APPENDIX 1

Public Consultation

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Greenstar Ltd., Unit 6 Ballyogan Business Park, Ballyogan Road, Sandyford Dublin 18, intends to apply to Wexford County Council for Planning Permission for the development of the Materials Recovery and Transfer Facility at Clavass, Enniscorthy, County Wexford. The proposed facility, which will be purpose built and designed and operated in accordance with best international practice, will handle up to 90,000 tonnes of non-hazardous household, Commercial & Industrial and Construction & Demolition waste annually. An Environmental Impact Statement (EIS) is being prepared as part of the planning application. Greenstar Ltd. invites interested parties to submit written comments on the proposed development for consideration in the EIS. Written submissions should be sent to O'Callaghan Moran & Associates, Granary House, Rutland Street, Cork to be received by the 31/08/2007.

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07- 048-19 - EIS Public Consult.

'St. Martha'
Old Dublin Road,
Enniscorthy,
Co. Wexford.

Telephone: 053 92 36568

RECEIVED 30 AUG 2007

27/08/07

Dear Mr. O'Callaghan,

Thank you for taking the time to discuss the proposed material recovery and transfer facility to be developed by Greenstar Ltd at Clovass, Enniscorthy. As you advised I am now putting in writing the topics which we discussed during our conversation and I will send a copy to Wexford County Council.

As industries go waste processing generally falls into the category of enterprises that raise all sorts of questions and worries in any community, especially when the development is to be located within close proximity to ones residence. As you can appreciate there are a number of concerns regarding the proposed development that we would like clarified.

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The main concern is the impact that the proposed development will have on our residence, which will have a direct proximity of about 100 meters from the site. The residential development where we are located is private and to date there are nine dwellings in it with the potential for 3 or 4 more. It has been the contention of the owner that the roadway into and around the residential development would be finished when all of the house construction was completed. It is worth noting that construction of dwelling houses on this site started in the mid 1970's and the last house actually built here was in c.1987. It is a matter of record that planning permission issues have been responsible for the non completion of this residential development. The arrival of the waste recovery and transfer facility will further detract the future development of the residential area. It may be worth stating that as this residential development was started some 30 years ago there is in our view if not a legal but at least a moral obligation on the local authority to uphold the residential status of this general area from further commercial development that would detract from the 'residentiality' of the area.

As well as developing the residential site or as we would see it 'finishing it off' the arrival of such a facility would not necessarily enhance the potential resale value of our house as the proximity of a waste handling unit where there is processing of domestic refuse is typically not a feature that one will be looking for in a prospective property.

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Other concerns outside that which pertain directly to our house and family are

Increase in road traffic activity and the corresponding compatibility with the residential area as regards use of the roadway by pedestrians, cyclists etc. Currently there are no footpaths and the road is quite a popular walking area both for exercise and for going to and from the local shops located approximately 1.5 km away. At this time of year the road traffic does increase due to grain intake and the difference that this makes is quite significant as regards road safety.

The current projected annual tonnage through the proposed unit is 90,000 tonnes per year; with an average of 40 tonnes being output per trailer load. This would mean 2,250 x 40 tonnes loads per year or approximately 45 such trailer loads per week, based on a 5 day working week. I appreciate these figures are based on operating at the plant's maximum capacity but with the possibility of further site development available we must assume that the current target will be met at some stage in the not too distant future even if it only to meet the return on investment. The above traffic figures only relate to outgoing materials from the unit and do not even come close to estimating what the vehicle activity may be for incoming materials to the unit.

This further raises the question as to the suitability of the road itself. Is it capable of handling such increased traffic volumes when coupled with the current traffic activity? It must have been noted that even at the more populated section of this road, at Kilcannon, the road surface quality is at best poor despite the Council themselves having a presence there. The surface quality does improve at Moyne Upper and Clovass but the road width could certainly not be classed as adequate as is our experience with the current traffic volumes. It would be assumed that additional road lighting may be required, a feature that may / may not be welcome given the current rural nature of this locale as further lighting may create a more urban feel to the area.

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Issues with the proposed development include;-

1. It is not uncommon for vehicles to inadvertently 'loose' part of their cargo and in the case of waste materials this would clearly be unacceptable given that a significant proportion of the waste will be household waste and its proximity to a residential area.
2. You have indicated that the activities of the development will be carried out inside the plant/transfer station and that there will be odour treatment of all emissions. In most plants where this activity is carried out it is impractical for all aspects of this process to be carried internally – movement of the material in and out of the premises being the main issues. The presence of household waste of unknown age or degradation and however well contained will not prevent all odour emissions to an area that has never been exposed to any such emissions previously. Vehicles that carry household waste both to and from the site will also be subject to odour emissions, including vehicles that are normally parked there. A further point on odour emissions would be what contingencies would be in place if the air/odour treatment system breaks down or power failure an event which is not uncommon in the area. This is of major significance especially as there will be a significant level of household waste scheduled to be processed within the proposed unit.

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3. Further to the presence of household waste we can also envisage that vermin such as rats will be attracted by such a Pied Piper - like enterprise. The installation of baited traps etc will foil some but may not detract from the potential increase in rodent population.
4. With the increase of commercial and vehicular activity there will also be an increase in noise levels. As was stated previously the increase in road traffic due to grain intake does make a noted difference both to noise and road safety. The current business park does not have any major processing industries except a joinery the rest are mainly small service industries and trade depots. These are type of enterprises that do not severely impact the residential nature of the general area.
5. At the moment it has not been made clear whether activity in the proposed development will only be carried out on an 8am to 6pm basis as if longer hours including Saturdays/Sundays and shift work are envisaged it will increase traffic, noise and general activity in the area.
6. You have indicated that the site as will only be developed to 50 % of its capacity. The proposed building will handle up to 90,000 tones per year and that future development while not currently under discussion is a possibility, especially with the ground available for such an expansion. This would only add to our concerns for this development.
7. It would also be interesting to know what other locations were considered along with the site at Clovass, Enniscorthy and why they are not the chosen site for the proposed development.

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Waste processing and handling are acknowledged necessities in our modern day world and they are to be welcomed not just from an environmental point of view but should be considered the right thing to do. It is however a little difficult to understand why more appropriate locations cannot be found that do not compromise established residential areas. It is natural to have pride in one's area and to try and uphold the factors that originally attracted residents to the area in the first place which were

1. Proximity to the town but still some distance from it
2. Quiet rural setting
3. Clean fresh air
4. Privacy
5. The aspiration that the house value might increase

It is impossible to live without change and this may involve some encroachment on factors which influenced original decisions. For sure the current commercial activity does infringe on some of the above but in our opinion not to the extent that a waste handling facility would.

Thank you for your time and we await your response regarding our concerns.

Yours sincerely,

Liam Cullen Ellen Cullen.

Liam & Ellen Cullen

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Mr. & Mrs. Liam Cullen,
"St. Martha",
Old Dublin Road,
Enniscorthy,
Co. Wexford.

4th September 2007

Re: Proposal to Develop a Materials Recovery Facility at Clavass, Enniscorthy,

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Dear Mr. & Mrs. Cullen,

I acknowledge receipt of your submission in relation to the above. The concerns expressed in your submission have been noted and will be addressed in the Environmental Impact Statement.

Yours Sincerely,

Jim O' Callaghan

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APPENDIX 2

Climatic Information

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KILKENNY

monthly and annual mean and extreme values

1961-1990

TEMPERATURE *(degrees Celsius)*	***jan***	***feb***	***mar***	***apr***	***may***	***jun***	***jul***	***aug***	***sep***	***oct***	***nov***	***dec***	***year***
mean daily max.	7.7	7.9	10.0	12.4	15.1	18.1	19.9	19.6	17.2	13.9	10.1	8.4	**13.4**
mean daily min.	1.4	1.6	2.3	3.4	5.6	8.4	10.4	9.9	7.9	6.1	2.8	2.1	**5.2**
mean	4.6	4.8	6.1	7.9	10.3	13.3	15.2	14.7	12.6	10.0	6.4	5.3	**9.3**
absolute max.	14.1	15.1	18.5	23.5	26.0	31.5	31.4	30.5	25.6	22.2	17.4	14.8	**31.5**
absolute min.	-14.1	-11.1	-7.9	-5.4	-3.7	0.5	2.3	1.2	-1.6	-4.4	-7.0	-10.8	**-14.1**
mean no. of days with air frost	10.8	8.7	7.4	4.1	0.8	0.0	0.0	0.0	0.4	2.0	8.4	10.5	**53.0**
mean no. of days with ground frost	18.2	14.9	14.3	12.4	7.3	2.0	0.4	0.8	3.4	6.8	14.2	16.8	**111.5**
RELATIVE HUMIDITY *(%)*													
mean at 0900UTC	88	87	85	79	76	76	78	82	85	88	89	89	**84**
mean at 1500UTC	80	74	68	64	64	65	65	66	69	76	78	82	**71**
SUNSHINE *(hours)*													
mean daily duration	1.71	2.29	3.32	4.85	5.47	5.15	4.65	4.50	3.82	2.71	2.22	1.48	**3.51**
greatest daily duration	8.2	9.7	12.1	14.0	15.8	16.3	16.0	14.2	11.8	10.2	9.0	7.3	**16.3**
mean no. of days with no sun	11	8	6	3	2	2	2	2	3	6	9	12	**65**
RAINFALL *(mm)*													
mean monthly total	86.3	66.1	63.9	51.4	61.9	50.5	52.5	69.4	73.5	84.9	73.8	88.6	**822.8**
greatest daily total	31.5	32.3	29.9	24.5	23.9	30	66.4	49.8	30	34.6	29	45.8	**66.4**
mean no. of days with >= 0.2mm	19	15	17	15	17	14	13	15	15	18	17	18	**192**
mean no. of days with >= 1.0mm	15	11	12	10	12	10	9	11	11	13	12	13	**137**
mean no. of days with >= 5.0mm	7	5	5	4	5	4	3	4	5	6	5	6	**58**
WIND *(knots)*													
mean monthly speed	7.4	7.4	7.7	6.7	6.4	5.8	5.6	5.6	5.9	6.4	6.4	7.1	**6.5**
max. gust	77	72	60	53	54	45	46	56	65	74	56	65	**77**
max. mean 10-minute speed	44	39	36	33	32	28	27	29	40	45	35	40	**45**
mean no. of days with gales	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	**1.4**

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APPENDIX 3

Traffic Impact Assessment

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PROPOSED MATERIALS RECOVERY FACILITY,
OLD DUBLIN ROAD,
ENNISCORTHY,
CO. WEXFORD

Traffic Impact Study

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October 2007

02801/311007/DR10/BM/jk

Bracetown Business Park, Clonee, Co. Dublin
Tel: +353 (0)1 801 4009 - Fax: +353 (0)1 801 4035
E-mail: info@trafficwise.ie Internet: www.trafficwise.ie

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TABLES & FIGURES

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APPENDICES

Appendix A

Traffic Survey Data

Appendix B

Network Flow Diagrams

Appendix C

Trafficwise Ltd. Drawing No. 02801/01/01/PL01

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1 NON TECHNICAL SUMMARY

1.1 This report addresses existing and potential future traffic conditions on the local road network in the vicinity of a proposed Materials Recovery Facility, located in the established industrial area on the Old Dublin Road in Enniscorthy.

1.2 The proposed facility will replace two smaller existing facilities in Gorey and Wexford town. Forecasts indicate that the facility will process some 60,000 tonnes of material per annum upon opening. This initial tonnage is predicted to increase incrementally by 6% per annum over an eight year period until the proposed ultimate processing capacity of 90,000 tonnes per annum is achieved.

1.3 Under the 'worst case' traffic generation scenario it is estimated that the facility has the potential, upon opening, to generate some 71 HGV trips on a daily basis. During the development peak hour[1], which is expected to occur between 1100-1200hrs or 1400-1500hrs, it is expected that some 6 HGV arrival trips[2] and 3 HGV departure trips will be generated. This is equivalent to a total of 9 HGV movements[3] in and 9 HGV movements out.

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1.4 The volume of traffic generated by the facility is expected to increase incrementally up to the ultimate processing capacity of 90,000 tonnes per annum. When at ultimate capacity the facility is, under a worst case traffic scenario, forecast to generate 105 HGV trips on a daily basis. During the development peak hour, this is calculated to equate to 8 HGV arrival trips and 5 HGV departure trips, or 13 HGV movements in and 13 HGV movements out.

1.5 Recent traffic surveys show the Old Dublin Road to have an existing AADT in the region of 1,100 to 1,400 vehicles along its northern end in the vicinity of the site. The proposed development is therefore estimated to increase traffic volumes by approximately 10% along the local section of the road in the immediate vicinity of the site (between site and N11).

[1] Development Peak Generation as opposed to traffic generation in the network peaks

[2] A **Trip** is the inbound movement of a vehicle combined with the return outbound movement (ie in empty and out full or vice versa).

[3] A vehicle **Movement** is simply an inbound or outbound vehicle taken in isolation.

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1.6 The N11 has an existing AADT in the region of 13,000 to 19,500 in the vicinity of the N11/N80 staggered crossroad junction. When the proposed development opens in 2009, it is forecast to increase daily traffic volumes on the N11 by approximately 0.5-1.0%. It should be noted nonetheless that at least half of the traffic which is likely to be generated by the facility is already using the N11 in the vicinity of the site at any rate. This existing traffic includes vehicular trips to larger sorting facilities in the Greater Dublin Area, accordingly it can be appreciated that not all traffic generated by the proposed facility will be entirely new to the N11. This existing traffic will now 'divert' from other existing opportunities to the proposed site.

1.7 The results of the analysis in this report shows that if the traffic generated by the proposed facility remains relatively constant when it reaches its operating capacity; then this traffic is not likely to have an adverse impact upon the capacity and operation of the receiving roads environment.

1.8 When opened the future N11 Enniscorthy Bypasses should offer a significantly enhanced level of service to the site with respect to capacity, accessibility and traffic safety.

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2 INTRODUCTION

2.1 Overview

2.1.1 **Traffic***wise* Ltd. has been retained by Greenstar Ltd. to carry out a Traffic Impact Study for the proposed development of a Materials Recovery Facility (MRF) at a green field site located on the Old Dublin Road on the outskirts of Ennsicorthy, County Wexford.

2.1.2 This report identifies existing traffic conditions and assesses the relative level of impact which the proposed development is likely to have on the local road network. Where appropriate, measures are discussed regarding the management of traffic associated with the proposed development.

2.1.3 This report is structured in accordance with the Institution of Highways & Transportation (IHT) document 'Guidelines for Traffic Impact Assessment' (September 1994). This document is acknowledged by the National Roads Authority (NRA): Traffic and Transport Assessment Guidelines (Sept 2007) to represent the best practice approach in preparing Traffic Impact Assessments.

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2.1.4 It is anticipated that this IHT recommended approach will provide the decision makers with a comprehensive picture of likely traffic impact and thus likely future traffic conditions on the receiving roads environment.

2.1.5 The scope and methodology of the study was agreed in pre-planning discussions with the Roads Section of the Local Authority.

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3 EXISTING CONDITIONS

3.1 Location of Site

3.1.1 The site is Greenfield and is located in an established industrial area on the northern outskirts of Enniscorthy. The site is situated on the Old Dublin Road approximately 600 metres south of the N11/N80/Old Dublin Road staggered ghost island crossroads.

3.1.2 The site is bounded to the west by the N11 National Primary Road and to the east by the Old Dublin Road, to which there is an existing gated access. To the north, the site is bounded by a developing industrial estate, whilst the southern boundary is defined by undeveloped lands.

3.1.3 The general site location is shown in Figure 1 below.

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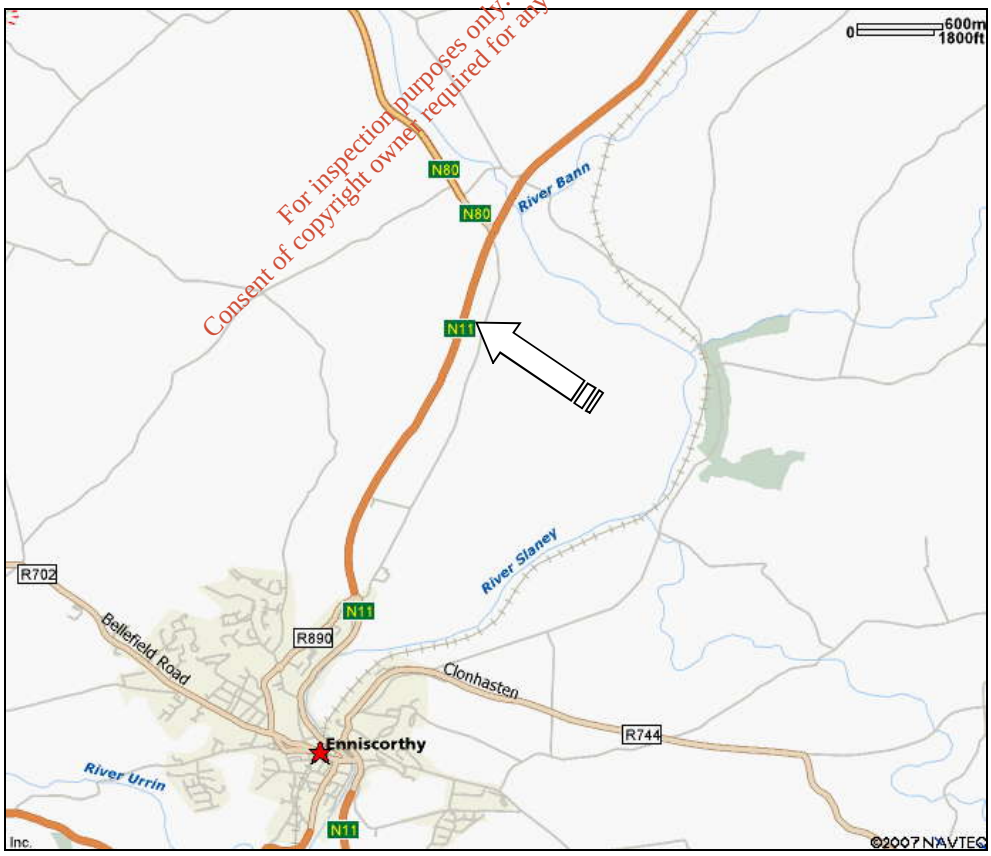

Figure 3.1 General Site Location

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3.2 The Local Road Network

3.2.1 The local road network is characterised by the Old Dublin Road and the N11 which are linked by three junctions, those being: the N11/N80 staggered crossroad junction (at the northern end); the N11/R702 roundabout junction (at the southern end); and the N11/IDA Link Road junction (central or between preceding junctions). These links and junctions are described below:

The Old Dublin Road

3.2.2 The Old Dublin Road runs for a length of approximately 2.7km, linking the N11/N80 staggered crossroad with the N11/R702 Roundabout. The road follows a north-south alignment and runs roughly parallel to the N11.

3.2.3 The Old Dublin Road is subject to a 60kph speed limit and although essential straight for the most part it varies in quality along its length. In general the road can be defined in three sections and these are briefly described below.

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3.2.4 The first section runs between the N11 roundabout and the IDA link road (EMO Petrol Filling Station) and is approximately 0.7km long. The average width of this section is 7.3m. This section is provided with at least one footway along its length and provides access to various developments on both sides. This section is considered typical of most industrial estate roads throughout the country.

3.2.5 The second section of the Old Dublin Road begins at the IDA Road and continues north for approximately 300m. The section similarly serves developments on both sides of the Old Dublin Road. The road has an average width of 6.5m along this section and there are no footways.

3.2.6 The remaining 1.7km length of the Old Dublin Road is more rural in character, nonetheless there are three industrial developments intermittently located on the western side of the road. This section is defined by a carriageway of 6.0m average width adjoined by 2.0m wide verges and mature hedgerow. There are parts of this road which have a bendy horizontal alignment; nonetheless past the site the road alignment is generally straight and flat.

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3.2.7 We have undertaken a visual inspection of the existing road pavement and it appears in relatively good condition with no significant structural defects.

N11/N80 Staggered Crossroad Junction

3.2.8 The N11/N80 staggered crossroad junction is provided with a dedicated ghost island right turn lane from the N11 which provides access to both the N80 and the Old Dublin Road. The junction is also provided with a near side auxiliary lane for traffic turning left onto the N80 from the N11.

3.2.9 Visibility sightlines at this junction are commensurate with the NRA: Design Manual for Roads and Bridges (DMRB) requirements.

3.2.10 This junction is considered to represent the quickest and easiest form of access from the site via the Old Dublin Road to the national road network.

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N11/R702 Roundabout Junction

3.2.11 The existing N11/R702 roundabout at the southern end of the Old Dublin Road provides a high level of service to existing road users. The industrial estate is well signed on all other roundabout approaches.

3.2.12 Visibility sightlines at this junction are commensurate with the NRA: DMRB requirements.

3.2.13 Vehicles accessing the proposed development from Enniscorthy and further south are considered likely to use this junction as the primary access to the site.

N11/IDA Link Road

3.2.14 The N11/IDA link road junction is characterised by a left turn deceleration lane adjacent to the southbound lane. 'No right turn' signage was observed to be erected in the verge adjacent to the N11 northbound lane, thereby prohibiting right turns from the N11 onto the IDA link road.

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3.2.15 This junction is located on a straight section of the N11 and accordingly visibility sightlines at the IDA junction are commensurate with the requirements of the DMRB.

3.3 Current Local Authority Policy and Roads Objectives

3.3.1 In summarising current roads policies for the Enniscorthy area, reference has been made to Transport 21; the Wexford County Development Plan 2005-2011; and the Enniscorthy Town and Environs development Plan 2001.

Transport 21

3.3.2 The most significant roads project to impact upon the proposed development will be the completion of the N11 Dublin to Rosslare strategic route, which has been identified as an objective for Transport 21.

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3.3.3 When completed the N11 will provide a road of motorway/high quality dual carriageway standard from south of Gorey to the M50. Under Transport 21 most of the upgraded route is expected to be constructed by 2010. The following sections of the N11 are currently outstanding:

- N11 Arklow to Rathnew (at tender stage]
- N11 Arklow Gorey Bypass (construction)
- N11 Clogh to Enniscorthy (constraints study stage)
- N11 Enniscorthy Bypass (preliminary design stage)
- N11 Enniskerry Junction Improvements (construction)

3.3.4 Of the schemes listed above, clearly the proposed N11 Enniscorthy Bypass is likely to impact most significantly upon the existing traffic patterns within and around Enniscorthy.

3.3.5 The Bypass scheme comprises of two routes: a 12.9km dual carriageway running to the east of Enniscorthy; and an 8.2km single carriageway road running to the west of Enniscorthy.

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3.3.6 The western route runs from the N11/N80 junction in the townland of Clavass to a proposed roundabout with the N30 at Clohass. The eastern route runs from the N11/N80 junction to the town of Scurlocksbush to the south, where it is proposed to join the N30 Enniscorthy to New Ross realignment scheme.

3.3.7 As part of the proposed N11 Enniscorthy bypass scheme, it is currently proposed to upgrade the existing N11/N80 staggered crossroads to provide an at grade roundabout junction.

3.3.8 The exact location of this roundabout and the links which it will serve are currently under consideration and will be dependent upon the proposed final alignment of the N11 Eastern and Western Bypasses and the N11 Clogh to Enniscorthy route.

3.3.9 Preliminary design is currently taking place of the southern section of the N11 Enniscorthy Eastern Bypass (from the R744 southwards) and the N11 Enniscorthy Western Bypass. The N11 Clogh to Enniscorthy scheme is at constraints study stage and this scheme will provide a bypass of Camolin and Ferns. Preliminary design of the northern section of the N11 Enniscorthy Eastern Bypass is expected to commence in early 2009. As such the proposed form and layout of the upgraded N11/N80 staggered crossroads is not fully known at the time of writing.

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3.3.10 Notwithstanding the above, the existing preferred route option shows an upgraded roundabout junction at Clavass; which is shown in Figure 3.2 below. This junction will provide links to the N11 (northwards), the N11 Enniscorthy Eastern and Western Bypasses and the N80, with no link provided to the existing Old Dublin Road.

3.3.11 In accordance with the preferred route alignment, the link with the Old Dublin Road at the proposed N11/N80 junction could be terminated; Following discussions with the NRA Tramore House Design Office, it has been established that the NRA is currently undertaking origin destination surveys and traffic count surveys to investigate the existing and likely future interaction between the existing links at this junction. Based upon the results of the NRA study a final decision as to the preferred junction arrangement is expected in early 2009.

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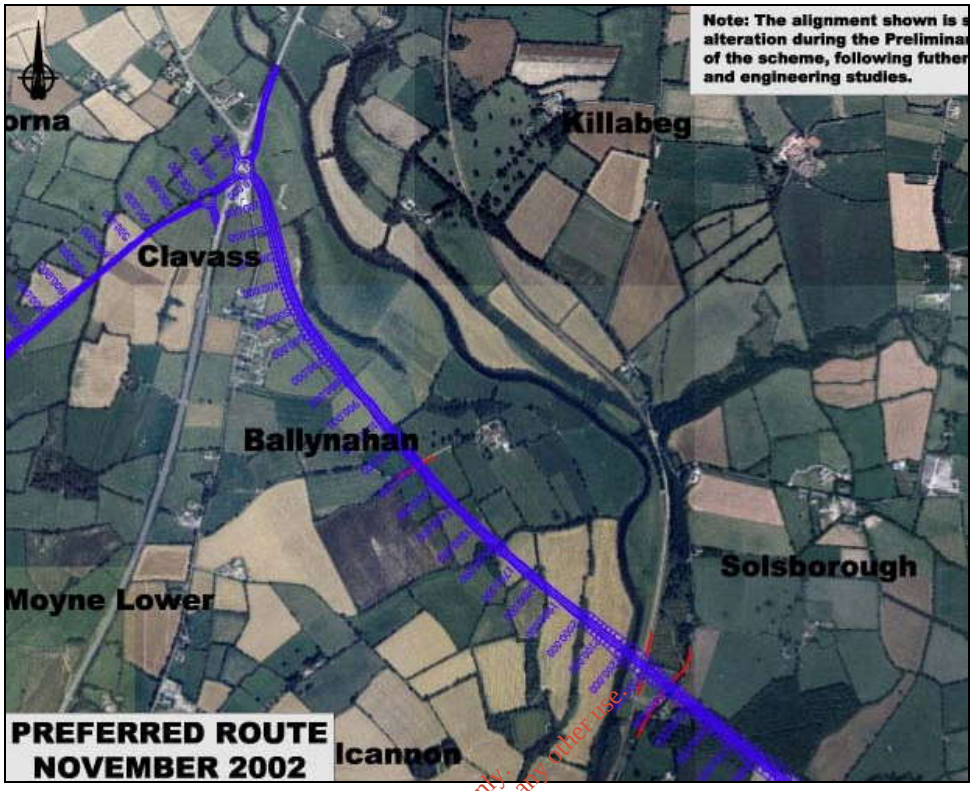

Figure 3.2 Proposed N11/N80/Enniscorthy Bypass Roundabout Junction[4]

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3.3.12 Construction is expected to start on the N11 Enniscorthy Bypass in 2010 with a forecast completion date of 2013.

Wexford County Development Plan 2005-2011

3.3.13 Aside from the upgrading of the N11 Wexford to Dublin route, the following major roads improvement projects are proposed to be undertaken during the course of the development plan:

- N30 Enniscorthy/New Ross
- N25 Rosslare Harbour/New Ross (Also in Transport 21)
- N80 Bunclody/Enniscorthy

[4] Schematic taken from www.thrdo.ie

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3.3.14 The N30 Enniscorthy/New Ross scheme has been divided into two sub-projects, those being: the N30 Enniscorty Clonroche scheme and the N30 Clonroche to New Ross scheme. The former was completed in April 2006 and consists of 5.3km of dual carriageway; whilst the latter is currently at preliminary design stage and incorporates the realignment of 14.4km of the existing road including a bypass of Clonroche.

3.3.15 The N25 Rosslare Harbour to New Ross scheme is a component part of the N25 Rosslare to Waterford scheme, which has a project completion date of 2015 under Transport 21. This route will provide improved links between the N9, N11 at its eastern end; and the proposed Atlantic Corridor at its western end; with the Port of Rosslare. The New Ross bypass forms part of this scheme and consists of a 13.6km orbital road from the townland of Jamestown to the west of New Ross to the townland of Ballymacar to the east of New Ross. The scheme will also include a link from the N25 to the N30. The New Ross scheme is currently at preliminary design stage.

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3.3.16 The Development Plan proposes an upgrade of the N80 National Secondary Route between Enniscorthy and Bunclody; albeit that no timescales have been provided.

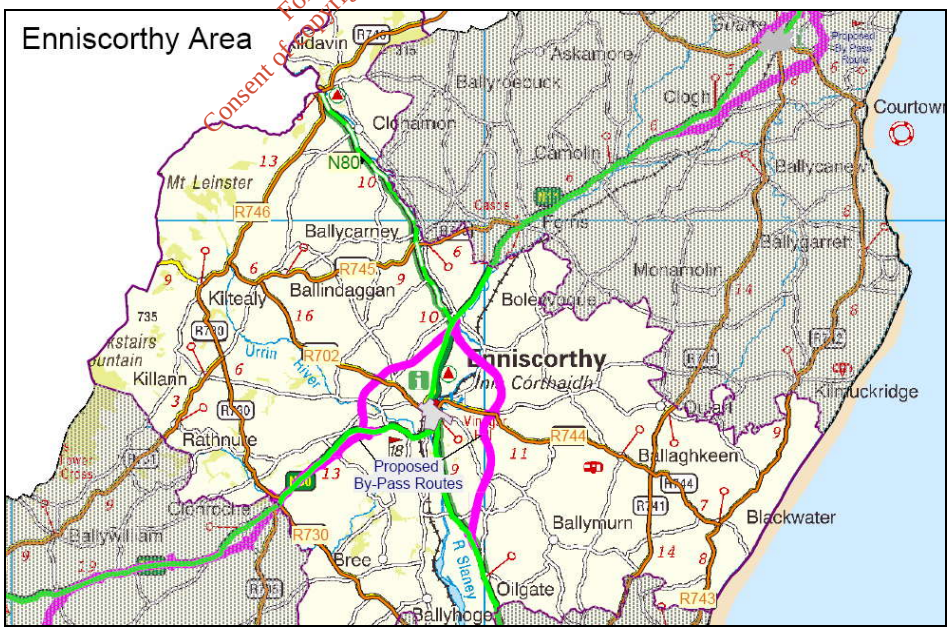

Figure 3.3 Proposed Road Schemes for Enniscorthy Area

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Enniscorthy Town and Environs Development Plan 2001

3.3.17 The site is located in an area which has been zoned for industrial land use.

3.3.18 The Enniscorthy Development Plan identifies road improvement works for the lower part of the Old Dublin Road; nonetheless no further detail has been provided as to what these works entail or when they might be likely to commence.

3.3.19 The Plan outlines a number of roads and traffic management objectives; however these are primarily associated with the town centre and are not considered to be pertinent considering the location of the site.

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4 EXISTING TRAFFIC FLOWS

4.1 Independent Traffic Surveys

4.1.1 In establishing the scope of the study, it was agreed with the Local Authority Area Engineer (Ms. Sinead Casey) that the following key junctions in the vicinity of the site should be assessed as a means of calculating the likely potential traffic impact on the receiving public road network:

- The N11/N80 Staggered Crossroad Junction
- The N11/R702 Roundabout Junction
- The N11/IDA Link Road

4.1.2 Abacus Transportation Surveys were commissioned to carry out 12-hour classified traffic turning count surveys at the N11/N80 staggered crossroad junction and the N11/R702 Roundabout junction.

4.1.3 In addition to these independent surveys, Trafficwise Ltd. carried out further counts at the N11/IDA Link Road during the network peak hours as identified from the 12-hour counts.

4.1.4 The independent traffic surveys were carried out on Tuesday 4 September 2007 over the period 0700-1900hrs using video surveillance (a copy of which can be made available upon request).

4.1.5 A copy of the original survey data together with a location map of the junctions surveyed is provided in Appendix A.

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Survey Traffic Flows on Old Dublin Road

4.1.6 The general traffic flow patterns recorded on the Old Dublin Road over the 12-hour survey period are shown graphically in Figure 4.1 below. Figure 4.1 is based upon the results of the survey at the northern end.

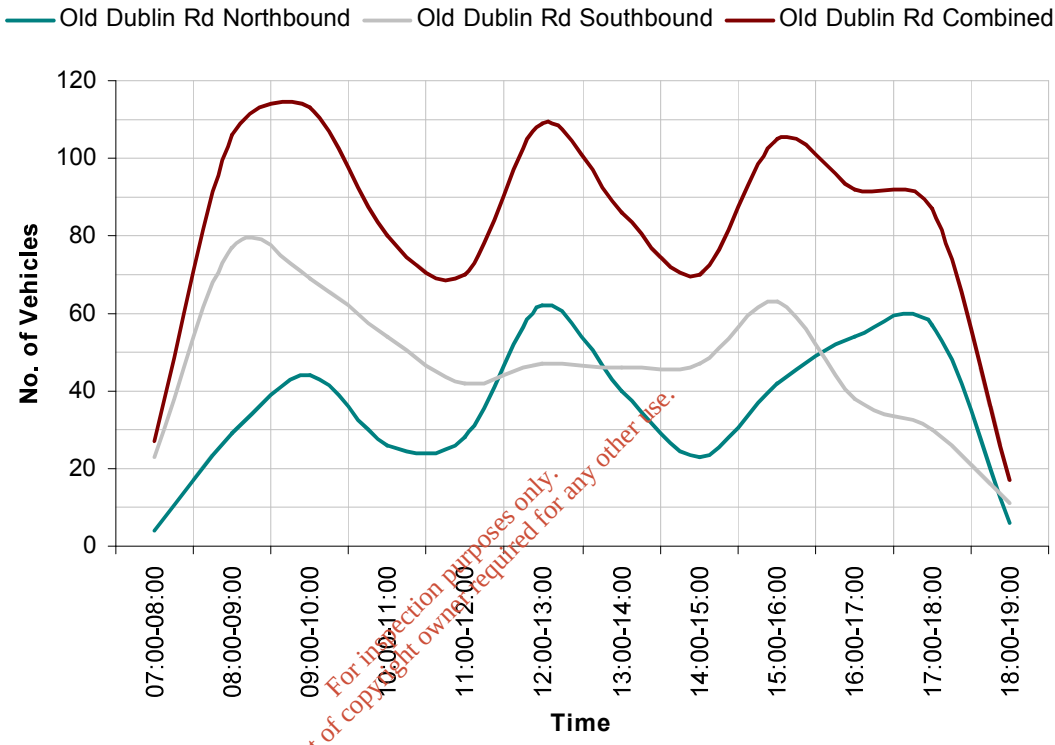

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Figure 4.1 Old Dublin Road Surveyed Traffic Flows (2007)

4.1.7 Figure 4.1 shows that the daily traffic profile on the Old Dublin Road is characterised by a series of peaks and troughs. The peaks broadly occur in the morning, lunchtime and the late afternoon periods.

4.1.8 The survey indicates that the Old Dublin Road is not very heavily trafficked throughout the day, with a two-way vehicular flow never greater than 120 vehicles.

4.1.9 The predominant direction of vehicular flow in the morning is southbound whilst in the evening there is a relatively equal distribution of traffic.

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4.1.10 The morning and evening peak hour periods on the Old Dublin Road were recorded between 0900-1000hrs and 1500-1600hrs respectively.

4.1.11 The morning peak hour recorded 113 two-way vehicular movements. Of these, 69 vehicles travelled southbound and 44 travelled northbound. In the evening peak hour, the two-way flow was recorded as 105 vehicle movements. Of these, 63 vehicles travelled southbound and 42 travelled northbound. During off peak periods traffic flow was observed to be relatively constant with an average two-way flow of 66 vehicles.

4.1.12 Over the entire survey period the Old Dublin Road carried 547 vehicles southbound and 415 vehicles northbound. Of the total volume of traffic in each direction, approximately 8% were HGV.

4.1.13 Using National Roads Authority document RT201 to convert the recorded traffic levels gives an indicative AADT for the Old Dublin Road somewhere in the range of 1,100 to 1,400 vehicles (at the 68% confidence interval).

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Survey Results for N11

4.1.14 Figure 4.2 below shows a graph of the recorded northbound and southbound traffic flows on the N11 at the junction with the N80 over the course of the survey period.

4.1.15 It can be seen from Figure 4.2 that there is a relatively consistent volume of traffic in both directions throughout the day. Between 0900hrs and 1000hrs the recorded two-way traffic flow is typically less than 700 vehicles.

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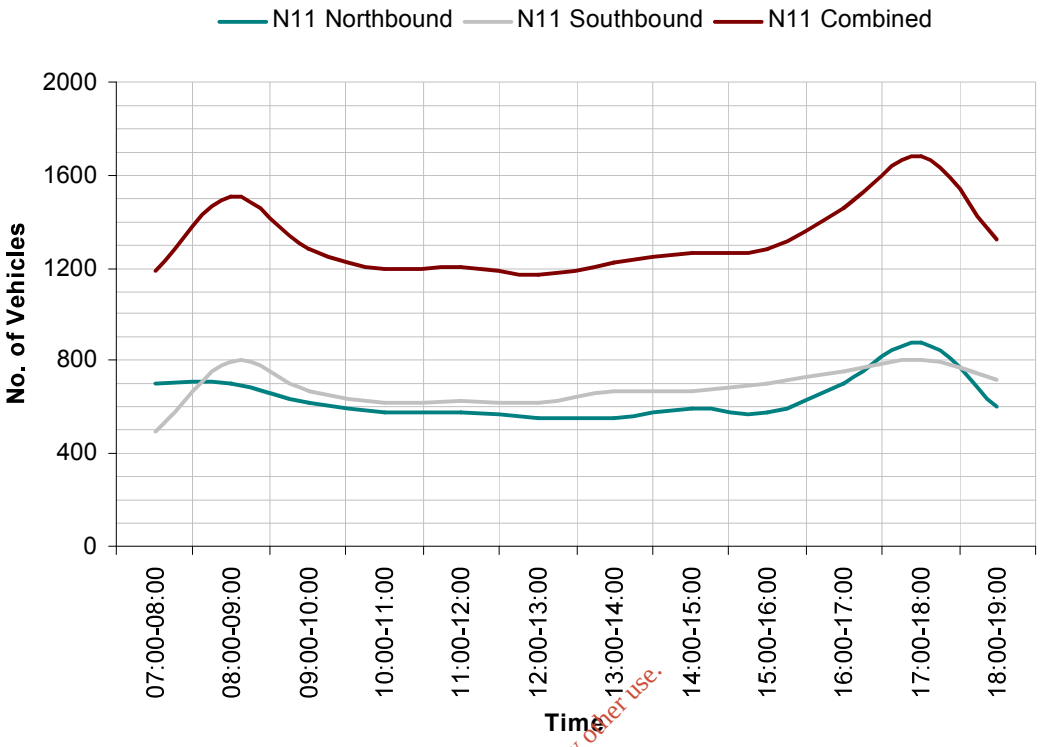

Figure 4.1 N11 Surveyed Traffic Flows (2007)

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4.1.16 In contrast to the Old Dublin Road, the N11 has an obvious morning peak hour which occurs between 0800-0900hrs. During this period a combined two-way vehicular flow of 1,504 vehicles was recorded. Of these, 798 vehicles travelled southbound and 706 vehicles travelled northbound.

4.1.17 The evening peak period was recorded to occur between 1700-1800hrs. During this period a two-way flow of 1,683 vehicles was recorded. Of these, 876 vehicles travelled northbound and 807 vehicles travelled southbound.

4.1.18 Over the entire survey period the N11 carried 8,144 vehicles southbound, of which 12% were HGV. In contrast some 7,631 vehicles travelled northbound, 13% of which were HGV.

4.1.19 Using National Roads Authority document RT201 to convert the recorded traffic levels gives an indicative AADT for the Old Dublin Road somewhere in the range of 13,000 to 19,500 vehicles (at the 68% confidence interval).

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4.2 Trafficwise Ltd. Surveys

4.2.1 In the interests of quantifying traffic activity at the N11/IDA Link Road junction, peak hour counts were carried out on 3 October 2007.

4.2.2 The results of the peak hour counts show that 100 vehicles were recorded travelling on the IDA Link road in the morning peak (0800-0900hrs). Of these 71 vehicles travelled westbound (to N11) and 29 vehicles travelled eastbound.

4.2.3 In the evening peak hour (1700-1800hrs), 122 vehicles were recorded. Of these, 102 vehicles travelled eastbound and 20 vehicles travelled westbound.

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5 PROPOSED DEVELOPMENT

5.1 Threshold Approach for a Traffic Impact Assessment

5.1.1 The NRA: Traffic and Transport Assessment Guidelines recommend the following thresholds for undertaking a Traffic Impact Assessment:

> *"Applications that exceed any of the following thresholds will be required to produce full TIAs:*
>
> - *Industry GFA in excess of 5,000sq.m*
> - *100 trips (in/out combined) in the peak hour*
> - *Development traffic exceeds 10% of two-way traffic flow on adjoining road*
> - *Development traffic exceeds 5% of two-way traffic flow on adjoining road if congestive or sensitive"*
>
> *(Reference-NRA Traffic and Transport Assessment Guidelines: Table 2.2; page 4)*

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5.1.2 The above thresholds have been used as a basis for undertaking this report, as well as establishing the area of influence or scope under consideration. We have included links and junctions on the local roads network, which have the 'potential' to experience increases in traffic flow of +10%, as a direct result of the proposed development.

5.2 Background to Proposed Facility and Processing Capacity

5.2.1 The proposed facility will replace two existing MRFs in Wexford Town and Gorey. The combined processing capacity of these two facilities is currently in the region of 60,000 tonnes per annum.

5.2.2 The processing capacity of the proposed facility will therefore be in the region of 60,000 tonnes per annum during the first year of the facility being operational.

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5.2.3 It is nonetheless intended that the facility will have an ultimate processing capacity of 90,000 tonnes per annum. This ultimate capacity will be reached on a phased basis. Under current projections the applicant has estimated that the ultimate processing capacity could be reached approximately eight years after it first opens in 2008. This forecast is based on the assumption that the total tonnage accepted at the facility will increase by 6% per annum year on year which might be considered relatively fast.

5.2.4 It is envisaged that the ultimate processing capacity would only be realised after the opening of the N11 Enniscorthy Bypass, which under current forecasts is expected to open in 2013.

5.2.5 The realisation of the ultimate processing capacity will allow for the progressive expansion of recycling capacity and thus facilitate Greenstar Ltd. to tender for local authority contracts in relation to collecting and recycling of waste.

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5.3 Development of Facility

5.3.1 When constructed the facility will include: a weighbridge; main sorting building; transfer yard; administration area; ESB substation; odour control plant; and car parking.

5.4 Hours of Operation

5.4.1 The proposed normal waste acceptance hours are 0600 to 2000hrs, Monday to Saturday inclusive. The operational hours will be 0600-2300hrs. The facility will not normally open on Sundays.

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6 FORECAST TRAFFIC GENERATION OF PROPOSED DEVELOPMENT

6.1 Overview

6.1.1 In the following an outline is given as to how waste will be delivered and transferred at the facility. Average tonnages per waste stream loads and the likely vehicles which will be used to transport each waste stream have been provided. This data has been obtained through reference to data of MRFs with similar operational criteria.

6.2 Waste Types and Volumes

6.2.1 The anticipated waste types and volumes that will be accepted at the facility for the year of opening and when the ultimate processing capacity is reached; are shown in Table 6.1 below.

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6.2.2 As stated earlier, when the facility first opens it will process approximately 60,000 tonnes of material per annum. This will eventually increase to an ultimate capacity of 90,000 tonnes per annum.

Waste Type	Operational Capacity	
	Year of Opening	Ultimate Capacity
C & D and C & I	25,000	37,800
Dry Recyclables	12,000	18,000
Municipal Solid Wastes	20,000	29,700
Other	3,000	4,500
TOTAL	**60,000**	**90,000**

Table 6.1 Total Waste Input to Facility

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6.2.3 From Table 6.1 C&D and C&I are construction and demolition waste and commercial and industrial waste respectfully; dry recyclables are a mixture of domestic mixed recyclables and dry segregated recyclables; municipal solid waste is the normal un-segregated household waste; and other represents a mixture of fines (soils from C&D or C&I waste), wood as well as other types of waste.

6.2.4 The percentage breakdown of waste into the various waste streams is provided in Figure 6.1 below.

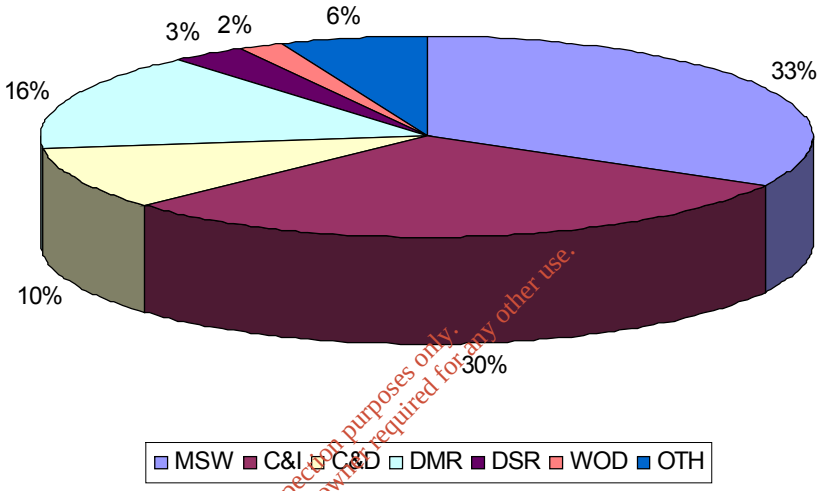

Figure 6.1 Percentage Breakdown of Waste Input to Facility

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6.3 Types of Vehicle Used To Transport Waste To Facility

6.3.1 In the following reference is made to the Greenstar MRF at Fassaroe County Wicklow. As part of the data collection process undertaken to quantify traffic movements at the facility, a classified traffic count of HGV entering and exiting the site was undertaken in 2006. Based upon the two-way recorded movement of HGV at the site, the following Figure 6.2 shows the breakdown in waste related HGV vehicle types using the existing facility.

