUBBERCURRY
3/1 *SLIGO 7.36 13.95 CR TO BOYLE L133 4588 14%
END TUBBERCURRY
ENTER CHARLESTOWN
4/1 *MAYO 5.57 21.31 JN WITH N5 TO LONGFORD 5027 10% 2
END CHARLESTOWN
5/1A MAYO 2.27 26.88 JN LHS WITH N83 3303 14% 1
6/1A MAYO 0.75 29.15 JN TO SWINFORD IN KILK'Y 3177 14%
7/1A MAYO 5.65 29.90 JN TO KILTAMAGH L139 5591 13% 3
8/1 MAYO 6.90 35.55 CR TO KILTAMAGH L140 3849 16% 3
ENTER CLAREMORRIS
9/1 *MAYO 0.03 42.45 JN TO BALLYHAUNIS N60 5279 15% 1
10/1 *MAYO 4.67 42.48 JN TO CASTLEBAR N60 6864 16% 2
END CLAREMORRIS
11/1 MAYO 12.12 47.15 JN TO DUNMORE L27 4317 12% 1
ENTER TUAM
12/1A*GALCO 0.98 59.27 40 SL N TUAM 8468 11% 2
13/1A*GALCO 0.90 60.25 JN N17/N83 ON GALWAY RD 11610 9% 2
END TUAM
14/1A GALCO 2.00 61.15 END SL S TUAM 10866 10% 1
15/1A GALCO 9.44 63.15 JN TO HEADFORD L98 10005 11%
16/1A GALCO 1.55 72.59 JN TO MOYLOUGH 16626 11%
17/1A GALCO 4.13 74.14 JN TO ORANMORE N18 16908 9% 1
ENTER GALWAY
18/1 *GALBO 0.45 78.27 30 SL NE GALWAY 17632 12% 1
END OF ROUTE : RO @ N6 / R336

****

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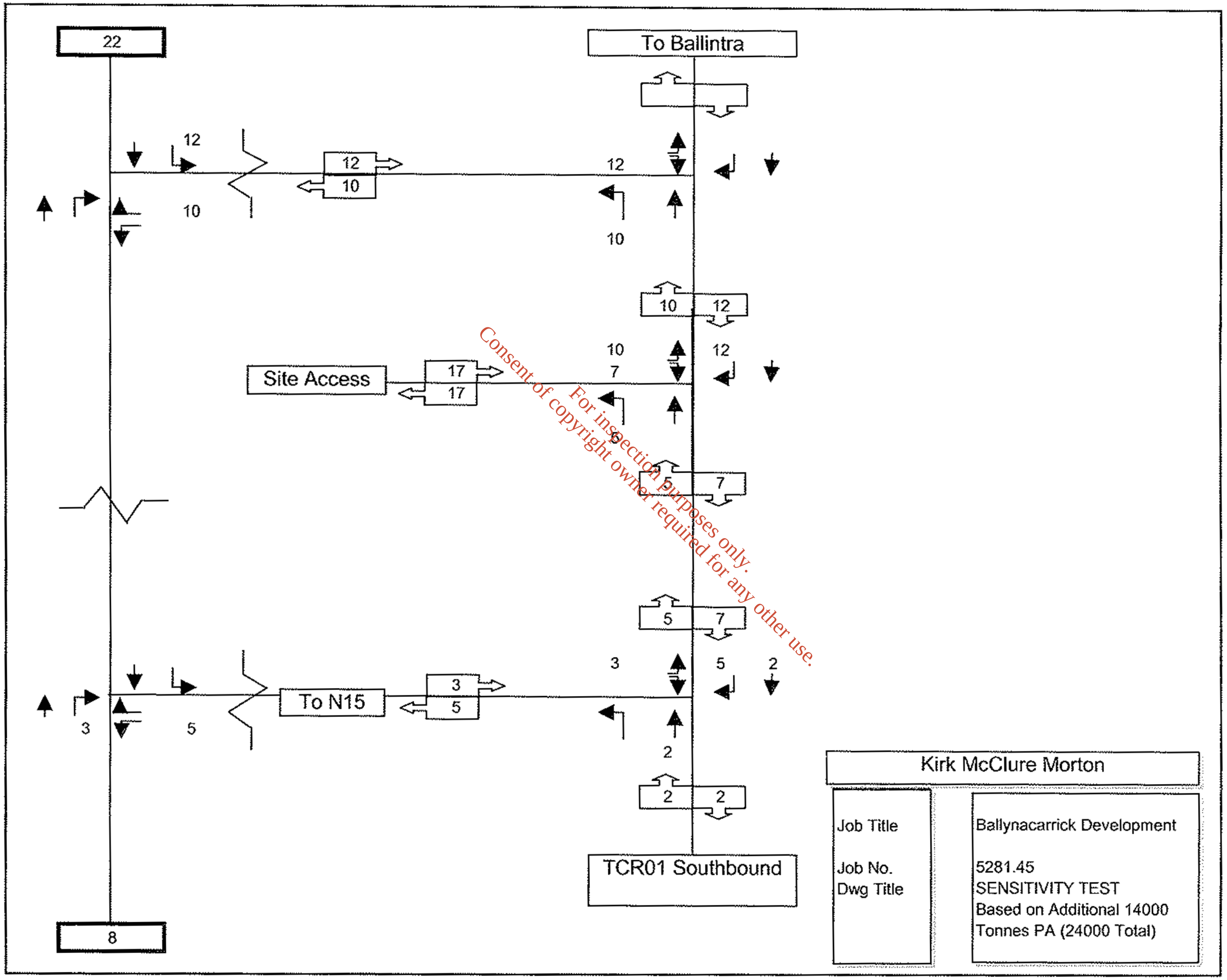

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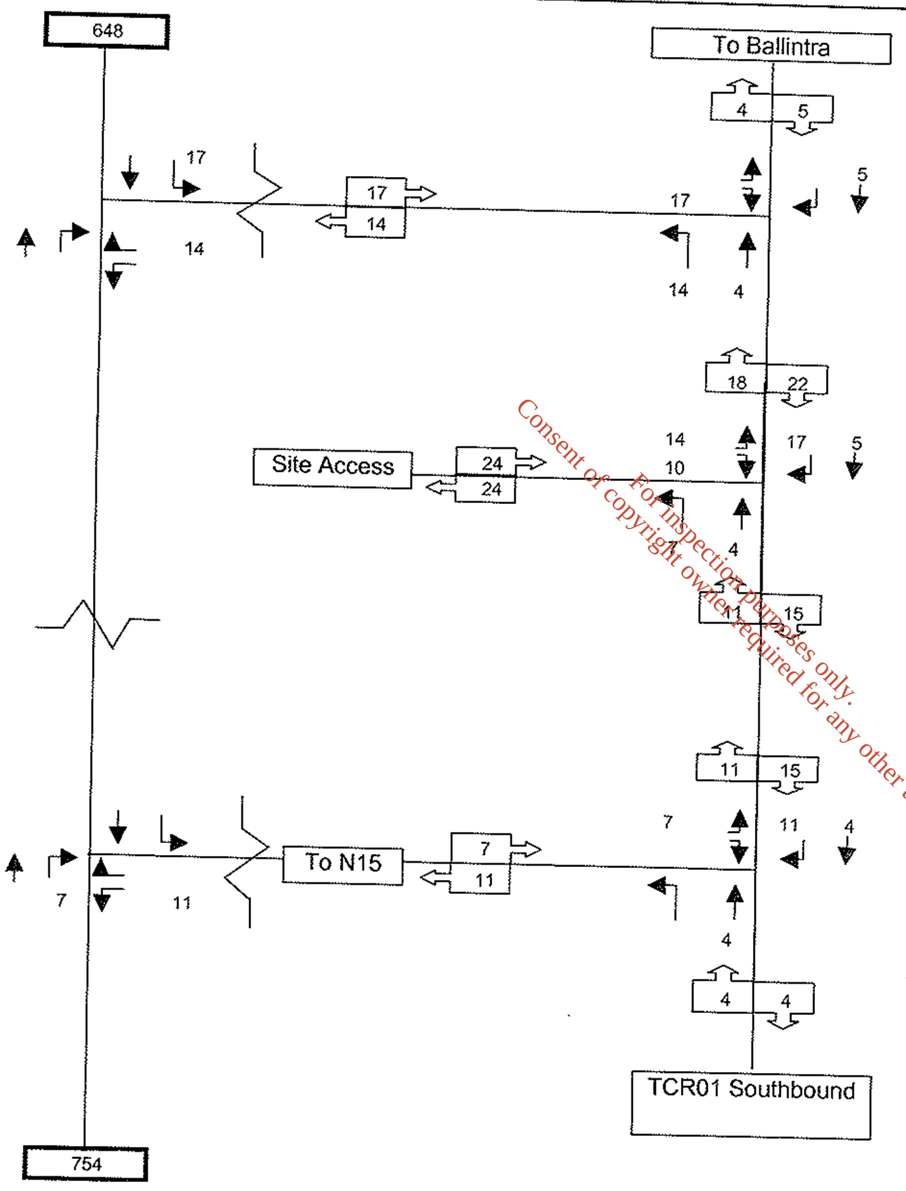