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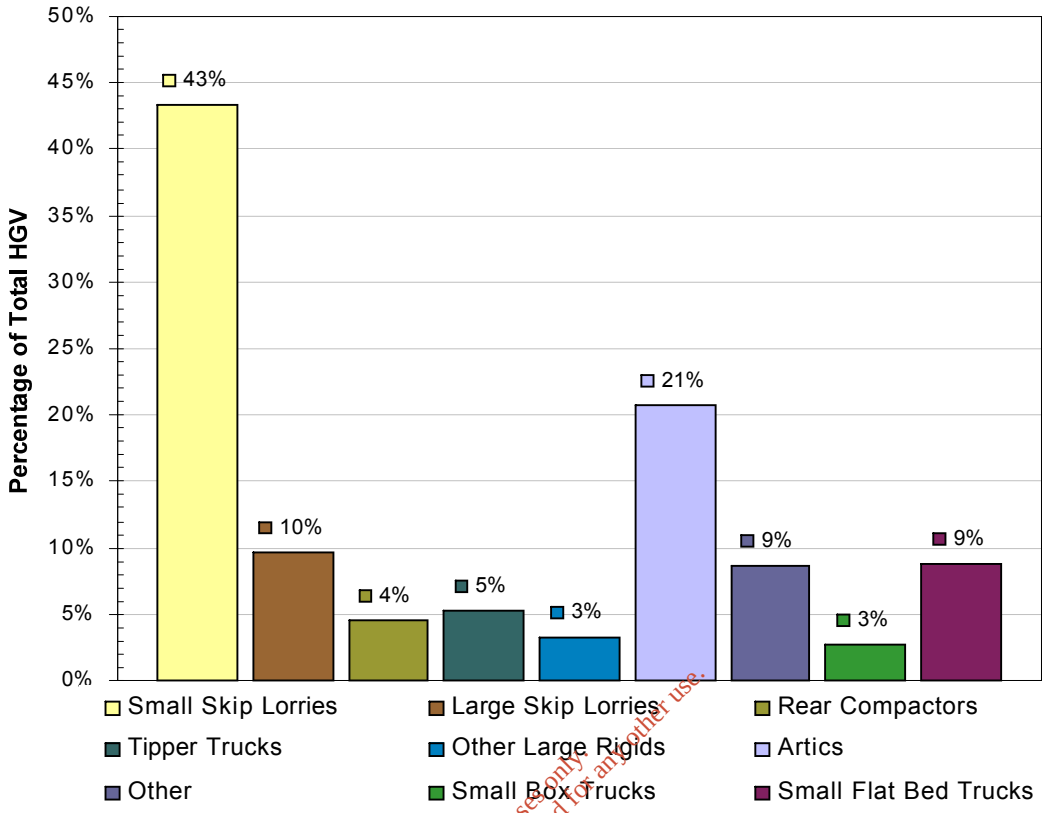

Figure 6.2 Percentage Breakdown of Vehicles used to Transport Waste

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6.3.2 It can be seen from Figure 6.2 that in general only 20% of HGV traffic entering and exiting the existing facility is composed of large articulated HGV. The vast majority of traffic is composed of smaller 'collection' type vehicles. Small skip trucks are shown to comprise approximately 43% of all HGV traffic movements at the existing facility. It is considered likely that the proposed facility could reasonably be expected to have a similar HGV composition to that shown in Figure 6.2 above.

6.4 Average Traffic Generation Assessment of Proposed Development

6.4.1 In the following an estimate of the average HGV traffic generation is provided. The average HGV traffic generation is the volume of traffic which the facility is likely to generate on a day to day basis. For the purposes of modelling later in the report, an upper traffic generation value has been used instead of the average value. This is done in line with IHT guidance to ensure a level of robustness in the calculations in order that new infrastructure is not undersized.

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6.4.2 In the following it is assumed that the vehicles delivering and transferring materials would be exclusively used for these purposes i.e. delivery vehicles are assumed to leave empty and removal vehicles are assumed to enter empty. This will ensure a factor of safety in the estimate of future traffic generation; since in reality this would be commercially unviable in relation to skip delivery and collection.

HGV Delivering Waste to Site (Input)

6.4.3 The loading characteristics at the existing Greenstar MRF are likely to reflect those at the proposed development. At the existing facility the C & I, C & D, and dry recyclable waste streams are generally brought to the facility in rear-end loaders and relatively small HGV carrying skips, trailers and hook loaders.

6.4.4 Table 6.2 below outlines typical average tonnages per load for waste streams which will be processed on site. These values have been obtained from data for the existing Greenstar MRF.

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Waste Stream	Average Tonnes/Load
C & I and C & D	6.3
Dry Recyclables	8.0
Municipal Solid Waste	7.9
Other	5.5

Table 6.2 Typical Average Tonnages per Load

6.4.5 From Tables 6.1 and 6.2 above and based upon the proposed 252 days of operation, the resultant average number of HGV loads associated with delivering waste to the facility is shown in Table 6.3 below.

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Waste Stream	Trips Per Weekday – Waste Input	
	Year of Opening (60,000 t/a)	Ultimate Capacity (90,000 t/a)
C & I and C & D	16	24
Dry Recyclables	6	9
Municipal Solid Waste	10	15
Other	2	3
TOTAL	**34**	**51**

Table 6.3 Forecast of Average No. of HGV Delivering Waste to the Site

HGV Transferring Waste from Site (Output)

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6.4.6 After the waste materials have been processed on site, they will then be transferred off site for further treatment or in some cases transported directly to landfill. It is likely that loads will be transferred off site in large articulated vehicles, which can generally carry loads in the region of 20 tonnes. This has been observed to be the case at the existing Greenstar MRF and should ensure a robust assessment, since in reality modern articulated vehicles can carry loads of up to 24 tonnes.

6.4.7 Skips that are used to deliver waste to the site must eventually be transferred off site. It is common practice that several of these empty skips get stacked on top of each other (normally in groups of two to three) and delivered to customers by a single skip lorry trip. Following on from this, in the opening year allowance has been made for an additional 10 HGV skip delivery trips per day. Similarly at ultimate capacity 15 HGV skip delivery trips per day have been allowed for[5].

[5] This is in addition to the assumption that all skip lorries enter full and exit empty (clearly a most robust assumption)

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6.4.8 The forecast number of HGV loads associated with transferring processed waste and delivery of skip containers is therefore provided in Table 6.4 below.

Waste Stream	Trips Per Weekday – Waste Output	
	Year of Opening (60,000 t/a)	Ultimate Capacity (90,000 t/a)
C & I and C & D	5	8
Dry Recyclables	3	4
Municipal Solid Waste	4	6
Other	1	1
Removal of Empty Skips	10	15
TOTAL	**23**	**34**

Table 6.4 Forecast No. of HGV Transferring Waste from Site

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Expected Total HGV Generation (Average)

6.4.9 From the above, the following Table 6.5 shows the forecast average daily traffic generation at the facility for the opening year and when it is operating to full capacity.

Type of Trip	Trips Per Weekday – Waste Output	
	Year of Opening (60,000 t/a)	Ultimate Capacity (90,000 t/a)
Delivery	34	51
Removal	23	34
TOTAL	**57**	**85**

Table 6.5 Forecast Average HGV Generation

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6.5 Upper Value Traffic Generation Assessment for Proposed Facility

6.5.1 The following is recommended in the IHT Guidelines, a document which is referenced by the NRA: Traffic and Transport Assessment Guidelines as best practice when compiling Traffic Impact Assessments:

> *"It is recommended that developers and highway authorities should adopt a robust forecast i.e. a value higher than the average."*

6.5.2 Following on from this, data available from the existing Greenstar MRF has been used to estimate the likely traffic during 'busier than average' periods.

6.5.3 Figure 6.1 shows a graphical representation of the monthly spread of HGV activity recorded by the weighbridge at the MRF over the period August 2005–September 2006.

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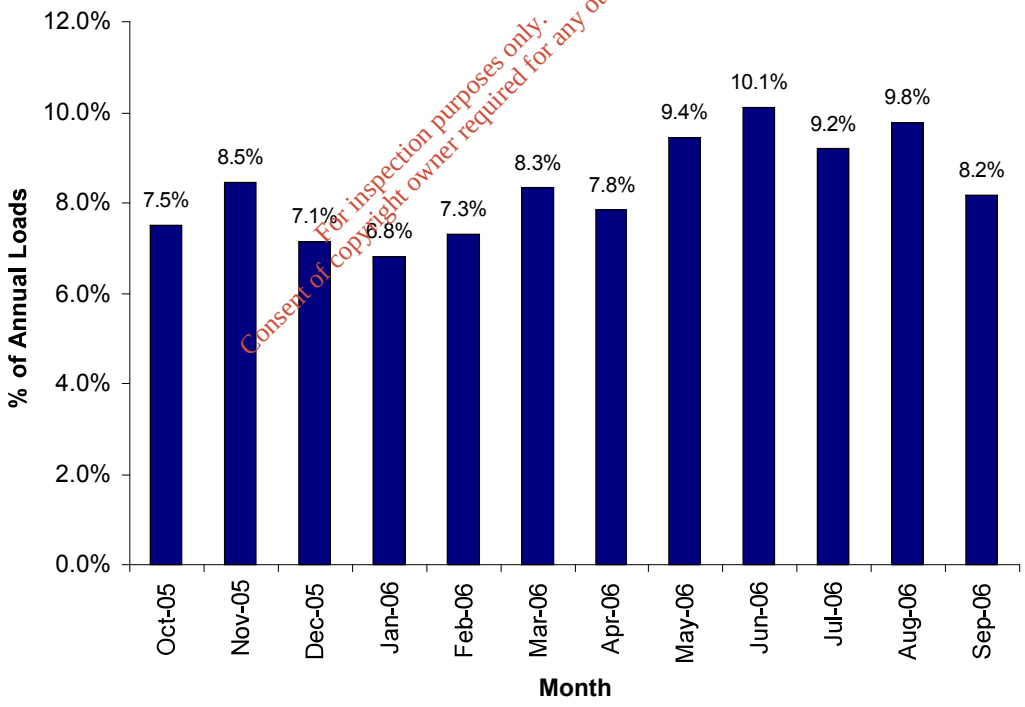

Figure 6.3 Annual Spread of HGV Activity at the existing Greenstar MRF

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6.5.4 As can be seen from Figure 6.3 above, the busiest period for HGV traffic generation was recorded during the month of June 2006, during which in the region of 10.1% of the total annual traffic generation was recorded by the weighbridge. This is an established pattern throughout the waste industry and accords for the increase in building activity and consumption during summer months.

Upper Value Assessment – Year of Opening (60,000 tonnes per annum)

6.5.5 It is estimated that, of the 60,000 tonnes per annum accepted in the opening year, a maximum of 6,060 tonnes (10.1% of 60,000) would be processed in any single summer month. It is assumed that there would be 20 weekdays within this month.

6.5.6 Taking the above into consideration, Table 6.5 below outlines the upper value traffic generation assessment for delivery and removal of waste materials at the proposed development.

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Waste Stream	Tonne Expected in Peak Month	Loading		Daily Traffic Generation (Trips)		
		Waste In (Tonnes)	Waste Out (Tonnes)	Delivery	Removal	Total
C & I and C & D	2,550	6.3	20	21	7	28
Dry Recyclables	1,210	8.0	20	8	3	11
Municipal Solid Waste	2,000	7.9	20	13	5	18
Other	300	5.5	20	3	1	4
Removal of Empty Skips					10	10
TOTAL	**6,060**			**45**	**26**	**71**

Table 6.5 Forecast Upper Value HGV Traffic Generation of Site (Opening)

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Upper Value Assessment – Ultimate Capacity (90,000 tonnes per annum)

6.5.7 Of the proposed 90,000 tonnes of material which the facility will accept every year, when it is processing at its ultimate capacity, it is estimated that a maximum of 9,090 tonnes (10.1% of 90,000) could be processed in any single summer month.

6.5.8 Table 6.6 below outlines the upper value traffic generation for delivery and removal of waste materials at the proposed development when it is operating at full capacity.

Waste Stream	Tonne Expected in Peak Month	Loading		Daily Traffic Generation (Trips)		
		Waste In (Tonnes)	Waste Out (Tonnes)	Delivery	Removal	Total
C & I and C & D	3,820	6.3	20	31	10	41
Dry Recyclables	1,820	8.0	20	12	5	17
Municipal Solid Waste	3,000	7.9	20	19	8	27
Other	450	5.5	20	4	1	5
Removal of Empty Skips					15	15
TOTAL	**9,090**			**66**	**39**	**105**

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Table 6.6 Forecast Upper Value HGV Traffic Generation of Site (Ultimate)

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6.6 Estimate of Peak Hour for Development Generated Traffic

6.6.1 The daily HGV traffic profile at the existing Greenstar MRF is shown in Figure 6.4 below. This profile has been determined through analysis of the weighbridge data and graphically represents the percentage distribution of HGV traffic over the weighbridge during the course of a typical weekday.

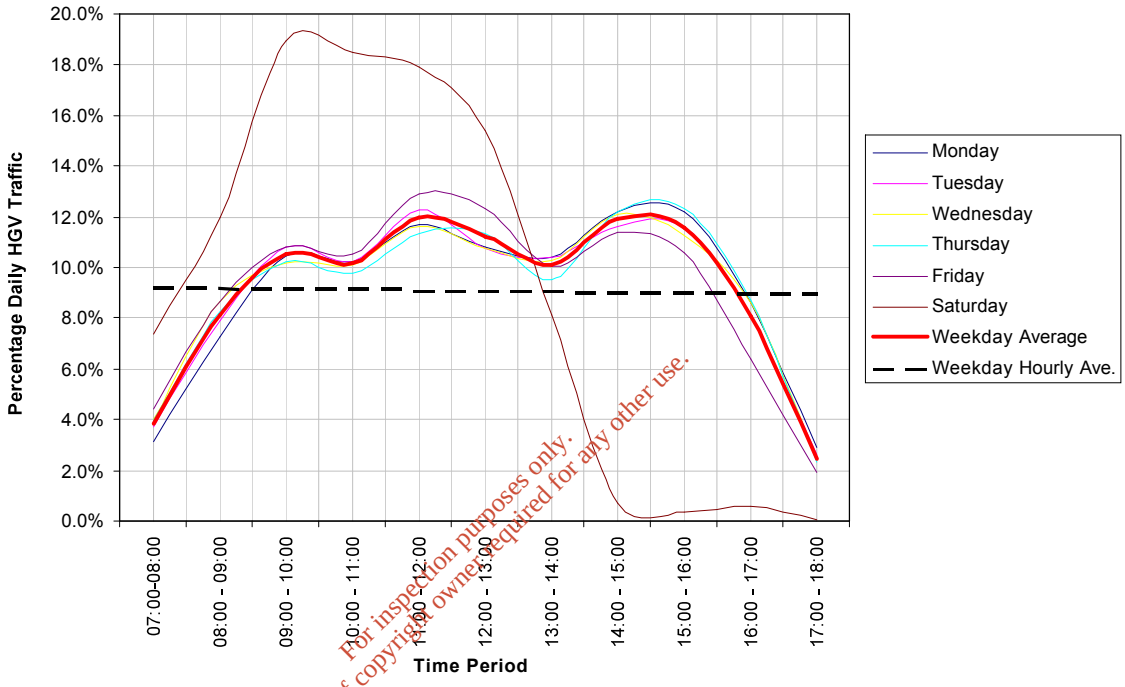

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Figure 6.4 Daily Profile of HGV Traffic at Greenstar MRF

6.6.2 Figure 6.4 shows that the busiest period for HGV traffic at the existing MRF occurs from 1100-1200hrs and 1400-1500hrs, during which 12.0% of the total daily traffic generation was recorded. It is therefore expected that the period of maximum impact for HGV traffic could be manifest during these periods.

6.6.3 The likely peak hour traffic generation of the proposed facility has been calculated based upon the assumption that the daily profile of HGV at the proposed facility will be similar to that of the Greenstar MRF. The results of the calculations are summarised in Table 6.7 below.

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Forecast Peak Hour Trips	Year of Opening (60,000t/year)		Ultimate Capacity (90,000t/year)	
	Average	Upper Bound	Average	Upper Bound
Delivery	4	6	6	8
Removal	3	3	4	5
TOTAL	**7**	**9**	**10**	**13**

Table 6.7 Forecast Peak Hour HGV Trips at the Proposed Development

6.6.4 In the assessments to follow the development peak hour of 1100-1200hrs and/or 1400-1500hrs has been assumed to coincide with the road network peak of 1700-1800hrs. This represents an extreme scenario, since all available data indicates that these two peak hours i.e. development and network, are not likely to occur at the same time.

6.6.5 This scenario, however likely or unlikely, is assessed in order to provide the Local Authority with sufficiently robust traffic data upon which to determine the traffic implications of the application with a high degree of surety or confidence. It can be seen from Figure 6.4 above nonetheless that contrary to the assumed assessment scenario, development generated traffic is likely to be at its lowest during the recognised network peak hour of 1700-1800hrs.

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6.7 Staff and Sundry Traffic Generation

6.7.1 In addition to the above HGV traffic, clearly there will be other types of traffic generation at the site. This traffic will arise primarily from staff, customers, inspectors, sundry visitors etc.

6.7.2 From discussions with the Applicant it is expected that a maximum of 10No full time on-site staff and 35No drivers will be required upon opening at the proposed development. When the facility is operating at full capacity it has been assumed that 15No full time staff and 40No drivers would be required.

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6.7.3 During the assessment network peak hour of 1700-1800hrs: upon opening the facility is assumed to generate in the region of 45No outbound private vehicle movements; whilst in the region of 55No outbound private vehicle movements have been assumed when the facility is operating at full capacity. We have also allowed for a marginal number of inbound private vehicle movements (5No) for both assessment scenarios.

6.8 Construction Related Traffic Attraction

6.8.1 It is not possible to provide a definitive programme for the construction of the proposed facility as this work will be tendered out and programmed by the successful contractor. Nonetheless, based on the experience of infrastructural projects of a similar scale an estimate has been made of the likely traffic movements associated with construction.

6.8.2 Table 6.8 below outlines the various stages in construction, together with an estimate of the duration of each stage and the expected number of deliveries.

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Description of Activity	Duration (Months)	Number of HGV Deliveries		
		Monthly Average	Daily Average	TOTAL
Construction of MRF Building	6	40	2	240
Administration Building	3	20	1	60
Maintenance Building	2	20	1	40
Siteworks/Landscaping/Boundary	4	20	1	80
Entry/Exit Works	2	20	1	40
Vehicle Wash	2	20	1	40
Total Deliveries	**6**	**140**	**7**	**500**

Table 6.8 Forecast Construction Programme & Associated Traffic Generation

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6.8.3 It is expected that on average there would be no more than 7 deliveries of construction materials per day to the site. It is expected that not more than one or two of these deliveries would occur in the network peak hour period.

6.8.4 In addition to the forecast number of deliveries there will be construction staff related trips. It is nonetheless expected that these trips are likely to occur outside the network peak in that contractors working hours are generally 0800 - 1800 hrs.

6.8.5 Since traffic generation during the construction period is forecast to be lower than when the facility is fully operational, we have not considered it worthwhile to undertake a separate assessment of the 'short term' traffic impact during construction.

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7 CAPACITY ASSESSMENTS - ASSUMPTIONS

7.1 Assessment Scope

7.1.1 The assessment scope (links and junctions to be modelled for future year traffic levels) is largely dependent on the emerging road network in the vicinity of the site. The final alignments of the proposed N11 Enniscorthy bypass have not yet been approved. The precise layout of key links and junctions in the vicinity of the site is therefore unknown.

7.1.2 At any rate it is expected that the existing N11/N80 staggered junction will be upgraded to a roundabout junction providing links between the N11 eastern bypass, N11 western bypass and the N80. It is also assumed that a separate link will be provided between the N11 western bypass and the existing N11 alignment which runs into Enniscorthy.

7.1.3 It is not yet known however whether the junction of the northern part of the Old Dublin Road with the N11 will be preserved in advancing the bypass scheme. Following on from this capacity assessments have been carried out based on two potential scenarios. These scenarios are described below.

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7.1.4 <u>Scenario No.1</u>

7.1.5 Scenario No.1 allows for the proposed roundabout junction of the N11 eastern bypass/N11 western bypass/N80 to be built; so as to preserve the existing junction of the N11 with the northern end of the Old Dublin Road; pending the opening of the bypass.

7.1.6 The traffic implications of Scenario No.1 are that practically all HGV traffic generated by the proposed development would use the junction of the N11 with the Old Dublin Road.

7.1.7 The assessment scope for Scenario No.1 will therefore concentrate on the performance of the proposed junction of the existing N11 with the proposed link to the N11 western bypass. A schematic of Scenario No.1 is shown in Figure 7.1 below (existing N11 shown green, Old Dublin Road shown black).

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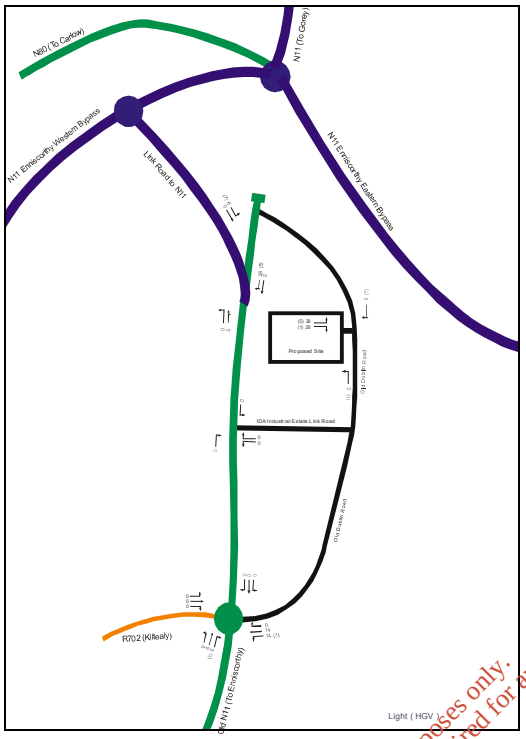

Figure 7.1 Schematic of Scenario No.1

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7.1.8 Scenario No.2

7.1.9 Scenario No.2 allows for the closure of the existing junction of the Old Dublin Road and the N11 when the existing N11/N80 staggered crossroads is upgraded to a roundabout. This would result in practically all site generated HGV traffic using the junction of the N11 with the IDA Link Road.

7.1.10 The assessment scope for Scenario No.2 will concentrate on the performance of the existing junction of the N11 with the IDA Link Road. A schematic of Scenario No. 2 is shown in Figure 7.2 below.

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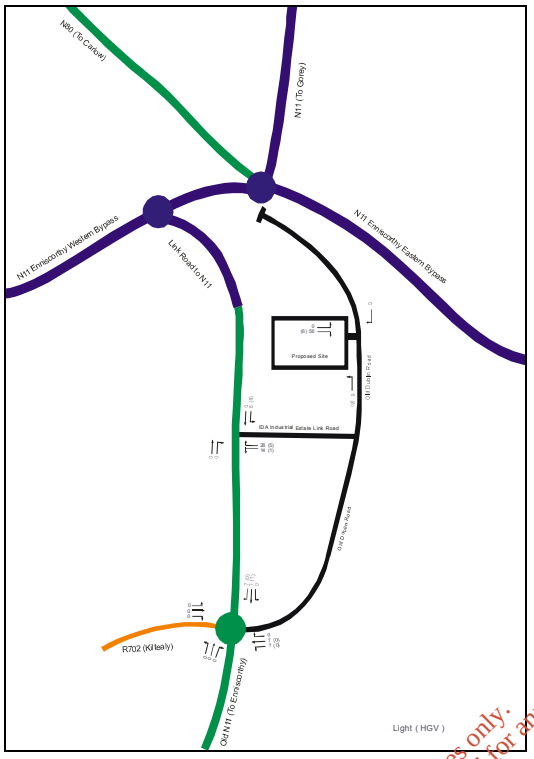

Figure 7.2 Schematic of Scenario No.2

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7.2 Assessment Years

7.2.1 Regarding the choice of appropriate assessment years the NRA: Traffic and Transport Assessment Guidelines advise as follows;

> *"Timescale: Traffic volumes for opening year, opening +5 and opening year +15. These timescales are fairly standard and should be expected".*

7.2.2 It is assumed that the development could be open in 2008; as such this has been selected as the Opening Year.

7.3 Assessment Peak Hour

7.3.1 The capacity assessments examine future performance of the road network during the network peak hour of traffic activity. From the traffic surveys the evening peak hour (1700-1800hrs) has been identified as the network peak hour.

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7.3.2 The assessments have nonetheless combined the peak hour for development generated traffic (mid morning or mid afternoon) with that of the network peak. This should represent an extreme 'worst case' scenario, which will provide the Local Authority with sufficiently robust traffic data upon which to determine the traffic implications of the application with high degree of surety or confidence.

7.4 Traffic Growth Rates

7.4.1 Development Traffic

7.4.2 The levels of traffic generation assumed at the site for the initial year of opening and when it is fully operational have already been outlined.

7.4.3 Once the facility reaches its processing capacity of 90,000 tonnes per annum, the levels of traffic generated by the site are not expected to grow any further over time.

7.4.4 It has been assumed in the analysis that the ultimate processing capacity of the facility will be reached in 2013, although based on current projections this is not likely to occur until approximately 2016. The assessment assumptions should ensure a robust assessment for the 2013 scenario.

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7.4.5 Impact of Proposed N11 Enniscorthy Bypass

7.4.6 For the purposes of this assessment it has been assumed that the development could open in late 2008. The N11 Enniscorthy Bypass is currently programmed to be completed by 2013. Clearly there is a need therefore, to reflect the influence of the bypass in the capacity assessments of key links from 2013 onwards.

7.4.7 There are currently no projections of future traffic levels along the N11, nonetheless it is considered reasonable to assume that the existing N11, which runs through Enniscorthy town centre, might experience a 50% reduction in traffic when the bypass opens in 2013. This has been agreed with the Local Authority Area Engineer.

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7.4.8 Network Traffic

7.4.9 The NRA document 'Future Traffic Forecasts 2002-2040' provides growth rates for traffic on National Primary, National Secondary and Non-national roads.

7.4.10 The growth rates used to derive Opening Year (2008), Opening Year +5 (2013) and Opening Year +15 (2023) from the surveyed 2007 flows are as follows:

- 2007-2008 (Opening Year) 1.04
- 2007-2013 (Opening Year +5) 1.23 (and reduce N11 by 50%)
- 2013-2023 (Opening Year +15) 1.30

These figures have been derived from growth rates for national primary roads.

7.4.11 Since traffic growth on the local roads network is mostly attributed to development in the area, it could be assumed that a portion of this network growth would account for the traffic generated by the proposed development.

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7.5 Directional Split

7.5.1 The proposed development will serve the general regions between Rosslare and New Ross in south County Wexford; up to Baltinglass and across to Arklow in south County Wicklow.

7.5.2 For inbound HGV traffic it has been estimated that approximately: 35% of HGV traffic will arrive from the Wexford direction; 20% from Enniscorthy itself; 35% from the Gorey direction; and 10% from the Carlow direction.

7.5.3 For outbound HGV traffic it has been estimated that approximately 90% of HGV will travel towards Dublin with 10% travelling towards New Ross.

7.5.4 For private vehicular traffic which will be generated by the proposed development, a 50/50 split of traffic to/from the Enniscorthy and Dublin directions has been assumed.

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7.5.5 The directional splits of site generated traffic before the opening of the bypass are shown in Figure 1 of Appendix B. When the bypass is open, the directional splits associated with Scenarios 1 and 2 are shown in Figures 2 and 3 respectively of Appendix B.

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8 CAPACITY ASSESSMENTS - RESULTS

8.1 Overview

8.1.1 The capacity of any road network is directly related to the performance of the key links and junctions within that network. It is therefore considered worthwhile to model key junctions in the vicinity of the site in order to evaluate the general performance of the road network.

8.2 Methodology Used To Determine Capacity

8.2.1 As recommended by the NRA: Design Manual for Roads and Bridges (DMRB) and the Institution of Highways & Transportation (IHT), the Transport Research Laboratory (TRL), the computer modelling programs ARCADY (Assessment of Roundabout CApacity and DelaY) and PICADY (Priority Intersection Control And Delay) have been used to assess the performance of the local road network.

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8.2.2 The output provides information for roads designers and planners with regards to capacity, queuing and delay. Generally a reserve capacity of 10-15% corresponding to a Ratio of Flow to Capacity (RFC) of 0.850-0.900 is accepted at junctions in urban areas and 0.75 in rural areas, however as with the other programs, this figure should not be considered in isolation and should be viewed together with queuing and delay information.

8.2.3 A copy of the full ARCADY and PICADY results can be made available upon request (Trafficwise Ltd. 01-8014009 Job Ref. No. 02801).

8.3 Assessment Scenarios

8.3.1 In the following the impact of development generated traffic on the operation of the local roads network has been assessed.

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8.3.2 A series of traffic scenarios have been assessed both with and without the proposed development in place. These are referred to respectively as the 'do nothing' and 'do something' scenarios and are normally provided so that the incremental impact of development traffic can be evaluated against a baseline scenario.

8.3.3 'Do nothing' and 'do something' assessments of the assessment peak hour (1700-1800hrs) have been carried out for the Opening Year (2008), Opening Year +5 (2013) and Opening Year +15 (2023).

8.3.4 Appendix B provides the future year assessment flows for all assessment scenarios. The following network flow diagrams are included:

Proposed Development

Figure 1: Peak Hour Traffic Generation in the Opening Year (2008) [60,000 tonnes per annum]

Figure 2: Peak Hour Traffic Generation in the Opening Year+5 (2013) and Opening Year+10 (2023) [90,000 tonnes per annum]

Existing Traffic

Figure 3: Existing Surveyed Flows (2007) During the Peak Hour for the Road Network (1700-1800hrs)

Opening Year 2008

Figure 4: Peak Hour - Do Nothing

Figure 5: Peak Hour - Do Something [60,000 tonnes per annum]

Opening Year +5 2013 Scenario 1

Figure 6: Peak Hour - Do Nothing

Figure 7: Peak Hour - Do Something [90,000 tonnes per annum]

Opening Year +5 2013 Scenario 2

Figure 8: Peak Hour - Do Nothing

Figure 9: Peak Hour - Do Something [90,000 tonnes per annum]

Opening Year +15 2023 Scenario 1

Figure 10: Peak Hour - Do Nothing

Figure 11: Peak Hour - Do Something [90,000 tonnes per annum]

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Opening Year +15 2023 Scenario 2

Figure 12: Peak Hour - Do Nothing

Figure 13: Peak Hour - Do Something [90,000 tonnes per annum]

8.4 Existing Performance of Junctions in the Vicinity of the Site

8.4.1 Table 8.1 below summarises the existing modelled performance of the key junctions, those being: the N11/N80 staggered cross roads; the N11/IDA Link Road; and the N11/R702/Industrial Estate roundabout.

Turning Movement/ Name of Roundabout Arm	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
N11/N80/Old Dublin Road Staggered Cross Roads Peak Hour					
Turn Left off Old Dublin Rd	3	6.6	0	0.006	99.4%
Turn Right off Old Dublin Rd	50	7.8	0	0.128	87.2%
Turn Right off N80	158	13.2	1	0.464	53.6%
Turn Right into Old Dublin Rd	1	5.4	0	0.002	99.8%
N11/IDA Link Road Peak Hour					
Turn Left onto N11	60	6.0	0	0.110	89.0%
Turn Right onto N11	34	8.4	0	0.091	90.9%
N11/R702/Industrial Estate Roundabout Peak Hour					
Industrial Estate Arm	347	9.0	1	0.594	40.6%
N11 (Enniscorthy Side)	583	4.2	1	0.498	50.2%
R702 Kiltealy Arm	289	4.2	0	0.328	67.2%
N11 (Gorey Side)	803	6.6	2	0.701	29.9%

Table 8.1 Existing Performance of Key Junctions

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8.4.2 It can be seen from Table 8.1 above that all three junctions of the N11 with the Old Dublin Road currently operate within capacity during the assessment peak hour period.

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8.5 Performance of Junctions in 2008 (Year of Opening)

8.5.1 Assuming the facility becomes operational in 2008; all site generated traffic is expected to access the Old Dublin Road and then the site via either the N11/N80 staggered crossroad junction or the N11/R702 roundabout.

8.5.2 It is therefore assumed that traffic travelling to/from the north will use the N11/N80 staggered crossroads whereas all traffic travelling to/from the south will use the N11/R702 roundabout. It is assumed therefore that under this scenario no site traffic is expected to use the N11/IDA Link Road.

8.5.3 Table 8.2 below summarises the modelled performance of the N11/N80 staggered cross roads in 2008 upon the realisation of the proposed development.

Turning Movement	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2008 Assessment Peak Hour – Without Development					
Turn Left off Old Dublin Rd	4	6.6	0	0.008	99.2%
Turn Right off Old Dublin Rd	53	8.4	0	0.141	85.9%
Turn Right off N80	167	13.8	1	0.504	49.6%
Turn Right into Old Dublin Rd	2	5.4	0	0.004	99.6%
2008 Assessment Peak Hour – With Development					
Turn Left off Old Dublin Rd	4	6.6	0	0.009	99.1%
Turn Right off Old Dublin Rd	77	8.4	0	0.206	79.4%
Turn Right off N80	168	14.4	1	0.514	48.6%
Turn Right into Old Dublin Rd	2	5.4	0	0.004	99.6%

Table 8.2 Performance of the N11/N80 Staggered Cross Roads in 2008

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8.5.4 Table 8.2 shows that the incremental impact of the proposed development upon the performance of the N11/N80 staggered cross roads is likely to be negligible.

8.5.5 Table 8.3 below summarises the expected performance of the N11/R702 roundabout in 2008 upon the realisation of the proposed development.

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Turning Movement/ Name of Roundabout Arm	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2008 Assessment Peak Hour – Without Development					
Industrial Estate Arm	363	10.2	2	0.644	35.6%
N11 (Enniscorthy Side)	607	4.2	1	0.528	47.2%
R702 Kiltealy Arm	304	4.8	1	0.351	64.9%
N11 (Gorey Side)	838	7.2	3	0.735	26.5%
2008 Assessment Peak Hour – With Development					
Industrial Estate Arm	385	9.0	2	0.684	31.6%
N11 (Enniscorthy Side)	615	4.2	1	0.534	46.6%
R702 Kiltealy Arm	304	4.8	1	0.353	64.7%
N11 (Gorey Side)	838	7.2	3	0.738	26.2%

Table 8.3 Performance of the N11/R702 Roundabout in 2008

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8.5.6 Table 8.3 above shows that the N11/R702 roundabout junction is not likely to be adversely affected as a result of traffic from the proposed development in the year of opening.

8.6 Performance of Junctions in 2013 (Opening Year +5)

8.6.1 The 2013 assessments allow for two potential scenarios catering for alternative layouts of the N11 Enniscorthy Bypass.

8.6.2 Scenario No.1

8.6.3 Scenario No.1 allows for the majority of HGV traffic accessing the site to do so via the junction of the N11 with the Old Dublin Road. In contrast private vehicular traffic is likely to be split almost 50/50 between the abovementioned junction and the N11/R702 Roundabout junction. The capacity assessments therefore concentrate on the performance of these two junctions. The layout and geometry of the future junction of the existing N11 with the proposed link to the N11 western bypass is assumed to be a standard T-junction with the minor road representing the N11 link to the Old Dublin Road.

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8.6.4 Table 8.4 below summarises the expected performance of the junction of the existing N11 with the proposed link to the N11 western bypass for the assessment year of 2013.

Turning Movement	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2013 Assessment Peak Hour – Scenario No. 1 Without Development					
Turn off Old Dublin Rd	66	9.0	0	0.185	81.5%
Turn Right onto Old Dublin Rd	2	5.4	0	0.003	99.7%
2013 Assessment Peak Hour – Scenario No. 1 With Development					
Turn off Old Dublin Rd	123	10.8	1	0.337	66.3%
Turn Right onto Old Dublin Rd	10	8.4	0	0.026	97.4%

Table 8.4 Performance of the N11/ Link to N11 Western Bypass in 2013 (Scenario No.1)

8.6.5 Table 8.5 below summarises the modelled expected performance of the existing N11/R702 Roundabout junction for the assessment year of 2013.

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Name of Roundabout Arm	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2013 Assessment Peak Hour – Scenario No.1 Without Development					
Industrial Estate Arm	399	7.8	1	0.570	43.0%
N11 (Enniscorthy Side)	513	3.6	1	0.422	57.8%
R702 Kiltealy Arm	266	4.2	0	0.280	72.0%
N11 (Gorey Side)	589	4.8	1	0.527	47.3%
2013 Assessment Peak Hour – Scenario No.1 With Development					
Industrial Estate Arm	422	7.8	1	0.603	39.7%
N11 (Enniscorthy Side)	513	3.6	1	0.425	57.5%
R702 Kiltealy Arm	266	4.2	0	0.280	72.0%
N11 (Gorey Side)	589	4.8	1	0.527	47.3%

Table 8.5 Performance of the N11/R702 Roundabout in 2013 (Scenario No.1)

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8.6.6 Tables 8.4 and 8.5 above show that the junctions in the vicinity of the site will not be adversely impacted upon as a result of the proposed development for the Scenario No.1 future roads layout.

8.6.7 Scenario No.2

8.6.8 Scenario No.2 involves practically all HGV traffic accessing the site via the existing junction of the N11 with the IDA Link Road, as a result of the closure of the junction of the N11 and the Old Dublin Road. Similar to Scenario No.1, private vehicular traffic is likely to be split almost 50/50 between the IDA Link Road and the N11/R702 Roundabout junction.

8.6.9 Table 8.6 below summarises the forecast performance of the IDA Link Road junction with the N11 for the assessment year of 2013.

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Turning Movement	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2013 Assessment Peak Hour – Scenario No. 2 Without Development					
Turn Left onto N11	74	6.6	0	0.145	85.5%
Turn Right onto N11	109	7.8	0	0.235	76.5%
2013 Assessment Peak Hour – Scenario No. 2 With Development					
Turn Left onto N11	101	6.6	0	0.199	80.1%
Turn Right onto N11	139	8.4	0	0.312	68.8%

Table 8.6 Performance of the N11/IDA Link Road in 2013 (Scenario No.2)

8.6.10 Table 8.7 below summarises the expected performance of the existing N11/R702 Roundabout junction for the assessment year of 2013.

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Name of Roundabout Arm	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2013 Assessment Peak Hour – Scenario No.2 Without Development					
Industrial Estate Arm	399	7.8	1	0.570	43.0%
N11 (Enniscorthy Side)	513	3.6	1	0.422	57.8%
R702 Kiltealy Arm	266	4.2	0	0.280	72.0%
N11 (Gorey Side)	589	4.8	1	0.527	47.3%
2013 Assessment Peak Hour – Scenario No.2 With Development					
Industrial Estate Arm	412	7.8	1	0.595	40.5%
N11 (Enniscorthy Side)	514	3.6	1	0.426	57.4%
R702 Kiltealy Arm	266	4.2	0	0.280	72.0%
N11 (Gorey Side)	603	4.8	1	0.540	46.0%

Table 8.7 Performance of the N11/R702 Roundabout in 2013 (Scenario No.2)

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8.6.11 Tables 8.6 and 8.7 above show that the junctions in the vicinity of the site will not be adversely affected as a result of the proposed development for the Scenario No.2 future roads layout.

8.7 Performance of Junctions in 2023 (Opening Year +15)

8.7.1 Scenario No.1

8.7.2 Table 8.8 below summarises the expected performance of the junction of the existing N11 with the proposed link to the N11 western bypass for the assessment year of 2023.

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Turning Movement	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2023 Assessment Peak Hour – Scenario No. 1 Without Development					
Turn Left onto N11	87	11.4	0	0.286	71.4%
Turn Right onto N11	3	6.0	0	0.006	99.4%
2023 Assessment Peak Hour – Scenario No. 1 With Development					
Turn Left onto N11	144	13.8	1	0.465	53.5%
Turn Right onto N11	11	8.4	0	0.030	97.0%

Table 8.8 Performance of the N11/Proposed Link to N11 Western Bypass in 2023 (Scenario No.1)

8.7.3 Table 8.9 below summarises the expected performance of the existing N11/R702 Roundabout junction for the assessment year of 2023.

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Name of Roundabout Arm	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2023 Assessment Peak Hour – Scenario No.1 Without Development					
Industrial Estate Arm	522	18.6	7	**0.879**	12.1%
N11 (Enniscorthy Side)	670	5.4	2	0.608	39.2%
R702 Kiltealy Arm	347	4.8	1	0.408	59.2%
N11 (Gorey Side)	768	7.2	2	0.717	28.3%
2023 Assessment Peak Hour – Scenario No.1 With Development					
Industrial Estate Arm	548	22.2	9	**0.924**	7.6%
N11 (Enniscorthy Side)	671	5.4	2	0.613	28.7%
R702 Kiltealy Arm	347	4.8	1	0.409	59.1%
N11 (Gorey Side)	768	7.2	2	0.717	28.3%

Table 8.9 Performance of the N11/R702 Roundabout in 2023 (Scenario No.1)

8.7.4 Table 8.9 above shows that the existing N11/R702 roundabout junction may reach capacity in the 2023 assessment scenario. This is forecast as likely to occur even without the proposed development, as can be seen from the 'do nothing' scenario.

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8.7.5 The proposed development is considered not to contribute significantly to this phenomenon in that its' incremental impact results in a net 4% increase in RFC.

8.7.6 Scenario No.2

8.7.7 Table 8.10 below summarises the expected performance of the junction of the existing N11 with the IDA Link Road for the assessment year of 2023.

Turning Movement	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2023 Assessment Peak Hour – Scenario No. 2 Without Development					
Turn Left onto N11	97	7.2	0	0.205	79.5%
Turn Right onto N11	143	9.6	1	0.343	65.7%
2023 Assessment Peak Hour – Scenario No. 2 With Development					
Turn Left onto N11	124	7.8	0	0.272	72.8%
Turn Right onto N11	173	10.8	1	0.423	57.7%

Table 8.10 Performance of the N11/IDA Link Road in 2023 (Scenario No.2)

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8.7.8 Table 8.11 below summarises the expected performance of the existing N11/R702 Roundabout junction for the assessment year of 2023.

Name of Roundabout Arm	Expected No. of Vehicles	Queuing Delay per vehicle (sec)	Maximum Queue (vehs)	Max RFC	Reserve Capacity
2023 Assessment Peak Hour – Scenario No.1 Without Development					
Industrial Estate Arm	522	18.6	7	**0.879**	12.1%
N11 (Enniscorthy Side)	670	5.4	2	0.608	39.2%
R702 Kiltealy Arm	347	4.8	1	0.408	59.2%
N11 (Gorey Side)	768	7.2	2	0.717	28.3%
2023 Assessment Peak Hour – Scenario No.1 With Development					
Industrial Estate Arm	561	28.8	14	**0.968**	3.2%
N11 (Enniscorthy Side)	671	5.4	2	0.616	28.4%
R702 Kiltealy Arm	347	4.8	1	0.408	59.2%
N11 (Gorey Side)	791	7.8	3	0.739	26.1%

Table 8.11 Performance of the N11/R702 Roundabout in 2023 (Scenario No.2)

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8.7.9 Table 8.11 above shows that the roundabout junction may near capacity in 2023; nonetheless this is likely to occur regardless of whether the facility opens or not. The incremental impact of the proposed facility is to increase the RFC from a 'do nothing' value of 0.879 to a 'do something' value of 0.968. The forecast average delay per vehicle of nearly 29 seconds further indicates that the junction is reaching capacity, although queuing of 14 vehicles is not considered excessive.

8.8 Summary of Capacity Assessment Results

8.8.1 Taking the proposed infrastructural improvements into account the results show that the local road network should function satisfactorily up to the assessment year of 2013 and beyond. It is nonetheless forecast that the capacity of the existing N11/R702/Old Dublin Road Roundabout may eventually and perhaps inevitably be reached in the year of 2023. This is likely to occur, not as a result of the proposed development, but rather due to the realisation of other potential future developments in the local vicinity.

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8.8.2 The results are not intended to highlight the failure of the local road network to accommodate potential future developments, rather they can be used a tool to identify the actual impact associated with the proposed development, when viewed in context with potential future developments. The capacity of the roundabouts has been shown to be exceeded in 2023, nonetheless this may not actually be the case since the assessments contained herein are very robust for the following reasons:

- A robust traffic growth rate year by year for all road links in line with that of national primary roads was adopted.
- The assumption that the development peak would occur at the same time as the network peak.
- A high proportion of the traffic which will be generated by the site is already on the local road network as it travels along the N11 to and from Gorey and Wexford town.
- An assumed 50% reduction in traffic as a result of the Bypass (in reality traffic could be reduced by up to 70%).
- No account has been taken of likely traffic reductions as a result of future improvements in public transport.

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9 VISIBILITY SIGHTLINE APPRAISAL

9.1 Proposed Site Accesses

9.1.1 It is proposed that the site will be served by two accesses onto the Old Dublin Road. The northernmost access will be used exclusively by HGV Operators and as such has been designed to accommodate an FTA Design Articulated Vehicle. The second access is located a further 45m to the south of the HGV access and will be used by staff and customers or any other visitor accessing the site in a private vehicle. The segregation of the commercial and private vehicle entrances has been done in the interest of safety (both staff and public).

9.1.2 The proposed access arrangements complete with visibility sightline appraisals and Auto TRACK analyses are shown on the attached Trafficwise Ltd. Drawing No. 02801/01/01/PL01.

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9.2 Visibility Criteria in accordance with NRA: DMRB

9.2.1 The roads standard by which the visibility sightlines have been evaluated is the NRA: Design Manual for Roads and Bridges (DMRB).

9.2.2 The Old Dublin Road is subject to a posted speed limit of 60kph. Preliminary speed measurements in the vicinity of the site confirmed that vehicular speeds are somewhere between 50-60kph. It is therefore considered appropriate to appraise the available visibility based on a design speed of 60kph.

9.2.3 Table 2 of TD9 'Highway Link Design' shows that the appropriate 'desirable' minimum Stopping Sight Distance or 'y' distance for a design speed of 60kph is 90m.

9.2.4 Paragraph 2.21 of TD41 provides advice on the required 'x' distance as follows:

> *"Normally an "x" distance of 4.5m shall be provided for a direct access where use in the design year is forecast not to exceed 500 AADT".*

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9.2.5 It follows that the visibility criteria of 'x'=4.5m and 'y'=90m has been adopted in our assessment of the accesses proposed at the site.

9.3 Appraisal of Visibility Sightlines

9.3.1 HGV Access

9.3.2 In terms of the northernmost HGV access, the attached drawing shows the full visibility envelope (measuring 90m from a 4.5m road edge set-back) is achievable to the north and south, albeit that an existing steel palisade fence is located within the visibility envelope when looking to the north. This was confirmed to be achievable by on site measurements during our site visit.

9.3.3 The fence defines the boundary of an industrial estate to the immediate north of the site and is approximately 2.0m in height above ground level. In contrast the typical driver's eye height associated with the sight distance envelope for an HGV can vary between 2.2-3.0m (above ground level). This differs from the stated driver's eye height of 0.26-2.0m for a private vehicle, which is advised by paragraph 2.2 of TD9. Clearly any sightline appraisal needs to take account of the expected mix of vehicles likely to use the access, which in this case is exclusively HGV. It is therefore considered that from a drivers' eye height of 2.2-3.0m, HGV Operators will be provided with a clear field of vision within the full visibility envelope from a 4.5m set-back when looking north. At any rate as HGV Operators move closer to the edge of the road, from a set-back of 3.8m the fence no longer infringes upon the northern visibility envelope. This arrangement is considered satisfactory to serve the site.

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9.3.4 Private Vehicle Access

9.3.5 The drawing shows that clear unobstructed sightlines measuring 90m from a 4.5m road edge set-back will be achievable in both directions from the proposed private vehicular access. This is subject to the setting back and replanting of the existing hedgerow along the eastern site boundary so that it will not infringe upon the visibility envelope in the vertical or horizontal plane.

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9.4 Appraisal of Forward Visibility Approaching Site Access

9.4.1 Forward visibility in the vicinity of the site access has been assessed in accordance with the advice provided in TD9 paragraph 2.2. The site itself is located on a straight section of road which is approached by a gradual bend to the immediately south of the site. To the north of the site the road follows a relatively straight alignment which affords ample forward visibility to southbound drivers.

9.4.2 Forward visibility of 90m is nonetheless currently achievable from a point 1.5 x Stopping Sight Distance [1.5 x 90 = 135m] in advance of either access. Accordingly, from the perspective of visibility sightlines the existing access points are compliant with the requirements of the DMRB. Clearly forward visibility and the presence of the site will be further enhanced as a result of the proposed setting back of the site boundary along the eastern side of the road.

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9.5 Conclusion

9.5.1 It can be seen from the drawings that the proposed development access is satisfactory and will, upon completion of the proposed development and associated road works, be strictly in accordance with the current requirements of the NRA: Design Manual for Roads and Bridges albeit that the existing Old Dublin Road is not compliant with such National Primary Roads design standards.

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10 FORECAST TRAFFIC IMPACT ON ROAD NETWORK

10.1 The proposed facility has been estimated to generate 71 HGV trips every day, upon opening [60,000 tonnes per annum]. This is expected to increase year by year until the facility generates somewhere in the region of 105 HGV trips per day [90,000 tonnes per annum].

10.2 The Old Dublin Road has an existing AADT in the region of 1,100 to 1,400 vehicles along its northern end in the vicinity of the site. The proposed development is therefore estimated to increase traffic volumes by approximately 10% along this section of the road in the vicinity of the site.

10.3 The N11 has an existing AADT in the region of 13,000 to 19,500 in the vicinity of the N11/N80 staggered cross roads. When the proposed development opens in 2009, it is forecast to increase daily traffic volumes on the N11 by approximately 0.5-1.0%.

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10.4 From the above it is considered that the predominant development impact will be manifest upon the Old Dublin Road. In terms of the N11, it should be noted that at least half of the traffic which is likely to be generated by the facility is already on this road.

10.5 The results of the analysis in this report shows that if the traffic generated by the proposed facility remains relatively constant when it reaches its operating capacity; then this traffic is not likely to have an adverse impact upon the capacity and operation of the receiving roads environment.

10.6 When opened, the future N11 Enniscorthy Bypasses should offer an improved level of service to the site with respect to capacity, accessibility and traffic safety.

10.6.1 It is not unreasonable to presume that in the design of the emerging roads network, the Local Authority has accounted for the land-use zoning and potential traffic demands of the general area and that the new roads system will be designed to cater for such likely future demand. We believe it to be clear form the above, that traffic impact arising from the development will not be significant.

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Appendix A

Traffic Survey Data

Copy of Classified Traffic Surveys

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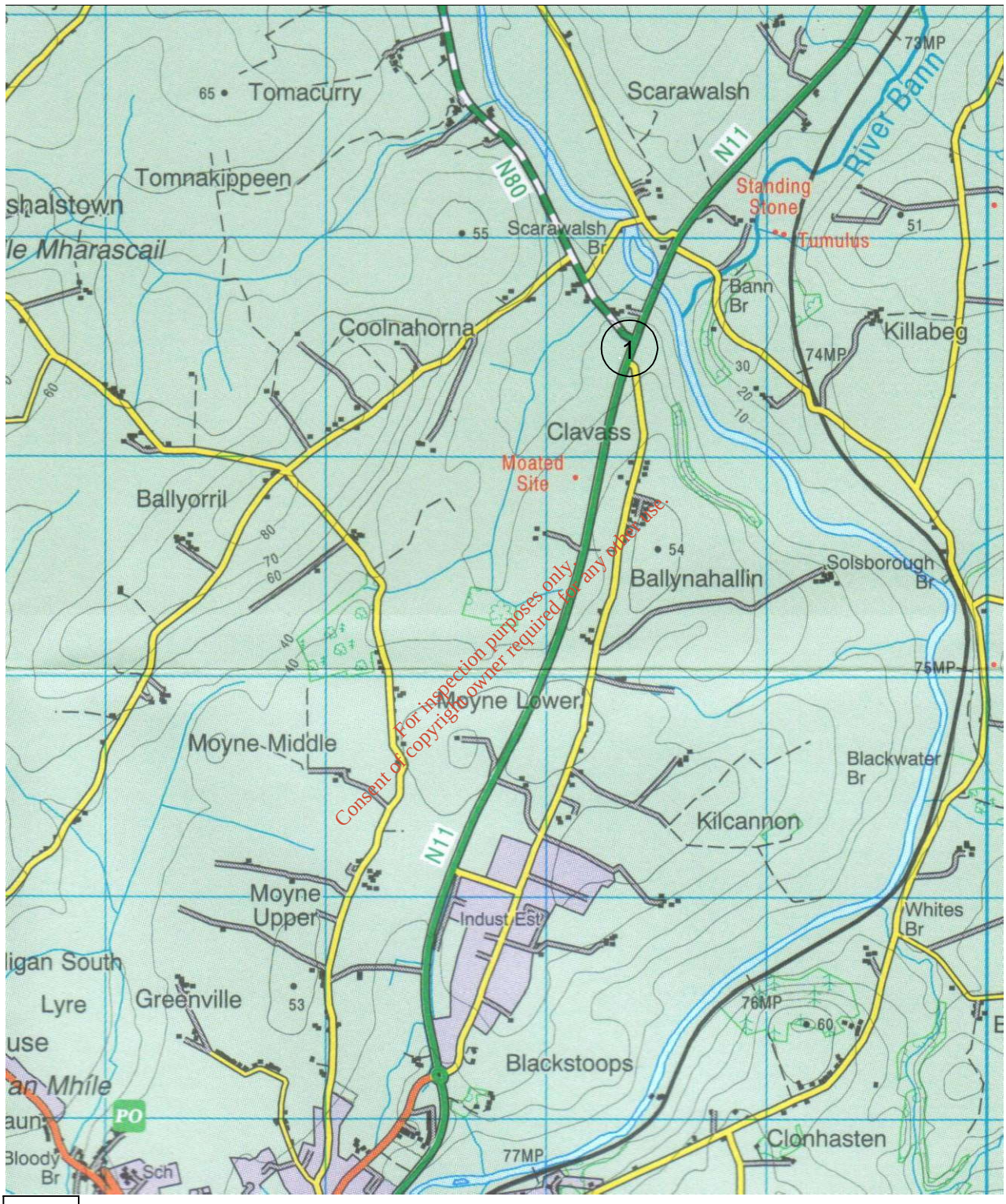

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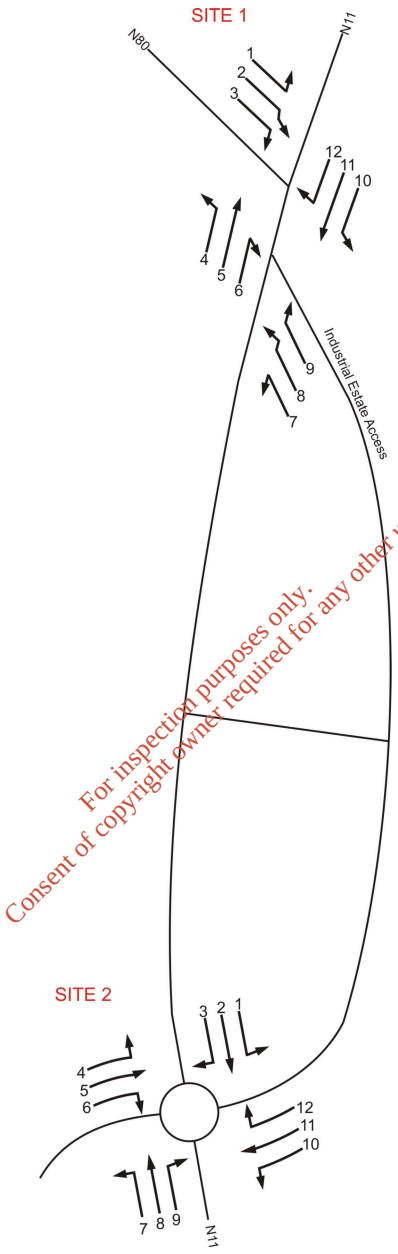

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 1						MOVEMENT 2						MOVEMENT 3					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	4	1	1	1	0	7	0	0	0	0	0	0	23	8	4	6	0	41
07:15	3	1	0	1	0	5	0	0	0	0	0	0	21	15	6	7	0	49
07:30	1	1	2	0	0	4	1	0	0	0	0	1	26	13	2	3	0	44
07:45	3	0	2	0	0	5	0	0	2	0	0	2	30	12	7	7	0	56
H/TOT	11	3	5	2	0	21	1	0	2	0	0	3	100	48	19	23	0	190
08:00	0	0	2	1	0	3	3	0	0	0	0	3	37	14	5	6	0	62
08:15	6	2	1	1	0	10	2	0	0	0	0	2	21	10	1	6	0	38
08:30	11	0	2	1	0	14	1	0	1	0	0	2	29	10	3	5	0	47
08:45	4	0	2	2	0	8	3	0	1	0	0	4	19	6	4	5	0	34
H/TOT	21	2	7	5	0	35	9	0	2	0	0	11	106	40	13	22	0	181
09:00	7	1	0	2	0	10	0	0	0	0	0	0	48	8	2	3	0	61
09:15	5	1	1	2	0	9	0	0	0	0	0	0	42	10	5	3	0	60
09:30	3	2	1	0	0	6	0	2	0	0	0	2	37	12	3	1	0	53
09:45	2	1	1	0	0	4	2	0	0	0	0	2	43	11	5	5	0	64
H/TOT	17	5	3	4	0	29	2	2	0	0	0	4	170	41	15	12	0	238
10:00	2	0	1	1	0	4	0	0	0	0	0	0	29	10	5	3	0	47
10:15	2	0	0	0	0	2	1	0	0	0	0	1	35	11	5	6	0	57
10:30	1	1	3	2	0	7	0	0	0	0	0	0	37	10	5	7	0	59
10:45	2	2	1	1	0	6	1	0	0	0	0	1	21	9	6	5	0	41
H/TOT	7	3	5	4	0	19	2	0	0	0	0	2	122	40	21	21	0	204
11:00	6	0	0	3	0	9	1	2	0	0	0	3	33	7	4	6	0	50
11:15	3	0	1	0	0	4	0	1	0	0	0	1	26	9	5	7	0	47
11:30	3	0	0	0	0	3	0	0	0	0	0	0	36	8	5	3	0	52
11:45	4	0	0	0	0	4	0	0	0	0	0	0	37	9	3	6	2	0
H/TOT	16	0	1	3	0	20	1	3	0	0	0	4	132	33	17	22	2	206
12:00	7	2	1	0	0	10	0	0	0	0	0	0	42	9	5	2	0	58
12:15	5	1	0	1	0	7	0	0	0	0	0	0	27	8	4	5	0	44
12:30	3	0	0	3	0	6	0	0	0	0	0	0	41	6	3	5	0	55
12:45	2	1	3	2	0	8	0	0	0	0	0	0	36	5	2	3	0	46
H/TOT	17	4	4	6	0	31	0	0	0	0	0	0	146	28	14	15	0	203

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 1						MOVEMENT 2						MOVEMENT 3					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	1	0	2	1	0	4	0	0	0	1	0	1	33	8	3	2	0	46
13:15	6	1	0	0	0	7	1	0	0	0	0	1	35	8	3	2	0	48
13:30	1	0	0	0	0	1	0	0	0	0	0	0	44	9	6	7	0	66
13:45	3	0	1	0	0	4	0	0	0	0	0	0	55	13	4	3	0	75
H/TOT	11	1	3	1	0	16	1	0	0	1	0	2	167	38	16	14	0	235
14:00	2	1	0	1	0	4	0	0	0	0	0	0	27	9	4	5	1	46
14:15	2	1	0	1	0	4	0	0	0	0	0	0	27	10	2	5	1	45
14:30	1	2	2	0	0	5	1	0	0	0	0	1	34	9	3	4	1	51
14:45	2	0	0	0	0	2	0	0	0	0	0	0	38	11	7	6	0	62
H/TOT	7	4	2	2	0	15	1	0	0	0	0	1	126	39	16	20	3	204
15:00	0	2	1	0	0	3	1	0	0	0	0	1	38	7	4	5	1	55
15:15	5	2	0	3	0	10	0	0	0	0	0	0	33	7	5	7	0	52
15:30	4	1	1	1	0	7	0	0	0	0	0	0	32	8	3	5	0	48
15:45	1	2	0	2	0	5	0	0	0	0	0	0	26	7	6	7	0	46
H/TOT	10	7	2	6	0	25	1	0	0	0	0	1	129	29	18	24	1	201
16:00	4	2	2	1	0	9	0	0	0	0	0	0	20	8	5	6	0	39
16:15	2	1	1	0	0	4	2	0	0	0	0	2	32	11	11	4	0	58
16:30	3	0	1	1	0	5	0	0	0	0	0	0	29	8	2	1	1	41
16:45	2	1	0	1	1	5	0	0	0	0	0	0	35	8	6	8	0	57
H/TOT	11	4	4	3	1	23	2	0	0	0	0	2	116	35	24	19	1	195
17:00	6	3	1	1	0	11	0	0	0	0	0	0	30	3	4	4	0	41
17:15	8	0	1	0	0	9	0	0	0	0	0	0	23	8	4	6	0	41
17:30	4	1	2	1	0	8	0	0	0	0	0	0	21	5	5	6	0	37
17:45	8	0	0	1	0	9	0	0	0	0	0	0	45	3	1	4	0	53
H/TOT	26	4	4	3	0	37	0	0	0	0	0	0	119	19	14	20	0	172
18:00	3	1	1	2	0	7	0	0	0	0	0	0	36	8	2	9	0	55
18:15	4	1	0	0	0	5	0	0	0	0	0	0	36	8	1	4	1	50
18:30	2	0	1	0	0	3	0	0	0	0	0	0	33	5	2	6	1	47
18:45	2	0	2	0	0	4	0	0	0	0	0	0	45	5	2	7	0	59
H/TOT	11	2	4	2	0	19	0	0	0	0	0	0	150	26	7	26	2	211
P/TOT	165	39	44	41	1	290	20	5	4	1	0	30	1583	416	194	238	9	2440

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 4						MOVEMENT 5						MOVEMENT 6					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	35	14	3	5	1	58	52	27	2	4	0	85	0	0	0	0	0	0
07:15	43	16	5	2	0	66	89	18	9	8	0	124	0	0	0	0	0	0
07:30	50	10	7	7	0	74	96	29	2	9	0	136	0	0	0	0	0	0
07:45	29	13	2	4	0	48	77	28	3	3	1	112	0	0	0	0	0	0
H/TOT	157	53	17	18	1	246	314	102	16	24	1	457	0	0	0	0	0	0
08:00	43	11	5	4	1	64	80	21	14	6	2	123	0	0	0	0	0	0
08:15	44	3	8	1	0	56	76	17	11	9	0	113	0	0	0	0	0	0
08:30	38	8	5	7	0	58	90	14	9	10	2	125	0	0	0	0	0	0
08:45	37	8	7	4	0	56	76	14	11	13	2	116	1	1	0	0	0	2
H/TOT	162	30	25	16	1	234	322	66	45	38	6	477	1	1	0	0	0	2
09:00	42	12	1	7	1	63	74	17	8	3	2	104	0	0	0	0	0	0
09:15	23	8	5	5	0	41	82	11	9	9	0	111	1	0	0	0	0	1
09:30	36	9	5	6	2	58	74	20	10	7	1	112	0	0	0	0	0	0
09:45	28	7	3	3	0	41	53	17	12	9	0	91	0	0	0	0	0	0
H/TOT	129	36	14	21	3	203	283	65	39	28	3	418	1	0	0	0	0	1
10:00	36	15	4	9	0	64	67	18	7	3	1	96	0	0	0	0	0	0
10:15	42	10	3	6	0	61	64	16	3	7	0	90	0	0	0	0	0	0
10:30	27	11	4	3	0	45	66	14	7	1	0	88	0	0	0	0	0	0
10:45	27	7	3	3	0	40	60	19	10	7	1	97	1	0	0	0	0	1
H/TOT	132	43	14	21	0	210	257	67	27	18	2	371	1	0	0	0	0	1
11:00	34	5	7	5	0	51	58	17	6	4	0	85	0	0	0	0	0	0
11:15	17	12	1	6	0	36	78	12	4	7	0	101	0	0	0	0	0	0
11:30	28	4	5	7	0	44	82	17	7	4	0	110	0	0	0	0	0	0
11:45	33	8	6	9	0	56	66	19	5	4	2	96	0	0	0	0	0	0
H/TOT	112	29	19	27	0	187	284	65	22	19	2	392	0	0	0	0	0	0
12:00	30	6	6	8	0	50	63	16	8	6	0	93	0	0	0	0	0	0
12:15	38	5	1	6	0	50	62	14	5	7	0	88	0	0	0	0	0	0
12:30	33	7	1	7	0	48	57	12	5	3	1	78	0	0	0	0	0	0
12:45	29	5	3	5	0	42	77	13	7	5	0	102	1	0	0	0	0	1
H/TOT	130	23	11	26	0	190	259	55	25	21	1	361	1	0	0	0	0	1

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 4						MOVEMENT 5						MOVEMENT 6					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	39	8	8	6	0	61	58	13	5	5	0	81	1	0	0	0	0	1
13:15	37	3	3	5	0	48	70	17	7	2	0	96	0	0	0	0	0	0
13:30	36	12	3	2	0	53	69	12	4	5	1	91	0	0	0	0	0	0
13:45	33	0	7	1	0	41	58	13	7	4	0	82	0	0	0	0	0	0
H/TOT	145	23	21	14	0	203	255	55	23	16	1	350	1	0	0	0	0	1
14:00	34	6	4	5	0	49	54	15	6	4	0	79	0	0	0	0	0	0
14:15	35	6	6	5	0	52	63	9	9	5	1	87	0	0	0	0	0	0
14:30	35	8	5	5	0	53	74	15	4	8	1	102	1	0	0	0	0	1
14:45	35	9	7	5	0	56	83	15	5	10	0	113	0	0	0	0	0	0
H/TOT	139	29	22	20	0	210	274	54	24	27	2	381	1	0	0	0	0	1
15:00	38	9	2	4	1	54	61	9	6	9	0	85	0	0	0	0	0	0
15:15	34	9	4	4	0	51	78	13	4	8	0	103	0	0	0	0	0	0
15:30	39	11	2	1	0	53	60	10	7	4	2	83	2	1	0	0	0	3
15:45	44	7	5	2	0	58	64	10	5	8	0	87	1	0	0	0	0	1
H/TOT	155	36	13	11	1	216	263	42	22	29	2	358	3	1	0	0	0	4
16:00	39	7	5	4	0	55	110	17	8	3	2	140	0	0	0	0	0	0
16:15	43	3	6	8	0	60	84	16	4	4	0	108	0	0	0	0	0	0
16:30	48	8	3	7	0	66	88	11	6	2	1	108	0	0	0	0	0	0
16:45	50	12	5	8	0	75	70	13	5	4	1	93	1	0	0	0	0	1
H/TOT	180	30	19	27	0	256	352	57	23	13	4	449	1	0	0	0	0	1
17:00	51	12	6	5	0	74	110	17	3	7	0	137	0	0	0	0	0	0
17:15	61	13	4	4	0	82	116	15	10	2	0	143	0	0	0	0	0	0
17:30	71	14	2	2	1	90	118	17	8	1	3	147	0	0	0	0	0	0
17:45	65	19	9	0	0	93	94	14	5	0	0	113	1	0	0	0	0	1
H/TOT	248	58	21	11	1	339	438	63	26	10	3	540	1	0	0	0	0	1
18:00	57	9	2	2	0	70	89	17	7	3	0	116	0	0	0	0	0	0
18:15	47	11	2	2	0	62	82	16	1	1	0	100	0	0	0	0	0	0
18:30	46	2	2	2	0	52	66	12	5	3	0	86	0	0	0	0	0	0
18:45	41	8	4	4	0	57	40	13	3	1	0	57	0	0	0	0	0	0
H/TOT	191	30	10	10	0	241	277	58	16	8	0	359	0	0	4	0	0	4
P/TOT	1880	420	206	222	7	2735	3578	749	308	251	27	4913	11	2	4	0	0	17

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 7						MOVEMENT 8						MOVEMENT 9					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
07:45	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	3
08:00	2	0	0	0	0	2	0	0	0	0	0	0	1	3	0	0	1	5
08:15	0	0	0	0	0	0	2	2	0	0	0	4	2	3	0	0	0	5
08:30	0	0	0	0	0	0	2	0	1	0	0	3	3	0	0	0	0	3
08:45	0	0	0	0	0	0	2	0	1	0	0	3	3	2	0	0	0	5
H/TOT	2	0	0	0	0	2	6	2	2	0	0	10	9	8	0	0	1	18
09:00	0	0	0	0	0	0	3	2	2	0	0	7	8	4	2	0	0	14
09:15	0	0	0	0	0	0	4	0	0	0	0	4	5	3	0	0	0	8
09:30	0	0	0	0	0	0	1	0	0	0	0	1	3	4	0	0	0	7
09:45	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1
H/TOT	1	0	0	0	0	1	8	2	2	1	0	13	17	11	2	0	0	30
10:00	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	5
10:15	0	0	0	0	0	0	2	0	0	0	0	2	3	2	0	0	0	5
10:30	0	0	0	0	0	0	1	0	0	0	0	1	4	1	0	0	0	5
10:45	1	0	0	0	0	1	3	0	0	0	0	3	3	1	0	0	0	4
H/TOT	1	0	0	0	0	1	6	0	0	0	0	6	13	6	0	0	0	19
11:00	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	6
11:15	0	0	0	0	0	0	2	0	0	0	0	2	5	1	0	0	0	6
11:30	0	0	0	0	0	0	3	0	0	0	0	3	4	0	1	0	0	5
11:45	0	0	0	0	0	0	1	0	0	0	0	1	3	2	0	0	0	0
H/TOT	0	0	0	0	0	0	6	0	0	0	0	6	16	5	1	0	0	22
12:00	1	0	0	0	0	1	2	1	0	0	0	3	2	1	2	0	0	5
12:15	0	1	0	0	0	1	2	2	1	0	0	5	5	3	3	0	0	11
12:30	0	0	0	1	0	1	4	0	0	0	0	4	8	0	0	1	0	9
12:45	1	0	0	0	0	1	4	2	1	1	0	8	9	3	1	0	0	13
H/TOT	2	1	0	1	0	4	12	5	2	1	0	20	24	7	6	1	0	38

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 7						MOVEMENT 8						MOVEMENT 9					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	0	0	0	0	0	0	6	0	0	0	0	6	8	2	0	0	0	10
13:15	0	0	0	0	0	0	2	1	0	0	0	3	1	0	1	0	0	2
13:30	1	1	0	0	0	2	1	0	0	0	0	1	2	0	1	1	0	4
13:45	0	0	0	0	0	0	2	0	0	0	0	2	6	3	0	1	0	10
H/TOT	1	1	0	0	0	2	11	1	0	0	0	12	17	5	2	2	0	26
14:00	1	0	0	0	0	1	1	0	0	1	0	2	1	0	0	0	0	1
14:15	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1	0	0	6
14:30	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	7
14:45	1	0	0	0	0	1	0	0	0	0	0	0	3	2	0	0	0	5
H/TOT	2	0	0	0	0	2	1	0	0	1	0	2	14	4	1	0	0	19
15:00	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
15:15	1	0	0	0	0	1	0	0	0	0	0	0	4	3	0	0	0	7
15:30	0	0	0	0	0	0	3	0	0	0	0	3	7	3	1	0	0	11
15:45	0	0	0	0	0	0	3	0	0	0	0	3	9	3	2	0	0	14
H/TOT	1	0	0	0	0	1	6	0	0	0	0	6	23	9	3	0	0	35
16:00	2	0	0	0	0	2	4	0	0	0	0	4	7	5	1	0	0	13
16:15	2	0	0	0	0	2	3	0	0	0	0	3	7	1	0	0	0	8
16:30	1	0	0	0	0	1	3	0	0	0	0	3	0	1	1	0	0	2
16:45	0	0	0	0	0	0	6	0	0	0	0	6	8	1	1	0	0	10
H/TOT	5	0	0	0	0	5	16	0	0	0	0	16	22	8	3	0	0	33
17:00	0	0	0	0	0	0	6	0	0	0	0	6	5	2	0	0	1	8
17:15	0	0	0	0	0	0	11	0	0	0	0	11	6	1	0	0	0	7
17:30	2	0	0	0	0	2	7	0	0	0	0	7	11	0	1	0	0	12
17:45	1	0	0	0	0	1	1	0	0	0	0	1	3	0	0	0	0	3
H/TOT	3	0	0	0	0	3	25	0	0	0	0	25	25	3	1	0	1	30
18:00	0	0	0	0	0	0	1	0	0	0	0	1	3	0	0	0	0	3
18:15	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	3	0	0	0	0	3	3	0	0	0	0	3
P/TOT	19	2	0	1	0	22	100	10	6	3	0	119	186	66	19	3	2	276

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 10						MOVEMENT 11						MOVEMENT 12					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	0	0	0	0	0	0	23	4	5	2	0	34	1	0	0	1	0	2
07:15	0	0	0	0	0	0	41	17	5	5	0	68	7	2	1	3	0	13
07:30	7	1	0	1	0	9	51	17	9	7	0	84	3	0	2	0	0	5
07:45	8	2	1	0	0	11	78	21	9	6	1	115	6	0	0	2	1	9
H/TOT	15	3	1	1	0	20	193	59	28	20	1	301	17	2	3	6	1	29
08:00	8	2	2	0	0	12	79	20	6	4	2	111	5	0	0	0	0	5
08:15	10	3	2	0	0	15	103	18	10	6	1	138	4	0	1	1	0	6
08:30	11	3	1	0	0	15	150	22	3	5	0	180	8	2	3	1	0	14
08:45	18	3	1	0	0	22	142	29	12	6	0	189	6	1	1	2	0	10
H/TOT	47	11	6	0	0	64	474	89	31	21	3	618	23	3	5	4	0	35
09:00	17	2	0	0	0	19	90	20	7	4	0	121	6	0	3	5	0	14
09:15	14	5	0	0	0	19	84	14	8	6	2	114	7	0	0	3	0	10
09:30	15	2	1	0	0	18	71	15	8	5	0	99	3	1	2	0	0	6
09:45	4	2	0	2	0	8	73	14	2	6	0	95	9	0	1	1	0	11
H/TOT	50	11	1	2	0	64	318	63	25	21	2	429	25	1	6	9	0	41
10:00	10	2	0	0	0	12	72	10	7	5	0	94	2	0	1	1	0	4
10:15	12	1	0	0	0	13	74	13	3	5	0	95	7	1	1	1	0	10
10:30	8	3	1	1	0	13	62	13	10	7	0	92	1	1	0	1	0	3
10:45	9	4	0	0	0	13	98	13	13	7	2	133	7	0	1	0	0	8
H/TOT	39	10	1	1	0	51	306	49	33	24	2	414	17	2	3	3	0	25
11:00	5	1	0	0	0	6	84	14	6	4	0	108	3	0	1	2	0	6
11:15	6	2	1	0	0	9	85	12	4	7	0	108	2	1	2	0	0	5
11:30	7	3	0	0	0	10	80	13	9	6	1	109	4	2	1	2	0	9
11:45	8	4	1	0	0	13	67	13	10	9	1	100	1	0	1	1	0	3
H/TOT	26	10	2	0	0	38	316	52	29	26	2	425	10	3	5	5	0	23
12:00	10	1	1	0	0	12	86	16	6	4	1	113	4	0	0	3	0	7
12:15	10	1	1	0	0	12	90	19	2	2	1	114	2	1	2	1	0	6
12:30	6	2	2	0	0	10	87	16	2	3	1	109	2	1	1	1	0	5
12:45	9	2	1	0	0	12	65	11	5	2	0	83	5	0	2	2	0	9
H/TOT	35	6	5	0	0	46	328	62	15	11	3	419	13	2	5	7	0	27

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 01 DATE: 4th September 2007

LOCATION: N80/N11 DAY: Tuesday

	MOVEMENT 10						MOVEMENT 11						MOVEMENT 12					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	2	0	0	2	0	4	74	19	3	3	0	99	3	0	0	0	0	3
13:15	7	3	0	2	0	12	75	21	6	2	1	105	3	0	1	0	0	4
13:30	6	1	2	0	0	9	83	18	7	4	0	112	4	2	1	1	0	8
13:45	16	0	1	1	0	18	89	19	5	3	1	117	8	1	2	1	0	12
H/TOT	31	4	3	5	0	43	321	77	21	12	2	433	18	3	4	2	0	27
14:00	7	3	0	0	0	10	73	20	5	3	1	102	7	0	1	2	0	10
14:15	9	0	0	0	0	9	82	20	8	6	1	117	8	2	1	2	0	13
14:30	10	0	1	1	0	12	90	26	6	5	2	129	7	0	2	2	0	11
14:45	13	1	0	0	0	14	91	19	9	6	0	125	5	2	3	2	0	12
H/TOT	39	4	1	1	0	45	336	85	28	20	4	473	27	4	7	8	0	46
15:00	12	0	0	1	0	13	98	28	5	5	1	137	8	1	1	3	0	13
15:15	8	0	0	0	0	8	87	19	9	6	1	122	3	1	1	2	0	7
15:30	15	5	1	1	0	22	89	28	7	7	0	131	5	1	4	2	0	12
15:45	9	5	1	0	0	15	73	24	10	7	1	115	9	1	1	0	0	11
H/TOT	44	10	2	2	0	58	347	99	31	25	3	505	25	4	7	7	0	43
16:00	7	2	0	0	0	9	85	26	16	7	0	134	5	0	2	3	0	10
16:15	9	4	1	0	0	14	109	24	9	7	1	150	3	0	1	2	0	6
16:30	3	1	1	0	0	5	99	28	3	5	1	136	5	0	2	3	0	10
16:45	5	1	1	0	0	7	90	29	9	8	0	136	3	0	0	3	0	6
H/TOT	24	8	3	0	0	35	383	107	37	27	2	556	16	0	5	11	0	32
17:00	2	3	0	0	0	5	121	25	11	7	0	164	11	1	2	0	0	14
17:15	13	4	0	0	0	17	115	30	9	5	1	160	6	3	1	2	0	12
17:30	1	0	0	0	0	1	107	29	4	5	0	145	18	2	1	1	0	22
17:45	5	1	0	0	0	6	136	22	3	3	0	164	11	2	2	1	0	16
H/TOT	21	8	0	0	0	29	479	106	27	20	1	633	46	8	6	4	0	64
18:00	4	2	0	0	0	6	99	18	3	3	0	123	12	2	1	0	0	15
18:15	0	0	0	0	0	0	105	19	4	4	2	134	6	1	1	2	0	10
18:30	1	0	0	0	0	1	106	21	2	2	0	131	4	0	0	0	0	4
18:45	0	0	0	0	0	0	96	20	3	5	0	124	6	0	4	2	0	12
H/TOT	5	2	0	0	0	7	406	78	12	14	2	512	28	3	4	4	0	39
P/TOT	376	87	25	12	0	500	4207	926	317	241	27	5718	265	35	60	70	1	431

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 1						MOVEMENT 2						MOVEMENT 3					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	0	1	0	0	0	1	24	10	8	9	0	51	6	3	0	0	0	9
07:15	2	0	0	0	0	2	35	28	11	10	0	84	11	4	1	1	0	17
07:30	1	1	0	0	0	2	48	25	5	15	0	93	12	7	2	0	0	21
07:45	4	2	0	0	0	6	44	18	12	9	0	83	23	11	2	1	0	37
H/TOT	7	4	0	0	0	11	151	81	36	43	0	311	52	25	5	2	0	84
08:00	4	0	0	0	0	4	64	15	4	10	2	95	20	13	0	3	1	37
08:15	8	1	0	0	0	9	66	17	5	8	1	97	31	4	2	0	0	37
08:30	10	1	0	1	0	12	94	12	5	10	0	121	62	12	2	1	0	77
08:45	7	2	1	0	0	10	81	25	9	10	0	125	55	8	1	0	0	64
H/TOT	29	4	1	1	0	35	305	69	23	38	3	438	168	37	5	4	1	215
09:00	8	3	1	1	0	13	67	13	9	11	0	100	41	6	1	0	0	48
09:15	6	1	1	1	0	9	84	24	10	6	2	126	30	10	4	1	0	45
09:30	5	2	1	1	0	9	71	10	9	7	0	97	34	12	0	0	0	46
09:45	3	1	0	2	0	6	71	11	3	9	0	94	27	9	1	0	0	37
H/TOT	22	7	3	5	0	37	293	58	31	33	2	417	132	37	6	1	0	176
10:00	2	2	0	1	0	5	61	14	9	4	0	88	25	16	2	1	0	44
10:15	5	1	1	1	0	8	77	19	10	10	0	116	31	13	1	0	0	45
10:30	0	0	1	0	0	1	69	15	8	10	0	102	25	13	1	1	0	40
10:45	10	2	2	1	0	15	75	16	10	13	2	116	28	10	4	1	0	43
H/TOT	17	5	4	3	0	29	282	64	37	37	2	422	109	52	8	3	0	172
11:00	3	1	1	0	0	5	86	20	5	8	0	119	27	14	4	0	0	45
11:15	4	0	2	1	0	7	71	22	5	13	0	111	30	5	0	0	0	35
11:30	4	0	2	1	0	7	82	15	7	11	1	116	36	10	1	0	0	47
11:45	3	2	2	0	0	7	70	12	8	15	2	107	29	7	8	0	0	0
H/TOT	14	3	7	2	0	26	309	69	25	47	3	453	122	36	13	0	0	171
12:00	9	0	0	2	0	11	86	18	8	9	1	122	29	7	2	0	0	38
12:15	6	0	2	0	0	8	73	16	4	5	1	99	20	7	1	1	0	29
12:30	9	0	0	0	0	9	98	12	5	10	1	126	31	11	1	1	0	44
12:45	4	0	0	1	0	5	58	11	5	4	0	78	37	3	1	1	0	42
H/TOT	28	0	2	3	0	33	315	57	22	28	3	425	117	28	5	3	0	153

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 1						MOVEMENT 2						MOVEMENT 3					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	8	4	3	0	0	15	85	12	4	1	0	102	29	11	2	0	0	42
13:15	3	2	0	0	0	5	73	12	0	5	1	91	41	3	2	1	0	47
13:30	7	1	1	1	0	10	79	18	10	5	0	112	45	6	2	0	0	53
13:45	11	2	5	0	0	18	79	13	7	9	1	109	44	12	1	1	0	58
H/TOT	29	9	9	1	0	48	316	55	21	20	2	414	159	32	7	2	0	200
14:00	12	6	1	1	0	20	66	14	7	6	0	93	26	5	1	2	0	34
14:15	9	3	1	0	0	13	65	14	9	7	1	96	38	16	1	0	1	56
14:30	7	3	0	1	0	11	57	19	9	5	2	92	50	11	2	1	1	65
14:45	12	2	4	0	0	18	75	18	14	13	0	120	29	8	3	0	0	40
H/TOT	40	14	6	2	0	62	263	65	39	31	3	401	143	40	7	3	2	195
15:00	16	1	4	0	0	21	88	27	7	10	0	132	37	16	2	0	0	55
15:15	10	1	0	0	0	11	58	12	6	13	3	92	35	5	4	1	0	45
15:30	7	2	2	0	0	11	59	12	6	6	0	83	49	10	4	0	0	63
15:45	9	3	1	1	0	14	54	17	11	7	1	90	31	15	6	0	0	52
H/TOT	42	7	7	1	0	57	259	68	30	36	4	397	152	46	16	1	0	215
16:00	9	3	2	2	0	16	61	12	7	13	0	93	38	14	2	0	0	54
16:15	5	2	1	1	0	9	76	22	11	12	1	122	47	8	2	1	0	58
16:30	15	3	1	0	0	19	51	13	5	6	1	76	47	14	0	0	0	61
16:45	15	4	4	0	0	23	68	20	11	9	0	108	42	16	1	0	0	59
H/TOT	44	12	8	3	0	67	256	67	34	40	2	399	174	52	5	1	0	232
17:00	15	6	4	1	0	26	88	22	8	10	0	128	95	25	1	1	0	122
17:15	16	6	3	0	0	25	65	17	6	7	1	96	60	25	2	0	1	88
17:30	11	1	2	0	0	14	46	16	3	18	0	83	52	30	1	2	0	85
17:45	5	0	1	0	0	6	66	17	1	9	0	93	80	33	1	0	0	114
H/TOT	47	13	10	1	0	71	265	72	18	44	1	400	287	113	5	3	1	409
18:00	4	1	1	0	0	6	69	13	4	10	1	97	57	16	2	3	0	78
18:15	3	1	0	0	0	4	52	19	6	3	2	82	59	17	1	0	0	77
18:30	6	2	2	0	0	10	83	20	4	6	1	114	58	15	1	0	0	74
18:45	5	1	0	0	0	6	68	15	1	11	0	95	33	19	2	1	0	55
H/TOT	18	5	3	0	0	26	272	67	15	30	4	388	207	67	6	4	0	284
P/TOT	337	83	60	22	0	502	3286	792	331	427	29	4865	1822	565	88	27	4	2506

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 4						MOVEMENT 5						MOVEMENT 6					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	30	20	0	0	0	50	3	3	0	0	0	6	0	0	0	0	0	0
07:15	48	27	0	0	0	75	7	4	1	0	0	12	0	0	0	0	0	0
07:30	54	23	1	0	0	78	12	8	1	0	0	21	0	0	2	0	0	2
07:45	50	22	5	0	0	77	59	7	1	0	0	67	1	0	0	0	0	1
H/TOT	182	92	6	0	0	280	81	22	3	0	0	106	1	0	2	0	0	3
08:00	40	10	4	0	1	55	23	9	2	0	0	34	1	0	0	0	0	1
08:15	50	11	1	1	0	63	27	13	3	1	0	44	2	0	0	1	0	3
08:30	40	9	2	2	0	53	20	13	1	0	0	34	9	0	0	2	0	11
08:45	43	6	4	0	2	55	39	8	4	1	0	52	8	0	1	0	0	9
H/TOT	173	36	11	3	3	226	109	43	10	2	0	164	20	0	1	3	0	24
09:00	38	7	2	0	0	47	30	6	4	0	0	40	5	1	0	0	0	6
09:15	36	5	1	0	0	42	26	10	0	1	0	37	6	0	0	1	0	7
09:30	27	10	1	0	0	38	17	11	1	1	0	30	4	2	0	0	0	6
09:45	24	11	2	0	0	37	19	8	0	1	0	28	4	0	2	0	0	6
H/TOT	125	33	6	0	0	164	92	35	5	3	0	135	19	3	2	1	0	25
10:00	23	7	0	1	0	31	16	9	0	0	0	25	4	1	0	0	0	5
10:15	26	7	1	0	0	34	13	2	1	0	0	16	3	1	1	1	0	6
10:30	27	8	1	0	0	36	25	10	5	1	0	41	4	0	1	0	0	5
10:45	22	9	3	0	0	34	19	10	1	1	0	31	5	0	1	0	0	6
H/TOT	98	31	5	1	0	135	73	31	7	2	0	113	16	2	3	1	0	22
11:00	28	8	1	1	0	38	14	8	1	0	0	23	6	2	0	0	0	8
11:15	21	9	1	0	0	31	20	5	4	0	0	29	5	0	0	0	0	5
11:30	32	10	0	0	0	42	24	12	1	0	0	37	3	2	1	0	0	6
11:45	23	8	2	0	0	33	14	7	4	0	0	25	7	0	0	1	0	8
H/TOT	104	35	4	1	0	144	72	32	10	0	0	114	21	4	1	1	0	27
12:00	19	8	3	0	0	30	9	7	0	0	0	16	1	0	1	0	0	2
12:15	25	3	0	0	0	28	25	5	1	0	0	31	1	1	2	0	0	4
12:30	20	4	2	0	0	26	20	4	2	0	0	26	3	1	2	0	0	6
12:45	22	5	1	0	0	28	18	6	0	0	0	24	2	0	1	0	0	3
H/TOT	86	20	6	0	0	112	72	22	3	0	0	97	7	2	6	0	0	15

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 4						MOVEMENT 5						MOVEMENT 6					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	36	2	4	1	0	43	28	3	3	0	0	34	7	0	0	0	0	7
13:15	38	4	2	1	0	45	18	6	2	2	0	28	2	1	0	0	0	3
13:30	33	4	0	0	0	37	18	8	0	0	0	26	2	1	0	0	0	3
13:45	29	5	2	0	0	36	27	6	3	0	0	36	3	1	0	0	0	4
H/TOT	136	15	8	2	0	161	91	23	8	2	0	124	14	3	0	0	0	17
14:00	20	4	2	0	0	26	23	7	1	0	0	31	3	0	0	0	0	3
14:15	27	7	1	1	0	36	15	6	1	0	0	22	4	0	1	0	0	5
14:30	24	2	1	0	0	27	9	9	4	1	0	23	2	1	0	0	0	3
14:45	40	8	0	0	0	48	23	7	1	0	0	31	5	1	0	0	0	6
H/TOT	111	21	4	1	0	137	70	29	7	1	0	107	14	2	1	0	0	17
15:00	29	10	1	1	0	41	17	10	2	1	0	30	7	0	0	1	0	8
15:15	25	6	0	0	0	31	17	5	2	0	0	24	2	1	0	0	0	3
15:30	30	6	2	1	0	39	19	8	3	0	0	30	0	0	1	0	0	1
15:45	22	8	1	0	0	31	25	1	4	0	0	30	2	2	0	0	0	4
H/TOT	106	30	4	2	0	142	78	24	11	1	0	114	11	3	1	1	0	16
16:00	32	9	1	0	0	42	23	5	0	1	0	29	3	1	1	0	0	5
16:15	34	7	3	0	0	44	20	5	3	0	0	28	5	0	0	0	0	5
16:30	45	5	0	1	0	51	17	2	4	0	0	23	3	1	0	0	0	4
16:45	39	7	1	0	0	47	16	7	1	0	0	24	4	1	0	0	0	5
H/TOT	150	28	5	1	0	184	76	19	8	1	0	104	15	3	1	0	0	19
17:00	38	8	1	0	0	47	19	6	3	0	0	28	6	0	0	1	0	7
17:15	48	11	1	0	0	60	15	9	3	0	0	27	3	2	0	0	0	5
17:30	49	5	3	0	0	57	14	2	1	0	0	17	5	1	0	0	0	6
17:45	33	6	1	0	0	40	12	2	1	0	0	15	6	1	0	0	0	7
H/TOT	168	30	6	0	0	204	60	19	8	0	0	87	20	4	0	1	0	25
18:00	33	7	2	0	0	42	5	1	0	0	0	6	6	0	1	0	0	7
18:15	40	7	1	1	0	49	9	2	0	0	0	11	4	0	0	0	0	4
18:30	31	7	0	0	0	38	4	2	0	0	0	6	4	0	0	0	0	4
18:45	21	7	0	0	0	28	7	0	0	0	0	7	4	1	1	0	0	6
H/TOT	125	28	3	1	0	157	25	5	0	0	0	30	18	1	2	0	0	21
P/TOT	1564	399	68	12	3	2046	899	304	80	12	0	1295	176	27	20	8	0	231

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 7						MOVEMENT 8						MOVEMENT 9					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	7	2	1	0	0	10	65	27	4	8	0	104	6	1	1	2	0	10
07:15	3	0	1	0	0	4	68	15	5	13	1	102	5	1	0	0	0	6
07:30	2	0	0	0	0	2	67	31	7	12	0	117	14	5	4	0	0	23
07:45	3	0	2	0	0	5	53	24	6	9	1	93	45	10	4	1	0	60
H/TOT	15	2	4	0	0	21	253	97	22	42	2	416	70	17	9	3	0	99
08:00	3	2	0	0	0	5	79	17	12	9	2	119	24	6	2	1	0	33
08:15	7	1	0	0	0	8	57	19	10	10	1	97	22	10	4	1	0	37
08:30	12	2	1	0	0	15	73	15	10	13	0	111	15	10	4	1	0	30
08:45	13	1	1	0	0	15	60	16	7	13	0	96	35	8	4	3	0	50
H/TOT	35	6	2	0	0	43	269	67	39	45	3	423	96	34	14	6	0	150
09:00	6	0	0	0	0	6	49	15	6	12	2	84	25	8	4	0	0	37
09:15	11	1	0	1	0	13	58	10	8	16	0	92	20	10	3	0	0	33
09:30	12	0	0	1	0	13	77	11	9	13	3	113	25	6	3	1	0	35
09:45	5	0	1	0	0	6	46	9	6	8	0	69	14	9	8	1	0	32
H/TOT	34	1	1	2	0	38	230	45	29	49	5	358	84	33	18	2	0	137
10:00	5	1	1	1	0	8	75	20	7	11	1	114	21	8	1	3	0	33
10:15	4	2	0	0	0	6	44	15	7	9	0	75	28	13	4	1	0	46
10:30	6	1	2	1	0	10	61	8	6	8	0	83	21	1	3	1	0	26
10:45	5	2	1	2	0	10	54	12	4	12	1	83	25	4	1	0	0	30
H/TOT	20	6	4	4	0	34	234	55	24	40	2	355	95	26	9	5	0	135
11:00	5	0	0	0	0	5	52	16	5	6	0	79	24	11	0	1	0	36
11:15	11	1	0	0	0	12	67	10	4	11	0	92	34	4	2	1	0	41
11:30	8	1	0	0	0	9	56	6	5	10	0	77	26	4	4	0	0	34
11:45	3	1	1	0	0	5	59	9	12	15	2	97	26	6	3	0	0	0
H/TOT	27	3	1	0	0	31	234	41	26	42	2	345	110	25	9	2	0	146
12:00	7	0	0	0	0	7	61	13	6	12	0	92	19	5	2	1	0	27
12:15	4	3	0	0	0	7	64	13	5	9	0	91	26	5	4	0	0	35
12:30	7	0	1	0	0	8	51	11	9	9	1	81	19	4	3	2	0	28
12:45	11	0	0	0	0	11	55	16	5	8	0	84	20	4	2	0	0	26
H/TOT	29	3	1	0	0	33	231	53	25	38	1	348	84	18	11	3	0	116