Kirk McClure Morton	
Job Title	Ballynacarrick Development
Job No.	5281.45 (Existing & Prop)
Dwg Title	Traffic 2004 Peak Hour Based on 24000 Tonnes PA

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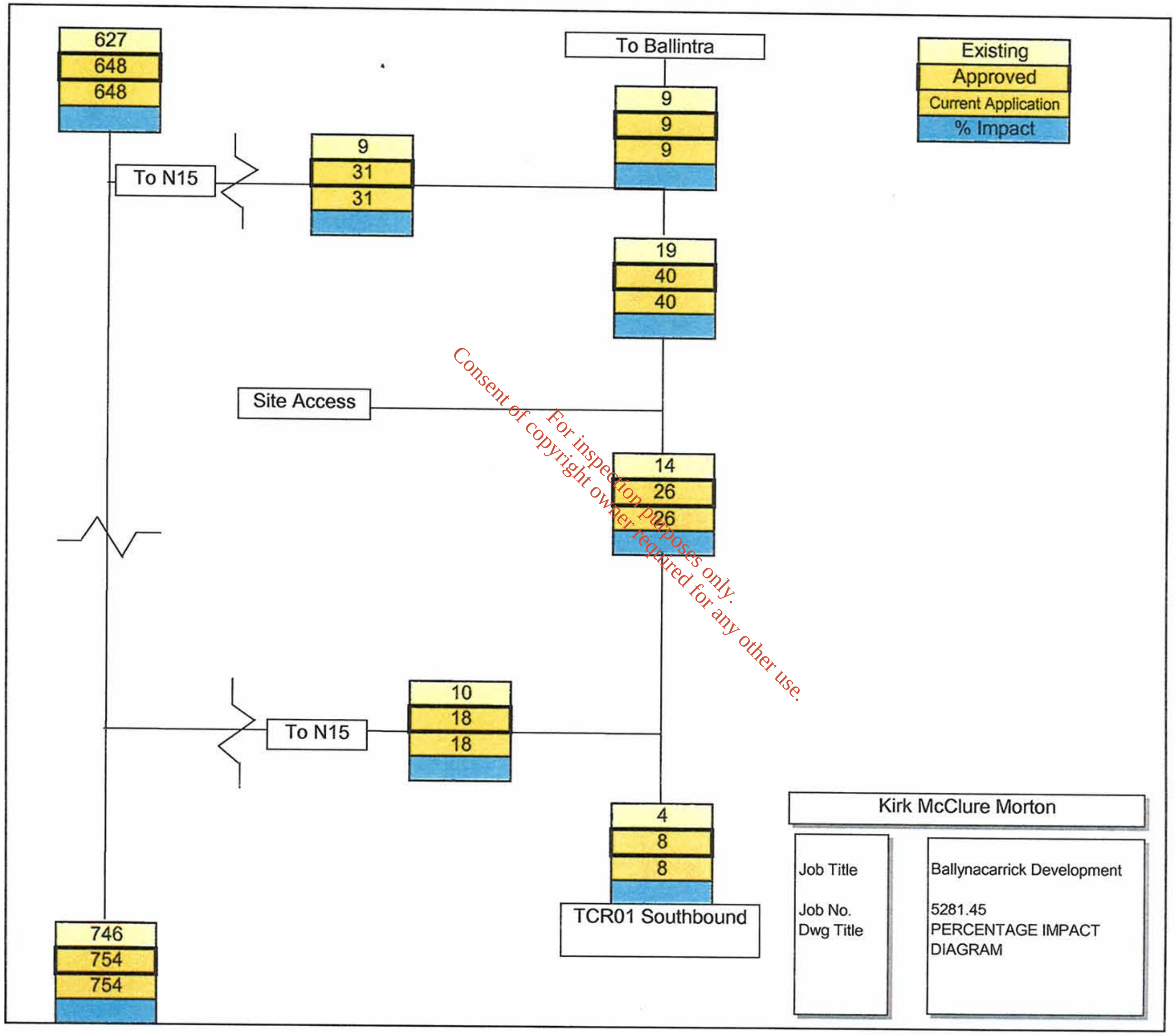

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TIA APPENDIX H.3

PROPOSED TRAFFIC

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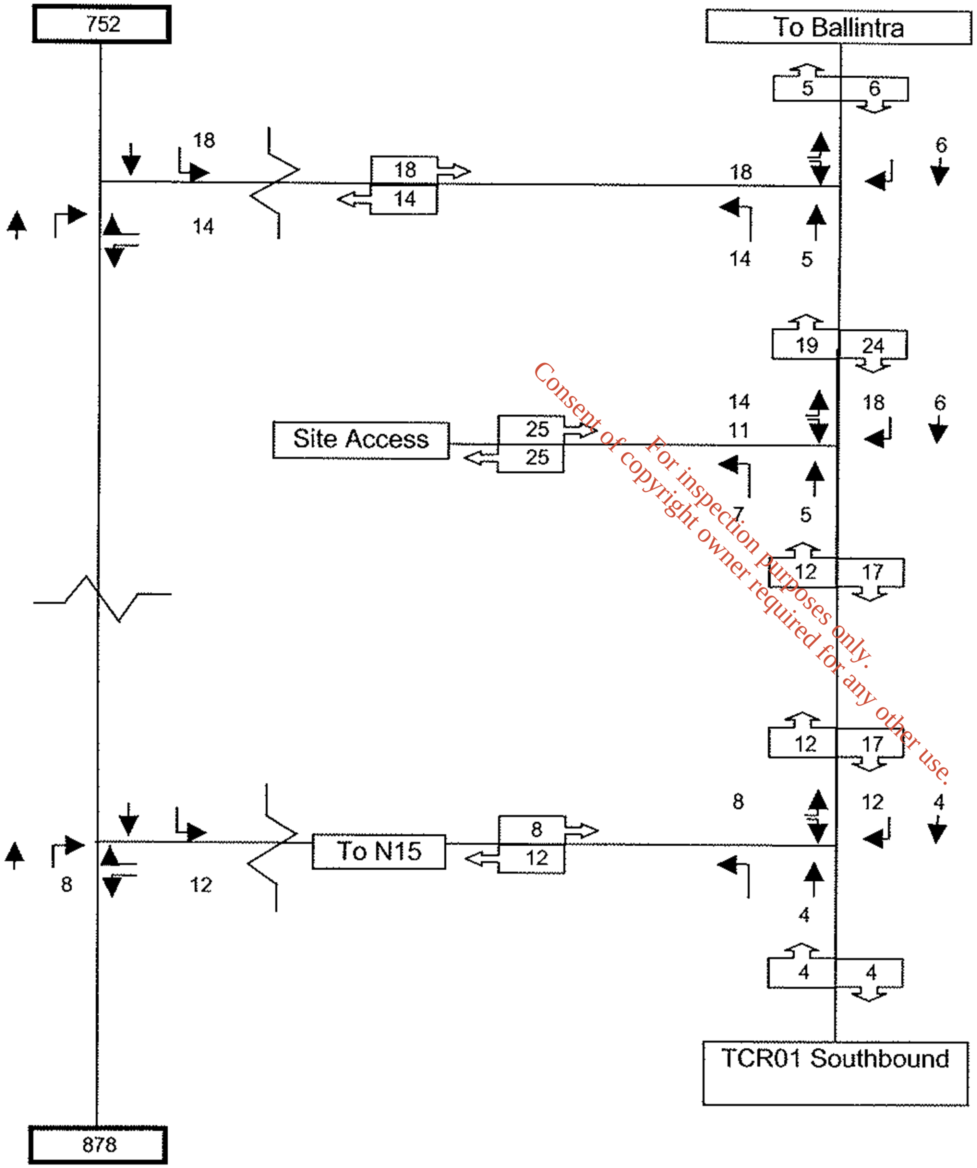