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 7						MOVEMENT 8						MOVEMENT 9					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	5	1	0	0	0	6	58	14	11	11	0	94	20	4	1	0	0	25
13:15	8	0	0	0	0	8	56	10	3	1	0	70	21	4	0	1	0	26
13:30	5	0	1	0	0	6	59	9	3	9	1	81	21	1	0	2	0	24
13:45	8	1	0	1	0	10	56	7	2	11	0	76	27	8	3	2	0	40
H/TOT	26	2	1	1	0	30	229	40	19	32	1	321	89	17	4	5	0	115
14:00	11	0	0	0	0	11	67	8	7	6	0	88	22	7	3	0	0	32
14:15	16	0	0	0	0	16	66	12	10	9	1	98	22	10	3	1	0	36
14:30	6	1	0	1	0	8	55	14	7	16	1	93	20	5	1	2	0	28
14:45	7	1	0	0	0	8	76	8	4	7	0	95	24	4	1	2	0	31
H/TOT	40	2	0	1	0	43	264	42	28	38	2	374	88	26	8	5	0	127
15:00	10	2	0	0	0	12	62	7	6	10	0	85	18	4	0	0	1	23
15:15	7	1	1	0	0	9	49	13	5	8	0	75	18	7	2	2	0	29
15:30	4	2	0	0	0	6	70	14	5	6	2	97	15	4	1	1	0	21
15:45	9	1	0	0	0	10	76	7	9	7	0	99	14	4	3	0	0	21
H/TOT	30	6	1	0	0	37	257	41	25	31	2	356	65	19	6	3	1	94
16:00	12	1	0	0	0	13	93	16	7	4	2	122	11	4	4	1	0	20
16:15	7	4	0	0	0	11	63	8	5	16	1	93	13	5	4	1	0	23
16:30	6	0	0	0	0	6	70	17	6	7	1	101	11	4	1	0	0	16
16:45	2	1	0	1	0	4	76	15	4	10	1	106	12	6	5	2	1	26
H/TOT	27	6	0	1	0	34	302	56	22	37	5	422	47	19	14	4	1	85
17:00	12	0	0	0	0	12	73	11	2	11	0	97	16	5	3	1	0	25
17:15	26	2	1	0	0	29	92	15	8	4	4	123	11	3	2	1	0	17
17:30	25	3	0	0	0	28	89	13	3	2	1	108	10	5	1	2	0	18
17:45	28	3	3	1	0	35	99	21	7	2	0	129	12	4	5	0	0	21
H/TOT	91	8	4	1	0	104	353	60	20	19	5	457	49	17	11	4	0	81
18:00	13	2	3	0	0	18	85	15	4	5	0	109	9	4	3	0	0	16
18:15	8	3	0	1	0	12	80	11	3	2	0	96	12	0	0	0	0	12
18:30	2	1	0	0	0	3	74	10	5	6	0	95	6	2	2	0	0	10
18:45	4	0	0	0	0	4	56	12	4	6	0	78	10	1	0	0	0	11
H/TOT	27	6	3	1	0	37	295	48	16	19	0	378	37	7	5	0	0	49
P/TOT	401	51	22	11	0	485	3151	645	295	432	30	4553	914	258	118	42	2	1334

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 10						MOVEMENT 11						MOVEMENT 12					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	0	1	1	0	0	2	0	2	2	1	0	5	1	0	0	0	0	1
07:15	1	1	1	4	0	7	0	3	1	0	0	4	0	0	2	1	0	3
07:30	4	1	1	2	0	8	1	0	1	1	0	3	0	0	0	0	0	0
07:45	3	1	1	1	0	6	3	2	0	1	0	6	0	0	0	1	0	1
H/TOT	8	4	4	7	0	23	4	7	4	3	0	18	1	0	2	2	0	5
08:00	6	1	2	1	0	10	3	0	0	0	0	3	2	1	2	0	0	5
08:15	7	3	2	0	0	12	9	1	0	0	0	10	2	0	0	0	0	2
08:30	8	2	3	2	0	15	14	3	1	0	0	18	0	1	2	0	0	3
08:45	6	6	2	0	0	14	12	4	1	0	0	17	7	1	2	1	0	11
H/TOT	27	12	9	3	0	51	38	8	2	0	0	48	11	3	6	1	0	21
09:00	6	6	4	0	0	16	10	2	3	0	0	15	3	2	1	0	0	6
09:15	7	6	4	0	0	17	6	3	1	0	0	12	4	0	2	0	0	6
09:30	10	5	5	1	0	21	6	7	2	0	0	15	4	5	2	0	0	11
09:45	11	6	1	0	0	18	6	3	1	0	0	10	3	1	2	0	0	6
H/TOT	34	23	14	1	0	72	28	17	7	0	0	52	14	8	7	0	0	29
10:00	18	5	2	1	0	26	10	2	1	0	0	13	2	5	0	0	0	7
10:15	5	4	2	1	0	12	3	3	0	0	0	6	3	2	3	1	0	9
10:30	15	4	2	0	0	21	8	4	2	0	0	14	3	0	0	0	0	3
10:45	15	2	3	1	0	21	10	8	2	0	0	20	2	1	1	0	0	4
H/TOT	53	15	9	3	0	80	31	17	5	0	0	53	10	8	4	1	0	23
11:00	15	7	6	0	0	28	11	2	1	0	0	14	2	2	1	1	0	6
11:15	14	4	4	1	0	23	14	3	1	1	0	19	3	1	0	0	0	4
11:30	13	2	3	0	0	18	15	3	2	1	0	21	2	3	1	0	0	6
11:45	11	2	1	0	0	14	16	3	2	0	0	21	5	2	1	0	0	8
H/TOT	53	15	14	1	0	83	56	11	6	2	0	75	12	8	3	1	0	24
12:00	18	4	3	2	0	27	20	2	3	0	0	25	0	1	0	0	0	1
12:15	19	7	3	0	0	29	14	4	1	0	0	19	5	1	1	1	0	8
12:30	14	3	1	0	0	18	16	2	1	0	0	19	3	1	0	0	0	4
12:45	19	4	2	1	0	26	20	3	2	1	0	26	4	2	1	1	0	8
H/TOT	70	18	9	3	0	100	70	11	7	1	0	89	12	5	2	2	0	21

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ABACUS TRANSPORTATION SURVEYS

ENNISCORTHY TRAFFIC COUNTS **SEPTEMBER 2007**
MANUAL CLASSIFIED JUNCTION COUNTS **ATH/07/301**

SITE: 02 DATE: 4th September 2007

LOCATION: N11/R890 Roundabout DAY: Tuesday

	MOVEMENT 10						MOVEMENT 11						MOVEMENT 12					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT	CAR	LGV	OGV1	OGV2	BUS	TOT
13:00	29	9	1	0	0	39	43	7	1	0	0	51	6	2	1	0	0	9
13:15	16	4	0	1	1	22	23	4	1	0	0	28	3	1	2	1	0	7
13:30	9	4	5	0	0	18	15	2	0	0	0	17	4	2	0	0	0	6
13:45	9	3	0	0	0	12	20	2	2	1	0	25	5	0	1	0	0	6
H/TOT	63	20	6	1	1	91	101	15	4	1	0	121	18	5	4	1	0	28
14:00	16	3	1	0	0	20	17	1	0	1	0	19	5	0	2	0	0	7
14:15	17	3	3	1	0	24	22	4	2	0	0	28	1	1	0	0	0	2
14:30	12	3	4	0	0	19	15	4	0	0	0	19	8	2	2	0	0	12
14:45	16	6	2	0	1	25	8	2	3	0	0	13	7	1	0	0	0	8
H/TOT	61	15	10	1	1	88	62	11	5	1	0	79	21	4	4	0	0	29
15:00	20	5	2	0	0	27	19	5	1	0	0	25	8	1	1	0	0	10
15:15	8	5	0	1	0	14	16	5	1	0	0	22	4	1	1	0	0	6
15:30	23	3	2	0	0	28	18	6	1	0	0	25	1	0	0	2	0	3
15:45	13	2	1	1	0	17	13	3	1	0	0	17	5	2	0	0	0	7
H/TOT	64	15	5	2	0	86	66	19	4	0	0	89	18	4	2	2	0	26
16:00	18	3	3	1	0	25	10	2	1	0	0	13	11	4	2	0	0	17
16:15	17	0	3	1	0	21	20	10	1	0	0	31	4	3	0	1	0	8
16:30	23	8	0	3	0	34	30	8	2	0	1	41	8	1	3	2	0	14
16:45	20	4	1	0	0	25	19	5	5	1	1	31	8	4	1	0	0	13
H/TOT	78	15	7	5	0	105	79	25	9	1	2	116	31	12	6	3	0	52
17:00	28	2	1	1	0	32	41	8	3	1	0	53	15	2	1	0	0	18
17:15	20	4	2	0	0	26	48	6	1	1	0	56	13	2	5	0	0	20
17:30	21	4	2	1	0	28	41	7	1	0	0	49	13	1	2	0	0	16
17:45	17	2	3	1	0	23	39	3	3	0	0	45	10	2	1	0	0	13
H/TOT	86	12	8	3	0	109	169	24	8	2	0	203	51	7	9	0	0	67
18:00	12	4	1	0	0	17	36	7	3	0	0	46	7	2	0	0	0	9
18:15	12	0	2	1	0	15	20	3	0	0	0	23	4	1	1	0	0	6
18:30	6	0	1	0	0	7	8	3	0	0	0	11	2	1	1	0	0	4
18:45	7	0	1	0	0	8	9	4	0	0	0	13	2	0	1	0	0	3
H/TOT	37	4	5	1	0	47	73	17	3	0	0	93	15	4	3	0	0	22
P/TOT	634	168	100	31	2	935	777	182	64	11	2	1036	214	68	52	13	0	347

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ABACUS TRANSPORTATION SURVEYS

MANUAL CLASSIFIED JUNCTION COUNTS

SITE: 01 DATE: Thursday 4 October 2007

LOCATION: IDA Access, N81 Enniscorthy DAY: Tuesday

MVT1 N11 Northbound
MVT2 N11 Southbound
MVT3 Left Turn from IDA Link onto N11
MVT4 Left Turn from N11 onto IDA Link
MVT5 Right Turn from IDA Link onto N11
MVT6 Right Turn from N11 onto IDA Link (Prohibited Movement)

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		MVT 1			MVT 2			MVT 3			MVT 4			MVT 5			MVT 6		
AM	TIME	LV	HV	TOT	LV	HV	TOT	LV	HV	TOT	LV	HV	TOT	LV	HV	TOT	LV	HV	TOT
	07:30-07:45	122	34	156	84	11	95	2	0	2	4	0	4	1	0	1	0	0	0
	07:45-08:00	134	32	166	93	25	118	5	0	5	14	0	14	1	0	1	0	0	0
	08:00-08:15	160	43	203	119	22	141	14	2	16	1	0	1	0	0	0	0	0	0
	08:15-08:30	139	24	163	137	12	149	10	2	12	1	1	2	5	0	5	0	0	0
	08:30-08:45	123	57	180	149	31	180	6	4	10	6	3	9	7	1	8	0	0	0
	08:45-09:00	135	80	215	158	43	201	8	6	14	13	4	17	5	1	6	0	0	0
	09:00-09:15	139	26	165	144	24	168	4	0	4	15	0	15	5	4	9	0	0	0
	09:15-09:30	133	25	158	129	11	140	2	1	3	15	0	15	3	1	4	0	0	0
PM	16:30-16:45	82	11	93	71	15	86	18	1	19	2	0	2	4	0	4	0	0	0
	16:45-17:00	122	10	132	146	28	174	30	0	30	4	0	4	7	0	7	1	0	1
	17:00-17:15	143	22	165	112	18	130	35	0	35	3	2	5	20	0	20	0	0	0
	17:15-17:30	149	16	165	154	12	166	9	1	10	4	5	9	6	0	6	0	0	0
	17:30-17:45	183	33	216	148	8	156	13	0	13	3	1	4	6	0	6	0	0	0
	17:45-18:00	179	20	199	169	21	190	4	3	7	2	0	2	4	1	5	0	0	0
	18:00-18:15	192	16	208	177	28	205	3	1	4	6	1	7	4	0	4	0	0	0
	18:15-18:30	157	24	181	139	20	159	5	0	5	2	0	2	2	0	2	0	0	0

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Appendix B

Network Flow Diagrams

Proposed Development

Figure 1: Peak Hour Traffic Generation in the Opening Year (2008) [60,000 tonnes per annum]

Figure 2: Peak Hour Traffic Generation in the Opening Year+5 (2013) and Opening Year+10 (2023) [90,000 tonnes per annum]

Existing Traffic

Figure 3: Existing Surveyed Flows (2007) During the Peak Hour for the Road Network (1700-1800hrs)

Opening Year 2008

Figure 4: Peak Hour - Do Nothing

Figure 5: Peak Hour - Do Something [60,000 tonnes per annum]

Opening Year +5 2013 Scenario 1

Figure 6: Peak Hour - Do Nothing

Figure 7: Peak Hour - Do Something [90,000 tonnes per annum]

Opening Year +5 2013 Scenario 2

Figure 8: Peak Hour - Do Nothing

Figure 9: Peak Hour - Do Something [90,000 tonnes per annum]

Opening Year +15 2023 Scenario 1

Figure 10: Peak Hour - Do Nothing

Figure 11: Peak Hour - Do Something [90,000 tonnes per annum]

Opening Year +15 2023 Scenario 2

Figure 12: Peak Hour - Do Nothing

Figure 13: Peak Hour - Do Something [90,000 tonnes per annum]

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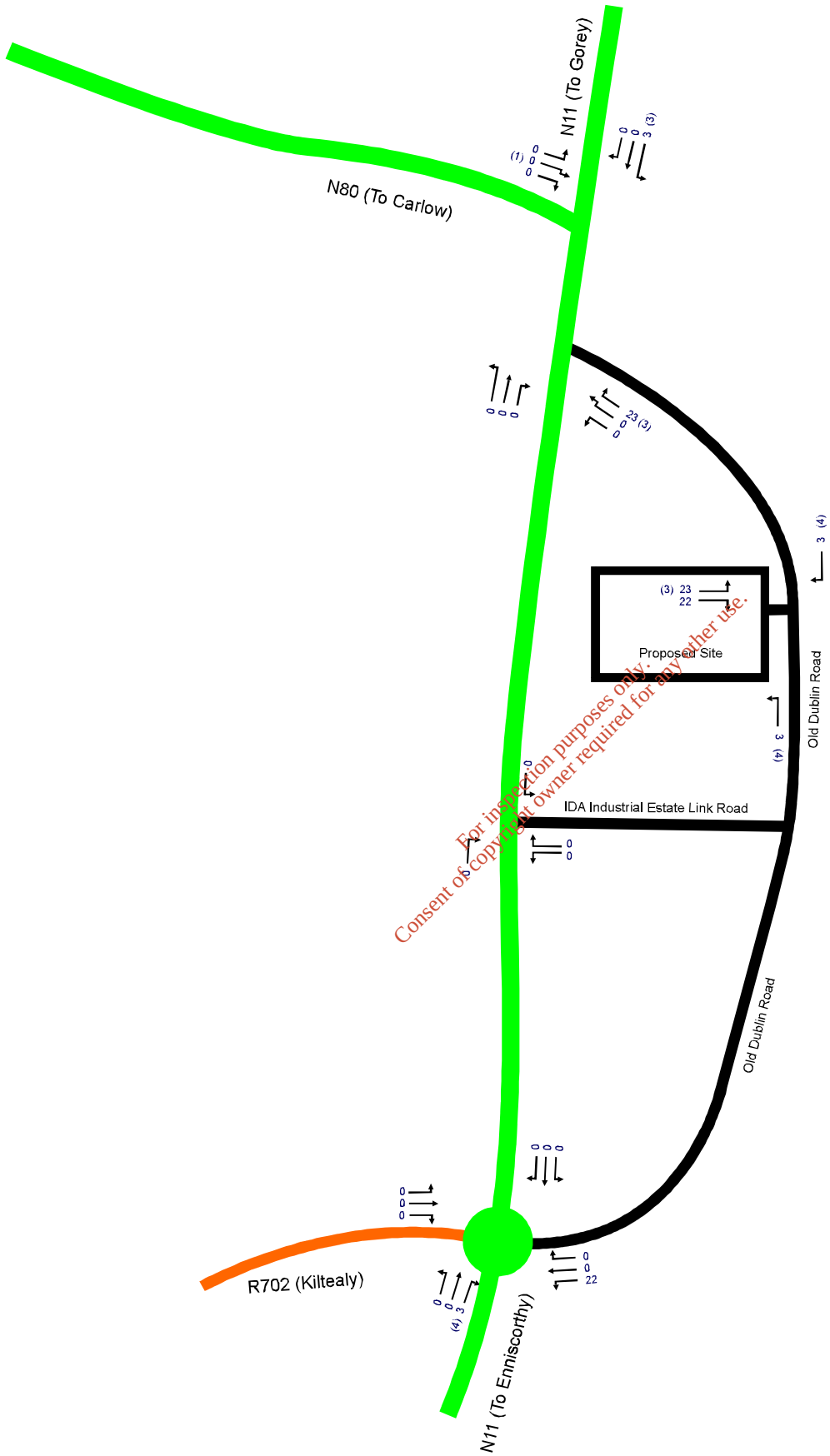

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Light (HGV)

Traffic wise traffic & transportation solutions Bracetown Business Park, Clonee, Dublin. Telephone: +353 (0)1 8014009 Fax: +353 (0)1 8014035 Website: www.trafficwise.ie E-mail: info@trafficwise.ie	Project/Job Title **Greenstar MRF in Enniscorthy**	Drawn by: David Ashe Date: November 2006	Checkedby: Barry May Date: November 2006
	Drawing Title **Peak Hour Traffic Generation for the Opening Year 2008 [60,000 tonnes per annum]**	Approved by: Julian Keenan Date: November 2006	Scale: N.A JOB No: 02801 Appendix B Figure 1

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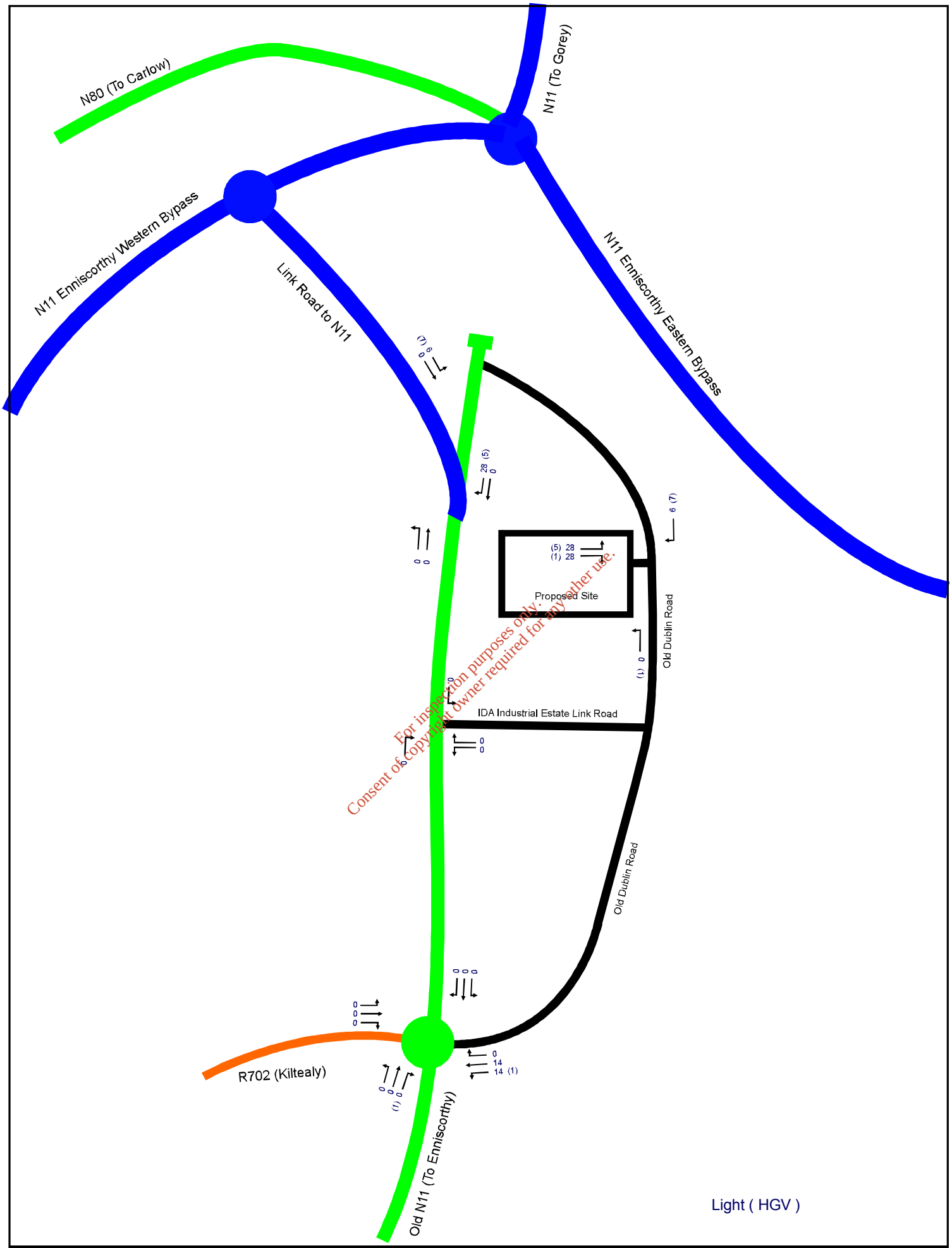

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E-mail: info@trafficwise.ie

Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Peak Hour Traffic Generation for the Opening Years+5 (2013) and +10 (2023) Scenario 1 [90,000 tonnes per annum]**

Drawn by:	Checkedby:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006
Scale: N.A	JOB No: 02801	Figure 2
	Appendix B	

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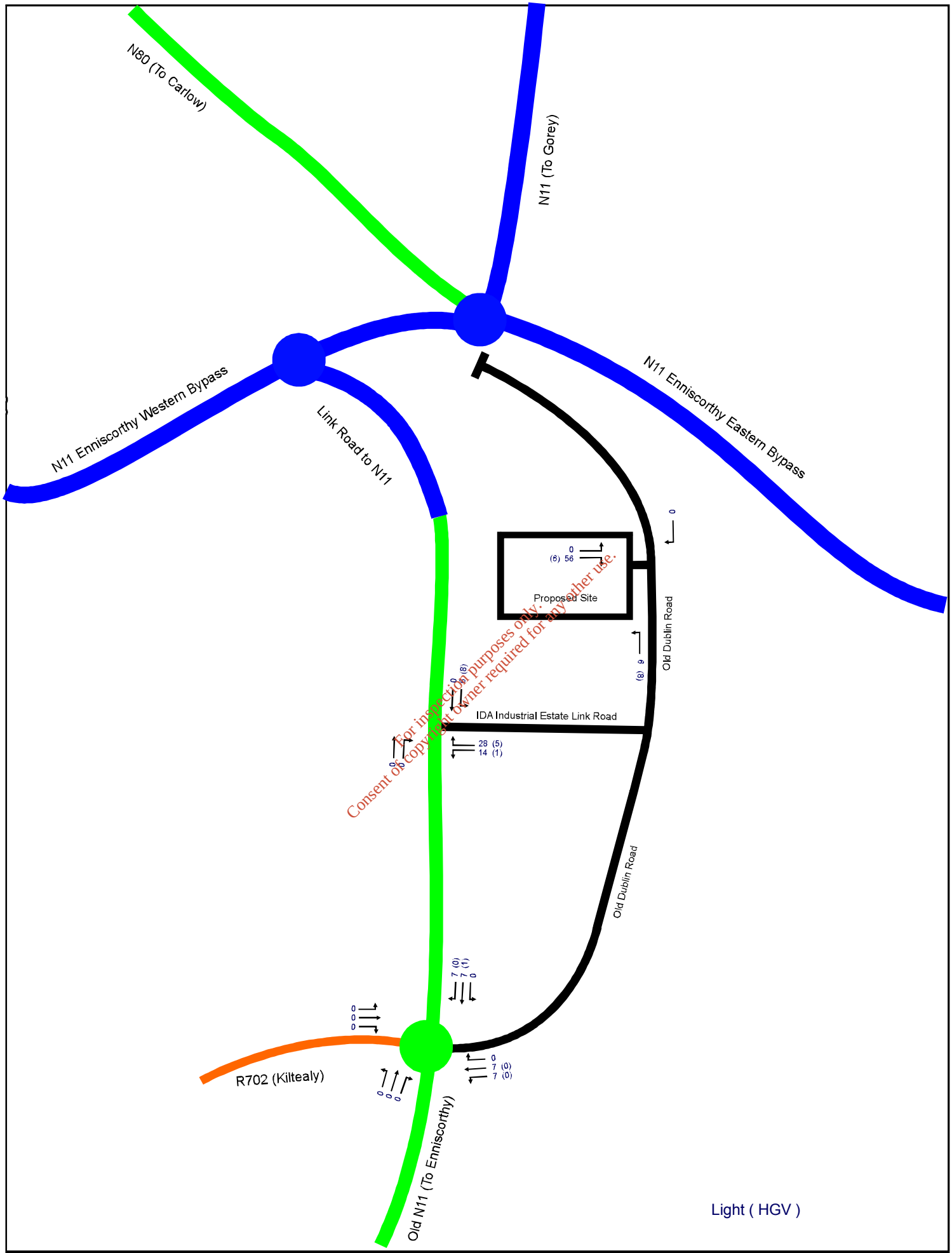

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Peak Hour Traffic Generation for the Opening Years+5 (2013) and +10 (2023) Scenario 2 [90,000 tonnes per annum]**

Drawn by:	Checked by:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006
Scale: N.A	JOB No: 02801	Figure 3
	Appendix B	

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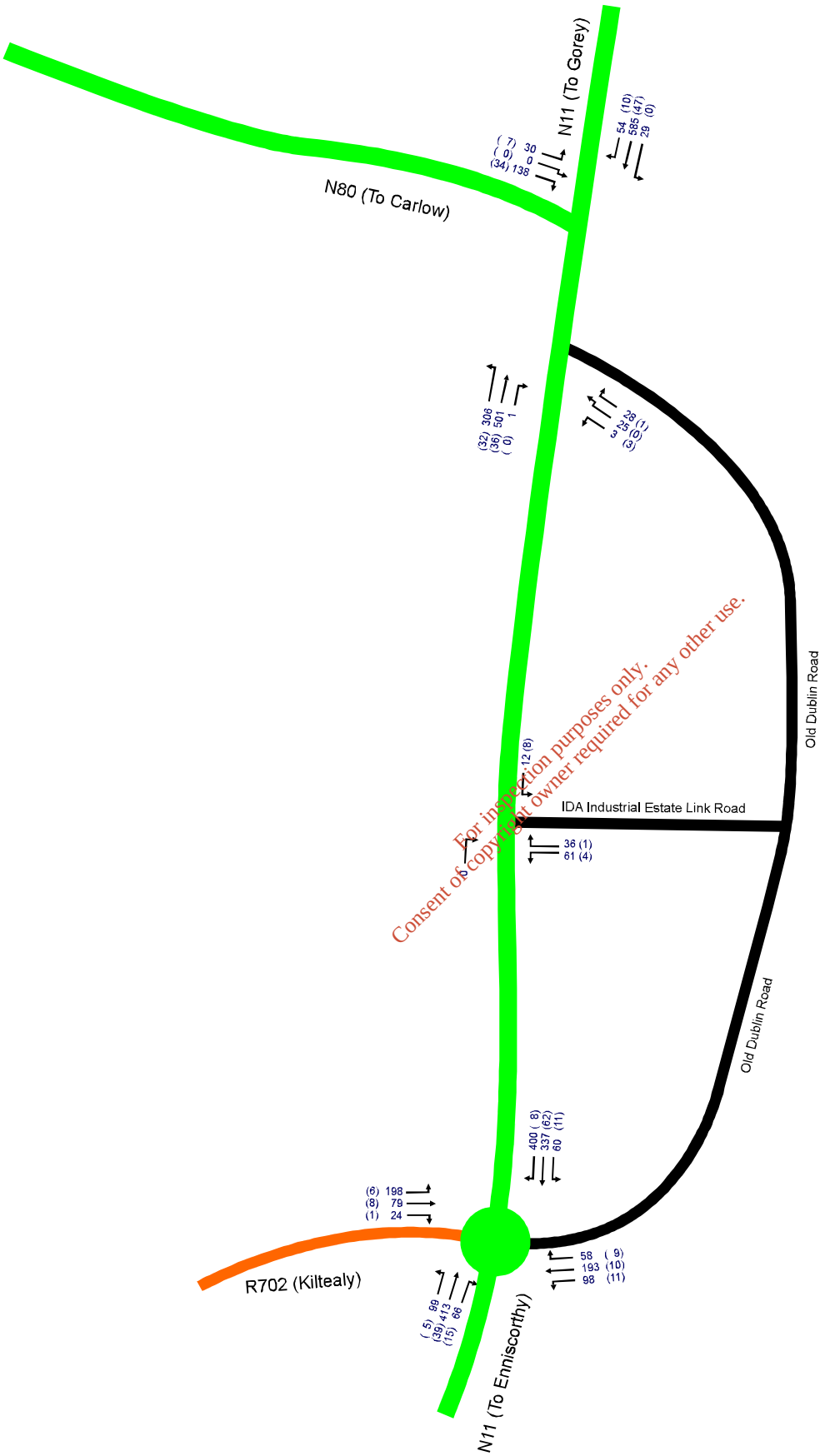

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	Drawing Title **Existing Surveyed Flows (2007) during Peak Hour for Road Network (1700-1800hrs)**	Date: November 2006	Date: November 2006	Date: November 2006
		Scale: N.A	JOB No: 02801	Figure 4
			Appendix B	

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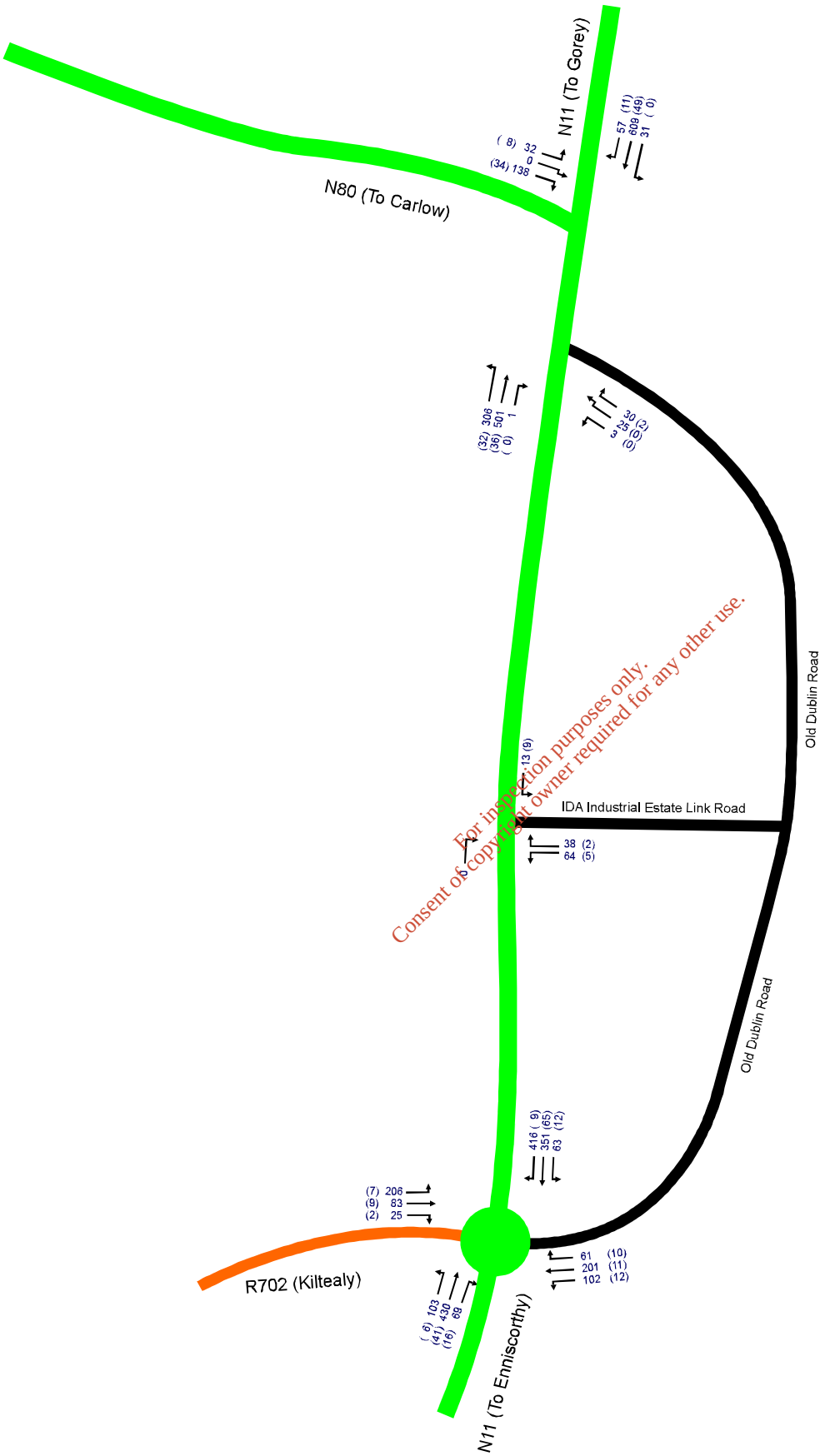

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year (2008)**
Peak Hour - Do Nothing

Drawn by:	Checked by:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006
Scale: N.A	JOB No: 02801	Figure 5
	Appendix B	

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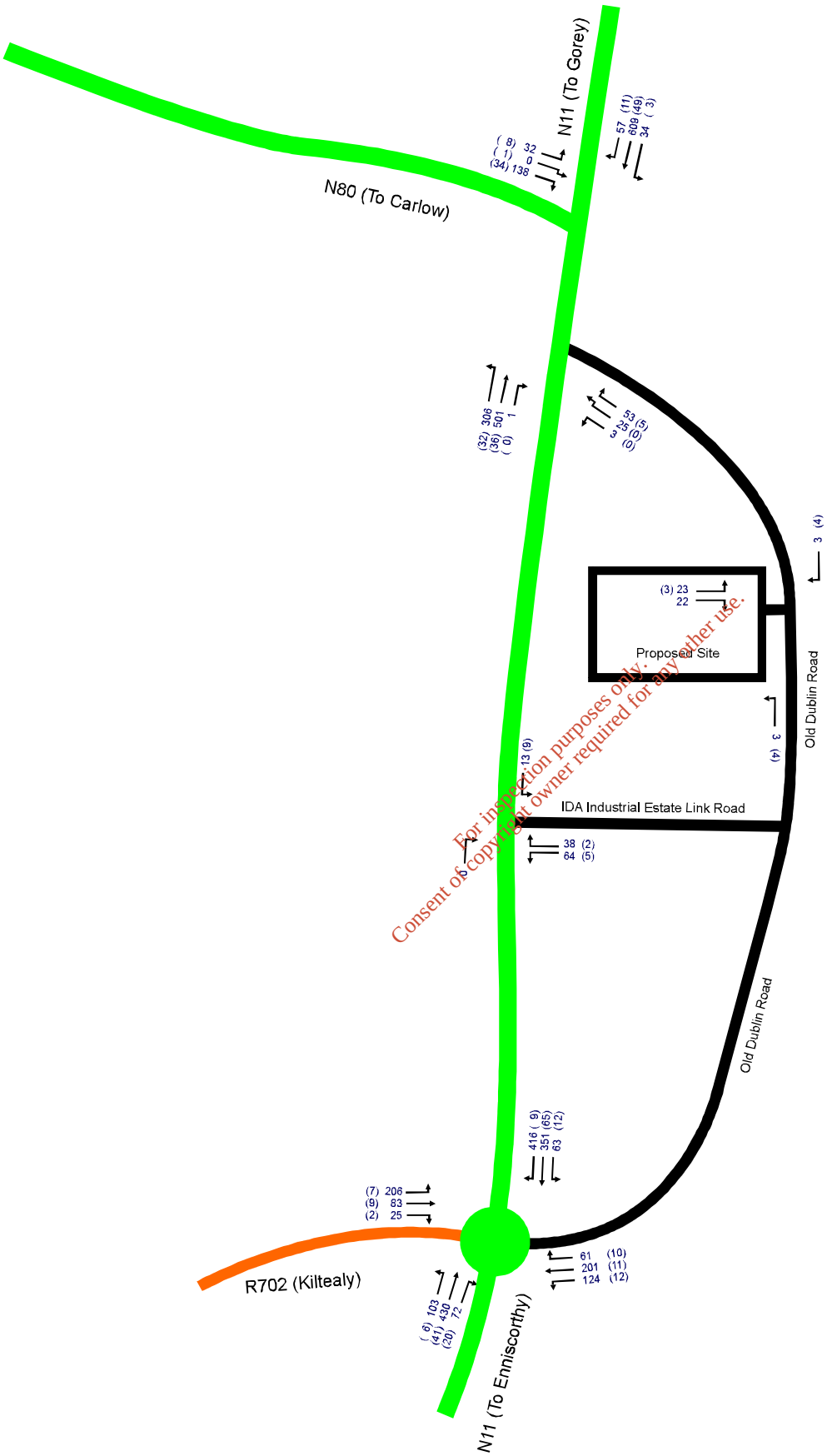

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Traffic wise traffic & transportation solutions	Project/Job Title: **Greenstar MRF in Enniscorthy**	Drawn by: David Ashe	Checked by: Barry May	Approved by: Julian Keenan
Bracetown Business Park, Clonee, Dublin. Telephone: +353 (0)1 8014009 Fax: +353 (0)1 8014035 Website: www.trafficwise.ie E-mail: info@trafficwise.ie	Drawing Title: **Opening Year (2008) Peak Hour - Do Something [60,000 tonnes per annum]**	Date: November 2006	Date: November 2006	Date: November 2006
		Scale: N.A	JOB No: 02801	Figure 6
			Appendix B	

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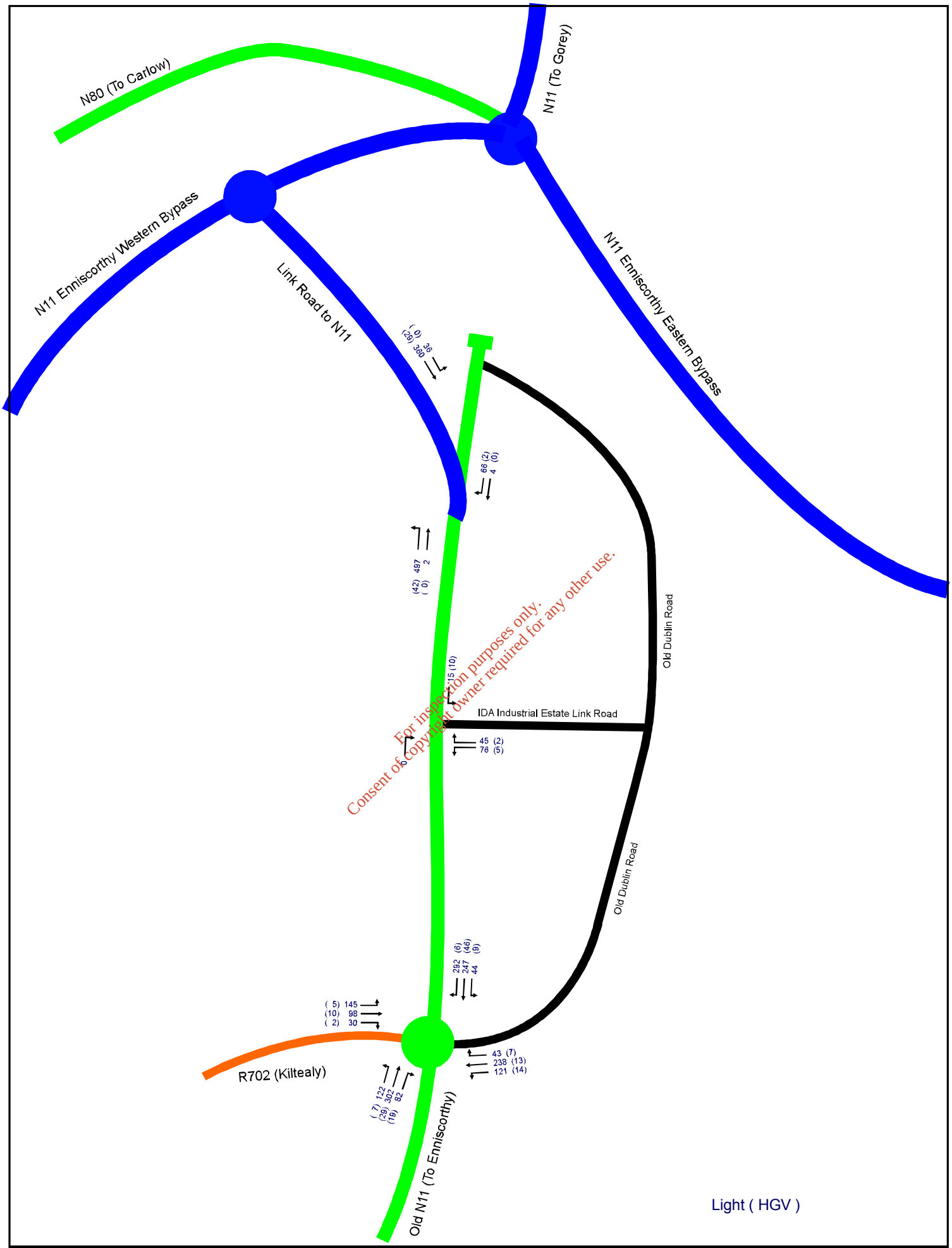

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year+5 (2013) Scenario 1 Peak Hour - Do Nothing**

Drawn by:	Checkedby:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006

Scale: N.A | JOB No: 02801 | Figure 7

Appendix B

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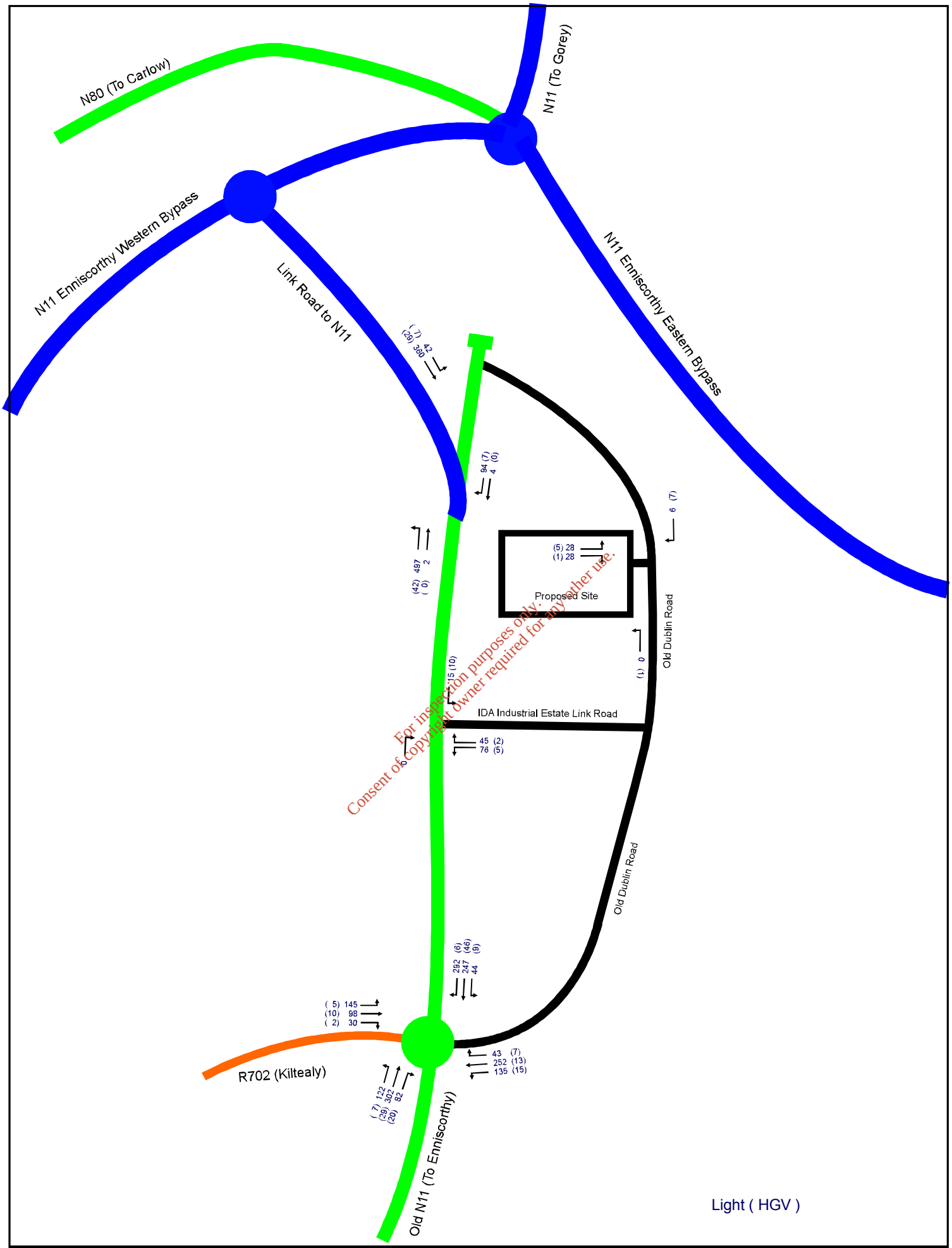

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year+5 (2013) Scenario 1 Peak Hour - Do Something [90,000 tonnes per annum]**

Drawn by:	Checkedby:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006
Scale: N.A	JOB No: 02801	Figure 8
	Appendix B	

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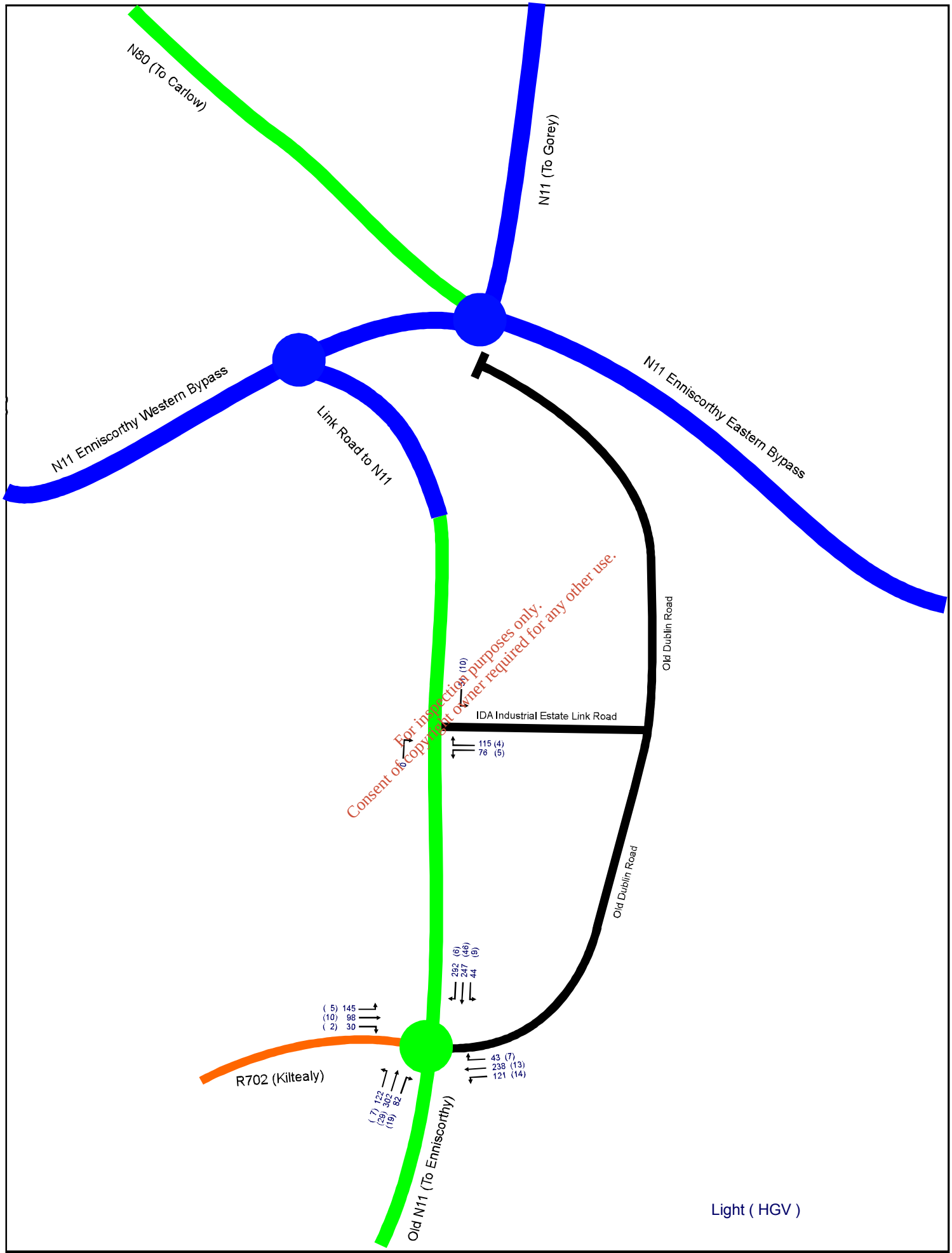

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year+5 (2013) Scenario 2 Peak Hour - Do Nothing**

Drawn by:	Checked by:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006

Scale: N.A | JOB No: 02801 | Figure 9

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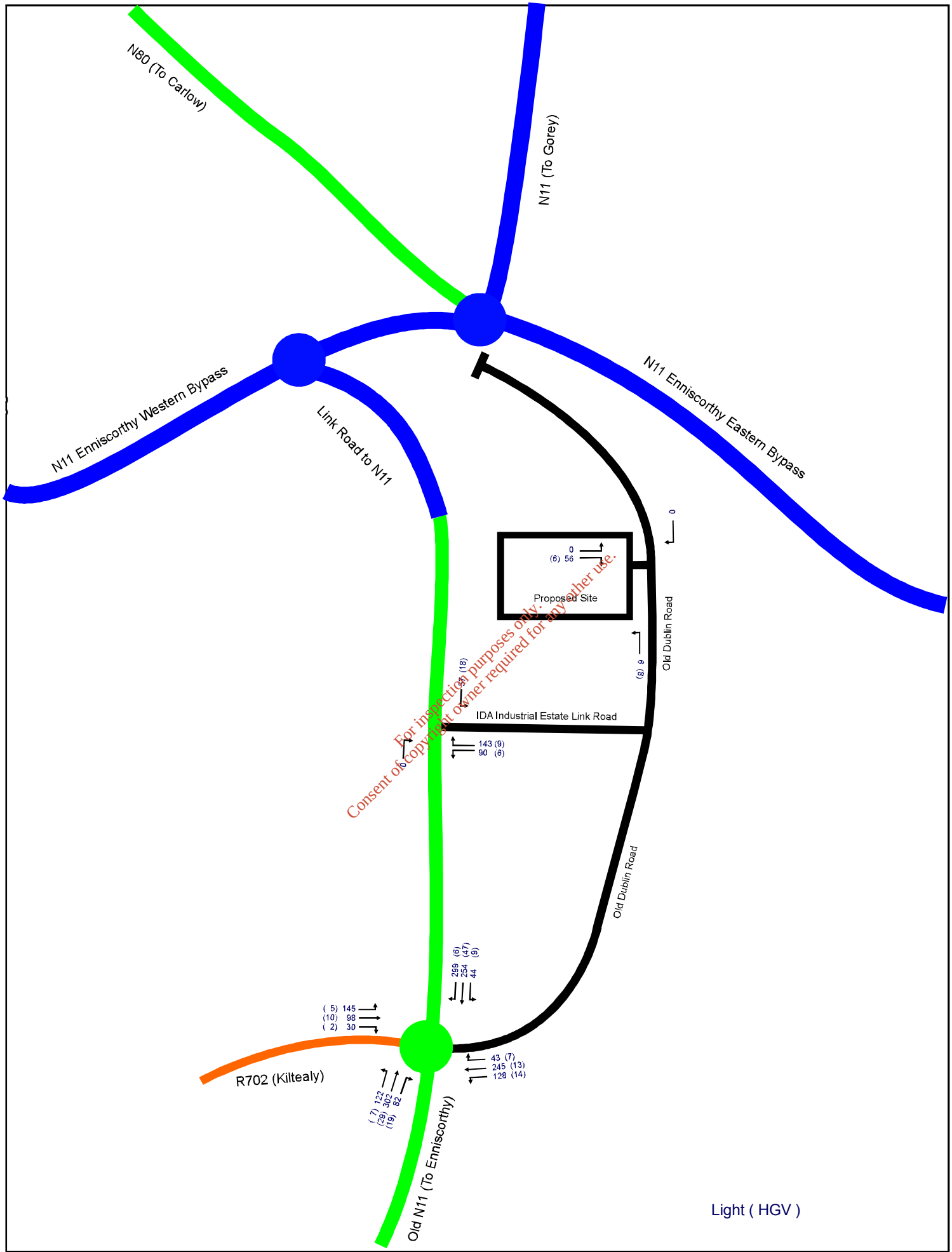

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	Drawing Title **Opening Year+5 (2013) Scenario 2 Peak Hour - Do Something [90,000 tonnes per annum]**	Date: November 2006	Date: November 2006	Date: November 2006
		Scale: N.A	JOB No: 02801	Figure 10
			Appendix B	

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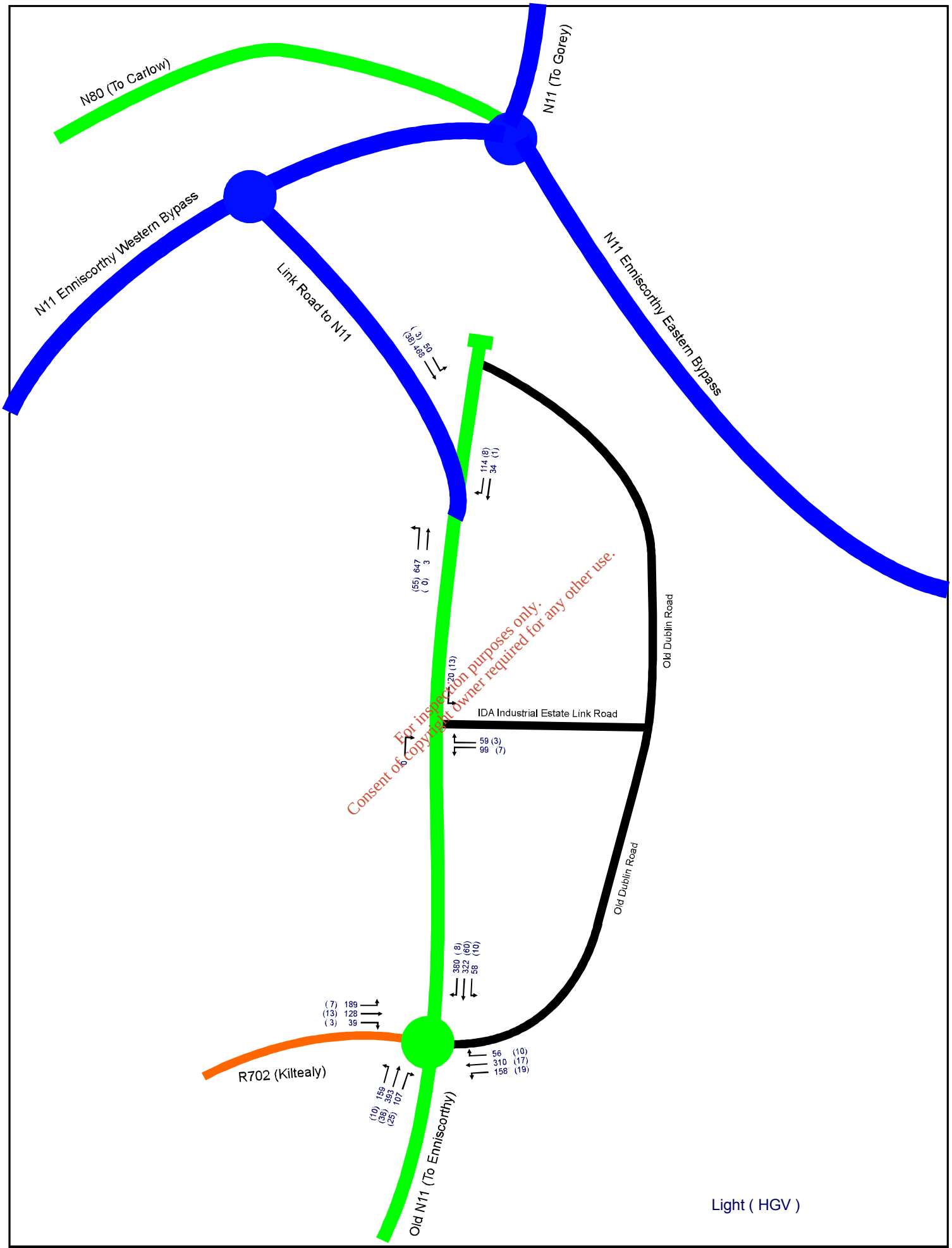

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year+15 (2023) Scenario 1 Peak Hour - Do Nothing**

Drawn by:	Checkedby:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006
Scale: N.A	JOB No: 02801	Figure 11
	Appendix B	

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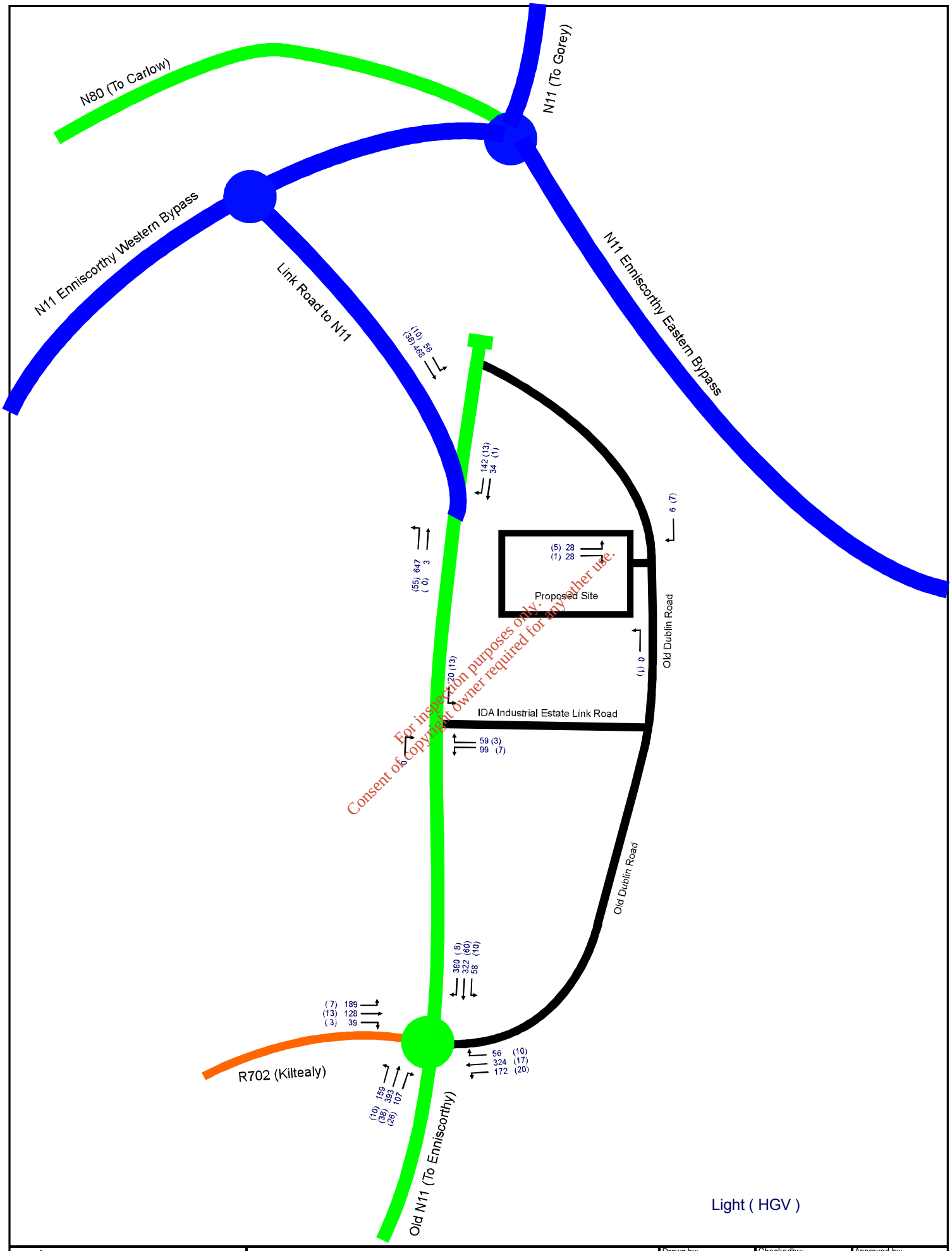

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year+15 (2023) Scenario 1 Peak Hour - Do Something (90,000 tonnes per annum)**

Drawn by:	Checked by:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006

Scale: N.A | JOB No: 02801 | Figure 12

Appendix B

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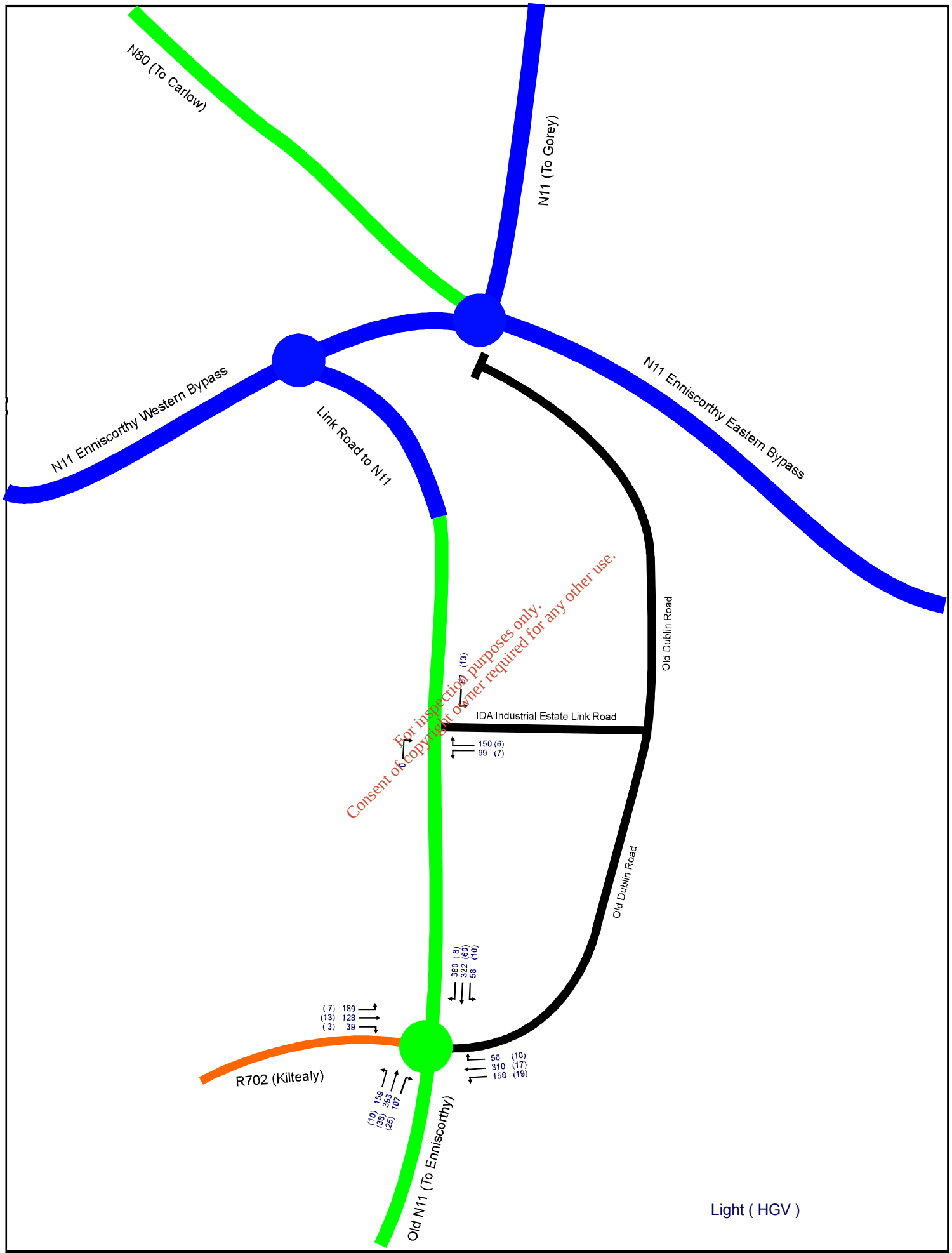

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	Drawing Title **Opening Year+15 (2023) Scenario 2 Peak Hour - Do Nothing**	Date: November 2006	Date: November 2006	Date: November 2006
		Scale: N.A	JOB No: 02801	Figure 13
			Appendix B	

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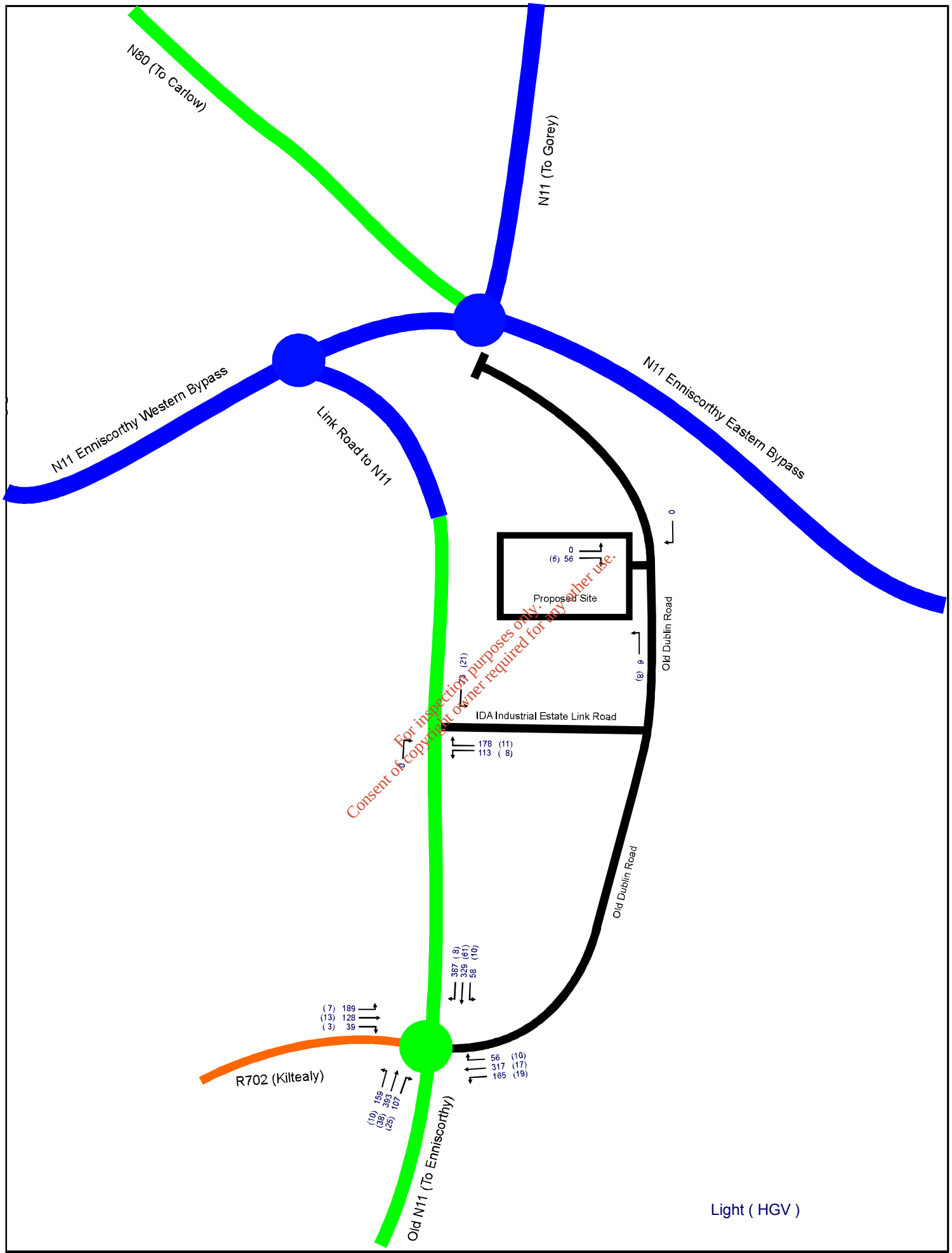

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Project/Job Title **Greenstar MRF in Enniscorthy**

Drawing Title **Opening Year+15 (2023) Scenario 2 Peak Hour - Do Something**

Drawn by:	Checked by:	Approved by:
David Ashe	Barry May	Julian Keenan
Date: November 2006	Date: November 2006	Date: November 2006

Scale: N.A | JOB No: 02801 | Figure 14

Appendix B

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Appendix C

Trafficwise Ltd. Drawing No. 02801/01/01/PL01

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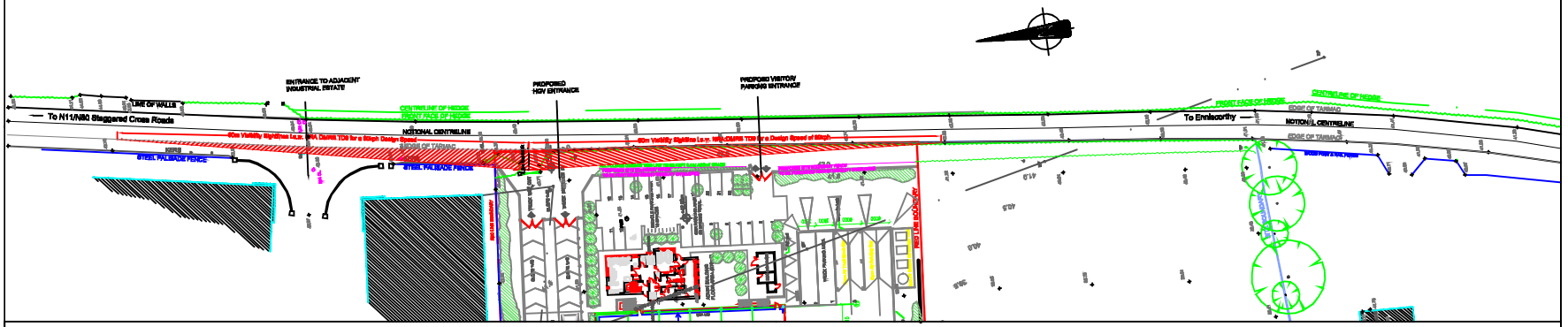
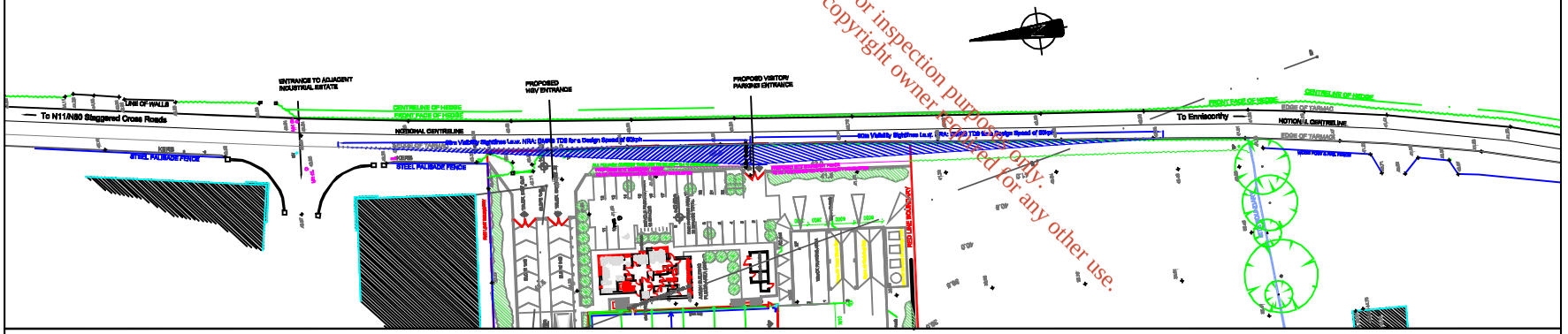
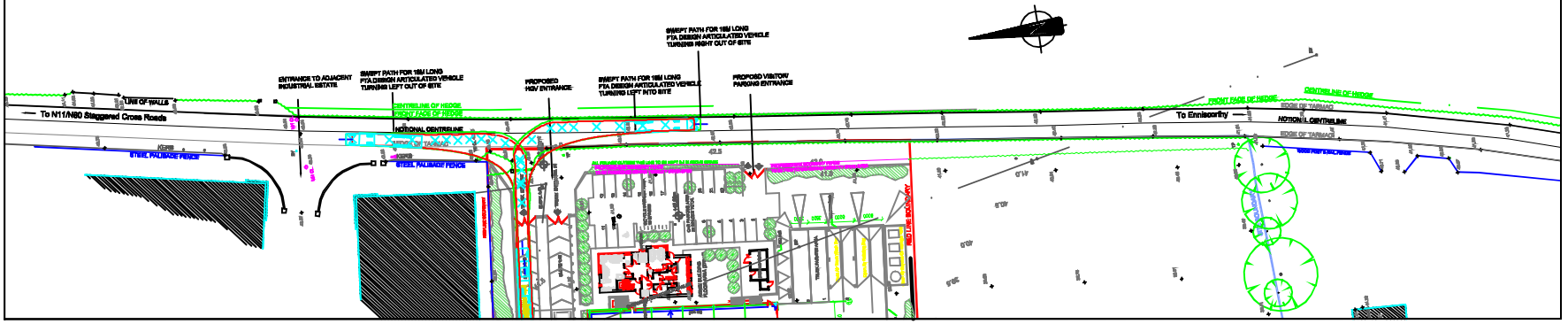
Visibility Sightlines from Proposed HGV Access



Visibility Sightlines from Proposed Private Vehicular Access



Auto Track Assessment of Proposed Accesses



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NOTES

Rev	Amendment	Drawn	Checked	Approved	Date

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Website www.trafficwise.ie

Greenstar Holdings Ltd.

Materials Recovery Facility
at Enniscorthy

Visibility Sightline Assessments
at Proposed Site Accesses
on the Old Dublin Road, Enniscorthy

1 of 1

DRAWN	CHECKED	APPROVED
BMay	BMay	JKeenan
DATE	DATE	DATE
October 2007	October 2007	October 2007

SCALE	JOB No.	REV
1:500	02801	*

DWG No. 027801/01/01/PL01

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APPENDIX 4

Surface Water Design Calculations

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GREENSTAR WASTE FACILITY, ENNISCORTHY, Co. WEXFORD **D 1080**

SHEET 1 of 1 **NETWORK 1**

Summary of Storm Design Output

Self cleansing velocity	=	0.80	m/s
Pipe roughness (k)	=	0.6	mm
Rainfall intensity (i)	=	50	mm/hr
Routing coefficent (C_r)	=	1.3	
Volumetric run-off coefficient ((	=	0.75	

1) Rainfall is 5 year return +20% for climate change
2) Velocities determined using the Colebrook-White Equation.
3) Surface run-off is determined by the modified rational method

BLUE - Input Cells
RED - Output Cells

Sewer Reference	Area	Discharge	Dia	Radius	Gradient		Q_{full}	V_{full}	Capacity	Colebrook-White Equation		
										Prop.	Depth	Velocity
	ha	l/s	mm	mm	1 in	Slope	m^3/s	m/s	l/s	Depth	mm	m/s
S1-S2	0.0860	11.66	225	113	200.0	0.005	0.037	0.92	37	38%	86	0.83
S2-S3	0.0860	11.66	225	113	30.0	0.033	0.095	2.40	95	23%	52	1.63
S3-S4	0.4120	55.84	225	113	36.0	0.028	0.087	2.19	87	58%	131	2.33
S4-S5	0.5880	79.69	300	150	95.0	0.011	0.114	1.61	114	61%	183	1.75
S10-S5	0.3820	51.77	300	150	300.0	0.003	0.064	0.90	64	67%	201	1.01
S5-S6	0.9700	131.46	450	225	300.0	0.003	0.186	1.17	186	61%	275	1.27
S6-S7	0.9700	131.46	450	225	300.0	0.003	0.186	1.17	186	61%	275	1.27
S7-S8	0.9700	131.46	450	225	300.0	0.003	0.186	1.17	186	61%	275	1.27
S8-S9	0.9700	131.46	450	225	300.0	0.003	0.186	1.17	186	61%	275	1.27

Area	Total Area (m^2)	Cumulative Area (m^2)
S1-S2	***860***	860.0
S2-S3	***0***	860.0
S3-S4	***3260***	4120.0
S4-S5	***1760***	5880.0
S10-S5	***3820***	3820.0
S5-S6	***0***	9700.0
S6-S7	***0***	9700.0
S7-S8	***0***	9700.0
S8-S9	***0***	9700.0

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GREENSTAR WASTE FACILITY, ENNISCORTHY, Co. WEXFORD D1080

SHEET 1 of 1

Summary of Foul Design Output

Pipe roughness (k)	=	0.60 mm

1) Foul drainage designed in accordance with BS 8301. **BLUE - Input Cells**
2) Velocities determined using the Colebrook-White Equatic **RED - Output Cells**
3) Fluid is water at 15° C (kinematic viscosity is 1.141 x 10^{-6})

Sewer Reference	D.U.	Flow	Dia	Radius	Gradient		Q_{full}	V_{full}	Capacity	Colebrook-White Equation		
	Cumul	l/s	mm	mm	1 in	Slope	m^3/s	m/s	l/s	Prop. Depth	Depth mm	Velocity m/s
		Fig. 2										
F1-F2	40	3.4	225	113	100.0	0.010	0.052	1.31	52	17%	38	0.75
F2-F3	40	3.4	225	113	50.0	0.020	0.074	1.85	74	14%	32	0.94
F3-F4	40	3.4	225	113	50.0	0.020	0.074	1.85	74	14%	32	0.94
F4-F5	40	3.4	225	113	20.0	0.050	0.117	2.94	117	11%	25	1.28
F4-F5	40	3.4	225	113	20.0	0.050	0.117	2.94	117	11%	25	1.28
F5-F6	40	3.4	225	113	100.0	0.010	0.052	1.31	52	17%	38	0.75
F6-PUMP	40	3.4	225	113	100.0	0.010	0.052	1.31	52	17%	38	0.75

Discharge Units Ratings	*Bath* → 7 D.U.	*WC* → 7 D.U.
	Washbasin → 1 D.U.	*Sink* → 6 D.U.

SEWER REFERENCE	UNIT Ref/ No	No of APPLIANCES				APPLIANCES D.U.				No of D.U. / Unit	No of D.U. / Pipe
		Bath	Washbasin	WC	Sink	Bath	Washbasin	WC	Sink		
F1-F2			7	3	2	0	7	21	12	40	**40**
F2-F3						0	0	0	0	40	**40**
F3-F4						0	0	0	0	40	**40**
F4-F5						0	0	0	0	40	**40**
F4-F5						0	0	0	0	40	**40**
F5-F6						0	0	0	0	40	**40**
F6-PUMP						0	0	0	0	40	**40**

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GREENSTAR WASTE FACILITY
ENNISCORTHY, Co. WEXFORD

Date Prepared: OCT '07

Sizing of Retention	**D1080**
Impermeable Area m²	**9700**
Total Area m²	**13776**
Allowable l/sec	**5.68**
Return Period	**1:100 Year**

Duration minutes	Rainfall mm	Runoff m³	Allowable m³	Retention Req. m³
5	11.00	106.70	1.703098686	105.00
10	17.00	164.90	3.406197373	161.49
15	21.00	203.70	5.109296059	198.59
30	27.00	261.90	10.21859212	251.68
60	35.50	344.35	20.43718424	323.91
120	44.00	426.80	40.87436847	385.93
240	54.00	523.80	81.74873694	442.05
360	65.00	630.50	122.6231054	507.88
720	80.50	780.85	245.2462108	535.60
1440	98.50	955.45	490.4924216	464.96
2880	115.00	1115.50	980.9848433	134.52

Max. Retention Required (m³)	**535.60**

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APPENDIX 5

Ecological Survey

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Ecological Assessment for a Proposed Materials Recovery and Transfer Facility in Enniscorthy Co. Wexford

13th September 2007

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1. INTRODUCTION

The proposed development is a material recovery and transfer building for Greenstar Ltd. The proposed development site is not located in any designated area. The nearest designated site is the Slaney valley which is located approximately 2km to the east. The habitats of the site are dominated by improved agricultural grassland and hedgerows are rated as being of low to moderate importance in a local context.

The proposed development works will impact directly on the improved agricultural grassland and one section of hedgerow along the north eastern boundary. These habitats will be covered by buildings and artificial surfaces. This impact is assessed as being of minor to moderate negative significance.

Preparation of this section included consultation, through publicly-available information, with:

- National Parks and Wildlife Service (NPWS);
- Botanical Society of the British Isles (BSBI);
- Environmental Protection Agency (EPA);

This study was undertaken by Ecofact Environmental Consultants Ltd. on behalf of O'Callaghan Moran & Associates.

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2. METHODOLOGY

2.1 Desktop Review

A desktop review was carried out to identify features of ecological importance within the study area and surrounding region. A review of areas designated (or being considered) for designation for nature conservation was carried out by consulting the National Parks & Wildlife Service (NPWS). These included Special Areas of Conservation, Special Protection Areas for birds (both internationally important) and proposed Natural Heritage Areas (of national importance). Furthermore, a review of the published literature was undertaken in order to collate data on species and habitats of conservation concern on and in the immediate environs of the proposed development site.

The digital database of the New Atlas of the British and Irish Flora (Preston et *al*, 2002) was consulted to assess the presence of rare plant species recorded from the 10 km square S94 in which the site is located. Likewise, “Exploring Irish Mammals” (Hayden and Harrington, 2000) was used to assess the importance of the study area for mammals.

The collation of this information, as well as examination of Ordinance Survey Maps 68 and 69 and OS aerial photographs allowed areas of potential ecological importance to be highlighted prior to the field survey.

2.2 Field Survey Work

A Phase 1 habitat survey of the site was conducted during August 2007 using methodology developed by the Joint Nature Conservation Committee (1993). Habitats were classified using habitat descriptions and codes published in the Heritage Council’s ‘A Guide to Habitat Types in Ireland’ (Fossitt, 2000). Plant species nomenclature follows Stace’s ‘New Flora of the British Isles’ (1997). The potential development site was also assessed for bird and mammals activity during the walkover survey in August 2007.

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2.3 Evaluation

The impact significance is a combined function of the value of the affected feature (its ecological importance), the type of impact and the magnitude of the impact. It is necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts.

The results of the ecological survey were evaluated to determine the significance of identified features located in the study area on an importance scale ranging from international-national-county-local. The local scale is approximately equivalent to one 10 km square but can be operationally defined to reflect the character of the area of interest. Because most sites will fall within the local scale, this is sub-divided into high local importance to local importance-local value. The criteria used are shown in Table 1.

Table 1 Criteria used in assessing the ecological importance of ecological features.

Importance	Criteria
International	An internationally designated site or candidate site (SPA, pSPA, SAC, pSAC, Ramsar Site, Biogenetic Reserve). Also Sites which qualify for designation as SACs or SPAs – this includes sites on the NGO shadow list of SAC's.
National	A nationally designated site or candidate site (NHA, pNHA) (unfortunately there is no published criteria used in selecting these areas). Sites which hold Red Data Book (Curtis and McGough, 1988) plant species.
County	Sites which hold nationally scarce plant species (recorded from less than 65 10 km squares), unless they are locally abundant. Sites which hold semi-natural habitats likely to be of rare occurrence within the county. Sites which hold the best examples of a semi-natural habitat type within the county.
High Local Importance	Sites which hold semi-natural habitats and/or species likely to be of rare occurrence within the local area. Sites which hold the best examples of a high quality semi-natural habitat type within the local area.
Local Importance	Sites which hold high quality semi-natural habitats
Local Value	Any semi-natural habitat

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3. RECEIVING ENVIRONMENT

3.1 Designated Areas

The designated area situated nearest the development site is the Slaney River valley SAC, which is located 1km to the east. The Slaney river valley is designated due to the occurrence of many differing Annex I habitats as listed on the EU habitats directive such as alluvial wet woodlands, floating river vegetation, estuaries, tidal mudflats and old oak woodlands. Furthermore the Slaney river valley SAC contains a number of Annex II species also listed on the EU habitats directive (See Tables 2 and 3).

Table 2 Summary details of the Slaney River valley cSAC / NHA

Name	Site Code	Designation	Distance from site	Notes
Slaney River	000781	SAC/ NHA	1km east	Priority Annex 1 habitat on the E.U. habitats directive include Alluvial wet woodlands, other Annex 1 habitats include floating river vegetation, estuaries, tidal mudflats and old oak woodlands Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Twaite Shad, Atlantic Salmon and otter.

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Table 3 Qualifying Interests of the Slaney River valley cSAC.

Site Code	Site Name	EU Habitat Code	Habitat Description
000781	Slaney River valley	91E0	Alluvial wet woodlands
		3260	Floating river vegetation
		1130	Estuaries
		1140	Mudflats and sandflats
		91AO	Old oak woodlands

Evaluation: The proposed development is not located within any area designated for nature conservation. The closest site is the Slaney River Valley SAC which is located 1km to the east. Sites designated as SAC's and SPA's are recognised as being of international importance. The Slaney River valley SAC is of international importance due to the abundance of important marine and freshwater invertebrate species in addition to the presence of a number of internationally important terrestrial and marine habitats.

3.1.1 Characteristics of the proposal

The characteristics of this proposal include the development of a materials recovery and transfer facility 2 km north of the town of Enniscorthy on the 'old' Wexford to Dublin road, now a third class road. The development will comprise the construction of a 9,000m^2 Materials Recovery and Transfer Building, weighbridge, 300m^2 offices, 20,000m^2 of concrete hardstand, a site security fence, landscaped areas and ancillary facilities. The development will involve stripping approximately 350 mm of the topsoils and subsoils, grading the subsoil to formation level, placement of approximately 300 mm of hardcore and the installation of a reinforced concrete slab across most of the site. The proposed development site has been historically used for

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agricultural purposes, principally as pastureland. It is proposed to develop approximately 4.0 acres of the 6.8 acre site

3.1.2 Potential Impacts

The proposed development area is located approximately 1km west of the Slaney River valley NHA/ SAC. All of the development works will occur outside of the designated area. Therefore there is no potential for direct impacts on this designated area. There is the potential for indirect impacts such as water pollution in the absence of mitigation.

3.2.4 Remedial or reductive measures

As the development is located approximately 1km away from the River Slaney SAC, there will no direct impacts on this designated area. A suitable water quality management plan will be required for both construction and operation phases of the proposed development to ensure that there are no indirect impacts on local surface and groundwater's that could eventually drain into the SAC.

3.2.5 Predicted impact of the proposal

No negative impacts are anticipated for the surrounding designated areas providing suitable site management procedures to control pollution are employed.

3.2.6 Monitoring

As the nearest designated area is located approximately 1 km away from the proposed development area no monitoring of the River Slaney Valley SAC will be required.

3.2.7 Reinstatement

No reinstatement will be required for the designated area.

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3.2 Flora

3.2.1 Receiving environment

3.2.1.1 Improved Agricultural Grassland (GA 1)

The majority of the 6.8 acre development site is categorised as improved agricultural grassland. This habitat is dominated by two species principally perennial rye-grass (*Lolium perenne*) and white clover *Trifolium repens*. Other grass species also occur occasionally particularly around the field margins include Yorkshire fog (*Holcus lanatus*) creeping bent (*Agrostis stolonifera*) and ribwort plantain (*Plantago lanceolata*). Broadleaf herbs recorded throughout include spear thistles *Cirsium vulgare* and creeping thistle *Cirsium arvense*. Docks are also common particularly the common sorrel *Rumex acetosa* and the broad leaved dock *Rumex obtusifolius* and dock (*Rumex* spp.). This habitat also contains dandelion (*Taraxacum* spp), nettles *Urtica dioca* and mouse ear chickweed *Cerastium fontanum*.

Evaluation: This habitat type is common in the surrounding countryside; species that occur are all common in the wider countryside. It is an intensively managed habitat and of low value to wildlife. Therefore is it deemed to be of low ecological importance.

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3.2.1.2 Hedgerows (WL1)

Hedgerows are situated along the southern and eastern boundaries of the development site. The southern boundary is dominated by hawthorn *Cratageous monogyna* and blackthorn with four large ash trees *Fraxinus excelsior* also comprising a large part of the habitat. Elder *Sambucus nigra* and grey willow *Salix cinerea* also occur occasionally.

The hedgerow along the eastern boundary is again dominated by hawthorn and blackthorn with ash occurring occasionally. Dog rose *Rosa canina* and bramble are also common on both of these hedgerow habitats. Herbaceous species recorded include primrose *Primula vulgaris*, herb Robert, lords and ladies *Arum maculatum* and hogweed *Heracleum sphondylium*.

Evaluation: This semi natural habitat is intact throughout the southern and eastern boundaries. It has the potential to facilitate birds and small mammals or at least act as a wildlife corridor from one between habitats. This habitat is of local ecological importance

3.2.1.3 Earth Banks (BL2)

The southern boundary of the site comprises an earth bank. The hedgerow habitat described above and the vegetation thereupon has developed upon this earth bank.

Evaluation: Earth banks are a common field boundary feature throughout many parts of the countryside. In addition to supporting hedgerow habitats they can also support many small mammals. As a result this habitat is of local ecological importance.

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3.2.1.4 Scrub (WS1)

An area of scrub is located along the western boundary which runs parallel with the N11. It comprises mainly gorse *Ulex europaeus*, bramble *Rubus fructicosus*, thistles *Cirsium* spp. and nettles while species such as goat willow *Salix caprea*, hawthorn *Cratageous monogyna* and hedge bindweed *Calystegia sepium* occur frequently. These species have colonised a concrete fence that had possibly been put in place with the development of the N11. Two planted juvenile sessile oak trees *Quercus petraea* (possibly planted as a landscaping feature) were also recorded along the western boundary.

Scrub is also present at the northwestern corner of the site with patches of gorse, willows, thistles and soft rush *Juncus effusus*.

Evaluation: This habitat is relatively species poor being dominated by gorse and bramble. It is also located on the margins of a national road which facilitates constant anthropogenic activity. As a result this habitat is not favourable for small mammals or birds and thus is deemed to be of low ecological value. These hedgerows are of local ecological importance.

3.2.1.5 Stone Walls and other stonework (BL1)

This habitat is located along the eastern boundary of the proposed development site. Ivy *Hedera helix* and herb Robert *Geranium robertanium* are present upon the stone wall. Hedgerow species also located along this boundary overhang this habitat while nettles and thistles grow at the base.

Evaluation: Stone walls of local ecological value support a numerous plant, invertebrate and mammal species. It is of local ecological value.

3.2.1.6 Rare plant species

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Common plant species recorded during the field survey are detailed in the habitat descriptions above. During the field survey, the habitats were also assessed as to their potential suitability for rare plants. The proposed development areas lay within the 10km square Ordnance Survey Grid S 94. A plant species list for this 10km square was generated from the CD-Rom version of the *New Atlas of British and Irish Flora* (Preston *et. al.,* 2002). This list was then compared to the lists of species protected under the Flora (Protection) Order of 1999; and those included in the Irish Red Data Book (Curtis and McGough, 1988).

Narrow leaved helleborine *Cephalanthera longifolia* is recorded as being present within the S94 10 km square grid. Narrow leaved helleborine is a rhizomatous perennial herb found in a variety of woodland types on calcareous soils, usually on chalk and hard limestone. It prefers permanent patches of light and is most frequent on steep, rocky slopes with an open tree canopy, but is also found along woodland edges and rides. The proposed development area is does not contain any suitable for this species and it was not recorded during fieldwork.

Opposite-leaved Pondweed *Groenlandia densa*, a perennial herb of shallow, clear, base-rich water which may grow in lakes and rivers was recorded by Preston *et al* (2002) as being present in the 10km square S 941 (recorded 1987-1999). This species is included in the Irish Red Data Book on the basis of its protected status in the Republic of Ireland. Curtis and McGough (1988) describe this as an endangered species. This plant was not recorded during the current survey.

3.2.2 Characteristics of the proposal

Refer to section 3.1.1.

3.2.3 Potential impact of proposed works

The proposed development works will impact directly on the improved agricultural grassland habitat where the 4.0 acres of the site will be covered by buildings and artificial surfaces. This habitat is deemed to be of low/ moderate ecological value and its loss is considered to be of minor negative impact.

An area of hedgerows along the north eastern boundary will be removed to facilitate the construction of an entrance area into the proposed development. The loss of these habitats is of moderate negative significance. The movement of heavy machinery near the hedgerows may cause overall habitat disturbance. This would be of minor ecological significance.

3.2.4 Remedial or reductive measures

The following mitigation measures are proposed to minimise the potential impacts on habitats and flora of the proposed development site and surrounding area.

Construction activities such as the use of heavy machinery will be restricted to within 2.5m metres of the hedgerows. Refuelling of machinery will be undertaken away from the hedgerows. Temporary toilet facilities will be provided and there will be no emissions from this unit. Site management procedures will include provisions for removing rubbish generated by on-site staff.

In order to compensate for the loss of the hedgerows along the north eastern boundary certain native tree and shrub species can be planted within the proposed development site. These will include ash *Fraxinus excelsior*, hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, holly *Ilex aquifolium* and oak *Quercus robur*. Smaller trees suitable for planting in car park areas include rowan *Sorbus aucuparia* and birches *Betula pubescens*.

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3.2.5 Predicted impact of the proposal

Minor negative ecological impacts are predicted following the removal of an area of improved agricultural grassland. An area of hedgerow along the north-eastern boundary will also be removed to facilitate the construction of the development. This will result in a moderate negative positive impact.

3.2.6 Monitoring

Monitoring is required to ensure that the mitigation measures to protect the boundary hedgerows are adhered to. This can be undertaken by site management staff.

3.2.7 Reinstatement

No reinstatement will be required in addition to the landscaping measures.

3.3 Fauna

3.3.1 Receiving environment

3.3.1.1 Birds

A low diversity of bird species are expected to use the site due to the poor supporting habitats. Late August is not the ideal time to undertake a bird survey as birds are moulting at this time. Only a few common species were recorded at the time of the survey. Bird populations on the site are of local value only.

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3.3.1.2 Mammals

There was little evidence of mammal activity within this site. The proposed development site is bordered on the west by the N11 and on the east by a third class road. As a result the potential for mammal habitation is limited due to the isolated nature of the site. Rabbit holes were identified along the earth bank on the southern boundary.

No badger setts were found throughout the boundaries of the site and it is thought that the presence of the two nearby roads would deter these species from inhabiting the site.

The site is not expected to be of any particular importance to bats due to its isolated nature. Although no bat roosts were identified during the current survey, bats may roost in the large ash trees present on the south boundary of the study area (i.e. pipistrelles).