Kirk McClure Morton	
Job Title	Ballymacarrick Development
Job No.	5281.45 (Existing & Prop)
Dwg Title	Traffic 2014 Peak Hour Based on 24000 Tonnes PA

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TIA APPENDIX H.4

COMPUTER ANALYSIS

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```
--------------------------------------------------------------------------------
iL              TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Peak
--------------------------------------------------------------------------------

.sual PICADY 4.10
:81 ^5 Existing Peak (10:45 AM -11:45 AM) Site Access Junction 2004
:P?    START=1030,FINISH=1200,INTERV=  15 &END
;OPTION LMARG=T,ODTAB=T,TEE=T   &END
:cess Road (to South)
.te access
:cess Road (to North)
:T5 and CT6 GEOMETRIC DATA
      W         WCR   PED DEMAND                      USERQ
   06.00      00.00
WID.RIGHT VIS.RIGHT CT6
     2.2       090.0      BLOCK
  WIDTH L    WIDTH R      VIS L      VIS R      FLARE CT7
    4.00       0.00        020        020
TURNING COUNTS (VEHICLES) FOR PEAK HOUR
0000.000  0002.000  0004.000
0003.000  0000.000  0004.000
0005.000  0005.000  0000.000
PERCENTAGES OF HEAVY VEHICLES
  023.00    073.00    050.00
=========================================== end of file ===============================================

Printed at 10:58:43 on 12/09/2002]
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Site Access 2004 Peak
Existing Traffic Base...

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EPA Export 25-07-2013:22:28:56

TRL VIEWER 2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Peak

TRL LIMITED

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:APACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAR 2001)

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NO WAY RELIEVED OF HIS RESPONSIBILITY FOR THE CORRECTNESS OF THE SOLUTION

with file:-
\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Peak 2004.vpi"
10:58:34 on Thursday, 12 September 2002

:N TITLE
****
81.45 Existing Peak (10:45 AM -11:45 AM) Site Access Junction 2004

.JOR/MINOR JUNCTION CAPACITY AND DELAY
****

'PUT DATA

```
MAJOR ROAD (ARM C) --------------------- MAJOR ROAD (ARM A)
                             I
                             I
                             I
                             I
                             I
                             I
                      MINOR ROAD (ARM B)
```

A IS Access Road (to South)
B IS Site access
C IS Access Road (to North)

EAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

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METRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	90.0 M.
- BLOCKS TRAFFIC		YES
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	20.0 M.
- VISIBILITY TO RIGHT	(VB-A)	20.0 M.
- LANE 1 WIDTH	(WB-C)	4.00 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

EPA Export 25-07-2013:22:28:56

TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 10.30 AND ENDS 12.00

LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN) BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.08	0.11	0.08
ARM B	15.00	45.00	75.00	0.09	0.13	0.09
ARM C	15.00	45.00	75.00	0.13	0.19	0.13

TURNING PROPORTIONS / TURNING COUNTS (VEH/HR) / (PERCENTAGE OF H.V.S)

TIME	FROM/TO	ARM A	ARM B	ARM C
10.30 - 12.00				
	ARM A	0.000	0.333	0.667
		0.0	2.0	4.0
		(0.0)	(23.0)	(23.0)
	ARM B	0.429	0.000	0.571
		3.0	0.0	4.0
		(73.0)	(0.0)	(73.0)
	ARM C	0.500	0.500	0.000
		5.0	5.0	0.0
		(50.0)	(50.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.30-10.45								
-AC	0.09	5.98	0.015		0.0	0.0	0.2	
-AB	0.06	6.98	0.009		0.0	0.0	0.1	
C-A	0.06							
A-B	0.03							
A-C	0.05							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.45-11.00								
B-AC	0.10	5.97	0.017		0.0	0.0	0.3	
C-AB	0.08	6.99	0.011		0.0	0.0	0.2	
C-A	0.07							
A-B	0.03							
A-C	0.06							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
.1.00-11.15								
B-AC	0.13	5.96	0.021		0.0	0.0	0.3	
C-AB	0.09	6.99	0.013		0.0	0.0	0.2	
C-A	0.09							
A-B	0.04							
A-C	0.07							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.15-11.30								
B-AC	0.13	5.96	0.021		0.0	0.0	0.3	
C-AB	0.09	6.99	0.013		0.0	0.0	0.2	
C-A	0.09							
A-B	0.04							
A-C	0.07							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.30-11.45								
B-AC	0.10	5.97	0.017		0.0	0.0	0.3	
C-AB	0.08	6.99	0.011		0.0	0.0	0.2	
C-A	0.07							
A-B	0.03							
A-C	0.06							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.45-12.00								
B-AC	0.09	5.98	0.015		0.0	0.0	0.2	
C-AB	0.06	6.98	0.009		0.0	0.0	0.1	
C-A	0.06							
A-B	0.03							
A-C	0.05							

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ARNING* NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

EUE FOR STREAM B-AC

ME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

EUE FOR STREAM C-AB

ME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

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RL TRL VIEWER 2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Pea

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND		* QUEUEING * * DELAY *		* INCLUSIVE QUEUEING * * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
B-AC	9.6	6.4	1.6	0.17	1.6	0.17
C-AB	6.9	4.6	1.0	0.15	1.0	0.15
C-A	6.8	4.5				
A-B	2.7	1.8				
A-C	5.5	3.7				
ALL	31.5	21.0	2.6	0.08	2.6	0.08

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.
==== ==================================== end of file ==

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-----------------------------------------------------------------------------------
1              TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Peak
-----------------------------------------------------------------------------------

sual PICADY 4.10
31.45 Existing Peak (10:45 AM -11:45 AM) Site Access Junction 2014
PARAM START=1030,FINISH=1200,INTERV=  15 &END
OPTION LMARG=T,ODTAB=T,TEE=T  &END
cess Road (to South)
te access
cess Road (to North)
T5 and CT6 GEOMETRIC DATA
      W         WCR  PED DEMAND                    USERQ
   06.00      00.00
WID.RIGHT VIS.RIGHT CT6
     2.2      090.0       BLOCK
 WIDTH L    WIDTH R      VIS L      VIS R      FLARE CT7
    4.00       0.00        020        020
TURNING COUNTS (VEHICLES) FOR PEAK HOUR
0000.000  0002.000  0005.000
0004.000  0000.000  0005.000
0006.000  0006.000  0000.000
PERCENTAGES OF HEAVY VEHICLES
  023.00    073.00    050.00
========================================== end of file ==============================================

Printed at 12:36:53 on 12/09/2002]
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Site Access 2014 ... Existing Traffic Base ... [illegible]

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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RELEASE 3.0 (MAR 2001)

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"i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Peak 2014.vpi"
at 12:36:40 on Thursday, 12 September 2002

RUN TITLE
****
5281.45 Existing Peak (10:45 AM -11:45 AM) Site Access Junction 2014

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY
****

INPUT DATA

```
MAJOR ROAD (ARM C) --------------------- MAJOR ROAD (ARM A)
                             I
                             I
                             I
                             I
                             I
                             I
                    MINOR ROAD (ARM B)
```

ARM A IS Access Road (to South)
ARM B IS Site access
ARM C IS Access Road (to North)

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

For inspection purposes only.
Consent of copyright owner required for any other use.

GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	90.0 M.
- BLOCKS TRAFFIC		YES
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	20.0 M.
- VISIBILITY TO RIGHT	(VB-A)	20.0 M.
- LANE 1 WIDTH	(WB-C)	4.00 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

EPA Export 25-07-2013:22:28:57

TRL VIEWER 2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Access Existing Peak

RAFFIC DEMAND DATA

IME PERIOD BEGINS 10.30 AND ENDS 12.00

ENGTH OF TIME PERIOD - 90 MINUTES.
ENGTH OF TIME SEGMENT - 15 MINUTES.

EMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.09	0.13	0.09
ARM B	15.00	45.00	75.00	0.11	0.17	0.11
ARM C	15.00	45.00	75.00	0.15	0.23	0.15

TURNING PROPORTIONS / TURNING COUNTS (VEH/HR) / (PERCENTAGE OF H.V.S)

TIME	FROM/TO	ARM A	ARM B	ARM C
10.30 - 12.00				
	ARM A	0.000	0.286	0.714
		0.0	2.0	5.0
		(0.0)	(23.0)	(23.0)
	ARM B	0.444	0.000	0.556
		4.0	0.0	5.0
		(73.0)	(0.0)	(73.0)
	ARM C	0.500	0.500	0.000
		6.0	6.0	0.0
		(50.0)	(50.0)	(0.0)

URNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.30-10.45								
B-AC	0.11	5.95	0.019		0.0	0.0	0.3	
C-AB	0.08	6.99	0.011		0.0	0.0	0.2	
C-A	0.07							
A-B	0.03							
A-C	0.06							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.45-11.00								
B-AC	0.13	5.94	0.023		0.0	0.0	0.3	
C-AB	0.09	6.99	0.013		0.0	0.0	0.2	
C-A	0.09							
A-B	0.03							
A-C	0.07							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.00-11.15								
B-AC	0.16	5.93	0.028		0.0	0.0	0.4	
C-AB	0.11	7.00	0.016		0.0	0.0	0.3	
C-A	0.11							
A-B	0.04							
A-C	0.09							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.15-11.30								
B-AC	0.16	5.93	0.028		0.0	0.0	0.4	
C-AB	0.11	7.00	0.016		0.0	0.0	0.3	
C-A	0.11							
A-B	0.04							
A-C	0.09							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.30-11.45								
B-AC	0.13	5.94	0.023		0.0	0.0	0.4	
C-AB	0.09	6.99	0.013		0.0	0.0	0.2	
C-A	0.09							
A-B	0.03							
A-C	0.07							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.45-12.00								
B-AC	0.11	5.95	0.019		0.0	0.0	0.3	
C-AB	0.08	6.99	0.011		0.0	0.0	0.2	
C-A	0.07							
A-B	0.03							
A-C	0.06							

NING* NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
?.00	0.0

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QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND		* QUEUEING * * DELAY *		* INCLUSIVE QUEUEING * * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
B-AC	12.3	8.2	2.1	0.17	2.1	0.17
C-AB	8.3	5.6	1.2	0.15	1.2	0.15
C-A	8.1	5.4				
A-B	2.7	1.8				
A-C	6.9	4.6				
ALL	38.4	25.6	3.3	0.09	3.3	0.09

DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

ND OF JOB

***** PICADY 4 run completed.
== end of file ==

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TRL             TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Acc Prop Pk 2014
--------------------------------------------------------------------------------

Visual PICADY 4.10
5281.45 Prop Pk (10:45 AM -11:45 AM) Site Access Junction 2014 SENSITIVITY
  RAM START=1030,FINISH=1200,INTERV=  15 &END
  TION LMARG=T,ODTAB=T,TEE=T  &END
Access Road (to South)
Site access
Access Road (to North)
*CT5 and CT6 GEOMETRIC DATA
*       W         WCR  PED DEMAND                     USERQ
    06.00      00.00
* WID.RIGHT VIS.RIGHT CT6
      2.2      090.0       BLOCK
*  WIDTH L    WIDTH R      VIS L      VIS R     FLARE CT7
     4.00      0.00        020        020
* TURNING COUNTS (VEHICLES) FOR PEAK HOUR
  0000.000  0007.000  0005.000
  0011.000  0000.000  0014.000
  0006.000  0018.000  0000.000
* PERCENTAGES OF HEAVY VEHICLES
    023.00     073.00     050.00
============================================ end of file ============================================
```

Sensitivity Analysis
2014 Peak
Site Access. Based on
24000 Tonnes P.A.

[Printed at 14:39:17 on 08/10/2002]

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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un with file:-
i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Site Acc Prop Pk 2014 SENSITIVITY.vpi"
t 14:38:52 on Tuesday, 8 October 2002

RUN TITLE
****
5281.45 Prop Pk (10:45 AM -11:45 AM) Site Access Junction 2014 SENSITIVITY

MAJOR/MINOR JUNCTION CAPACITY AND DELAY
****

INPUT DATA