3.3.1.3 Invertebrates

The habitats present at the site are of low conservation importance and support a limited diversity of native plant species. It is therefore considered highly unlikely that the site supports invertebrate communities or species of conservation interest.

3.3.2 Characteristics of the proposal

Refer to section 3.1.1

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3.3.2 Potential impact of proposed works

3.3.2.1 Birds

Bird populations on the site have been rated as being of 'Local Value'. All the species recorded on site will probably also use the site following implementation of the proposed landscaping measures. Impact on birds is therefore assessed as being Imperceptible.

3.3.2.2 Mammals

There are no significant mammal populations on the site so limited potential impacts on this group would occur. The site is used by rabbits but these are not a protected species.

Although no bat roosts were identified during the current survey, common bat species could potentially use the large ash trees present on the south boundary of the study area. It is unlikely that any significant roost is present. These trees will be retained so no impacts are envisaged.

3.3.4 Remedial or reductive measures

Under the Wildlife (Amendment) Act 2000 restrictions are placed on the removal of (on previously uncultivated land), hedges and ditch clearance, with such works prohibited between 1st March and 31st August. The construction schedule will pay due cognisance

3.3.5 Predicted impact of the proposal

Disturbance to mammals during the construction phase is not anticipated due to the absence of mammal species at the northern end of the site.

The removal of trees and hedgerows within the site will have a minor negative impact on mammals and birds through the loss of foraging areas and commuting routes. All the bird species currently using the site will probably also use the site following implementation of the proposed landscaping measures. Impact on birds is therefore assessed as being imperceptible.

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3.3.6 Monitoring

Provided the outlined remedial measures are adhered to it is anticipated that no further monitoring will be necessary.

3.3.7 Reinstatement

It is envisaged that no reinstatement will be required in addition to the landscaping measures.

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Plates

Plate 1 Improved agricultural grassland located within the proposed development site

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Plate 2 An area of hedgerow located on the southern boundary of the 6.8 acre site

Plate 3 An area of scrub dominated by gorse *Ulex europaeus* on the western boundary

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Plate 4 Stone wall located on the eastern boundary of the site

Plate 5 Earth banks located on the southern boundary of the 6.8 acre site

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Appendix 1 Assessment of Impacts and Impact Significance

Criteria for assessing impact type and magnitude are presented in Tables A2.1 and A2.2, respectively.

In assessing the magnitude and significance of impacts it is important to consider the value of the affected feature, this is taken into account in Table A2.2.

Table A2.1. Criteria for assessing impact type

Impact type	Criteria
Positive impact:	A change is likely to improve the ecological feature in terms of its ecological value.
Neutral	No effect.
Negative impact:	The change is likely to adversely affect the ecological value of the feature.

Table A2.2 Criteria for assessing impact magnitude

Impact magnitude	Definition
No change:	No discernible change in the ecology of the affected feature.
Imperceptible Impact:	A change in the ecology of the affected site, the consequences of which are strictly limited to within the development boundaries.
Minor Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary, but these consequences are not considered to significantly affect the distribution or abundance of species or habitats of conservation importance.
Moderate Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary. These consequences are considered to significantly affect the distribution and/or abundance of species or habitats of conservation importance.
Substantial Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary. These consequences are considered to significantly affect species or habitats of high conservation importance and to potentially affect the overall viability of those species or habitats in the wider area.
Major Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary. These consequences are considered to be such that the overall viability of species or habitats of high conservation importance in the wider area[2] is under a very high degree of threat (negative impact) or is likely to increase markedly (positive impact).

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Appendix 2 NPWS Site Synopses.

SITE NAME: SLANEY RIVER VALLEY
SITE CODE: 000781

This site comprises the freshwater stretches of the Slaney as far as the Wicklow Mountains; anumber of tributaries the larger of which include the Bann, Boro, Glasha, Clody, Derry, Derreen, Douglas and Carrigower Rivers; the estuary at Ferrycarrig and Wexford Harbour. The site flows through the counties of Wicklow, Wexford and Carlow. Towns along the site but not in it are Baltinglass, Hacketstown, Tinahely, Tullow, Bunclody, Camolin, Enniscorthy and Wexford. The river is up to 100 m wide in places and is tidal at the southern end from Edermine Bridge below Enniscorthy. In the upper and central regions almost as far as the confluence with the Derry River the geology consists of granite. Above Kilcarry Bridge, the Slaney has cut a gorge into the granite plain. The Derry and Bann Rivers are bounded by a narrow line of uplands which corresponds to schist outcrops. Where these tributaries cut through this belt of hard rocks they have carved deep gorges, more than two miles long at Tinahely and Shillelagh. South of Kildavin the Slaney flows through an area of Ordovician slates and grits.

The site is a candidate SAC selected for alluvial wet woodlands, a priority habitat on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for floating river vegetation, estuaries, tidal mudflats and old oak woodlands, all habitats listed on Annex I of the E.U. Habitats Directive. The site is further selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Twaite Shad, Atlantic Salmon and Otter.

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Floating river vegetation is found along much of the freshwater stretches within the site. Species present here include Pond Water-crowfoot (*Ranunculus peltatus*), Water-crowfoot (*Ranunculus* spp.), Canadian Pondweed (*Elodea canadensis*), Broad-leaved Pondweed (*Potamogeton natans*), Water Milfoil (*Myriophyllum* spp.), Common Club-rush (*Scirpus lacustris*), Water-starwort (*Callitriche* spp.), Hemlock Water-dropwort, Fine-leaved Waterdropwort (*Oenanthe aquatica*), Common Duckweed (*Lemna minor*), Yellow Water-lily (*Nuphar lutea*), Unbranched Bur-reed (*Sparganium emersum*) and the moss *Fontinalis antipyretica*. Two rare aquatic plant species have been recorded in this site: Short-leaved Water-starwort (*Callitriche truncata*), a very rare, small aquatic herb found nowhere else in Ireland; and Opposite-leaved Pondweed (*Groenlandia densa*), a species that is legally protected under the Flora Protection Order, 1999.

Good examples of wet woodland are found associated with Macmine marshes, along banks of the Slaney and its tributaries and within reed swamps. Grey Willow (*Salix cinerea*) scrub and pockets of wet woodland dominated by Alder (*Alnus glutinosa*) have become established in places. Ash (*Fraxinus excelsior*) and Birch (*Betula pubescens*) are common in the latter and the ground flora is typical of wet woodland with Meadowsweet (*Filipendula ulmaria*), Angelica (*Angelica sylvestris*), Yellow Iris, Horsetail (*Equisetum* spp.) and occasional tussocks of Greater Tussock-sedge (*Carex paniculata*). These woodlands have been described as two types: one is quite eutrophic, is dominated by Willow and is subject to a tidal influence. The other is flushed or spring-fed subject to waterlogging but not to flooding and is dominated by Alder and Ash.

Old oak woodlands are best represented at Tomnafinnoge though patches are present throughout the site. At Tomnafinnoge the wood is dominated by mature, widely spaced Sessile Oak (*Quercus petraea*), which were planted around 1700, with some further planting in 1810. There is now a varied age structure with overmature, mature and young trees; the open canopy permits light to reach the forest floor and encourages natural regeneration of Oak. As well as Oak, the wood includes the occasional Beech (*Fagus sylvatica*), Birch (*Betula* sp.), Rowan (*Sorbus aucuparia*) and Scots Pine (*Pinus sylvestris*).

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The shrub layer is well-developed with Hazel (*Corylus avellana*) and Holly (*Ilex aquifolium*) occurring. The ground layer consists of Great Wood-rush (*Luzula sylvatica*) and Bilberry (*Vaccinium myrtillus*), with some Bracken (*Pteridium aquilinum*) and Brambles (*Rubus fruticosus* agg.). Herbaceous species in the ground layer include Primrose (*Primula vulgaris*), Wood-sorrel (*Oxalis acetosella*), Common Cow-wheat (*Melampyrum pratense*) and Bluebell (*Hyacinthoides non-scripta*). Many of the trees carry an epiphytic flora of mosses, Polypody Fern (*Polypodium vulgare*), and lichens such as *Usnea comosa, Evernia prunastri*, *Ramalina* spp. and *Parmelia* spp.

Tomnafinnoge Wood is a remnant of the ancient Shillelagh Oak woods, and it appears that woodland has always been present on the site. In the past, the wood was managed as a Hazel coppice with Oak standards, a common form of woodland management in England but not widely practised in Ireland. The importance of the woodland lies in the size of the trees, their capacity to regenerate, their genetic continuity with ancient woodland and their historic interest. The nearest comparable stands are at Abbeyleix, Co. Laois and Portlaw, Co. Waterford.

Below Enniscorthy there are several areas of woodland with a mixed canopy of Oak, Beech, Sycamore (*Acer pseudoplatanus*), Ash and generally a good diverse ground flora. Near the mouth of the river at Ferrycarrig is a steep south facing slope covered with Oak woodland. Holly and Hazel are the main species in the shrub layer and a species-rich ground flora typical of this type of Oak woodland has abundant ferns - *Dryopteris filix-mas, Polystichum setiferum, Phyllitis scolopendrium* - and mosses - *Thuidium tamariscinum, Mnium hornum, Eurynchium praelongum.*

North of Bunclody, the river valley still has a number of dry woodlands though these have mostly been managed by the estates with the introduction of Beech and occasional conifers. The steeper sides are covered in a thick scrub from which taller trees protrude. At the southern end of the site, the Red Data Book species Yellow Archangel (*Lamiastrum galeobdolon*) occurs. Three more Red Data Book species have also been recorded from the site: Basil Thyme (*Acinos arvensis*), Blue Fleabane (*Erigeron acer*) and Small Cudweed (*Filago minima*). A nationally rare species Summer Snowflake (*Leucojum aestivum*) is also found within the site.

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Mixed woodlands occur at Carrickduff and Coolaphuca in Bunclody. Oak trees, which make up the greater part of the canopy, were originally planted and at the present time are not regenerating actively. In time, if permitted, the woodland will probably go to Beech. A fair number of Yew (*Taxus baccata*) trees have also reached a large size and these, together with Holly give to the site the aspect of a south-western Oak wood.

The site is considered to contain a very good example of the extreme upper reaches of an estuary. Tidal reedbeds with wet woodland are present in places. The fringing reed communities support Sea Club-rush (*Scirpus maritimus*), Grey Club-rush (*S. tabernaemontani*) and abundant Common Reed (*Phragmites australis*). Other species occurring are Bulrush (*Typha latifolia*), Reed Canary-grass (*Phalaris arundinacea*) and Branched Bur-reed (*Sparganium erectum*). The reed-swamp is extensive around Macmine, where the river widens and there are islands with swamp and marsh vegetation.

Further south of Macmine are expanses of intertidal mudflats and sandflats and shingly shore often fringed with a narrow band of salt marsh and brackish vegetation. Narrow shingle beaches up to 10 m wide occur in places along the river banks and are exposed at low tide. Upslope the shingle is sometimes colonised by Saltmarsh Rush (*Juncus gerardi*), Townsend's Cord-grass (*Spartina townsendii*), Common Saltmarsh-grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Hemlock Water-dropwort (*Oenanthe crocata*) and Himalayan Balsam (*Impatiens glandulifera*).

Wexford Harbour is an extensive, shallow estuary which dries out considerably at low tide exposing large expanses of mudflats and sandflats. The harbour is largely sheltered by the Raven Point to the north and Rosslare Point in the south.

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Other habitats present within the site include species-rich marsh in which sedges such as *Carex disticha, Carex riparia* and *Carex vesicaria* are common. Among the other species found in this habitat are Yellow Iris (*Iris pseudacorus*), Water Mint (*Mentha aquatica*), Purple Loosestrife (*Lythrum salicaria*) and Soft Rush (*Juncus effusus*). Extensive marshes occur to the west of Casltebridge associated with the tidal areas of the River Sow.

The site supports populations of several species listed on Annex II of the EU Habitats Directive including the three Lampreys - Sea Lamprey (*Petromyzon marinus*), River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey (*Lampetra planeri*), Otter (*Lutra lutra*), Salmon (*Salmo salar*), small numbers of Freshwater Pearl Mussel (*Margaritifera margaritifera*) and in the tidal stretches, Twaite Shad (*Alosa fallax fallax*). A survey of the Derreen River in 1995 estimated the population of Freshwater Pearl Mussel at about 3,000 individuals. This is a significant population, especially in the context of eastern Ireland. The Slaney is primarily a spring salmon fishery and is regarded as one of the top rivers in Ireland for early spring fishing. The upper Slaney and tributary headwaters are very important for spawning.

The site supports important numbers of birds in winter. Little Egret are found annually along the river. This bird is only now beginning to gain a foothold in Ireland and the south-east appears to be its stronghold. Nationally important numbers of Black-tailed Godwit, Teal, Tufted Duck, Mute Swan, Little Grebe and Black-headed Gull are found along the estuarine stretch of the river. The mean of the maximum counts over four winters (1994/98) along the stretch between Enniscorthy and Ferrycarrig is: Little Egret (6), Golden Plover (6), Wigeon (139), Teal (429), Mallard (265), Tufted Duck (171), Lapwing (603), Shelduck (16), Blacktailed Godwit (93), Curlew (81), Red-breasted Merganser (11), Black-headed Gull (3030), Goldeneye (45), Oystercatcher (19), Redshank (65), Lesser Black-backed Gull (727), Herring Gull (179), Common Gull (67), Grey Heron (39), Mute Swan (259) and Little Grebe (17). Wexford Harbour provides extensive feeding grounds for wading birds and Little Terns, which are listed on Annex I of the E.U. Birds Directive have bred here in the past.

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The Reed Warbler, which is a scarce breeding species in Ireland, is regularly found in Macmine Marshes but it is not known whether or not it breeds in the site. The Dipper also occurs on the river. This is a declining species nationally.

The site supports many of the mammal species occurring in Ireland. Those which are listed in the Irish Red Data Book include Pine Marten, Badger, Irish Hare and Daubenton's Bat. Common Frog (*Rana temporaria*), another Red Data Book species, also occurs within the site.

Agriculture is the main landuse. Arable crops are important. Improved grassland and silage account for much of the remainder. The spreading of slurry and fertiliser poses a threat to the water quality of this salmonid river and to the populations of Annex II animal species within it. Run-off is undoubtedly occurring, as some of the fields slope steeply directly to the river bank. In addition, cattle have access to the site in places. Fishing is a main tourist attraction along stretches of the Slaney and its tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place. There are some gravel pits along the river below Bunclody and many of these are active. There is a large landfill site adjacent to the river close to Hacketstown and at Killurin. Boating, bait-digging and fishing occur in parts of Wexford Harbour.Waste water outflows, runoff from intensive agricultural enterprises, a meat factory at Clohamon and a landfill site adjacent to the river and further industrial development upstream in Enniscorthy and in other towns could all have potential adverse impacts on the water quality unless they are carefully managed. The spread of exotic species is reducing the quality of the woodlands. The site supports populations of several species listed on Annex II of the EU Habitats Directive, and habitats listed on Annex I of this directive, as well as important numbers of wintering wildfowl including some species listed on Annex I of the EU Birds Directive. The presence of wet and broad-leaved woodlands increases the overall habitat diversity and the occurrence of a number of Red Data Book plant and animal species adds further importance to the Slaney River site.

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Appendix 3 Plant species list of different habitats.

Common name	Species name	Improved agricultural grassland	Hedgerows	Scrub	Earth banks	Stone walls
Ash	*Fraxinus excelsior*		✓		✓	
Beech	*Fagus sylvatica*		✓			
Bent	*Agrostis spp*	✓				
Blackthorn	*Prunus spinosa*		✓			
Bramble	*Rubus fruiticosus agg.*		✓	✓		
Chickweed	*Stellaria media*	✓				
Cleavers	*Galium aparine*		✓			
Clovers	*Trifolium spp*	✓				
Cock's-foot	*Dactylis glomerata*	✓				
Common mouse ear	*Cerastium fontanum*	✓				
Common Ragwort	*Senecio jacobaea*		✓	✓		
Creeping Bent	Agrostis stolonifera	✓				
Creeping Buttercup	*Ranunculus repens*	✓				
Creeping cinquefoil	*Potentilla reptans*	✓				
Daisy	*Bellis perennis*	✓				
Dandelion	*Taraxacum officinale*	✓				
Dock	*Rumex* spp.	✓				
Dog Rose	*Rosa canina*		✓			
Elder	*Sambucus nigra*		✓			
Ferns	*Asplenium spp*		✓		✓	✓
Foxglove	*Digitalis purpurea*		✓			
Gorse	*Ulex europaeus*			✓		
Hartstongue	*Asplenium scolopendrium*		✓		✓	
Hawthom	*Cratageous monogyna*		✓		✓	
Hedge bindweed	*Calystegia sepium*		✓			
Herb robert	*Geranium robertanium*					✓
Hogweed	*Heracleum sphondylium*	✓	✓			
Holly	*Ilex aquifolium*		✓			
Honeysuckle	*Lonicera periclymenum*		✓			
Lord's and ladies	*Arum maculatum*		✓			
Mountain ash	*Sorbus aucuparia*		✓			
Meadow foxtail	*Alopecurus pratensis*	✓				
Meadow grasses	*Poa spp*	✓				
Osier	*Salix viminalis*		✓			
Ox eye Daisy	*Leucanthemum vulgare*		✓			
Perennial Rye-grass	*Lolium perenne*	✓				
Primrose	*Primula vulgaris*		✓		✓	
Ribwort	*Plantago lanceolata*	✓				

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Common name	Species name	Improved agricultural grassland	Hedgerows	Scrub	Earth banks	Stone walls
plantain						
Self-heal	*Prunella vulgaris*	✓				
Sessile oak	*Quercus petraea*		✓			
Silverweed	*Potentilla anserina*	✓				
Soft rush	*Juncus effusus*	✓				
Sow thistles	*Sonchus spp.*	✓		✓		
Sycamore	*Acer pseudoplatanus*		✓			
Sweet vernal grass	*Anthoxanthum odoratum*	✓				
Thistles	*Cirsium spp*	✓				
Willows	*Salix spp*		✓			
Yorkshire fog	*Holchus lanatus*	✓				

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APPENDIX 6

Air Quality Report

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AIR QUALITY CHAPTER FOR THE PROPOSED GREENSTAR RECYCLING MATERIALS RECOVERY AND TRANSFER FACILITY TO BE LOCATED IN ENNISCORTHY, CO. WEXFORD.

PREPARED BY ODOUR MONITORING IRELAND ON BEHALF OF O'CALLAGHAN MORAN CONSULTING ENGINEERS,

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PREPARED BY:	Dr. Brian Sheridan,
ATTENTION:	Mr. Michael Watson & Mr. Jim O Callaghan
DATE:	07th Nov 2007
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Document Amendment Record

Client: ***O Callaghan Moran Consulting Engineers Ltd***

Title: Air quality environmental impact assessment of proposed Greenstar Ltd Materials Recovery and Transfer Facility to be located in Enniscorthy, Co. Wexford.

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Project Number: 2007.A387(1)			**Document Reference:** Air quality environmental impact assessment of proposed Greenstar Ltd Materials Recovery and Transfer Facility to be located in Enniscorthy, Co. Wexford.		
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11.1. Air quality environmental assessment

11.1.1 Introduction

Odour Monitoring Ireland were commissioned to undertake a baseline air quality survey in order to assess the potential impact to air quality from the proposed Greenstar Ltd Materials Recovery and Transfer Facility to be located in Enniscorthy, Co. Wexford. This study will identify, describe and assess the impact of the development in terms of its impact on air quality.

A baseline air quality assessment has been carried out in the area between the time periods August to September 2007 in the vicinity of the proposed development. The purpose of this survey was to identify existing pollutant trends in the vicinity of the proposed development, and to assess the potential impact of the proposed development. This will establish sufficient spatial information in order to determine compliance with relevant ambient air quality legislation. Additionally, comparison with longer period limit values can be used to establish trends and are important in defining baseline air quality.

This section should be read in conjunction with the site layout plans for the site.

11.1.2 Study methodology-Assessment Criteria

The EU has introduced several measures to address the issue of air quality management. In 1996, Environmental Ministers agreed a Framework Directive on ambient air quality assessment and management (Council Directive 96/62/EC). As part of the measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, 1999/30/EC, has set limit values which replaced existing limit values under Directives 80/779/EEC, 82/884/EEC and 85/203/EEC in April 2001. The new directive as relating to limit values for sulphur dioxide, lead, PM_{10} and nitrogen dioxide, is detailed in *Table 11.1.1* EU Council Directive 2000/69/EC defines limit values for both carbon monoxide and benzene in ambient air and is presented in *Table 11.1.2.*

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The National Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002) transpose those parts of the "Framework" Directive 92/30/EC on ambient air quality assessment and management not transposed by Environment Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999 (S.I. No. 33 of 1999). The 2002 Regulations also transpose, in full, the 1st two "Daughter" Directives 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air and 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air.

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Table 11.1.1. Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC).

Pollutant	Regulation	Limit Type	Margin of Tolerance	VALUE
Nitrogen Dioxide	1999/30/EC SI 271 of 2002	Hourly limit for protection of human health - not to be exceeded more than 18 times/year-1 hour average	50% until 2001 reducing linearly to 0% by 2010 for 199/30/EC 40% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010 for SI 271 2002	200 $\mu g/m^3$ NO_2
		Annual limit for protection of human health-Annual	50% until 2001 reducing linearly to 0% by 2010 for 1999/30/EC 40% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010 for SI 271 2002	40 $\mu g/m^3$ NO_2
		Annual limit for protection of vegetation-Annual	None	30 $\mu g/m^3$ NO + NO_2
Lead	1999/30/EC	Annual limit for protection of human health-Annual average	100% until 2001 reducing linearly to 0% by 2005	0.5 $\mu g/m^3$
Sulphur Dioxide	1999/30/EC SI 271 of 2002	Hourly limit for protection of human health – not to be exceeded more than 24 times/year-1 hour average	43% until 2001 reducing linearly until 0% by 2005 for 199/30/EC 90 $\mu g/m^3$ from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by 30 $\mu g/m^3$ to reach 0 $\mu g/m^3$ by 1 January 2005 for SI 271 of 2002	350 $\mu g/m^3$
		Daily limit for protection of human health – not to be exceeded more than 3 times/year-24hr average	None	125 $\mu g/m^3$
		Annual & Winter limit for the protection of ecosystems-Annual	None	20 $\mu g/m^3$

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Table 11.1.1 continued. Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC).

Particulate Matter Stage 1	1999/30/EC SI 271 of 2002	24-hour limit for protection of human health - not to be exceeded more than 35 times/year-24 hour average	50% until 2001 reducing linearly to 0% by 2005 for 1999/30/EC 30% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005 for SI 271 of 2002	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health-Annual	20% until 2001 reducing linearly to 0% by 2005 for 1999/30/EC 12% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 moths thereafter by equal annual percentages to reach 0% by 1 January 2005	40 $\mu g/m^3$ PM_{10}
Particulate Matter Stage 2	1999/30/EC SI 271 of 2002	24-hour limit for protection of human health - not to be exceeded more than 7 times/year-24 hour average	To be derived from data and to be equivalent to Stage 1 limit value for 1999/30/EC Not to be exceeded more than 28 times by 1 January 2006, 21 times by 1 January 2007, 14 times by 1 January 2008, 7 times by 1 January 2009 and zero times by 1 January 2010 for SI 271 of 2002	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health-Annual	50% until 2005 reducing linearly to 0% by 2010 for 1999/30/EC and SI 271 of 2002	20 $\mu g/m^3$ PM_{10}

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Table 11.1.2. Irish and EU Ambient Air Standard (SI 271 of 2002 and 2000/69/EC).

Pollutant	Regulation	Limit Type	Margin of Tolerance	VALUE
Benzene	2000/69/EC SI 271 of 2002	Annual limit for protection of human health	100% until 2003 reducing linearly to 0% by 2010 for 2000/69/EC 100% from the date of entry into force of these Regulations, reducing on 1st January 2006 and every 12 months thereafter by 1 $\mu g/m^3$ to reach 0 $\mu g/m^3$ by 1st January 2010	5 $\mu g/m^3$
Carbon Monoxide	2000/69/EC SI 271 of 2002	8-hour limit (on a rolling basis) for protection of human health	50% until 2003 reducing linearly to 0% by 2005 for 2000/69/EC 6 mg/m^3 from the date of entry into force of these Regulations, reducing on 1st January 2003 and every 12 months thereafter by 2 mg/m^3 to reach 0 mg/m^3 by 1st January 2005	10 mg/m^3

11.2. Receiving environment-Air

11.2.1 General

The site, which encompasses an area of c. 1.5 ha, is located in the townland of Clavass, approximately 4 km north of Enniscorthy at National Grid Reference E 298250 N 143520 (*see Figure 4.1 of the EIS*). The site is bounded to the west by the N 11 National primary route, to the east by the Old Dublin Road, to the north by an Industrial Estate and to the south by an open field. Enniscorthy is the closest settlement to the facility. The Village of Ferns is located approximately 7 km to the north of the facility on the N11.

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The site is one of two adjoining lots owned by Greenstar. It is currently completely grassed and was formerly used for agricultural purposes. The site falls to the west, towards the N11 from an elevation of 42 m OD to 36 mOD. There are no surface water drains on the site. A foul sewer, which serves the Industrial Estate on the adjoining northern lot, runs through the west of the site, to a pumping station in the adjoining Greenstar owned lot to the south.

The surrounding land uses consist of a mix of industrial and agricultural activities, with residential dwellings on the Old Dublin Road to the north and south of the site, as shown on *Figure 4.2 of the EIS*.

The site is located in an area zoned for industrial use. The adjoining lot to the north has recently been developed and is occupied by a Commercial Park. The Park consists of three main buildings subdivided into units, which are occupied by shop fitters, electrical wholesale suppliers, plumbing wholesalers and communications companies. To the east the land is used for agricultural purposes, especially tillage. To the west of the N11 the lands are also used for agricultural purposes.

Greenstar owns the lot immediately adjoining the southern boundary of the application site and it is not proposed to develop this lot. The nearest residence is approximately 80m from the north eastern site boundary. There are a total of 25 private residences within 500m of the site boundary.

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11.2.2 Baseline air quality

A total of ten sample locations were chosen to represent the baseline air quality for named parameters in the vicinity of the proposed development. These locations are listed in *Table 11.2.1* and presented in *Figure 11.7.1.*

Table 11.2.1. Description of air monitoring locations.

Reference	Monitoring parameters	Description and monitoring location
A1	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, PM_{10}, H_2S and Speciated VOC's	Monitored using passive diffusion tubes, Partisol PM10 analyser, Jerome analyser and Pumped sorbent tube.
A2	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.
A3	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, H_2S and Speciated VOC's	Monitored using passive diffusion tubes, Jerome analyser and Pumped sorbent tube.
A4	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.
A5	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.
A6	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.
A7	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.
A8	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, H_2S and Speciated VOC's	Monitored using passive diffusion tubes, Jerome analyser and Pumped sorbent tube.
A9	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.
A10	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide and H_2S	Monitored using passive diffusion tubes and Jerome analyser.

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As a result of the existing site conditions and the potential for traffic, residential and amenity-derived pollution, the following parameters were monitored:

11.2.2.1 Benzene, Toluene, Ethyl benzene and ortho and para Xylene (BTEX)

The sources associated with individual volatile organic compounds (VOCs) tend to be dependent on the nature of industries in the sample region. Benzene, Toluene, Ethyl benzene, p/o xylene (BTEX) and other aromatic/alkanes are most likely derived from petrol driven vehicle exhausts. Heavier semi-volatile organic compounds are frequently derived from diesel-powered engines. Benzene is a known carcinogen, poisonous by inhalation and a severe eye and moderate skin irritant. Materials Recovery and Transfer facility processes are not known sources of BTEX but this has been assessed for completeness sake in the context of the vehicles which will use the facility.

At each of the five monitoring locations (A1 to A5) (*see Figure 11.7.1 and Table 11.2.1*), the air quality was monitored for BTEX, over a 28-day period, using BTEX diffusion tubes. The

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sample tubes were analysed for BTEX at a UKAS accredited laboratory (ISO 17025) using gas chromatography flame ionisation detector. The results are presented in *Table 11.2.2*.

Table 11.2.2. Average BTEX concentrations at each location as measured by passive diffusion tubes.

Location	Benzene (µg/m^3) [1, 3]	Toluene (µg/m^3) [1,3]	Ethyl benzene (µg/m^3) [1,3]	p-Xylene (µg/m^3) [1,3]	o-Xylene (µg/m^3) [1,3]
A1[2]	1.866	4.846	0.774	1.067	0.366
A2[2]	1.946	5.494	0.821	1.527	0.626
A3[2]	2.145	4.258	0.704	1.019	0.334
A4[2]	1.637	4.643	0.588	1.289	0.438
A5[2]	2.053	5.552	0.629	1.213	0.392
EPA value-Wexford town hourly value[6]	0.90	-	-	-	-
Limit Value	**5[4]**	**4700[5]**	**10,875[5]**	**5525[5]**	**5525[5]**

Notes: *[1] denotes the lower limit of detection was 5.91 ηg of sorbed compound per tube;*
[2] denotes sampling period August to September 2007;
[3] denotes Lower limit of detection 2.88 ng;
[4] denotes Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC);
[5] denotes No specific ambient air limits. Rule of thumb is using 1/40th of the 8-hour Occupational Exposure Limit as stated in the National Authority for Occupational Safety and Health 2002 "Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations".
[6] denotes Air Quality Monitoring Report, 2006-Wexford station;

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The results illustrated in *Table 11.2.2* for BTEX at A1 to A5 are all in compliance with Irish and EU limit values (i.e. SI 271 of 2002 and EU Directive 2000/69/EC) for Benzene. Average Benzene concentrations were up to 57% lower than the Irish and EU directive limit values. The rule of thumb for guidelines for ambient air quality of volatile organic compounds without legislative limit values is using 1/40th of the 8-hour Occupational Exposure Limit as stated in the National Authority for Occupational Safety and Health 2002 "Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations". Toluene, Ethyl benzene and Xylene isomers are well within their respective fractional exposure limit values.

11.2.2.2 Nitrogen dioxides (NO_2)

Nitrogen is a constituent of both the natural atmosphere and of the biosphere. When industrial metabolism releases nitrogen to the environment it is considered a "pollutant" because of its chemical form: NO, NO_2, and N_2O. These oxides of nitrogen can be toxic to humans, to biota, and they also perturb the chemistry of the global atmosphere. Materials Recovery and Transfer facility processes are not known sources of Nitrogen dioxides but this has been assessed for completeness sake in the context of the vehicles which will use the facility. In the transportation sector, the NOx emissions result from internal combustion engines.

At each of the five monitoring locations (A1 to A5) (*see Figure 11.7.1 and Table 11.2.1*), levels of NO_2 were measured using diffusion tubes, which were left on site for a 28-day period. The tubes were then analysed using UV spectrophotometer, at a UKAS accredited laboratory (ISO 17025), giving an average concentration over the 28-day period. The results are presented in *Table 11.2.3*.

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Table 11.2.3. Average NO_2 concentrations at each location as measured by passive diffusion tubes.

Location	Sampling Period	Average NO_2 conc. ($\mu g/m^3$)[2]
A1	Aug to Sept 2007	10.23
A2	Aug to Sept 2007	9.38
A3	Aug to Sept 2007	7.63
A4	Aug to Sept 2007	8.31
A5	Aug to Sept 2007	13.00
EPA Wexford town annual hourly average	2006	12.60
Limit value-Annual average	**-**	**40**
Limit value 1 hour average	**-**	**200**

Notes:[1] *denotes Lower limit of detection 0.003 µg/m*^{3}*;*
[2] *denotes Air Quality Monitoring Report, 2006-Wexford station;*

The dominant source of NO_2 in the area appears to be from motor vehicle exhausts and the burners/boiler of space heating of local light industry and business units. The measured concentrations of NO_2 at all monitoring locations are within the Irish and EU Ambient Air Standards. Monitoring locations A1 to A5 are an average 68% lower than currently established Irish and European ambient air regulatory levels for annual averages.

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11.2.2.3 Sulphur dioxide (SO_2)

Sulphur dioxide is a colourless gas, about 2.5 times as heavy as air, with a suffocating faint sweet odour. Sulphur dioxide occurs in volcanic gases and thus traces of sulphur dioxide are present in the atmosphere. Other sources of sulphur dioxide include smelters and utilities, electrical generation, iron and steel mills, petroleum refineries, pulp and paper mills, metallurgical processes, chemical processes and the combustion of the iron pyrites, which are contained in coal. Small sources include residential, commercial and industrial space heating

SO_2 can be oxidised to sulphur trioxide, which in the presence of water vapour is readily transformed to sulphuric acid mist. SO_2 is a precursor to sulphates, which are one of the main components of respirable particles in the atmosphere. Health effects caused by exposure to high levels of SO_2 include breathing problems, respiratory illness, changes in the lung's defences, and worsening respiratory and cardiovascular disease. People with asthma or chronic lung or heart disease are the most sensitive to SO_2. It also damages trees and crops. SO_2, along with nitrogen oxides, are the main precursors of acid rain. This contributes to the acidification of lakes and streams, accelerated corrosion of buildings and reduced visibility. SO_2 also causes formation of microscopic acid aerosols, which have serious health implications as well as contributing to climate change.

At each of the five monitoring locations (A1 to A5) (*see Figure 11.7.1 and Table 11.2.1*), levels of SO_2 were measured using diffusion tubes, which were left on site for a 28-day period. The tubes were then analysed using Ion chromatography, at a UKAS accredited laboratory (ISO 17025), giving an average concentration over the 28-day period. The results are presented in *Table 11.2.4*.

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Table 11.2.4. Average SO_2 concentrations at each location as measured by passive diffusion tubes.

Location	Sampling Period	Average SO_2 conc. ($\mu g/m^3$)[1]
A1	Aug to Sept 2007	1.18
A2	Aug to Sept 2007	1.79
A3	Aug to Sept 2007	0.81
A4	Aug to Sept 2007	1.74
A5	Aug to Sept 2007	0.74
EPA Wexford town, maximum 24 hour period	2006	50.60 [2]
Limit value-Annual average	**-**	**20**

Notes: *[1] denotes lower limit of detection 0.06 µg/m³;*
[2] denotes Air Quality Monitoring Report, 2006-Wexford station;

The dominant source of SO_2 in the area appears to be from motor vehicle exhausts and the burners/boiler/solid fuel heating local single residences and industrial units. The measured concentrations of SO_2 at all monitoring locations are within the Irish and EU Ambient Air Standards. Monitoring locations A1 to A5 are an average 91% lower than currently established Irish and European ambient air regulatory levels.

11.2.2.4 Carbon monoxide (CO)

Carbon monoxide is produced as a result of incomplete burning of carbon-containing fuels including coal, wood, charcoal, natural gas, and fuel oil. It can be emitted by combustion sources such as un-vented kerosene and gas heaters, furnaces, woodstoves, gas stoves, fireplaces and water heaters, automobile exhaust from attached garages, and tobacco smoke. Carbon monoxide interferes with the distribution of oxygen in the blood to the rest of the body. Depending on the amount inhaled, this gas can impede coordination, worsen cardiovascular conditions, and produce fatigue, headache, weakness, confusion, disorientation, nausea, and dizziness. Very high levels can cause death. The symptoms are sometimes confused with the flu or food poisoning. Foetuses, infants, elderly, and people with heart and respiratory illnesses are particularly at high risk for the adverse health effects of carbon monoxide.

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Due to power and equipment safety issues existing baseline monitoring data from EPA monitoring sites was used for assessment of baseline Carbon monoxide air quality. The EPA monitoring location and results are presented in *Table 11.2.5.*

Table 11.2.5. Average ambient baseline CO concentrations for the proposed site development.

Location	Sampling Period	Ambient CO conc. (mg/m^3)
EPA-Maximum annual mean Coalraine St	2005	1.10
EPA- 8 hour value-Coalraine St	2005	1.80
EPA-Maximum 8 hourly average value, Wexford town	2006	2.90

Notes: *[1] denotes Irish and EU ambient air standard (SI 271 of 2002 and 2000/69/EC) as an 8 hour running average;*

CO monitoring is also very limited in Ireland. Data sets developed by the EPA indicate 8 hour running average CO levels of 0.38 and 0.60mg m^{-3}, respectively for Dublin city locations. The dominant source of CO in this area would appear to be vehicle emissions, boilers (i.e. Home heating and Industrial heating), industrial processes and construction activities. The CO emissions measured in Dublin City would be considered worst case in comparison to the proposed site location. CO emissions are on average 71% lower than Irish and EU ambient

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air limit values at the similar suburban monitoring locations, which would be considered worst case in terms of exposure for the area (*see Table 11.2.5*).

11.2.2.5 Particulate matter (PM_{10})

Major sources of particulates include industrial/residential combustion and processing, energy generation, vehicular emissions and construction projects. The particulate matter created by these processes is responsible for many adverse environmental conditions including reduced visibility, contamination and soiling, but also recognised as a contributory factor to many respiratory medical conditions such as asthma, bronchitis and lung cancer. PM_{10} (Particulate Matter 10) refers to particulate matter with an aerodynamically diameter of 10 μm. Generally, such particulate matter remains in the air due to low deposition rates. It is the main particulate matter of concern in Europe and has existing air quality limits. In order to obtain a baseline PM_{10} for the proposed work area, a PM_{10} analyser was used to monitor the PM_{10} ambient concentration levels at one location (A1) within the vicinity of the proposed works. Continuous monitoring was performed over a 2-day period. The monitoring location is presented in *Figure 11.7.1 and Table 11.2.1*. Results are presented in *Table 11.2.6*.

Table 11.2.6. Average ambient PM_{10} concentrations in the vicinity of the proposed development.

Location	Sampling Period	Ambient PM_{10} conc. ($\mu g/m^3$)
A1-24 hour average	Sept 2007	26
A1-24 hour average	Sept 2007	33
EPA measured conc. – Wexford Town, 24 hour mean value [4]	2006	25.30
Limit Value at 98.07th percentile	-	50 [1, 2]
Limit Value-annual mean Stage 1		40
Limit value-annual mean Stage 2		20 [3]

Notes: *[1] denotes Irish and EU ambient air standard (SI 271 of 2002 and 1999/30/EC) as a 24-hour average;*
[2] denotes maximum number of exceedence 7 times in a one-year period;
[3] denotes annual limit value for Stage 2 implementation 2010;
[4] denotes Air quality Monitoring Report, 2006-Wexford town.

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PM_{10} monitoring in Ireland is limited to continuous monitoring stations operated by the Local Authorities and the Irish EPA, mainly in large urban centres. Average 24-hour ambient air concentrations monitored in the Phoenix Park and Whitehall, respectively by Dublin Corporation are in the range of 16 μg m^{-3} and 17 μg m^{-3} for an annual mean in 1999. The EPA measured an annual mean of 15 μg m^{-3} at a monitoring station located within the Phoenix Park. The dominant source of PM_{10} in the area appears to be vehicle emissions, boilers (i.e. Home heating and Industrial heating), industrial processes and construction activities. The average ambient PM_{10} concentrations are comparable to those monitored by Dublin Corporation. Maximum-recorded ambient PM_{10} concentrations were on average 34% lower than the Irish and EU 24 hour ambient air quality limit value.

11.2.2.6 Hydrogen sulphide

H_2S is commonly associated with waste handling operations. It is used as an indicator gas for the assessment of significant odour nuisance in the vicinity of waste handling facilities. The current California Ambient Air Quality standard for hydrogen sulphide, based on a 1-hour averaging time, is 42 μg m^{-3} (30 ppb). On this basis, the proposed REL of 10 μg m^{-3} (8 ppb) is likely to be detectable by many people under ideal laboratory conditions, but it is unlikely to be recognized or found annoying by more than a few. It is therefore expected to provide reasonable protection from odour annoyance in practice. Based on a review of 26 studies, the average odour detection threshold ranged from 0.00007 to 1.4 ppm (Amoore, 1985).

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Hydrogen sulphide is noted for its strong and offensive odour. The geometric mean of these studies is 0.008 ppm. In general, olfactory sensitivities decrease by a factor of 2 for each 22 years of age above 20 (Venstrom and Amoore, 1968); the above geometric mean is based on the average age of 40. Laboratory experiments performed by Sheridan (2003) in California measured H_2S detection threshold at 2 μg m^{-3} while the recognition odour threshold was 22 μg m^{-3}. At the current California Ambient Air Quality Standard (CAAQS) of 30 ppb, the level would be detectable by 83% of the population and would be discomforting to 40% of the population. These estimates have been substantiated by odour complaints and reports of nausea and headache (Reynolds and Kauper 1985) at 0.030 ppm H2S exposures from geyser emissions. The World Health Organization (WHO) recommends that in order to avoid substantial complaints about odour annoyance among the exposed population, hydrogen sulphide concentrations should not be allowed to exceed 0.005 ppm (5 ppb; 7 μg m^{-3}), with a 30-minute averaging time. The OEHHA (2000) adopted a level of 8 ppb (10 μg m^{-3}) as the chronic Reference Exposure Level (cREL) for use in evaluating long-term emissions from hot spots facilities. The only instrument capable of providing comparison with such reference levels is a Jerome meter analyser. These are real time data-logging H_2S analyser for the measurement of ambient hydrogen sulphide concentration levels (Sheridan, 2003).

An ambient H_2S profile monitoring exercise was carried out in the vicinity of the proposed site using a pre-calibrated H_2S analyser (Jerome metre). Samples were taken approximately 1.2 meter above ground level. The analyser is a real time analyser with a range of detection from 3 ppb to 50 ppm. Samples were collected at ten locations (i.e. A1, to A10), as shown in *Figure 11.7.1 and Table 11.2.1*. The purpose of this monitoring is to assess the baseline H_2S in the vicinity of the site. The results are presented in *Table 11.2.7*.

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Table 11.2.7. Hydrogen sulphide levels at each monitoring location.

Sample Reference	Sampling period	Hydrogen sulphide conc. (μg/m^3)
A1	Sept 2007	<4.5
A2	Sept 2007	<4.5
A3	Sept 2007	<4.5
A4	Sept 2007	<4.5
A5	Sept 2007	<4.5
A6	Sept 2007	<4.5
A7	Sept 2007	<4.5
A8	Sept 2007	<4.5
A9	Sept 2007	<4.5
A10	Sept 2007	<4.5
Recommended Limit value	**-**	**7.50**

Currently in Ireland, there are no statutory limits for hydrogen sulphide concentrations in ambient air, however, guidance suggest an ambient air concentration level of less than 7.50 μg/m^3 to limit odour nuisance. This value was not exceeded at any of the sample locations with all measured values at least 40% lower than the recommended limit value.

11.2.2.7 Speciated Volatile organic compounds (VOC's)

Speciated VOC's to include alkanes, Mercaptans, organic acids, aromatics and nitrogen containing organics in ambient air at elevated concentrations can lead to the formation of odours. In order to ascertain the baseline levels of speciated VOC's in the vicinity of the proposed site location, ambient pumped sampling of VOC's was performed in order to ascertain the baseline profile of such compounds.

In order to pre-concentrate speciated VOC upon each sorbent, a pre-calibrated controlled volume of sample air was drawn through each tube by a pre-calibrated SKC constant flow sampling pump for a period range of 180 minutes (i.e. Active sampling/pumped sampling). Each SKC pump was pre-calibrated with their specific sorbent using a Bios Primary flow

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calibrator (NIST traceable certified) with calibration flow checked following the completion of the sample run. Each pump was calibrated to a flow rate of between 71 and 200 ml min^{-1} depending on the sample, sample pump and sorbent tube as recommended by the sorbent manufacturer, analysing laboratory and sampling/test methodology. When sampling was completed all tubes were sealed and stored in flexible air tight containers and transported to the gas chromatography laboratory and analysed by means of thermal desorption GCFID/GCMS in a UKAS accredited laboratory.

Samples were taken approximately 1.2 meter above ground level using two-bed silcosteel packed sorbent tubes on the 12th September 2007. Samples were collected at three locations across the proposed site (i.e. A1, A3 and A8), as shown in *Figure 11.7.1 and Table 11.2.1*. The purpose of this monitoring is to assess the baseline speciated VOC concentration level and profile in the vicinity of the proposed site. The results are presented in *Table 11.2.7, 11.2.8 and 11.2.9*.

Table 11.2.7. Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A1.

Compound identity	Ambient air conc. (µg/m^3)
2,5-Furandione	9.81
2-Ethoxyamphetamine	1.87
Hexahydropyridine,	5.21
Decanal	2.97
Ethanol, 2-phenoxy-	1.85
Oxirane, tetradecyl-	2.79
Cyclotetradecane	5.74
3-Piperidinone,	2.40
2-Ethylhexyl chloroformate	9.09
Total VOC's	**58.25**

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Table 11.2.8. Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A3.

Compound identity	Ambient air conc. (µg/m^3)
2,5-Furandione	18.69
2-Propenamide	3.99
5H-Naphtho[2,3-c]carbazole, 5-methyl-	8.12
Nonanal	6.69
Decanal	5.27
3,4-Dichlorobenzyl alcohol	2.73
E-14-Hexadecenal	10.98
Heptadecane, 4-methyl-	4.12
2-Ethylhexyl chloroformate	3.12
Total VOC's	**140.19**

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Table 11.2.8. Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A8.

Compound identity	Ambient air conc. (µg/m^3)
2,5-Furandione,	46.86
Imidazole,	3.00
Benzeneethanamine, .	3.94
Thiophene,	4.59
Acetic acid,	2.48
Oxirane, hexadecyl-	4.90
Cyclotetradecane	22.74
1,3-oxazole-4-carboxylic acid,	12.29
Total VOC's	**150.48**

Currently in Ireland, there are no statutory limits for total volatile organic compound concentrations in ambient air, however, guidance suggest an ambient air concentration level of less than 250 µg/m^3 to limit impact. The compounds detected in ambient would be typical of emissions detected close to busy roadways and in agricultural locations. No background concentrations of Mercaptans or Sulphur containing organics were detected and the absence of such compounds suggests in general that odour air quality is good in the vicinity of the site. The profiles can be compared with any additional profiles measured when the facility is operational in order to ascertain any increases in ambient air concentrations of speciated VOC's. The overall background level of speciated VOC's as total VOC's is slightly elevated which may be a result of traffic numbers in the vicinity of the proposed site.

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11.3. Characteristics of the proposal

The site, which encompasses an area of c. 1.50 ha, is located in the townland of Clavass, approximately 4 km north of Enniscorthy at National Grid Reference E 298250 N 143520 (*see Figure No.4.1*). The site is bounded to the west by the N 11 National primary route, to the east by the Old Dublin Road, to the north by an Industrial Estate and to the south by an open field. Enniscorthy is the closest settlement to the facility. The Village of Ferns is located approximately 7 km to the north of the facility on the N11.

The proposed development will involve the construction of one main building (3,150m^2), offices, a double weighbridge, a vehicle wash, plant refuelling area, ESB Substation, open yards, an odour treatment plant, a site security fence and landscaping measures. The waste vehicles will enter and exit through the existing entrance off the Old Dublin Road, and a new entrance for staff cars will be provided further south.

This Planning Application will be to develop a Materials Recovery and Transfer Facility. The development will facilitate the processing of approximately 90,000 tones per annum of Construction and Demolition (C&D) waste, Commercial and Industrial (C&I) waste and municipal solid waste. All waste handling equipment, separations equipment and transfer of recovered materials and waste will be performed in doors within an enclosed materials recovery and transfer facility building.

11.4. Potential Impacts of the Proposal

11.4.1 Construction Phase

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There is the potential for a number of emissions to atmosphere during the construction of the development with wind blown dust been most significant. Wind blown dust emissions may arise during the construction phase of the proposed development, which may impact upon the surrounding environment. The deposition of dust and mud on the local roads is both unsightly and dangerous. Dust may be a particular problem during periods of dry windy weather. There is no anticipated impact from dust emissions when the development has been constructed, as all activities will be carried out indoors. Localised dust abatement will be provided upon certain recycling equipment as required, thereby minimising the quantity of dust emitted to the building headspace.

Potential sources of dust from construction and operation include the following:

- Vehicles carrying dust on their wheels,
- Un-vegetated stockpiles of construction materials,
- The handling of construction materials for the construction phase of the development,
- The generation of dust from the recycling activities to be carried out indoors within the facility.

The construction and operation vehicles, generators, etc., will also give rise to petrol and diesel exhausts emissions, although this is of minor significance compared to dust.

11.4.2 Operation Phase

11.4.2.1 Scheduled Emissions

Regarding operations at the proposed development, the activities to be located in the development are indoor recycling activities. Recycling equipment will contain localised dust abatement equipment where necessary in order to prevent the release of dust to the headspace of the building. No scheduled emission point will occur to atmosphere from this recycling/processing equipment with all air recycled within the putresible waste handling area of the building. Odourous waste handled within the dedicated sealed odourous waste handling building is discussed in more details in Section 12 *of the EIS*. This will consist of a negative ventilation carbon filtration odour control unit, which will exhaust treated air through a single scheduled emission point. This will emit treated gases if required to atmosphere.

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11.4.2.2 Climate

There is a potential for impacts to climate as a result of any development that requires fuel and energy. These impacts are the generation of greenhouse gas emissions (principally carbon dioxide and oxides of nitrogen) from traffic and electrical supply. Since traffic generated as part of the collection of C&I, C&D and MSW waste would occur anyway, the overall impacts of this proposed development on climate are considered negligible.

The potential effects of climate change on a global scale have been investigated by the Intergovernmental Panel on Climate Change (IPCC). The resulting impacts in Ireland are outlined in the National Climate Change Strategy and recently by the EPA and include the following:

- Significant increases in winter rainfall, of the order of 10% in the southeast, with a corresponding increase in the water levels in rivers, lakes and soils. Serious flooding more frequent than at present.

- Lower summer rainfall, of the order of 10% in the southern half of the country. Less recharge of reservoirs in the summer leading to more regular and prolonged water shortages than at present. Loss of bog land due to regular water deficits.

- Increased agricultural production, with new crops becoming more viable and potentially reduced agricultural costs. Grass growth could enjoy beneficial effects

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with an increase in 20% possible with higher temperatures and changes in rainfall patterns.

It is recognised that Ireland cannot, on its own, prevent or ameliorate the impacts of climate change. However, the National Climate Change Strategy states that Ireland must meet its responsibilities with regard to reducing CO_2 emissions in partnership with the EU and the global community.

11.4.3"Do-nothing" Scenario

The baseline survey results suggest that air quality in the vicinity of the proposed development is average and shows typical levels for a rural and suburban area with all pollutants within the relevant Irish and EU limits. The air quality may improve slightly in future years due to improvements in engine technology and greater controls on petrol, diesel, coal and gas composition and purity. If the proposed development were not to take place, the current air pollutant concentrations will remain unchanged followed by potential decreases in future years for the reasons outlined above. In relation to dust, non-development of the site would result in no movement of soils/sands and no construction activity and therefore no dust creation as a result of construction works. Impacts associated with odours as demonstrated in Section 12 of the EIS and are considered negligible as a result of the mitigation measures to be used at the proposed facility. This will be discussed in more detail in Section 12 of the EIS.

11.4.4 Remedial or Reductive Measures

11.4.4.1 Construction Phase

Construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface as a result of the development. Any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust may be regularly watered, as appropriate, during extended dry and/or windy conditions.

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Vehicles using site roads shall have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road and on hard surfaced roads that site management dictates speed shall be restricted to 20 km per hour.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

In relation to the completion of the proposed development, the hard standing surface, and all roads will be tarmacadamed/concreted. In periods of dry weather when dust emission would be greatest, a road sweeper, which would also dampen the road, may be employed in order to prevent the generation of dust.

11.4.4.2 Operation Phase

It is not anticipated that dust will be a significant problem during the operation of the development. All recycling activities will be carried out in doors while localised dust extraction where necessary and abatement will be provided on recycling plant and equipment with air recirculated internally.

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Emissions of pollutants from road traffic can be controlled by either controlling the number of road users or by controlling the flow of traffic. For the majority of vehicle-generated pollutants, emissions rise as speed drops. Emissions are also higher under stop-start conditions when compared with steady speed driving. The free flow of the traffic in the vicinity of the proposed development is essential in order to minimise the generation of traffic related pollutants.

It is envisaged that the proposed development will not have a significant impact on the surrounding air quality. However, as discussed previously a number of mitigation measures have been suggested. Moreover, dust monitoring could be carried out during the construction phase of the development if deemed necessary by the planning authority. If the level of dust is found to exceed 350 mg/m^2/day in the vicinity of the site, further mitigation measures will be incorporated into the construction and operation of the proposed development. In terms of odours, the carbon filtration media will be changed frequently as required.

11.4.4.3 Climate

Road traffic and power usage would be expected to be the dominant sources of greenhouse gas emissions as a result of the proposed development. Vehicles and power used to operate the plant will give rise to CO_2 and N_2O emissions as a result of the proposed development. It is expected that the number of vehicles accessing the site will be a weekly average of 1260 vehicles in 2023 for truck movements and 1080 vehicle movements per week for small vehicles such as passenger cars. This will lead to the emission of 19,582 tonnes of CO_2 per annum, which is equivalent to 0.00024% of the National Emissions in Ireland in 2005. With reference to relevant evaluation criteria such as the Kyoto Protocol, which has set objectives to be achieved by 2008 – 2012, GHG emissions as a result of this proposal will be imperceptible.

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11.5. Predicted Impacts of the development

11.5.1.1 Construction Phase

The effect of construction of the facility on air quality will not be significant following the implementation of the proposed mitigation measures. The main environmental nuisance associated with construction activities is dust. However, it is proposed to adhere to good working practices and dust mitigation measures to ensure that the levels of dust generated will be minimal and are unlikely to cause an environmental nuisance. A series of such good working practices and mitigation measures are outlined earlier in this chapter (*see Section 11.4.4.1*).

11.5.1.2 Operation Phase

Traffic

The predicted increases in traffic volumes as a result of the development along the existing road network are expected to be lower than if the facility were to be operated solely as a business park. The detailed information on traffic provided in the traffic section of the Statement has been used to identify whether any significant impact on sensitive receptors will occur. The traffic information has been input into the Design Manual for Roads and Bridges (DMRB), Volume 11 (February 2003) model. This model was prepared by the United Kingdom Department of Transport, the Scottish Office of Industrial Development, the Welsh Office and the Department of Environment for Northern Ireland as a screening tool to assess worst-case air quality impact associated with roads developments.

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The screening model uses a worst-case scenario in calculating emissions. The emission factors used for each pollutant are intentionally biased to overestimate the actual emission rate. Also, wind speeds are assumed to be 2 m s^{-1} (approximately 3.9 knots compared to a mean wind speed of between 4 to 5 m s^{-1} from nearest Met stations (Rosslare met station). In addition to this, the background concentrations incorporated into the model are worst-case scenario concentrations. For these reasons, it can be assumed with confidence that a project will not produce air pollution from traffic if this model identifies none.

Traffic figures have been assessed using the Annual Average Daily Traffic (AADT) figures. The Heavy Goods Vehicle (HGV) percentage was calculated to be 8.0 % from actual traffic counts. For Scenario 1, if the proposed development progresses, the overall % HGV will increase to approximately 15% of the total ADDT value in year 2008, 17% in year 2013 and 19% in year 2023 for north bound traffic while figures predicted for south bound traffic are fractionally lower. For Scenario 2, with the north junction of the Dublin Rd/N11 closed, the overall %HGV will increase to a maximum of 42%, which is a direct result of overall traffic numbers in general on this access road decreasing dramatically. As the average speed of vehicles has a significant effect on the generation of pollutants, calculations are carried out for two different traffic speed scenarios. The speeds are 20 km hr^{-1}, to represent gridlock conditions and 50 km hr^{-1}, to represent free-flowing traffic conditions in the area. The growth rate per annum assumed for the area is based on NRA future traffic forecasts for non-national roads. In addition, the assumption that the N11 Enniscorthy bypass will proceed in 2013 is taken account off.

Traffic flow predictions are made for two scenarios with traffic either travelling north or south of the facility. Scenario 1 assumes that the northern junction of old Dublin Rd/N11 will remain open while Scenario 2 assumes that the northern junction of old Dublin Rd/N11 will close.

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Scenario 1

- 2007-Existing Baseline Scenario,
- 2008-“Do-nothing” Scenario (proposed development does not proceed),
- 2008-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels north (Loc J1),
- 2008-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels south (Loc J2),
- 2013-“Do-nothing” Scenario (proposed development does not proceed),
- 2013-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels north (Loc J1),
- 2013-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels south (Loc J2),
- 2023-“Do nothing” scenario
- 2023-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels north (Loc J1),
- 2023-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels south (Loc J2),

Scenario 2

- 2013-“Do-nothing” Scenario (proposed development does not proceed),
- 2013-“Do-something” Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels north (Loc J2),
- 2023-“Do nothing” scenario

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- 2023-"Do-something" Scenario (proposed development proceeded as Materials recovery and transfer facility) and % level of traffic entering or exiting the facility travels south (Loc J2),

The DMRB only assesses the potential impacts from traffic up to and including the year 2023. Even though the development design period goes beyond this date, this is not considered significant since impacts are expected to be even lower beyond this date due to improvements in engine technology etc. The impacts associated with the proposed development are well within the ground level impact concentrations in year 2023 (as predicted by the model).

Using the model, concentrations of Carbon Monoxide, Benzene, Oxides of Nitrogen and PM_{10} (particulate matter with an average 10 μm aerodynamic diameter), have been determined for a receptor point J1 to the north of the old Dublin Rd and J2 to the south of the old Dublin Rd. The location of the receptor points is presented in *Figure 11.7.1*. The results of these calculations are presented in *Tables 11.5.1* (J1) and *11.5.2* (J2) for Scenario 1 and *Table 11.5.3* (J2) for Scenario 2 (proposed upgrade to road network).

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Table 11.5.1. SCENARIO 1 - Screening Air Quality Assessment, GreenstarLtd Materials Recovery and Transfer Facility-Receptor at location J1.

Scenarios	Traffic Speed Km hr^{-1}	Carbon Monoxide (mg/m^3)	Benzene ($\mu g/m^3$)	Oxides of Nitrogen ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)
	-	Annual Average-Traffic component	Annual Average-Traffic component	Annual Average NO_2-Traffic component	Annual Average-Traffic component
Existing Scenario 2007	20	0.02	0.02	3.11	0.40
	50	0.02	0.02	2.29	0.24
2008 "Do Nothing" Scenario	20	0.02	0.02	2.94	0.36
	50	0.02	0.02	2.16	0.24
2008 "Do Something" Scenario	20	0.02	0.02	5.31	0.58
	50	0.02	0.02	3.76	0.34
2013 "Do Nothing" Scenario	20	0.02	0.02	2.09	0.23
	50	0.02	0.02	1.57	0.14
2013 "Do Something" Scenario	20	0.02	0.02	4.18	0.39
	50	0.02	0.02	2.99	0.23
2023 "Do nothing" Scenario	20	0.02	0.02	2.32	0.26
	50	0.02	0.02	1.74	0.16
2023 "Do Something" Scenario	20	0.02	0.02	5.06	0.46
	50	0.02	0.02	3.59	0.27
Irish and EU Standards	-	-	**5**	**40**	**40**

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Table 11.5.2. SCENARIO 1 - Screening Air Quality Assessment, Greenstar Recycling Materials Recovery and Transfer Facility-Receptor at location J2.

Scenarios	Traffic Speed Km hr^{-1}	Carbon Monoxide (mg/m^3)	Benzene ($\mu g/m^3$)	Oxides of Nitrogen ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)
	-	Annual Average-Traffic component	Annual Average-Traffic component	Annual Average NO_2-Traffic component	Annual Average-Traffic component
Existing Scenario 2007	20	0.02	0.02	3.11	0.40
	50	0.02	0.02	2.29	0.24
2008 "Do Nothing" Scenario	20	0.02	0.02	2.94	0.36
	50	0.02	0.02	2.16	0.24
2008 "Do Something" Scenario	20	0.02	0.02	3.44	0.38
	50	0.02	0.02	2.51	0.22
2013 "Do Nothing" Scenario	20	0.02	0.02	2.09	0.23
	50	0.02	0.02	1.57	0.14
2013 "Do Something" Scenario	20	0.02	0.02	2.31	0.24
	50	0.02	0.02	1.73	0.15
2023 "Do nothing" Scenario	20	0.02	0.02	2.32	0.26
	50	0.02	0.02	1.74	0.16
2023 "Do Something" Scenario	20	0.02	0.02	1.90	0.20
	50	0.02	0.02	1.46	0.13
Irish and EU Standards	-	-	**5**	**40**	**40**

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Table 11.5.3. SCENARIO 2 - Screening Air Quality Assessment, Greenstar Recycling Materials Recovery and Transfer Facility-Receptor at location J2.

Scenarios	Traffic Speed Km hr^{-1}	Carbon Monoxide (mg/m^3)	Benzene ($\mu g/m^3$)	Oxides of Nitrogen ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)
	-	Annual Average-Traffic component	Annual Average-Traffic component	Annual Average NO_2-Traffic component	Annual Average-Traffic component
2013 "Do Nothing" Scenario	20	0.001	0.001	0.1	0.01
	50	0.001	0.001	0.1	0.01
2013 "Do Something" Scenario	20	0.001	0.001	2.06	0.15
	50	0.001	0.001	1.42	0.09
2023 "Do nothing" Scenario	20	0.001	0.001	0.06	0.01
	50	0.001	0.001	0.06	0.01
2023 "Do Something" Scenario	20	0.001	0.001	1.64	0.11
	50	0.001	0.001	1.14	0.06
Irish and EU Standards	-	-	**5**	**40**	**40**

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For carbon monoxide (CO) under all traffic scenarios at both speeds, the predictions indicate that even under worst-case scenario conditions the maximum CO level will not breach the EU limit at locations J1 and J2 for Scenario 1 and location J2 for Scenario 2. The model predicts that under the 2008 ”Do-nothing” and ”Do something” scenarios, the ambient carbon monoxide concentrations will fractional increase at location J1 and J2. In comparing the 2023 ”Do-nothing” and ”Do something” scenarios, there is a negligible net increase in CO concentrations in general but not significant. When added to baseline the overall ambient air concentrations of CO are well within the Irish and EU limit values.

The predicted results for benzene at the two speed scenarios indicate that the concentrations are below the relevant Irish and EU limit at both locations. Again, the predicted levels drop with increases in speed. As with the CO results, the predicted levels at all receptors actual remain relative equal over the development years. There are negligible increases in overall ambient air concentrations of Benzene at receptor locations J1 and J2 for both Scenario 1 and 2 due to increases in traffic movements. When added to baseline the overall ambient air concentrations of Benzene are well within the Irish and EU limit values.

The predicted levels of nitrogen dioxide (NO_2) at the two speed scenarios for Scenario 1 and 2 indicate that the development of the proposed facility will cause negligible increases NO_2 on the surrounding area. The relative concentrations of NO_2 stay relatively constant whether the proposed development proceeds or not. There is a general overall improvement in the NO_2 levels as the development proceeds from 2008 to 2023 due to improvements in engine technology. When added to baseline the overall ambient air concentrations of NO_2 are well within the Irish and EU limit values.

For particulate matter (PM_{10}) the predictions indicate that even under worst-case scenario conditions the annual average will not breach the Irish and EU limit at either location for Scenario 1 or 2. The predictions show a variation with speed resulting in lower levels of particulates produced under normal traffic conditions (50 km/hr). Predicted decreases in PM_{10} will occur at locations J1 and J2 for year 2023 because of improvements in engine technology. The is no significant difference on air quality impact whether the development proceeds or not.

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The computer model predictions indicate the following findings:

- Ambient concentrations will, in general, decrease due to legislation driven improvements in engine technology and fuel content. Any increases will be slight.
- There will be negligible increases in NO_2 and PM_{10} concentrations at J1 and J2 for Scenario 1 and 2 as the development phases are implemented.
- The net impact of the proposed development will be a slight negative for NO_2 and PM_{10} but will remain well within the Irish and EU legislative limit values.

11.5.1.3 Climate

The effect of the proposed materials recovery and transfer facility is not considered to be significant. Planned improvements in the road network should improve overall air quality due to the reduction in idling events.

All space heating and energy requirements for the proposed development should be designed in accordance with best practice. The Building Regulations 2002 “Technical Guidance Document Part L – Conservation of Fuel an Energy Dwellings” should be used as a reference for best practice in order to reduce the impact of the proposed development on greenhouse gas emissions.

11.5.1.4 “Worst Case” Scenario

For traffic-derived pollutants, the “worst-case” scenario consists of gridlock conditions with large volumes of traffic on the road, simultaneously. This has been accounted for within the

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model whereby it is predicted that traffic movements will occur simultaneously on the road network. In addition gridlock is also assessed.

The DMRB predictive model employed is a screening model that is used to generate worst-case scenario predictions for air quality. If this model indicates that pollutant levels will not breach the Irish and EU limits, then it can be assumed with some confidence that a project will not produce air pollution problems if none are identified by this method. There are no predicted breaches of Irish and EU legislation for all future years, speeds and receptors. As a result of these model predictions it may be concluded that the worst-case impact of the traffic alterations associated with the proposed development are predicted to be a slight negative.

11.5.2 Monitoring

11.5.2.1 Construction Phase

It is envisaged that the proposed development will not have a significant impact on the surrounding air quality. However, as discussed previously a number of dust mitigation measures have been suggested. Moreover, dust monitoring could be carried out during the construction phase of the development if deemed necessary by the planning authority. If the level of dust is found to exceed 350mg/m^{2}day in the vicinity of the site, further mitigation measures will be incorporated into the construction of the proposed site.

In terms of odours, the exhaust emission point of the carbon filtration system will be monitored for odours using both onsite subjective assessment and biannual monitoring, if this is deemed necessary by the regulatory authority.

Internal closed loop dust abatement equipment fitted to the necessary materials recovery equipment will be continuously monitored using differential pressure sensor, which will alarm if requiring service.

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11.5.2.2 Operational phase

In terms of odours, the exhaust emission point of the carbon filtration system will be monitored for odours using both onsite subjective assessment and biannual monitoring, if this is deemed necessary. Greater detail on odours can be found in Section 12 *of the EIS*.

Internal closed loop dust abatement equipment fitted to the materials recovery equipment will be continuously monitored using differential pressure sensor, which will alarm if requiring service.

Dust monitoring will be carried out during the operation phase of the development if deemed necessary by the regulatory authority. If the level of dust is found to exceed 350mg/m^{2}day in the vicinity of the site, further mitigation measures will be incorporated into the operation of the proposed site.

11.5.3 Reinstatement

Not Applicable

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11.6. Non-Technical Summary

A baseline ambient air quality survey was carried out in the vicinity of the proposed Greenstar Ltd Materials Recovery and Transfer Facility development. Currently the air quality is average with levels of criteria and baseline odour pollutants for traffic, industrial and residential derived pollution (BTEX, NO_2, NO, CO, PM_{10}, H_2S and Speciated VOC's) below the relevant Irish and European Union limits. The main source of air pollution in the area is from motor vehicle exhausts, construction and industrial activities, and associated suburban emissions. There is the risk that emissions from dust and odours could result in air quality impacts in the vicinity of the proposed site location. Since all activities will be carried out indoors, focused dust extraction and abatement will be applied to the recycling equipment where necessary and all odourous waste stored, handled and processed within an enclosed sub building with negative air extraction applied, then it is anticipated that no associated impacts will occur with the proposed development.

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11.7. Appendix I-Monitoring and predictive traffic emission modelling locations

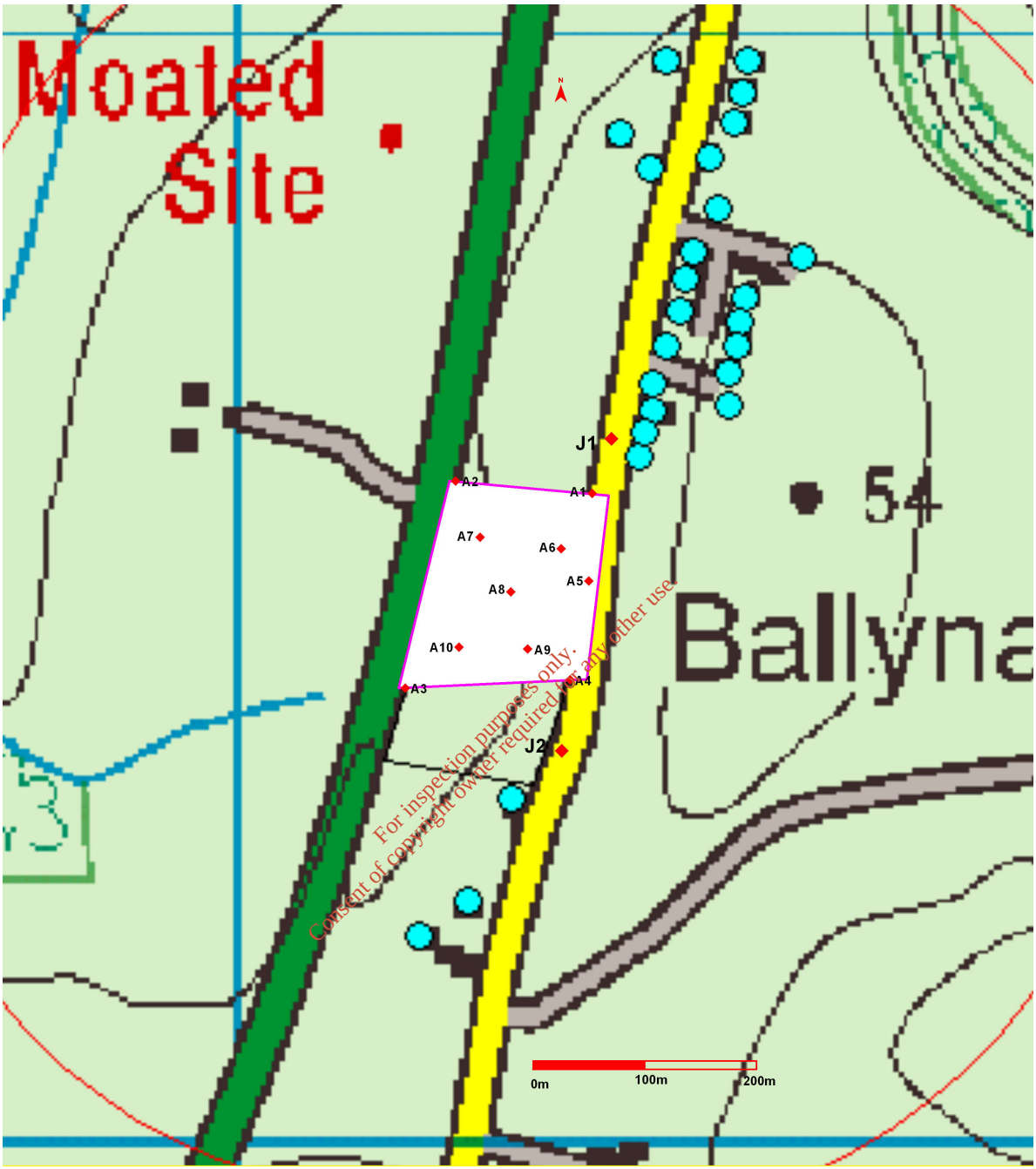

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Figure 11.7.1. Overview of monitoring locations A1 to A10 and receptor location J1 and J2.

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APPENDIX 7

Odour Impact Assessment

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ODOUR IMPACT ASSESSMENT OF THE PROPOSED MATERIALS RECOVERY AND TRANSFER FACILITY TO BE LOCATED IN ENNISCORTHY, CO WEXFORD.

PERFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF O CALLAGHAN MORAN CONSULTING ENGINEERS

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PREPARED BY:	Dr. Brian Sheridan
DATE:	08th Nov 2007
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Document Amendment Record

Client: ***O Callaghan Moran Consulting Engineers***

Title: Odour impact assessment of proposed Materials Recovery and Transfer Facility to be located in Enniscorthy, Co. Wexford.

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1. Executive Summary

Odour Monitoring Ireland was commissioned by O Callaghan Moran Consulting Engineers to carry out a desktop odour impact assessment of the proposed Materials Recovery and Transfer Facility (MRTF) design located in Enniscorthy, Co. Wexford. The purpose of this assessment was to determine the potential for the generation of odour impact on the surrounding population from the proposed MRTF.

The potential odour sources were identified and were used to construct the basis of the modelling assessment. Odour emission rates were calculated from library olfactometry data. Odour dispersion modelling was used to perform an impact assessment of the proposed upgraded MRTF design without and with the implementation of odour mitigation protocols.

Following development of odour emission rates, two data sets for odour emission rates were calculated to determine the potential odour impact of MRTF during its proposed future operation. These included:

Ref Scenario 1: Predicted overall odour emission rate from proposed MRTF without the implementation of odour mitigation protocols (*see Table 4.1*).

Ref Scenario 2: Predicted overall odour emission rate from proposed MRTF design with the incorporation of odour management, minimisation and mitigation protocols (*see Table 4.2*).

Aermod Prime was used to determine the overall odour impact of the proposed MRTF operation without and with odour mitigation protocols implemented as set out in odour impact criteria presented in *Table 2.1*. The output data was analysed to calculate:

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Ref Scenario 1:

- Predicted odour emission contribution of overall proposed MRTF operation without odour mitigation (*see Table 4.1*), to odour plume dispersal at the 98th percentile for an odour concentration of less than or equal to 1.50 Ou_E m^{-3} (*see Figure 8.1*).

This odour impact criterion was chosen for the proposed MRTF in order to ascertain the level of proposed odour impact to the surrounding residential and industrial population in the vicinity of the proposed MSW handling area within the MRTF without mitigation.

Ref Scenario 2:

- Predicted odour emission contribution of overall proposed MRTF operation with odour abatement protocols implemented (*see Table 4.2*) to odour plume dispersal at the 98th percentile for an odour concentration of less than or equal to 0.70 Ou_E m^{-3} (*see Figure 8.2*) for 3 years of hourly sequential meteorological data.
- Predicted odour emission contribution of overall proposed MRTF operation with odour abatement protocols implemented (*see Table 4.2*) to odour plume dispersal at the 99.5th percentile for an odour concentration of less than or equal to 1.0 Ou_E m^{-3} (*see Figure 8.3*) for 3 years of hourly sequential meteorological data.

These odour impact criterions were chosen for the proposed MRTF to allow for assessment of potential impact with the facility in operation.

These computations give the odour concentration at each Cartesian grid receptor location that is predicted to be exceeded for 0.5%(44 hours) and 2% (175 hours) of three years of meteorological data. Additionally, individual sensitive receptors and 30 five metre spaced boundary receptors were established within the modelling assessment.

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It was concluded that:

- In accordance with odour impact criterion in *Table 2.1*, and in keeping with current recommended odour impact criterion in this country, odour impact could be perceived by residents in the vicinity of the proposed MRTF if odour mitigation measures are not implemented.
- In accordance with odour impact criterion in *Table 2.1*, and in keeping with current recommended odour impact criterion in this country, no significant odour impact will be perceived by residents in the vicinity of the proposed MRTF following the installation of proposed odour management, minimisation and mitigation protocols. The overall perceived impact of odours as a result of proposed mitigation will result in ground level concentrations of odours approximately 53% and 63% lower than the 98th and 99.5th percentile guideline values to minimise odour impact.
- Those management and mitigation strategies discussed through this document should be considered within the design of the proposed section of building handling and processing municipal solid waste (MSW) only (*see Section 9.6, 9.7 and 9.8*).

The following recommendations were developed during the study:

1. Odour management, minimisation and mitigation procedures as discussed within this document in general will be implemented at the proposed MSW handling area for the MRTF building in order to prevent any odour nuisance in the surrounding vicinity.
2. Maintain good housekeeping practices (i.e. keep yard area clean, etc.), closed-door management strategy (i.e. to eliminate puff odour emissions from MSW building), and clean fouled surfaces regularly to minimise the generation of odours within the sub section building for handling MSW.
3. Ensure that the building fabric skin for the MSW handling area is tight to prevent the fugitive release of odours as a result of wind and temperature pressure effects. In terms of this assessment it is assumed that a good building skin with no gap will be installed for this area. It has been assumed that an air exchange rate of 4 AC/hr will be implemented. This air exchange rate could be reduced to between 2 and 2.5 AC/hr if a tight building skin with joint taping, individual pad sheet sealing and flexi seal of apex, eves and rising push wall occurs. The confirmation of the effectiveness of such sealing would be verified before operation through smoke testing. In addition, the fitting of air curtains to the rapid roller access doors would ensure minimal leakage through the door opening and therefore allow for the operation of the ventilation system at this reduced air exchange rate.
4. Implement and operate a negative air extraction and odour treatment system to minimise the emissions of odours from the MSW handling section of the overall building.

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2. Introduction

Odour Monitoring Ireland was commissioned by O Callaghan Moran Consulting Engineers to perform a predictive odour impact assessment of the proposed Greenstar Ltd Materials Recovery and Transfer facility (MRTF) utilising dispersion modelling software Aermod Prime. Like the majority of industries, the operation of the proposed MRTF in Enniscorthy is faced with the issue of preventing odours causing impact to the public at large.

In order to obtain odour emission data for the site, library based odour emission data was collated. Utilising the indicative design and library odour emission data; dispersion-modelling techniques were used to establish the extent any odour impact on the surrounding population without and with the implementation of odour mitigation techniques.

Two odour emission scenarios were developed to take account of the operation of the proposed design without and with the implemented of odour mitigation strategies. These odour emission rates and specified source characteristics were input into Aermod Prime in order to determine any overall odour impact from the MRTF design.

It was concluded from the study that the operation of the proposed MRTF will cause intermittent odour impact during routine operation and system upset if odour mitigation techniques namely a odour control system are not implemented. Following the implementation and installation of odour management and mitigation protocols as recommended in this report, it is predicted all residential neighbours in the vicinity of the MRTF will perceive an odour concentration less than 0.70 Ou_E m^{-3} at the 98th percentile for three years of meteorological data (*see Figure 8.2*). In addition, potential short-term worst-case odour impacts were also assessed by examination of the 99.5th percentile odour contour. As a result of proposed odour mitigation techniques, all residential neighbours will perceive and odour concentration less than 1.0 Ou_E/m^3 at the 99.5th percentile of hourly averages over three years of meteorological data. Therefore, it is concluded that the proposed handling of odourous waste within the sub section building of the overall MRTF will not result in odour impacts. This assessment was performed in accordance with currently recommended international guidance for the assessment of odour impact criterion to limit odour nuisance.

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2.1. Key assessment criteria used in this report

The following key assessment criteria were used throughout the development of this report. This will allow the client representative to compare submitted proposals. These include:

1. AERMOD Prime dispersion model *Version 07026* was used throughout the dispersion modelling assessment. In using the AERMOD Prime account was taken of building wake effects that could occur within MRTF (i.e. Prime 04274 was used).
2. Cumulative meteorological data (i.e. three years) allowed for the development of worst case 98th and 99.5th percentile maximum ground level concentrations of odours.
3. All data was geo referenced to Irish Grid Coordinated system to allow for greatest accuracy in assessing plume distance and spread. This is in accordance with Irish EPA guidance.
4. All building height structures and dimensions were utilised in the dispersion-modelling scenario to take account of building wake effects.
5. All source characteristics were taken account of in the dispersion model including stack height, temperature, efflux velocity, total mass emission rate, volumetric airflow and stack base height level.
6. All assessment works was performed in accordance with the Guidance documents - Irish and UK EPA guidance documents “Odour impacts and odour emission control measures for intensive agriculture, EPA, 2001 and H Horizontal Guidance notes Parts 1 and 2, UK Environment Agency and International experience taken from Odour Monitoring Irelands database.

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3. Materials and Methods

This section will describe the materials and methods used throughout the study period.

3.1. Site

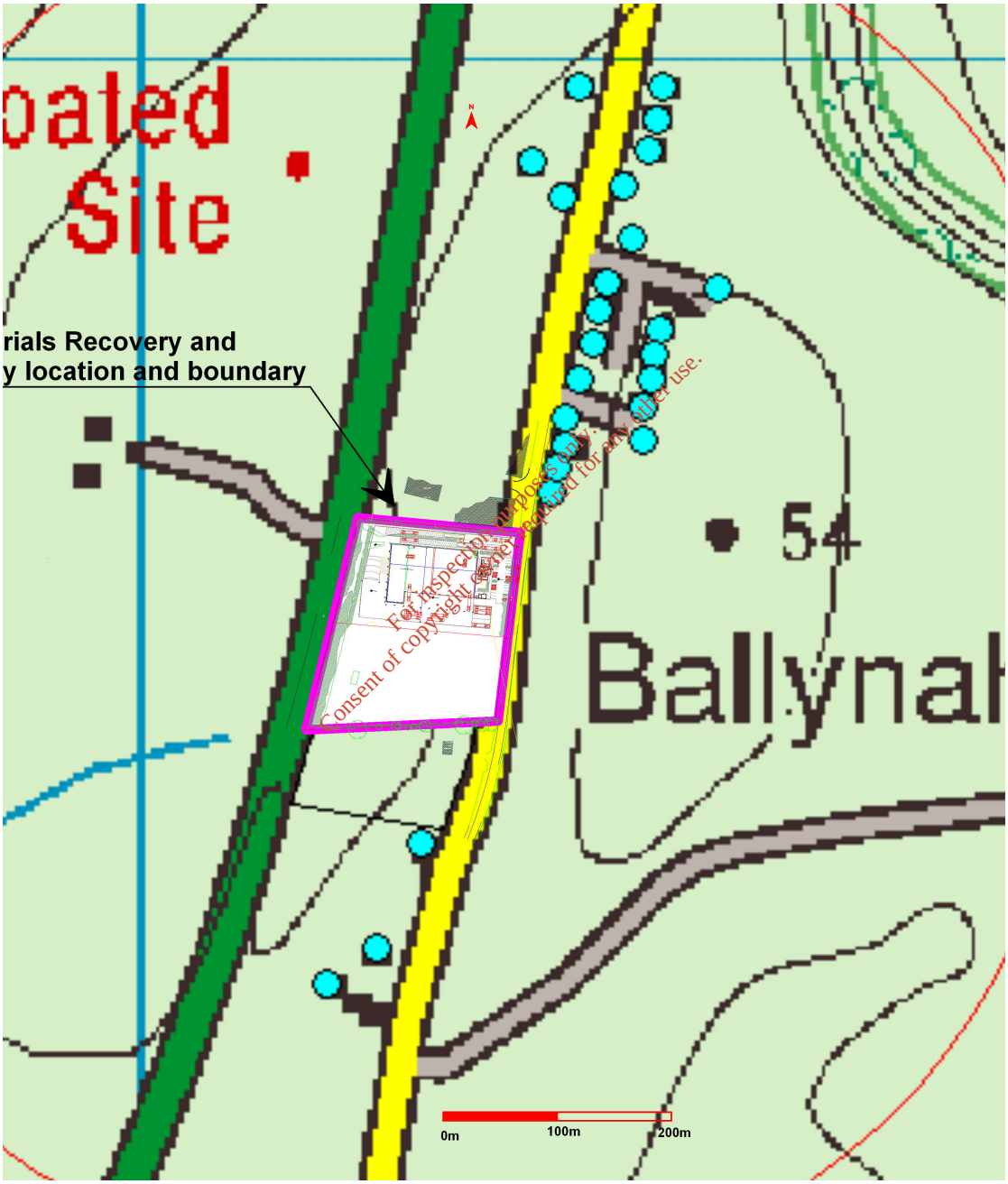

Figure 3.1. General location of proposed Materials Recovery and Transfer facility boundary ( ) and relative location of residences ( )

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The different distances and directions that the proposed MRTF is located from the neighbouring sensitive receptors are presented in *Figure 3.1*. As can be observed, the closest residential receptors include three properties situated 100 -250m due south of the proposed facility while up to 22 residential properties are situated from approximately 50 to 400 m due north of the site boundary. In addition, there are a number of industrial units in the vicinity of the facility boundary.

3.2. Odour emission rate calculation.

The measurement of the strength of a sample of odourous air is, however, only part of the problem of quantifying odour. Just as pollution from a stack is best quantified by a mass emission rate, the rate of production of an odour is best quantified by the odour emission rate. For a chimney or ventilation stack, this is equal to the odour threshold concentration (Ou_E m^{-3}) of the discharge air multiplied by its flow-rate (m^3 s^{-1}). It is equal to the volume of air contaminated every second to the threshold odour limit (Ou_E s^{-1}). The odour emission rate can be used in conjunction with dispersion modelling in order to estimate the approximate radius of impact or complaint (Hobson et al, 1995).

3.3. Dispersion modelling

3.3.1. Atmospheric dispersion modelling of odours: What is dispersion modelling?

Any material discharged into the atmosphere is carried along by the wind and diluted by wind turbulence, which is always present in the atmosphere. This process has the effect of producing a plume of air that is roughly cone shaped with the apex towards the source and can be mathematically described by the Gaussian equation. Atmospheric dispersion modelling has been applied to the assessment and control of odours for many years, originally using Gaussian form ISCST 3 and more recently utilising advanced boundary-layer physics models such as ADMS and AERMOD (Keddie et al. 1992). Once the odour emission rate from the source is known, (Ou_E s^{-1}), the impact on the vicinity can be estimated. These models can effectively be used in three different ways: firstly, to assess the dispersion of odours and to correlate with complaints; secondly, in a “reverse” mode, to estimate the maximum odour emissions which can be permitted from a site in order to prevent odour complaints occurring; and thirdly, to determine which process is contributing greatest to the odour impact and estimate the amount of required abatement to reduce this impact within acceptable levels (McIntyre et al. 2000). In this latter mode, models have been employed for imposing emission limits on industrial processes, odour control systems and intensive agricultural processes (Sheridan et al., 2002).

Any dispersion modelling approach will exhibit variability between the predicted values and the measured or observed values due to the natural randomness of the atmospheric environment. A model prediction can, at best, represent only the most likely outcome given the apparent environmental conditions at the time. Uncertainty depends on the completeness of the information used as input to the model as well as the knowledge of the atmospheric environment and the ability to represent that process mathematically. Good input information (emission rates, source parameters, meteorological data and land use characteristics) entered into a dispersion model that treats the atmospheric environment simplistically will produce equally uncertain results as poor information entered into a dispersion model that seeks to simulate the atmospheric environment in a robust manner. It is assumed that odour emission rates are representative of maximum odour events, source parameters accurately define the point of release and surrounding structures, meteorological conditions define the local atmospheric environment and land use characteristics describe the surrounding natural environment. These conditions are employed within the dispersion modelling assessment therefore providing good confidence in the generated predicted exposure concentration values.

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3.3.2. AERMOD Prime

The AERMOD model was developed through a formal collaboration between the American Meteorological Society (AMS) and U.S. Environmental Protection Agency (U.S. EPA). AERMOD is a Gaussian plume model and replaced the ISC3 model in demonstrating compliance with the National Ambient Air Quality Standards (Porter et al., 2003) AERMIC (USEPA and AMS working group) is emphasizing development of a platform that includes air turbulence structure, scaling, and concepts; treatment of both surface and elevated sources; and simple and complex terrain. The modelling platform system has three main components: AERMOD, which is the air dispersion model; AERMET, a meteorological data pre-processor; and AERMAP, a terrain data pre-processor (Cora and Hung, 2003).

AERMOD is a Gaussian steady-state model which was developed with the main intention of superseding ISCST3 (NZME, 2002). The AERMOD modeling system is a significant departure from ISCST3 in that it is based on a theoretical understanding of the atmosphere rather than depend on empirical derived values. The dispersion environment is characterized by turbulence theory that defines convective (daytime) and stable (nocturnal) boundary layers instead of the stability categories in ISCST3. Dispersion coefficients derived from turbulence theories are not based on sampling data or a specific averaging period. AERMOD was especially designed to support the U.S. EPA's regulatory modeling programs (Porter at al., 2003)

Special features of AERMOD include its ability to treat the vertical in-homogeneity of the planetary boundary layer, special treatment of surface releases, irregularly-shaped area sources, a three plume model for the convective boundary layer, limitation of vertical mixing in the stable boundary layer, and fixing the reflecting surface at the stack base (Curran et al., 2006). A treatment of dispersion in the presence of intermediate and complex terrain is used that improves on that currently in use in ISCST3 and other models, yet without the complexity of the Complex Terrain Dispersion Model-Plus (CTDMPLUS) (Diosey et al., 2002).

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3.3.3. Commonly used odour annoyance criteria utilised in dispersion models

An odour impact criterion defines the odour threshold concentration limit value above baseline in ambient air, which will result in an odour stimulus capable of causing an odour complaint. There are a number of interlinked factor, which causes a nearby receptor (i.e. resident) to complain. These include:

- Odour threshold concentration, odour intensity and hedonic tone-defined measurable parameters at odour source,
- Frequency of odour-how frequently the odour is present at the receptor location,
- Duration of odour-how long the odour persists at the receptor location,
- Physiological-previous experiences encountered by receptor, etc.

By assessing these combined interlinked factors, the ability for a facility to cause odour complaint can be determined. As odour is not measurable in ambient air due to issues in sampling techniques, limit of detections for olfactometers and the inability to monitor continuously, therefore dispersion models become useful tools in odour impact assessments and odour risk analysis. Dispersion modelling also allows for the assessment of proposed changes in processes within the MRTF without actually having to wait for the processes to be changed (i.e. predictive analysis).

When utilising dispersion models for impact assessment, specific impact criterion (odour concentrations) need to be established at receptors. For odour assessment in general terms, this is called an odour impact criterion, which defines the maximum allowable ground level concentration (GLC) of odour at a receptor location for a particular exposure period (i.e. $\leq$ 1.50 Ou_E m^{-3} at the 98th percentile of hourly averages). Commonly used odour annoyance criteria in Ireland, UK, Netherlands and other world wide countries are illustrated in *Table 2.1*. The odour

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concentration, % odour exposure at this odour concentration, the dislike ability, the dispersion model and industry it applies are presented (*see Table 2.1*).

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Table 2.1. Odour annoyance criterion used for environmental odours.

Country	Odour conc. limit (Ou_E m^3)	Percentile value (%)	Average time (minutes)	Industry type	Dispersion model	Type area it applies	Dislike ability (scale 0 to 20)	Application of criterion
Ireland	≤3.0[1]	98th	60	Intensive pig production	Complex 1	Limit value for existing pig production units	12.80	For all pig production units in Ireland
Ireland	≤1.50[2]	98th	60	Slaughter house	Complex 1/ISC ST3	Limit value for new slaughter house facilities	17.0	Limit value for new slaughter house facilities
Ireland	≤1.50[3]	98th	60	Balbriggan WWTP	ISC Prime/ISC ST3	Limit value at sensitive receptor locations	12.90	Limit value for existing facility at sensitive receptor locations.
UK	≤1.50[4]	98th	60	WWTP	ADMS/ AERMOD	Indicative odour exposure criterion for licensing	12.90	IPPC H4 Guidance Notes Part 1-Regulation and Permitting, Environment Agency
Ireland	≤3.0[3]	98th	60	Enniscorthy WWTP	ISC Prime/ISC ST3	Limit value at sensitive receptor locations	12.90	Limit value for existing facility at sensitive receptor locations.
UK	≤1.50[4]	98th	60	Livestock feed factory	ADMS/ AERMOD	Indicative odour exposure criterion for licensing	13.20	IPPC H4 Guidance Notes Part 1-Regulation and Permitting, Environment Agency
UK	≤1.50[4]	98th	60	Oil refinery	ADMS/ AERMOD	Indicative odour exposure criterion for licensing	13.20	IPPC H4 Guidance Notes Part 1-Regulation and Permitting, Environment Agency
NL	≤1.50[5]	98th	60	WWTP	Complex 1	Limit value to prevent odour nuisance new plant	12.90	Industry sector specific air quality criterion for odours in Netherlands

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Notes: [1] denotes reference BAT Note development for intensive agriculture sector & EPA, 2001. Odour Impacts and Odour emissions control for Intensive Agriculture. R&D Report Series no. 14. EPA, Johnston Castle, Wexford.

[2] denotes EPA, (2004). BAT Notes for the Slaughterhouse sector, EPA, Johnston Castle, Wexford.

[3] denotes Odour limit values used during EIA application for WWTP's.

[4] denotes Environment Agency, (2002). Technical Guidance Notes IPPC H4-IPPC, Horizontal Guidance for Odour, Part 1-Regulation and Permitting. Environment Agency, Bristol, UK.

[5] denotes EPA, 2001. Odour Impacts and Odour emissions control for Intensive Agriculture. R&D Report Series no. 14. EPA, Johnston Castle, Wexford

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Table 2.1. illustrates the range of odour impact criterion used in Ireland, UK and Netherlands. Waste handling and treatment plants have similar dislike ability to intensive pig production facilities and therefore it would be rational to suggest a similar odour impact criterion to intensive pig production facilities. Other factors that require consideration include, the location of the facility (sensitivity), the surrounding sensitive receptors, and amount of odour mitigation to be implemented into the overall design. For example in Ireland, pig production facilities are generally located in rural environments, whereby sensitive receptors in the vicinity of the facility are working in similar livestock operations and therefore do not consider the perceived odour as offensive as say a person not familiar with the odour. On the other hand the proposed MRTF will be located close to residential locations and therefore has to be treated as a potential sensitive site location. Taking into account these factors for the proposed MRTF, it is proposed that:

- All sensitive locations and areas of amenity should be located outside the 1.50 Ou_E m^{-3} at the 98th percentile of hourly averages over three meteorological year.
- All sensitive locations and areas of amenity should be located outside the 3.0 Ou_E m^{-3} at the 99.5th percentile of hourly averages over three meteorological year.

These proposed odour impact criterion is sufficiently conservative to provide protection to the community at large taking into account latest suggested odour impact criterion by environmental agencies in Ireland, UK and Netherlands. The 99.5th percentile of hourly averages is used to complement the 98th percentile of hourly averages to take account of predicted downwind odour concentrations during short time worst-case meteorological conditions.

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3.4. Meteorological data.

Rosslare Harbour meteorological station Year 2004 to 2006 inclusive was used for the operation of Aermod Prime. This allowed for the determination of the worst-case meteorological year for the determination of overall odour impact from the proposed MRTF on the surrounding population.

3.5. Terrain data.

Topography affects in the vicinity of the site were not accounted since the facility and emission point characteristics are considered simple in terms of terrain.

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4. Results

This section will present the results obtained from the study.