```
MAJOR ROAD (ARM C) --------------------- MAJOR ROAD (ARM A)
                             I
                             I
                             I
                             I
                             I
                             I
                      MINOR ROAD (ARM B)
```

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RM A IS Access Road (to South)
RM B IS Site access
RM C IS Access Road (to North)

TREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

EOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	90.0 M.
- BLOCKS TRAFFIC		YES
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	20.0 M.
- VISIBILITY TO RIGHT	(VB-A)	20.0 M.
- LANE 1 WIDTH	(WB-C)	4.00 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

EPA Export 25-07-2013:22:28:57

TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 10.30 AND ENDS 12.00

LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.15	0.23	0.15
ARM B	15.00	45.00	75.00	0.31	0.47	0.31
ARM C	15.00	45.00	75.00	0.30	0.45	0.30

TIME	FROM/TO	ARM A	ARM B	ARM C
		TURNING PROPORTIONS / TURNING COUNTS (VEH/HR) / (PERCENTAGE OF H.V.S)		
10.30 - 12.00	ARM A	0.000	0.583	0.417
		0.0	7.0	5.0
		(0.0)	(23.0)	(23.0)
	ARM B	0.440	0.000	0.560
		11.0	0.0	14.0
		(73.0)	(0.0)	(73.0)
	ARM C	0.250	0.750	0.000
		6.0	18.0	0.0
		(50.0)	(50.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.30-10.45								
B-AC	0.31	5.92	0.053		0.0	0.1	0.8	
C-AB	0.23	6.98	0.033		0.0	0.0	0.5	
C-A	0.07							
A-B	0.09							
A-C	0.06							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.45-11.00								
B-AC	0.37	5.91	0.063		0.1	0.1	1.0	
C-AB	0.27	6.98	0.039		0.0	0.0	0.6	
C-A	0.09							
A-B	0.10							
A-C	0.07							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.00-11.15								
B-AC	0.46	5.89	0.078		0.1	0.1	1.2	
C-AB	0.33	6.98	0.048		0.0	0.1	0.8	
C-A	0.10							
A-B	0.13							
A-C	0.09							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.15-11.30								
B-AC	0.46	5.89	0.078		0.1	0.1	1.3	
C-AB	0.33	6.98	0.048		0.1	0.1	0.8	
C-A	0.10							
A-B	0.13							
A-C	0.09							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.30-11.45								
B-AC	0.37	5.91	0.063		0.1	0.1	1.0	
C-AB	0.27	6.98	0.039		0.1	0.0	0.6	
C-A	0.09							
A-B	0.10							
A-C	0.07							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.45-12.00								
B-AC	0.31	5.92	0.053		0.1	0.1	0.9	
C-AB	0.23	6.98	0.033		0.0	0.0	0.5	
C-A	0.07							
A-B	0.09							
A-C	0.06							

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WARNING* NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

UEUE FOR STREAM B-AC

IME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.1
11.00	0.1
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

UEUE FOR STREAM C-AB

IME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.1
11.30	0.1
11.45	0.0
12.00	0.0

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QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-AC	34.3	22.9	6.1	0.18	6.1	0.18
C-AB	25.0	16.7	3.8	0.15	3.8	0.15
C-A	7.9	5.3				
A-B	9.6	6.4				
A-C	6.9	4.6				
ALL	83.6	55.8	9.9	0.12	9.9	0.12

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

** PICADY 4 run completed.

====================================== end of file ==

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-------------------------------------------------------------------------------
               TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adjacent Junction 2004 E:
-------------------------------------------------------------------------------

sual PICADY 4.10
31.45 Existing Peak (10:45 AM -11:45 AM) Junction to  South of Access 2004
PARAM START=1030,FINISH=1200,INTERV=  15 &END
OPTION LMARG=T,ODTAB=T,TEE=T  &END
ith Road (Road to Northern Ireland)
ad to N15
rthern Road (to Ballintra)
T5 and CT6 GEOMETRIC DATA
     W        WCR  PED DEMAND                          USERQ
  06.00      00.00
VID.RIGHT VIS.RIGHT CT6
    2.2      090.0      BLOCK
 WIDTH L    WIDTH R      VIS L      VIS R      FLARE CT7
   3.00       0.00        017        017
TURNING COUNTS (VEHICLES) FOR PEAK HOUR
0000.000  0000.000  0002.000
0000.000  0000.000  0004.000
0002.000  0006.000  0000.000
PERCENTAGES OF HEAVY VEHICLES
  036.00    018.00    028.00
========================================== end of file ==========================================

Printed at 11:36:27 on 12/09/2002]
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Road to South of Site
Peak Hour 2004 [illegible]

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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Run with file:-
"i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adjacent Junction 2004 Existing Peak.vpi"
at 11:36:18 on Thursday, 12 September 2002

RUN TITLE
****
5281.45 Existing Peak (10:45 AM -11:45 AM) Junction to South of Access 2004

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY
****

‾"PUT DATA

```
MAJOR ROAD (ARM C) --------------------- MAJOR ROAD (ARM A)
                            I
                            I
                            I
                            I
                            I
                            I
                     MINOR ROAD (ARM B)
```

ARM A IS South Road (Road to Northern Ireland)
ARM B IS Road to N15
ARM C IS Northern Road (to Ballintra)

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	90.0 M.
- BLOCKS TRAFFIC		YES
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	17.0 M.
- VISIBILITY TO RIGHT	(VB-A)	17.0 M.
- LANE 1 WIDTH	(WB-C)	3.00 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

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RAFFIC DEMAND DATA

IME PERIOD BEGINS 10.30 AND ENDS 12.00

ENGTH OF TIME PERIOD - 90 MINUTES.
ENGTH OF TIME SEGMENT - 15 MINUTES.

EMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN) BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.03	0.04	0.03
ARM B	15.00	45.00	75.00	0.05	0.08	0.05
ARM C	15.00	45.00	75.00	0.10	0.15	0.10

TIME	FROM/TO	TURNING PROPORTIONS / TURNING COUNTS (VEH/HR) / (PERCENTAGE OF H.V.S) ARM A	ARM B	ARM C
10.30 - 12.00	ARM A	0.000	0.000	1.000
		0.0	0.0	2.0
		(0.0)	(36.0)	(36.0)
	ARM B	0.000	0.000	1.000
		0.0	0.0	4.0
		(18.0)	(0.0)	(18.0)
	ARM C	0.250	0.750	0.000
		2.0	6.0	0.0
		(28.0)	(28.0)	(0.0)

URNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.30-10.45								
B-AC	0.05	8.96	0.006		0.0	0.0	0.1	
C-AB	0.08	8.16	0.009		0.0	0.0	0.1	
C-A	0.02							
A-B	0.00							
A-C	0.03							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.45-11.00								
B-AC	0.06	8.96	0.007		0.0	0.0	0.1	
C-AB	0.09	8.16	0.011		0.0	0.0	0.2	
C-A	0.03							
A-B	0.00							
A-C	0.03							

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TRL TRL VIEWER 2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adjacent Junction 2004

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.00-11.15								
B-AC	0.07	8.95	0.008		0.0	0.0	0.1	
C-AB	0.11	8.17	0.013		0.0	0.0	0.2	
C-A	0.04							
A-B	0.00							
A-C	0.04							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.15-11.30								
B-AC	0.07	8.95	0.008		0.0	0.0	0.1	
C-AB	0.11	8.17	0.013		0.0	0.0	0.2	
C-A	0.04							
A-B	0.00							
A-C	0.04							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.30-11.45								
B-AC	0.06	8.96	0.007		0.0	0.0	0.1	
C-AB	0.09	8.16	0.011		0.0	0.0	0.2	
C-A	0.03							
A-B	0.00							
A-C	0.03							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.45-12.00								
B-AC	0.05	8.96	0.006		0.0	0.0	0.1	
C-AB	0.08	8.16	0.009		0.0	0.0	0.1	
C-A	0.02							
A-B	0.00							
A-C	0.03							

RNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
2.00	0.0

EPA Export 25-07-2013:22:28:57

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND		* QUEUEING * * DELAY *		* INCLUSIVE QUEUEING * * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
B-AC	5.5	3.7	0.6	0.11	0.6	0.11
C-AB	8.3	5.5	1.0	0.12	1.0	0.12
C-A	2.7	1.8				
A-B	0.0	0.0				
A-C	2.7	1.8				
ALL	19.2	12.8	1.6	0.09	1.6	0.09

DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

ND OF JOB

***** PICADY 4 run completed.
=== end of file ===

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EPA Export 25-07-2013:22:28:57

```
--------------------------------------------------------------------------------
TRL             TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adjacent Junction 2014
--------------------------------------------------------------------------------

Visual PICADY 4.10
5281.45 Existing Peak (10:45 AM -11:45 AM) Junction to  South of Access 2004
 &   AM START=1030,FINISH=1200,INTERV=  15 &END
 &  .ION LMARG=T,ODTAB=T,TEE=T  &END
South Road (Road to Northern Ireland)
Road to N15
Northern Road (to Ballintra)
*CT5 and CT6 GEOMETRIC DATA
*       W        WCR  PED DEMAND                   USERQ
     06.00     00.00
* WID.RIGHT VIS.RIGHT CT6
       2.2     090.0      BLOCK
*  WIDTH L   WIDTH R      VIS L     VIS R     FLARE CT7
      3.00      0.00       017       017
* TURNING COUNTS (VEHICLES) FOR PEAK HOUR
  0000.000  0000.000  0002.000
  0000.000  0000.000  0005.000
  0002.000  0007.000  0000.000
* PERCENTAGES OF HEAVY VEHICLES
    036.00    018.00    028.00
============================================= end of file ================================================


 [Printed at 11:37:07 on 12/09/2002]
```

Road to South of Site
Peak Hour 2004 Survey

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EPA Export 25-07-2013:22:28:57

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,              TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adjacent Junction 2014 Ex
----------------------------------------------------------------------------------

                              TRL LIMITED

                          (C) COPYRIGHT 2001

 CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

                       PICADY 4.1  ANALYSIS PROGRAM
                          RELEASE 3.0 (MAR 2001)

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                   BY PERMISSION OF THE CONTROLLER OF HMSO
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un with file:-
i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adjacent Junction 2014 Existing Peak.vpi"
: 11:36:59 on Thursday, 12 September 2002

RUN TITLE
*********
5281.45 Existing Peak (10:45 AM -11:45 AM) Junction to  South of Access 2004


MAJOR/MINOR JUNCTION CAPACITY AND DELAY
***************************************

INPUT DATA
----------

                    MAJOR ROAD (ARM C) --------------------- MAJOR ROAD (ARM A)
                                              I
                                              I
                                              I
                                              I
                                              I
                                              I
                                         MINOR ROAD (ARM B)

RM A IS South Road (Road to Northern Ireland)
RM B IS Road to N15
RM C IS Northern Road (to Ballintra)


TREAM LABELLING CONVENTION
--------------------------

      STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

      STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

      ETC.



EOMETRIC DATA
-------------
```

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	90.0 M.
- BLOCKS TRAFFIC		YES
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	17.0 M.
- VISIBILITY TO RIGHT	(VB-A)	17.0 M.
- LANE 1 WIDTH	(WB-C)	3.00 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

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TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 10.30 AND ENDS 12.00

LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.03	0.04	0.03
ARM B	15.00	45.00	75.00	0.06	0.09	0.06
ARM C	15.00	45.00	75.00	0.11	0.17	0.11

TURNING PROPORTIONS / TURNING COUNTS (VEH/HR) / (PERCENTAGE OF H.V.S)

TIME	FROM/TO	ARM A	ARM B	ARM C
10.30 - 12.00				
	ARM A	0.000	0.000	1.000
		0.0	0.0	2.0
		(0.0)	(36.0)	(36.0)
	ARM B	0.000	0.000	1.000
		0.0	0.0	5.0
		(18.0)	(0.0)	(18.0)
	ARM C	0.222	0.778	0.000
		2.0	7.0	0.0
		(28.0)	(28.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.30-10.45								
B-AC	0.06	8.96	0.007		0.0	0.0	0.1	
C-AB	0.09	8.16	0.011		0.0	0.0	0.2	
C-A	0.02							
A-B	0.00							
A-C	0.03							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.45-11.00								
B-AC	0.07	8.96	0.008		0.0	0.0	0.1	
C-AB	0.10	8.16	0.013		0.0	0.0	0.2	
C-A	0.03							
A-B	0.00							
A-C	0.03							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.00-11.15								
B-AC	0.09	8.95	0.010		0.0	0.0	0.2	
C-AB	0.13	8.17	0.016		0.0	0.0	0.2	
C-A	0.04							
A-B	0.00							
A-C	0.04							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.15-11.30								
B-AC	0.09	8.95	0.010		0.0	0.0	0.2	
C-AB	0.13	8.17	0.016		0.0	0.0	0.2	
C-A	0.04							
A-B	0.00							
A-C	0.04							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.30-11.45								
B-AC	0.07	8.96	0.008		0.0	0.0	0.1	
C-AB	0.10	8.16	0.013		0.0	0.0	0.2	
C-A	0.03							
A-B	0.00							
A-C	0.03							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.45-12.00								
B-AC	0.06	8.96	0.007		0.0	0.0	0.1	
C-AB	0.09	8.16	0.011		0.0	0.0	0.2	
C-A	0.02							
A-B	0.00							
A-C	0.03							

WARNING* NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

UEUE FOR STREAM B-AC

IME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

UEUE FOR STREAM C-AB

IME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

EPA Export 25-07-2013:22:28:57

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND		* QUEUEING * * DELAY *		* INCLUSIVE QUEUEING * * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
B-AC	6.9	4.6	0.8	0.11	0.8	0.11
C-AB	9.6	6.4	1.2	0.12	1.2	0.12
C-A	2.7	1.8				
A-B	0.0	0.0				
A-C	2.7	1.8				
ALL	21.9	14.6	2.0	0.09	2.0	0.09

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

****** PICADY 4 run completed.

==================================== end of file ==

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L              TRL VIEWER    2.0 AD i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adj Jct SENSITIVITY 2014
-----------------------------------------------------------------------------------

sual PICADY 4.10
81.45 Prop SENSITIVITY (10:45 AM -11:45 AM) Junction to  South of Access 2014
PARAM START=1030,FINISH=1200,INTERV=  15 &END
OPTION LMARG=T,ODTAB=T,TEE=T  &END
uth Road (Road to Northern Ireland)
ad to N15
rthern Road (to Ballintra)
T5 and CT6 GEOMETRIC DATA
     W         WCR  PED DEMAND                    USERQ
   06.00     00.00
WID.RIGHT VIS.RIGHT CT6
     2.2     090.0     BLOCK
 WIDTH L   WIDTH R     VIS L      VIS R      FLARE CT7
    3.00      0.00       017        017
TURNING COUNTS (VEHICLES) FOR PEAK HOUR
0000.000  0000.000  0004.000
0000.000  0000.000  0012.000
0004.000  0016.000  0000.000
PERCENTAGES OF HEAVY VEHICLES
  036.00    018.00    028.00
========================================== end of file ==============================================

Printed at 11:59:57 on 12/09/2002]
```

Sensitivity Analysis
2014 Peak
Access Road to South of Site

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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Run with file:-
"i:\25Jobs\5281\5281.45 Meenaboll & Ballymacarrick\Models\Adj Jct SENSITIVITY 2014 proposed Peak.vpi"
at 11:59:47 on Thursday, 12 September 2002

RUN TITLE
****
5281.45 Prop SENSITIVITY (10:45 AM -11:45 AM) Junction to South of Access 2014

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY
****

INPUT DATA

```
MAJOR ROAD (ARM C) --------------------- MAJOR ROAD (ARM A)
                             I
                             I
                             I
                             I
                             I
                             I
                      MINOR ROAD (ARM B)
```

ARM A IS South Road (Road to Northern Ireland)
ARM B IS Road to N15
ARM C IS Northern Road (to Ballintra)

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

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GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	90.0 M.
- BLOCKS TRAFFIC		YES
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	17.0 M.
- VISIBILITY TO RIGHT	(VB-A)	17.0 M.
- LANE 1 WIDTH	(WB-C)	3.00 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

RAFFIC DEMAND DATA

IME PERIOD BEGINS 10.30 AND ENDS 12.00

ENGTH OF TIME PERIOD - 90 MINUTES.
ENGTH OF TIME SEGMENT - 15 MINUTES.

EMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.05	0.08	0.05
ARM B	15.00	45.00	75.00	0.15	0.23	0.15
ARM C	15.00	45.00	75.00	0.25	0.38	0.25

TURNING PROPORTIONS / TURNING COUNTS (VEH/HR) / (PERCENTAGE OF H.V.S)

TIME	FROM/TO	ARM A	ARM B	ARM C
10.30 - 12.00	ARM A	0.000	0.000	1.000
		0.0	0.0	4.0
		(0.0)	(36.0)	(36.0)
	ARM B	0.000	0.000	1.000
		0.0	0.0	12.0
		(18.0)	(0.0)	(18.0)
	ARM C	0.200	0.800	0.000
		4.0	16.0	0.0
		(28.0)	(28.0)	(0.0)

URNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.30-10.45								
B-AC	0.15	8.95	0.017		0.0	0.0	0.2	
C-AB	0.20	8.17	0.025		0.0	0.0	0.4	
C-A	0.05							
A-B	0.00							
A-C	0.05							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
10.45-11.00								
B-AC	0.18	8.95	0.020		0.0	0.0	0.3	
C-AB	0.24	8.18	0.029		0.0	0.0	0.5	
C-A	0.06							
A-B	0.00							
A-C	0.06							

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TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.00-11.15								
B-AC	0.22	8.94	0.025		0.0	0.0	0.4	
C-AB	0.30	8.18	0.036		0.0	0.0	0.6	
C-A	0.07							
A-B	0.00							
A-C	0.07							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.15-11.30								
B-AC	0.22	8.94	0.025		0.0	0.0	0.4	
C-AB	0.30	8.18	0.036		0.0	0.0	0.6	
C-A	0.07							
A-B	0.00							
A-C	0.07							

IME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.30-11.45								
B-AC	0.18	8.95	0.020		0.0	0.0	0.3	
C-AB	0.24	8.18	0.029		0.0	0.0	0.5	
C-A	0.06							
A-B	0.00							
A-C	0.06							

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
11.45-12.00								
B-AC	0.15	8.95	0.017		0.0	0.0	0.3	
C-AB	0.20	8.17	0.025		0.0	0.0	0.4	
C-A	0.05							
A-B	0.00							
A-C	0.05							

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NING* NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
10.45	0.0
11.00	0.0
11.15	0.0
11.30	0.0
11.45	0.0
.00	0.0

EPA Export 25-07-2013:22:28:57

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-AC	16.5	11.0	1.9	0.11	1.9	0.11
C-AB	22.1	14.7	2.8	0.13	2.8	0.13
C-A	5.3	3.5				
A-B	0.0	0.0				
A-C	5.5	3.7				
ALL	49.4	32.9	4.7	0.09	4.7	0.09

DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

ND OF JOB

***** PICADY 4 run completed.
== end of file ==

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<u>TIA APPENDIX H.5</u>

SITE ANALYSIS

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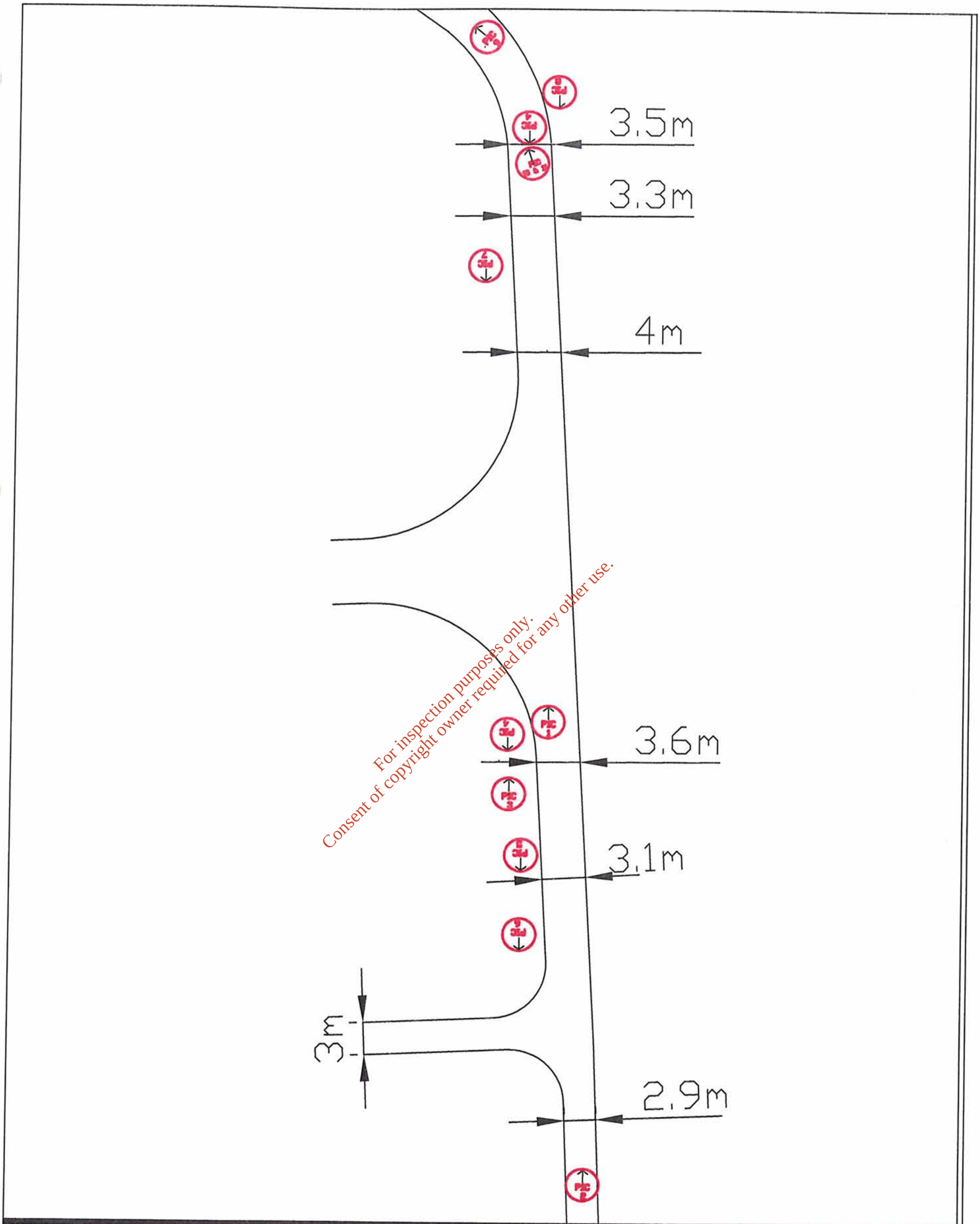

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TITLE SITE MEASUREMENTS AND PHOTOGRAPH LOCATIONS	TITLE 5281.45

PROJECT	BALLYMACARRICK LANDFILL SITE BALLINTRA, CO. DONEGALL					
CLIENT	DONEGAL COUNTY COUNCIL					
DRAW SCALE	NTS	DRAWN DATE		CHECKED DATE		APPROVED DATE

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A4C-REV 2

Photo G5.1 Approaching the site from the south

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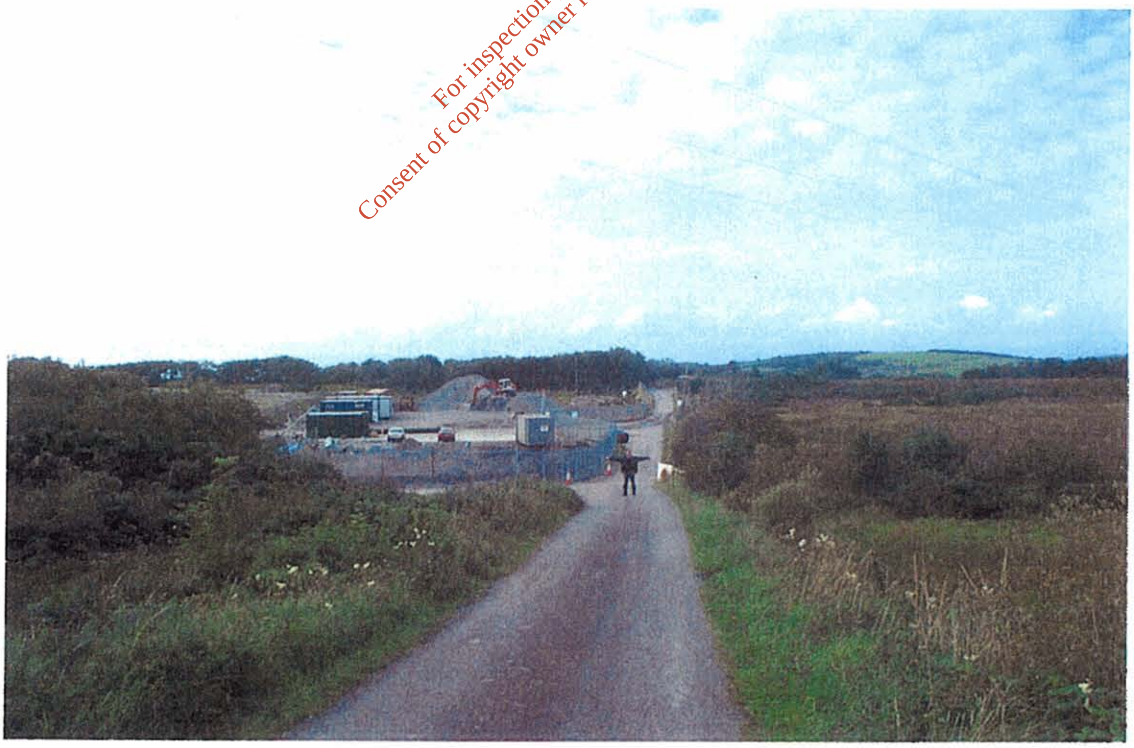

Photo G5.2 Approaching the site from the south

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Photo G5.3 Approaching the site entrance from the south

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Photo G5.4 Leaving the site to the south

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Photo G5.5 Leaving the site to the south

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Photo G5.6 Leaving the site to the south

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Photo G5.7 Approaching the site from the north

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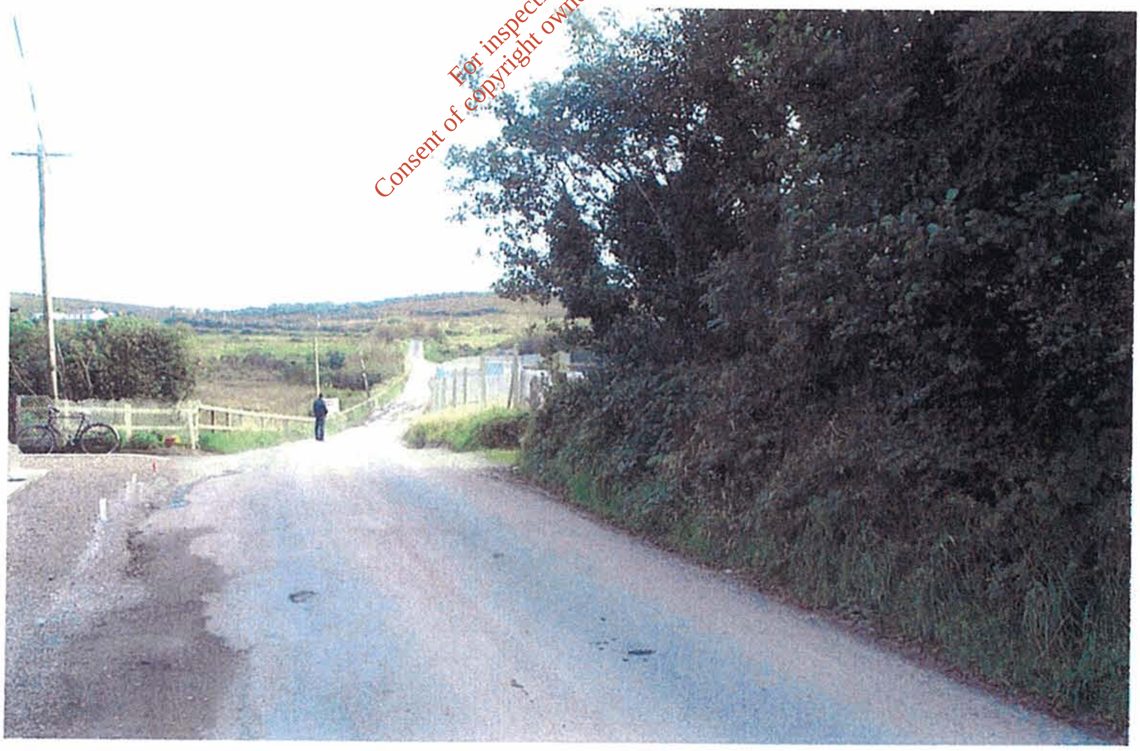

Photo G5.8 Approaching the site from the north

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Photo G5.9 Approaching the site from the north

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Photo G5.10 First bend (northwards) before resurfacing

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Photo G5.11 **First bend (northwards) after resurfacing**

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TIA APPENDIX H.6

INITIAL COMMENTS TO DONEGAL COUNTY COUNCIL

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9 September 2002

BALLYNACARRICK LANDFILL SITE SURVEY of 5-9-02

TRAFFIC TO AND FROM THE SITE

The attached traffic diagram highlights that the survey period was between 08.45-16.00. During this time the road network to and from the existing landfill site access and the surrounding "T" junction was examined. The survey highlighted the low volume of traffic on the surrounding road network and the turning movement into and out of the site in relation to HGV and other vehicular movement.

The assessment highlights that most of the traffic into the site were HGV's which entered and left the site from and to the north (towards Ballintra). A small number turned right from the site and right again towards the N15. Site observations highlighted that these were mainly cars and vehicles that had unloaded and returning to the N15.

IDENTIFICATION OF LAY-BYS TO FACILITATE PASSING

In general the maximum road widths on the surrounding road network was 4m.

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From the N15to the site via the road to the south of the site

Use of the access road from the N15 road is not encouraged due to the quality and possible subsidence of the road, although a number of private vehicles and empty lorries are able to use this road. For this reason we looked at the road to the N15 to examine possible lay-by locations to accommodate two way traffic. If possible we looked at natural lay-bays where acquisition of third party land is not required.

From exiting the N15 there are a couple of small verges on both sides of the road near the N15. From the N15 to the landfill site there is a farmhouse at 0.6 miles chainage on the right with a natural lay-by directly opposite (on the left) that could accommodate the passing of an HGV and a car. Generally there is poor road alignment along this road. At 1.1 miles chainage there is a natural verge on the left approximately 2.5 m wide and 15m long. There are a couple of points where there are small verges that could accommodate two cars passing. There is a mini crossroads at 1.2-mile chainage, beyond which there have been problems with the road quality. There is a possible verge at 1.4 miles and another at 1.5 miles adjacent to the site. The photograph enclosed shows the perimeter to the south of the site, which could accommodate a lay-by at any point adjacent with the perimeter of the site. At 1.6 miles there is a T-junction (traffic counted) onto the site access road with the site entrance at 1.7 miles chainage.

From the N15 to the site via the road to the north of the site

This is the preferred route for site traffic to the existing Ballymacarrick Landfill Site. At this time we have studied from the crossroad leading to the site access. From the crossroads there is a small verge

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on the right hand side, and another about 0.2 miles towards the site. At this point the road is poor and very narrow. At the "T" junction a left should be taken, and there is a small verge on the right. There are two further existing verges that could be improved on the right hand side, on of which is relatively wide and about 25m long. A right hand turn is made into the site.

In general the turning head at the site access is adequate with visibility good. Care needs to be taken if an additional boundary is erected around the site to ensure that existing adequate visibility is maintained.

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