4.1. Odour emission data

Two data sets for odour emission rates were calculated to determine the potential odour impact of the proposed MSW handling operations in the MRTF building design utilising library based odour emission data. These scenarios included:

Ref Scenario 1: Predicted overall odour emission rate from proposed MRTF without the implementation of odour mitigation protocols (*see Table 4.1*).

Ref Scenario 2: Predicted overall odour emission rate from proposed MRTF design with the incorporation of odour management, minimisation and mitigation protocols (*see Table 4.2*).

~~4.2.~~ Odour emission rates from proposed MRTF operations with and without mitigation for atmospheric dispersion modelling Scenario 1 and 2

Table 4.1 and *Table 4.2* illustrate the overall odour emission rate from the proposed MSW handling area within the MRTF building without and with the implementation of odour mitigation techniques. The overall volume of treatment air for the mitigated scenario 2 is based on worst-case estimates. It is likely that the implementation of specific mitigation strategies will allow for the reduction of the air exchange rate from 4 AC/hr to 2.5 AC/hr depending on implemented strategy.

As can be observed in *Table 4.1*, the overall odour emission rate from the proposed MRTF without mitigation is high with a total odour emission rate of 56,472 Ou_E/s. This overall source odour emission rate is based on worst case estimated of maximum emissions that could occur from the MSW operations.

Table 4.2 illustrates the overall odour emission rate from the proposed MRTF with the implementation of odour mitigation strategies. The overall source odour emission is predicted to be at or less than 12,794 Ou_E/s.

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Table *4.1*. Predicted overall odour emission rate from proposed MSW handling area within the MRTF design (ref Scenario 1).

Source identity	Volumetric airflow rate (m^3/s)	Odour threshold conc. (Ou_E/m^3	Odour emission rate (Ou_E/s)
Main access door to MSW handling area in MRTF building	19.50	2896	56,472
Total odour emission rate (Ou/s)	**-**	**-**	56,472

Notes: [1] denotes volumetric airflow rate based on a open door area of 31.20 m^2, a wind coefficient factor of 0.25, an average wind speed of 3 m/s and it is assumed that the facility is operational between the hours of 6 AM and 10PM in terms of door operation.
[2] denotes that odour threshold concentration based on library data measured on similar facility operations.

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Table *4.2.* Predicted overall odour emission rate from proposed MRTF design with the incorporation of odour mitigation protocols (ref Scenario 2).

Source identity	Volumetric airflow rate (m^3/s)	Odour threshold conc. (Ou_E/m^3)	Odour emission rate (Ou_E/s)
MSW access door[1]	0	0	0
Carbon filtration odour control unit	25.59[2]	500[3]	12,794
Total proposed odour emission rate (Ou_E/s)	**-**		**12,794**

Notes: [1] denotes that the application of negative air extraction on the access doorway will result in no leakage of odours from the MSW handling area.
[2] denotes assumes that the total exchange rate of 4 AC/hr applied to the MSW handling area.
[3] denotes maximum allowable odour threshold concentration in the exhaust gas of the odour control unit (based on library data).
[4] denotes exhaust emission point at a height of 16 m and an efflux of 19 m/s

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Table 4.3. Comparison in odour emission rates for the proposed MRTF building with and without the implementation of odour mitigation.

Scenario identity	Odour emission rate ($Ou_E\ s^{-1}$)
Scenario 1-Proposed MRTF without abatement	56,472
Scenario 2- Proposed MRTF with abatement	12,794

Due to the implementation of odour mitigation protocols, there is an overall odour emission decrease of 4.41 times.

4.3. Results of odour dispersion modelling for the proposed MRTF operation and design

Aermod Prime was used to determine the overall odour impact of the proposed Greenstar Recycling MRTF to be located in Enniscorthy, Co. Wexford at as set out in odour impact criteria *Table 2.1*. The output data was analysed to calculate:

Ref Scenario 1:

- Predicted odour emission contribution of overall proposed MRTF operation without odour mitigation (*see Table 4.1*), to odour plume dispersal at the 98th percentile for an odour concentration of less than or equal to 1.50 $Ou_E\ m^{-3}$ (*see Figure 8.1*).

This odour impact criterion was chosen for the proposed MRTF in order to ascertain the level of proposed odour impact to the surrounding residential and industrial population in the vicinity of the proposed MSW handling area within the MRTF without mitigation.

Ref Scenario 2:

- Predicted odour emission contribution of overall proposed MRTF operation with odour abatement protocols implemented (*see Table 4.2*) to odour plume dispersal at the 98th percentile for an odour concentration of less than or equal to 0.70 $Ou_E\ m^{-3}$ (*see Figure 8.2*) for 3 years of hourly sequential meteorological data.
- Predicted odour emission contribution of overall proposed MRTF operation with odour abatement protocols implemented (*see Table 4.2*) to odour plume dispersal at the 99.5th percentile for an odour concentration of less than or equal to 1.0 $Ou_E\ m^{-3}$ (*see Figure 8.3*) for 3 years of hourly sequential meteorological data.

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These computations give the odour concentration at each Cartesian grid receptor location that is predicted to be exceeded for 0.50% (44 hours) and 2% (175 hours) of a standard meteorological year.

This will allow for the predictive analysis of any potential impact on the neighbouring sensitive locations while the facility is in operation. It will also allow the operators of the MRTF site to assess the effectiveness of their suggested odour abatement/minimisation strategies. The intensity of the odour from two or more sources of the MRTF operation will depend on the strength of the initial odour threshold concentration from the sources and the distance downwind at which the prediction and/or measurement is being made. Where the odour emission plumes from a number of sources combine downwind, then the predicted odour concentrations may be higher than that resulting from an individual emission source. It is important to note that various odour sources have different odour characters. This is important when assessing those odour sources to minimise and/or abate. Although an odour source may have a high odour emission rate, the corresponding odour intensity (strength) may be low and therefore it is easily diluted. Those sources that express the same odour character, as an odour impact should be investigated first for abatement/minimisation before other sources are examined as these sources are the driving force behind the character of the perceived odour.

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5. Discussion of results

This section will discuss the results obtained during the study.

5.1. Odour plume dispersal for proposed MRTF without odour mitigation

The plotted odour concentrations of ≤ 1.50 Ou_E m^{-3} for the 98th percentile for the proposed MRTF operation without odour mitigation is illustrated in *Figure 8.1*. As can be observed, it is predicted that odour plume spread is large with a radial spread of up to 250 metres from the boundary. In accordance with odour impact criterion in *Section 3.3.3*, and in keeping with currently recommended odour impact criterion in this country, odour impact could be perceived by receptors in the vicinity of the proposed MRTF. Greater odour impact will be perceived by properties located to the north east and south of the facility operations. A total of 15 residential properties will perceive an odour concentration greater than 1.50 Ou_E/m^3 at the 98th percentile for three years of meteorological data. Therefore, odour mitigation measures will require to be implemented into the overall design of the MRTF.

5.2. Odour plume dispersal for proposed MRTF with the incorporation of odour mitigation protocols

The plotted odour concentrations of ≤ 0.70 Ou_E m^{-3} for the 98th for the proposed MRTF operation with the implementation of odour mitigation are illustrated in *Figure 8.2*. As can be observed, it is predicted that odour plume spread is small with a radial spread of 20 metres from the boundary of the facility in a northerly direction. In accordance with odour impact criterion in *Section 3.3.3*, and in keeping with currently recommended odour impact criterion in this country, no long-term odour impacts will be generated by receptors in the vicinity of the proposed MRTF. This is approximately 53% lower than the specified odour impact criterion contained in Table 2.1 and therefore it is concluded that no odour impact will be perceived in the vicinity of the facility for the reported data set.

The short-term odour impact associated with the MRTF operation was assessed by examining the odour plume spread at the 99.5th percentile odour concentration of less than or equal to 1.0 Ou_E m^{-3} for three years of meteorological data. As can be observed in *Figure 8.3,* the radial odour plume spread for the proposed MRTF operation is 20 metres from the boundary of the proposed facility. This is 66% lower than the require odour impact criterion contained in Section 3.3.3. No short-term odour impacts should be perceived in the vicinity of the proposed MRTF by residential or industrial properties.

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6. Conclusions

A worst-case odour emission scenario was modelled using the atmospheric dispersion model Aermod Prime with meteorology data representative of the study area. A worst-case odour emission data set was used to predict any potential odour impact in the vicinity of the proposed MSW handling area within the MRTF building. Odour impact potential was discussed for the proposed operation of the MRTF with and without the implementation of mitigation protocols. It was concluded that:

- In accordance with odour impact criterion in *Table 2.1*, and in keeping with current recommended odour impact criterion in this country, odour impact could be perceived by residents in the vicinity of the proposed MRTF if odour mitigation measures are not implemented.
- In accordance with odour impact criterion in *Table 2.1*, and in keeping with current recommended odour impact criterion in this country, no significant odour impact will be perceived by residents in the vicinity of the proposed MRTF following the installation of proposed odour management, minimisation and mitigation protocols. The overall perceived impact of odours as a result of proposed mitigation will result in ground level concentrations of odours approximately 53% and 63% lower than the 98th and 99.5th percentile guideline values to minimise odour impact.
- Those management and mitigation strategies discussed through this document should be considered within the design of the proposed section of building handling and processing municipal solid waste (MSW) only.

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7. Recommendations

The following recommendations were developed during the study:

1. Odour management, minimisation and mitigation procedures as discussed within this document in general will be implemented at the proposed MSW handling area for the MRTF building in order to prevent any odour nuisance in the surrounding vicinity (*see Section 9.6, 9.7 and 9.8*).
2. Maintain good housekeeping practices (i.e. keep yard area clean, etc.), closed-door management strategy (i.e. to eliminate puff odour emissions from MSW building), and clean fouled surfaces regularly to minimise the generation of odours within the sub section building for handling MSW.
3. Ensure that the building fabric skin for the MSW handling area is tight to prevent the fugitive release of odours as a result of wind and temperature pressure effects. In terms of this assessment it is assumed that a good building skin with no gap will be installed for this area. It has been assumed that an air exchange rate of 4 AC/hr will be implemented. This air exchange rate could be reduced to between 2 and 2.5 AC/hr if a tight building skin with joint taping, individual clad sheet sealing and flexi seal of apex, eves and rising push wall occurs. The confirmation of the effectiveness of such sealing would be verified before operation through smoke testing. In addition, the fitting of air curtains to the rapid roller access doors would ensure minimal leakage through the door opening and therefore allow for the operation of the ventilation system at this reduced air exchange rate.
4. Implement and operate a negative air extraction and odour treatment system to minimise the emissions of odours from the MSW handling section of the overall building.

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8. Appendix I-Odour dispersion modelling contour results

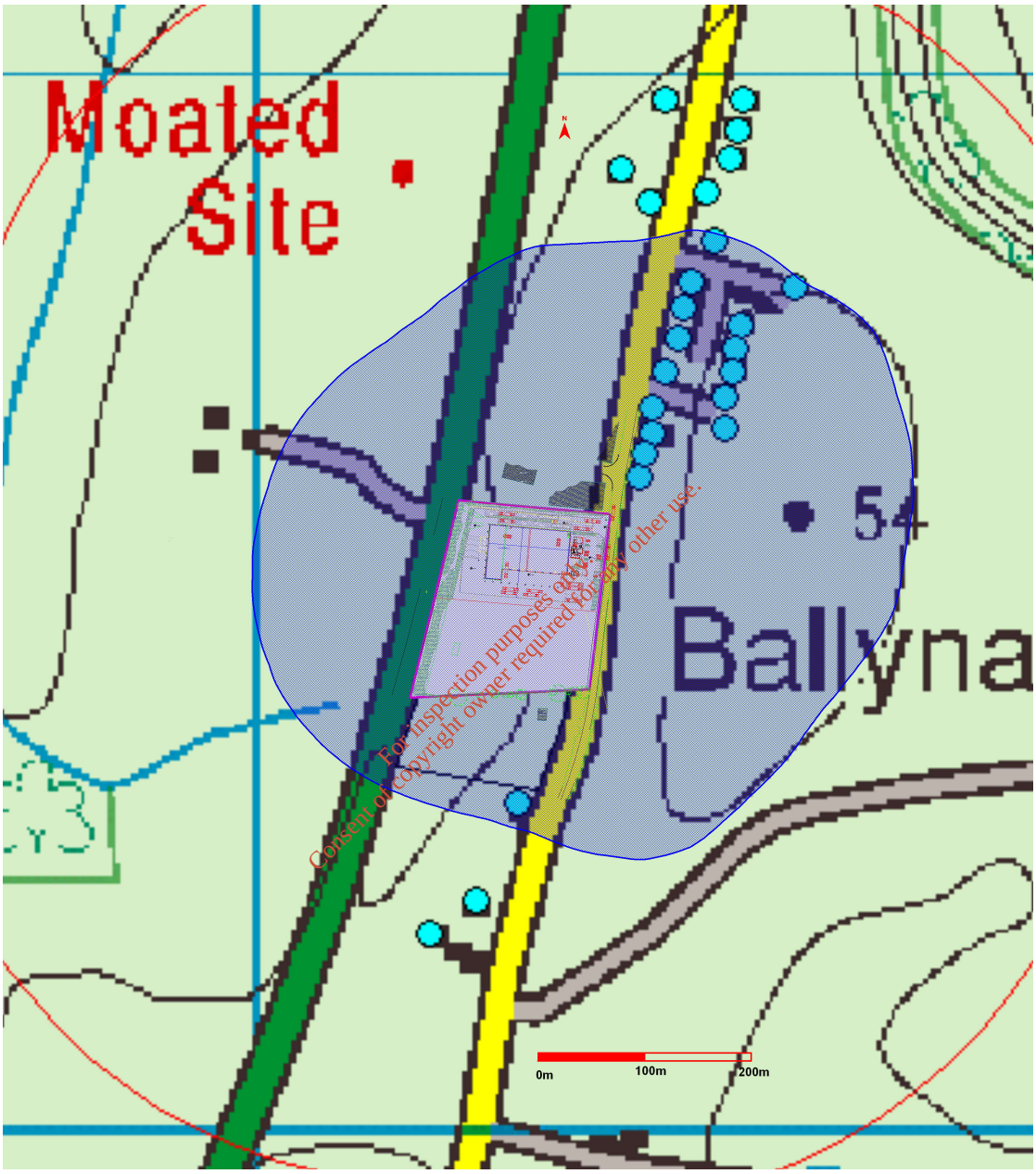

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Figure 8.1. Predicted odour emission contribution of proposed overall proposed Greenstar Recycling MRTF operation without odour abatement protocols implemented to odour plume dispersal for the 98th percentile for an odour concentration of ≤ 1.50 Ou_E m^{-3} (——) for 3 years of hourly sequential meteorological data from Rosslare Harbour (2004 to 2006 inclusive).

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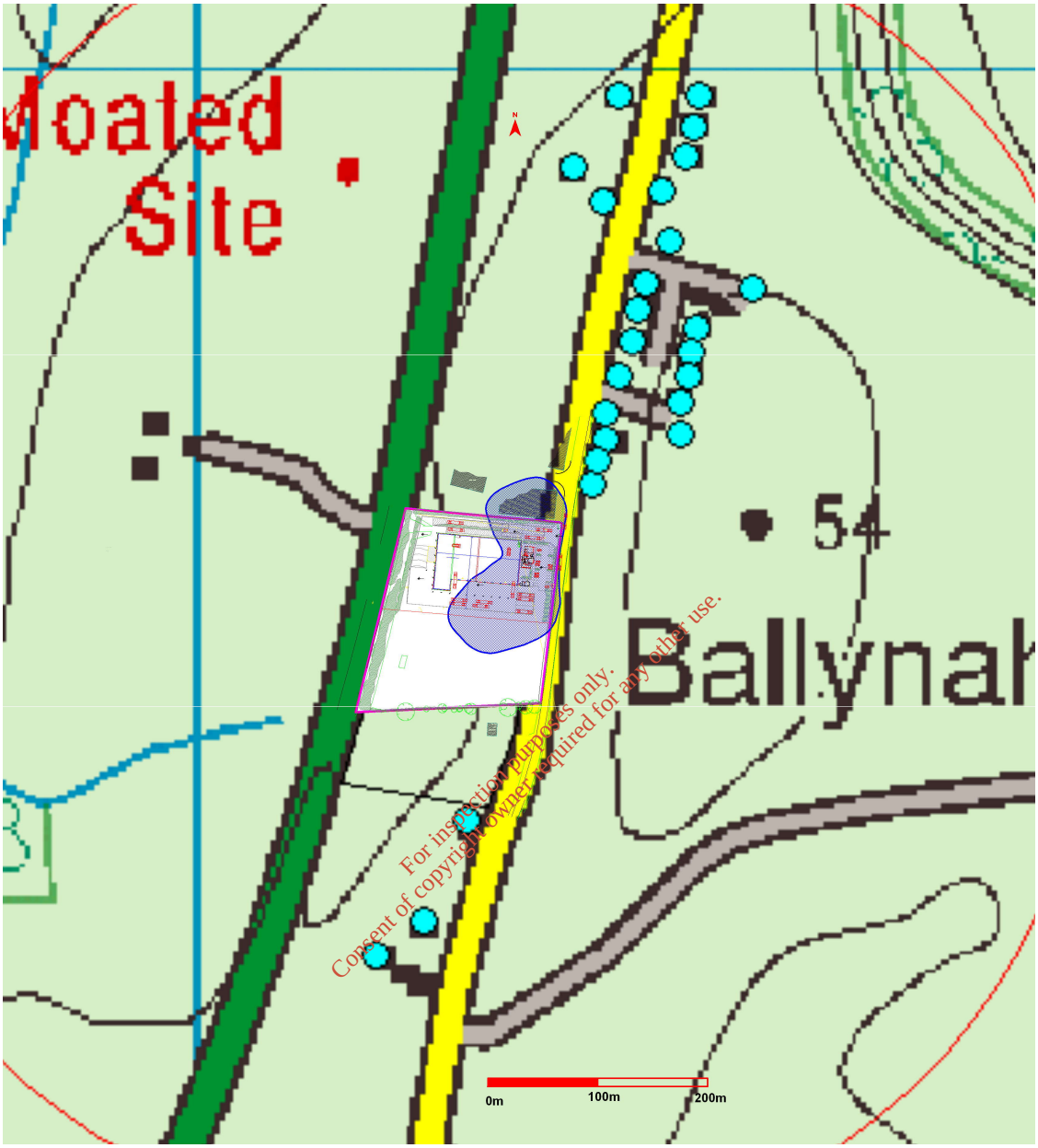

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Figure 8.2. Predicted odour emission contribution of proposed overall proposed Greenstar Recycling MRTF operation with odour abatement protocols implemented to odour plume dispersal for the 98th percentile for an odour concentration of $\leq$ 0.70 Ou_E m^{-3} (——) for 3 years of hourly sequential meteorological data from Rosslare Harbour (2004 to 2006 inclusive).

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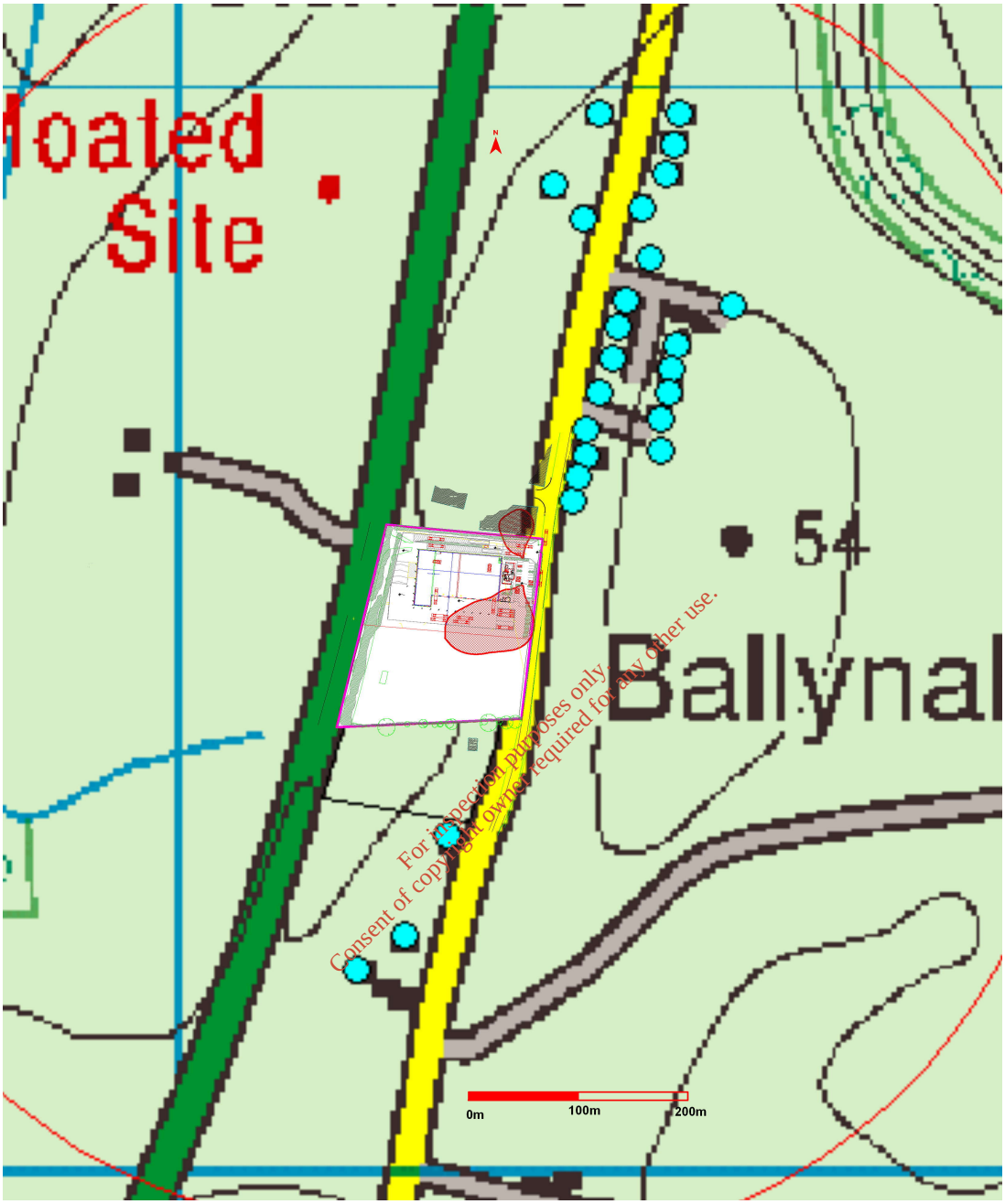

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Figure 8.3. Predicted odour emission contribution of proposed overall proposed Greenstar Recycling MRTF operation with odour abatement protocols implemented to odour plume dispersal for the 99.5th percentile for an odour concentration of $\leq$ 1.0 Ou_E m^{-3} (▬) for 3 years of hourly sequential meteorological data from Rosslare Harbour (2004 to 2006 inclusive).

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9. Appendix II Information on odours pertaining to MRTF odour impact assessment.

9.1. Legislation pertaining to odours in Ireland

The Public Health Act of 1878 introduced legislation to control nuisance in Ireland, but its execution only became viable after the implementation of the Planning and Development Act (1963) (Scannell, 1995). Any industry producing a nuisance was controlled under these regulations and subsequent pressure from environmental lobby groups together with the development of scientific measurement techniques made it practical to quantify and control the release of gaseous environmental pollutants from these enterprises.

Odour impact from a waste treatment facility on the surrounding vicinity may be considered a nuisance. Section 107 of the Public Health Act 1878 states that “sanitary authorities are bound to inspect their district for nuisances. Upon the receipt of any information respecting the existence of a statutory nuisance, the sanitary authority is obliged, if satisfied of the existence of the nuisance, to serve an abatement notice on the person by whose act or default the nuisance arises or continues or, if such a person cannot be found, on the owner or occupier of the premises on which the nuisance arises” (Scannell, 1995).

In order to control the possible pollution effects of large developments, relevant legislation was enacted under the Environmental Protection Agency (EPA) Act of 1992. Private and public sector developers of certain types and sizes of projects are required under section 72(4) of the EPA Act (1992) to submit a copy of an Environmental Impact Statement. If the project is of a class listed in Part II of the first schedule to the 1989 EIA regulations but does not exceed the threshold or criteria specified, the planning authority must require an Environmental Impact Statement (EIS) if it considers the project is likely to have a significant impact on the environment. One of those impacts relates to odour and is defined as environmental pollution in section 4(2) of the EPA Act (1992), as to cause a nuisance through noise or odour and/or adversely affect the countryside or place of special interest (Scannell, 1995).

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Waste licensing and Integrated Pollution Control Licensing (IPC) (now IPPC) for specified facility types was implemented in 1996 by the EPA and the related guidance note was termed BATNEEC (Best Available Technology Not Entailing Excessive Cost) (i.e. now BAT which complement the BATNEEC Notes) (EPA, 1996). It set out specific conditions for these specific industries (i.e. Intensive Agricultural Production, Landfills, Waste transfer stations, etc) to be implemented in order to comply with the environmental requirements of the EPA. Minimisation of odour emissions and complaints is one of the requirements of the BATNEEC Guidance Note for industries likely to cause odour emissions. For example, a typical IPC license/Waste license condition states “that there shall be no emission to the atmosphere of environmental significance and that all operations on site shall be carried out in a manner such that air emissions and/or odours do not result in significant impairment and/or interference with amenities beyond the site boundary and at odour sensitive locations in the area” (EPA, 1996).

Local authorities and the EPA have responsibility for ensuring enterprises meet their planning and environmental requirements. Where these facilities are found to be causing odour nuisance, local government enforces Section 29 of the 1987 Air Pollution Act and serves the offenders with an abatement notice. If the facility is licensed as an IPC or Waste enterprise, the EPA can enforce the conditions of the license and either serves the facility with non-compliances for odour detected beyond the site boundary or prosecute the facility and seek a high court injunction to close the facility. Verification for the presence of odour nuisance usually encompasses the licensing officer visiting the facility and detecting the odour beyond the boundary.

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9.2. Characterisation of odour.

The sense of smell plays an important role in human comfort. The sensation of smell is individual and unique to each human and varies with the physical condition of the person, the odour emission conditions and the individual's odourous education or memory. The smell reaction is the result of a stimulus created by the olfactory bulb located in the upper nasal passage. When the nasal passage comes in contact with the odourous molecules, signals are sent via the nerve fibres where the odour impressions are created and compared with stored memories referring to individual perceptions and social values. Since the smell is individual some people will be hypersensitive and some will be less sensitive (ansomia). Therefore, the sense of smell is the most useful detection technique available as it specialises in synthesising complex gas mixtures rather than analysing the chemical compound (Sheridan, 2000).

9.3. Odour qualities

An odour sensation and complaint consists of a number of inter-linked factors. These include:

- Odour threshold/concentration,
- Odour intensity,
- Hedonic tone,
- Quality/Characteristics
- Component characteristics

The odour threshold concentration dictates the concentration of the odour in Ou_E m^{-3}. The odour intensity dictates the strength of the odour. The Hedonic quality allows for the determination of pleasantness/unpleasantness. Odour quality/characteristics allow for the comparison of the odour to a known smell (i.e. turnip, like dead fish, flowers). Individual chemical component identity determines the individual chemical components that constitute the odour (i.e. ammonia, hydrogen sulphide, methyl mercaptan, carbon disulphide, etc.). Once odour qualities are determined, the overall odour impact can be assessed. This odour impact assessment can then be used to determine if an odour minimisation strategy is to be implemented and if so, which technology. Additionally, by suitably characterising the odour through complaint logs, the most likely source of the odour can be determined. This allows for the implementation of immediate odour mitigation techniques to prevent such emission in the future.

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9.4. Perception of emitted odours.

Complaints are the primary indicators that odours are a problem in the vicinity of any facility. Perceptions of odours vary from person to person, with several conditions governing a person's perception of odour:

- **Control:** A person is better able to cope with an odour if they feel it can be controlled.
- **Understanding:** A person can better tolerate an odour impact if they understand its source.
- **Context:** A person reacts to the context of an odour as they do to the odour itself (i.e. rancid odour source due to waste).
- **Exposure:** When a person is constantly exposed to an odour:
    - They may lose their ability to detect that odour. For example, a facility operator who works in the facility may grow immune to the odour *or*
    - There tolerance to the odour grows smaller and they complain more frequently.

From these criteria, we can predict that odour complaints are more likely to occur when:

- A new facility locates in areas where people are unfamiliar with facilities;
- When a new process establishes within the facility (i.e. anaerobic digestion processes);
- Or when an urban population encroaches on an existing facility.

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The ability to characterise odours being emitted from the facility will help to develop a better understanding of the impact of the odour on the surrounding vicinity. It will also help to implement and develop better techniques to minimise/abate odours using existing technologies and engineering design. The correct recording of odour complaints data is very important to resolving any odour impact.

9.5. Characteristics of Waste odours

Odours from MSW handling arise mainly from the uncontrolled anaerobic biodegradation of waste to produce unstable intermediates. Other odours come directly from the material and handling/processing of the material. Odours are generated by a number of different components, the most significant being the sulphur containing compounds (thiols, mercaptans, hydrogen sulphide), volatile fatty acids (butyric acid, valeric acid), amines (methylamine, Dimethylamine), phenols (4-methylphenol), chlorinated hydrocarbons (trichloroethylene, tetrachloride), etc. (Dawson et al. 1997). Most of these compounds have very low odour threshold concentrations as illustrated in *Table 9.1*. Different concentrations and mixtures of these compounds can intensify or reduce odour threshold concentration, determined as synergism and antagonism respectively.

Table 9.1. Odour detection thresholds of wastewater odour precursors.

Chemical component	Threshold Conc. (mg m^{-3})	Odour character
Ammonia	0.03-37.8	Pungent, sharp, irritating
Methylamine	0.0012-6.1	Fishy, Putrid Fishy
Trimethylamine	0.00026-2.1	Fishy, Pungent fishy
Dimethylamine	0.34 ppmv	Putrid fishy
Ethylamine	0.27 ppmv	Ammonia like
Triethylamine	0.48 ppmv	Fishy
Pyridine	0.66 ppmv	Sour, putrid fishy
Indole	0.0006-0.0071	Faecal, nauseating
Skatole	0.00035-0.00078	Faecal, nauseating
Hydrogen Sulphide	0.0005-0.002	Rotten eggs
Methyl mercaptan	0.0000003-0.038	Rotten cabbage
Ethyl mercaptan	0.000043-0.00033	Decaying cabbage/flesh
Propyl mercaptan	0.0001 ppmv	Intense rotten vegetables, Unpleasant
Allyl mercaptan	0.0001 ppmv	Garlic, coffee
Benzyl mercaptan	0.0003 ppmv	Skunk, unpleasant
Thiocresol	0.449 ppmv	Skunk
Dimethyl disulphide	0.000026 ppmv	Rotten vegetables
Carbon disulphide	0.0077-0.0096 ppmv	Rubber, intense sulphide
Acetic acid	0.024 to 0.120	Vinegar
Butyric acid	0.0004-42	Rancid
Valeric acid	0.0008-0.12	Sweaty, rancid
Propionic acid	0.028 ppmv	Rancid, pungent
Hexanoic acid	0.018 to 0.096	sharp, sour, rancid odour, goat-like odour
Formaldehyde	0.05 to 1.0 ppm	Pungent, medicinal
Acetone	0.067 ppmv	Pungent, fruity, sweet
Butanone	0.128	Sweet, solventy
Acetophenone	0.05 to 0.10 ppmv	Sweet pungent odour of orange blossom or jasmine
Limonene	0.063	Intense orange/lemons
Alpha Pinene	0.006 ppmv	Intense pine, fresh
THN Tetrahydronaphthalene	-	Meat

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O'Neill & Phillips et al. (1992) and Suffet at al., 2004.

9.6. Odour compound formation from the proposed development

Odour formation from the handling of MSW mainly airse from the following activities. These include:

- Waste tipping;
- •Waste movement through front-end loader operation. Sealed refuse sacks are broken easily and emit odourous compounds and trapped gases;
- •Waste movement through use of grab; the waste is removed and thrown into the trailer using a grab. This movement allows for the stripping and volatilisation of odourous compounds from the waste matrix. Waste refuse sacks are squeezed and odourous gases are released;
- Waste storage within the building has the potential to contaminate any air in contact with the waste. Also anaerobic conditions proliferate and the waste "cooks";
- Other minor sources include waste trucks, waste storage trucks, grease traps, oil separator and exposed manholes around the yard. Generally, these sources are insignificant to overall emissions but localised complaints may be received from local walkers especially if a grease trap does not operate properly and are not cleaned regularly;
- All dirty surfaces especially in warmer summer months radiate odour. It is important to clean and disinfect using appropriate regulated agents;
- Dust deposits within the building radiate odour and increase background odours within the building;
- Waste sorting lines are generally low odourous sources due to the high dry matter content and low organic matter content with the waste matrix. In-frequently they may become odourous due to material process type. This list is non-exhaustive.

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9.7. Odour management plan

The Odour Management Plan (OMP) is a core document detailing operational and control measures appropriate to management and control of odour at a site. The format of the OMP provides sufficient detail to allow operators and maintenance staff to clearly understand the odour management operational procedures for both normal and abnormal conditions.

The OMP includes sufficient feedback data to enable site management (and local authority inspectors) to audit site operations on odour management. An example of some of the issues to be considered are summarised as follows.

- A summary of the site, odour sources and the location of receptors,
- Details of site management responsibilities and procedures for reporting faults, identifying maintenance needs, replenishing consumables and complaints procedure,
- Odour management equipment operation procedures (e.g. correct use of equipment, process, materials, checks on equipment performance, maintenance and inspection (*see Section 3.4*),
- Operative training,
- Housekeeping,
- Maintenance and inspection of plant (both routine and emergency response),
- Spillage/contaminated surface management procedures,
- Record keeping – format, responsibility for completion and location,
- Emergency breakdown and incident response planning including responsibilities and mechanisms for liaison with the local authority.
- Public relations.

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The Odour Management Plan will be regularly reviewed and upgraded. It should form the basis of a document Environmental and Odour Management system for the operating site. The Odour Management System (OMS) documentation defines the roles of the Plant Operator and staff and sets out templates in relation to the operating of the facility and reporting procedures to be employed. Requirements for the Odour management plan should be implemented thought-out the site with a branched management system implemented in order to share responsibility around the site. The site manager will ensure all works are performed in accordance with the OMP. The OMP will be integrated in the overall Environmental Management/Performance System for the site.

Greenstar Recycling will develop in agreement with the regulatory authority and implement a detailed odour management plan for the actual as built plant before commencement of treatment of waste at the proposed MRTF to be located in Enniscorthy, Co. Wexford.

9.8. General rules for reduction of odour emissions for wastewater treatment plants operation by design.

General process layout

The following requirements will be adhered to when designing the layout of the MSW handling building. These include:

- Segregation and where possible enclosure of the area/plant used to handle odorous waste to prevent odours from permeating areas used to handle non odorous waste streams.
- Minimisation of the number and area of access doors to the odorous waste handling area.
- Minimisation of the duration that access doors are open, by installation of fast closing doors.
- Provision of air curtains to reduce turbulence during entry of vehicles through external access doors and minimise the risk of displacement of building air to the atmosphere.
- Optimisation of the building infrastructure in this area (including walls and roofs) to reduce leakage.
- The total MSW building volume will be approximately 23,031 m^3. Internal wall should be constructed of materials, which minimise the routes for air leakage and the mixing of relatively non-odourous air with odourous air. Odour generating processes should be hood/specific duct ventilated where possible. This will significantly reduce the requirements of large treatment volumes. In general, approximately 4 AC/hr are required to minimise odour release. The implementation of air curtains on access doors, high quality clad joint taping and sealing could result in significant reduction of overall air exchange rate (i.e. down to 2 to 2.5 AC/hr). Integrity testing of the building fabric and containment systems before commencement of works will confirm whether this reduced air exchange rate can be used.
- Generally locate odourous processes together and away from doorways. This will allow for the focused optimisation of odour extraction.

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Minimisation of odour development

Building design plays a part in odour control largely in the sphere of maintenance, by ensuring that materials capable for generating odours are not trapped in inaccessible places and that their removal by cleaning agents is carefully regulated. The following principles are particularly applicable to plants handling putrescent materials, but have a general validity for all processes handling potentially odourous products:

- Floors of processing areas should be impervious, easy to clean, robust, in good repair and resistant to corrosion by raw materials, products of the process and cleaning agents.
- Floors should be divided in discrete areas by walls or troughs to contain waste water or other cleaning fluids in relatively small areas. The uncontrolled dispersion of odours from washing waters should be rigorously avoided.
- Floors should slope towards drains.
- Wash waters and liquid effluents should be collected in drains fitted with easily cleared traps

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to collect solids.
- Walls should have similar characteristics to floors and be easily cleaned.
- Buildings should be well lighted with emphasises in the detection of waste accumulations.
- Plants should be mounted on the floor in such a way as to facilitate cleaning and drainage.
- All conveyors and ducts should have sufficient slope to facilitate cleaning and drainage.
- Conveyors, ducts and pipes should be mounted away from walls, floors and ceilings and other equipment to prevent traps for soil and to facilitate access for maintenance and cleaning.

Ensure the building fabric is sealed through utilisation of two possible methods.
- The sealing of the stress points in the building fabric using expanding foam application. The predominate areas of application include the area between the rising concrete push wall and the clad structure, all flashing points to include the eves and apex of the building, area around flashing of roller shutter doors, area of flashing around smoke release fire vents. All wire entry points should also be sealed. There should be essentially no ventilation points into the building apart from scheduled fresh air intake points for make up air into the building during negative extraction. All joints should essentially be sealed.
- The taping and flexi sealing of all joints on the MSW handling building.
- Any material used to seal the building fabric should meet the requirements of the of fire safety and insurance standards (i.e. EN and ISO certified). The Health and Safety at work Act (2005) should also be considered.

The following should be specified before application:
- Fire Safety Standard requirements (EN and ISO requirements),
- Application depth required for noise abatement and sealing efficiency,
- Requirements for any antistatic impregnation to prevent dust build-up,
- Finish type and colour to take account of cleaning and appearance.

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Doorways for machinery/lorry access/personnel access

One of the primary identified odour escape point on waste recovery and transfer facilities is open doorways. The number of access doorways to the waste handling area should be minimised and fitted with fast acting doors. Such fast acting doors should consider fixed panel type and gasketed to prevent odour leakage from them while they are closed. All access doorways to be used for the acceptance of odourous waste where possible should be fitted with air curtains. This will facilitate the reduction on overall air extraction rates.

The following requirements should be considered for access doorways including personnel doorways:
- Minimise the number of doorways accessing the odourous waste handling and processing area,
- All machinery doorways should be fitted with fast acting roller shutter doors. The rigid fast open and close type with integrated controller should be specified.
- All machinery doorways accessing the odourous area should be interlocked so as to prevent opening together. This will minimisation of wind tunnel affects within the building and the release of large quantities of odour from the building. This will also minimise the pressurisation of the process building and minimise the release of odours area through the building fabric.
- All personnel access doorways should be self-closing and alarmed to prevent opening over long periods of time.
- All machinery access doorways to the waste process area should be fitted with air curtains so as to prevent the release of odours from the building during door opening.
- The process layout should be designed so as to allow the lorries/handling equipment to

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fully fit into the building so as to allow the rapid roller door to close while tipping, filling and movement of waste.
- In addition to air curtains, doorways should be fitted with heavy-duty PVC curtains to a height of 3.6 metres above ground level.
- Air curtain design should be specified for a wind speed factor of 9 m/s and be automatically actuated to operate when the rapid roller door commences opening. The air curtain should be fitted to the outside of the doorway so as to prevent pressurisation of the waste processing building and prevent floor bounce of odourous air (i.e. if fitted on the inside of the door within the waste processing building). The air curtain should provide sufficient air mass to prevent curving in wind speeds ranging from 0 to 9 m/s.
- All equipment/lorry access and personnel doorways should be alarmed and self closing.

Maintenance, monitoring and management issues.

The final issue to consider from the perspective of maintaining effective control of odours generated from the facility relates to the implementation of robust maintenance and monitoring procedures, and ensuring that the management of the facility is optimised to reduce the risk of avoidable emissions of odour to a minimum.

The specific recommendations, having regard to the improvements identified in the preceding section and the operational requirements at the site, are as follows:

- The duration that vehicles used to deliver and collect waste are retained outside the building should be reduced to a minimum.
- The duration that odorous material is retained within the MSW handling area should be minimised as far as possible.
- The responsibility for maintenance and operation of the odour minimisation systems (i.e. building fabric, rapid roller doors, air curtains, etc.) applied at the site should be allocated to named members of staff. Training should be provided to ensure that staff are fully aware of the operation of the system, and the actions to be taken in the event of malfunction or process failure.
- All routine and reactive monitoring and maintenance activities should be documented and incorporated into the site document management system.
- All air curtains and doors should be inspected daily to ensure correct operation and to identify the need for remedial measures. Any damage to the doors or the building, which compromises the containment efficiency of the building, should be rectified as a matter of priority.
- Essential spares should be retained on site to enable prompt response to plant malfunction. A full list of such spares should be developed once the final design of the system has been confirmed.
- Olfactory monitoring should be performed around the site boundary on a daily basis to identify waste odour. Where odours are detected, the source of the release should be investigated and suitable remedial action implemented as a priority.

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9.9. Complaints management and recording

It is generally accepted that the handling of MSW must deal with nuisance odour complaints. It is therefore no new information to expect odours from MSW if proper design and control techniques are not implemented for the control of odour from these facilities. A systematic response to odour complaints will minimise the amount of effort spent dealing with the issue and minimise the potential for litigation and other negative outcomes. As part of an Environmental Management System, a dedicated recording system should be put in place to allow for the analysis of odour complaints. As part of this Environmental Management System, quickly accessible records should be available for odour abatement system controlling odour emissions on site. This allows for the analysis of system

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upset in conjunction with the receipt of complaint. The odour complaint investigation begins as soon as the complaint is received. Gathering information from the complainant is a crucial step in determining the source of the offending odour. Someone who can understand and act on the information received should immediately handle the investigation, typically a lead operator or plant manager. If they are not available, the person receiving the complaint should be trained and equipped to obtain the appropriate information. It is also important to maintain a professional and compassionate demeanor. The person registering the complaint should know that the issue is being taken seriously and that an investigation will be quickly undertaken. Don't take offense to the complaint and don't be surprised if the complainant is upset, odours can elicit strong emotional responses. The professionalism exhibited by the staff member taking the call can go a long way to calming someone upset by nuisance odours. Information from the complainant should be taken in a systematic process. A pre-prepared form for logging information should be available and used so important information is requested and recorded.

In order to analyses complaints accurate complaints recording should be performed. The most important factors associated with odour complaint recording include:

- Easily contactable phone number or web page for complainant to discuss their respective complaint. A free phone number is preferable. During normal working hours, an experienced person who is familiar with the process should answer the phone. Only during out of hours should an answer phone be used. The answer phone should clearly state the information required of the complainant. The complainant should always be contacted back if a message is recorded. The least desirable means of receiving a complaint is via an elected official or governing body. If someone has resulted to this method of complaining it probably means one of the methods noted above was not available or easy to work through. No matter what method is used to receive odour complaints, it is important that a system be established to provide prompt feedback.

- Clearly established questions and format of recording in order to isolate the most relevant information. This includes;
- Date and time of complaint (very important)
- Name of complainant,
- Location of complainant,
- Duration of complaint,
- Where they detected the odour,
- How strong the odour is (Intensity on a scale of 0 to 5 where 0 is not perceptible, 1 is very weak, 2 is weak, 3 is distinct, 4 is strong and 5 is very strong)?
- What did the odour smell like-A number of random descriptors should be proposed by the MSW representative or offered by the resident (saying that the odour smells bad is not sufficient),
- Details of the responses made to the complainant.

- Monitoring of meteorological data onsite using a met station recording data in accordance with World Meteorological Organization (WMO).

- The person responsible for complaint recording if not exposed to odour should visit the complainant location immediately and perform subjective analysis of the immediate area. The most important of these tools are the investigators own nose, eyes and ears. If appropriate (i.e. characteristic rotten eggs odour detected), continuous monitors should be put in place at the location. The complainant location should also be geo referenced and relative direction to north from the facility should be calculated and added to the complaint register. Monitoring odours in the field can be a difficult task. The odours detected by the complainant may have significantly or completely abated by the time the investigator arrives on the scene. Brief interaction with the complainant should be performed. The personnel responsible with field inspections should be familiar with all major odour sources on site including odour characteristics.

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- Visual observation of the complaint area is also important and should be recorded. Details regarding the location where the odour was perceived, over how broad an area and whether the odour was detected indoors or outdoors should be discussed with the complainant. This will help determine if the odour is coming directly from your system and impacting the neighborhood.

- Complaints should be assessed taking into account the following factors:
  - The quality of the complaint;
  - The volume of complaints against the alleged nuisance;
  - The frequency of complaints, e.g. is it a one-off event or a regular occurrence?
  - Knowledge of potential sources other than the facility.

- The person responsible for complaint recording should contact processes operators/maintenance personnel and record any process anomalies, upsets or maintenance activities that may have lead to the release of odours from your system.

- All complainant response procedures should be file and available for inspection by the relevant regulatory body.

Table 9.2 illustrates a typical odour complaint recording form for use within an Environmental Management System. This will be used in conjunction with the Odour abatement equipment management procedures/system.

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Table 9.2. Odour complaint recording form.

Record No.:_____	**Odour complaint recording form**		
Complainant details			
Complainant name		**Date of complaint**	
Complainant location (grid reference-N &E)		**Time of complaint (24hr clock)**	
Duration of complaint (minutes)		**Type of complaint (i.e. odour, noise,)**	
Name of person logging complaint		**How was complaint received (phone, etc)**	
How long till complainant contacted back (minutes)		**Complainant address:**	
Notes:			

Odour characteristics			
Odour intensity (0 to 5)	**Please tick one**	**Odour hedonic tone (0 to 4)**	**Please tick one**
No odour (0)		**Neutral odour (0)**	
Very weak odour (1)		**Mildly unpleasant (-1)**	
Weak odour (2)		**Moderately Unpleasant odour(-2)**	
Distinct (they can clearly recognise the odour) (3)		**Unpleasant odour (-3)**	
Strong odour (4)		**Very unpleasant odour (-4)**	
Very strong odour (5)			
What did the odour smell like-Descriptor? Please refer to *Section 1.10*			
Is the odour fluctuating or constant?			
Is the complainant a resident (R) of commercial receptor (C)?			
Notes:			

Weather condition *Please append historical records from met station to this record*			
Wind speed (m/s)		**Temperature (^{0}C)**	
Wind direction (from plant to complainant)		**Relative humidity (%)**	
Solar irradiance (W/m^2)		**Cloud cover (0 to 8)**	
Precipitation & Rainfall (mm/m^2)		**Cloud height (low, medium, high)**	
Notes:			

Complaint logging personnel only			
Name of personnel:		**Did you detect an odour?**	
Have you received training (Y/N)		**What did it smell like-Descriptor?**	
How fast was your response time (minutes)		**Distance of odour detection to MRTF as crow flies (m)**	
Odour Intensity (0 to 5)		**Odour hedonic tone (0 to –4)**	
Is the odour fluctuating?		**Are there any other odour sources in the immediate location**	
Odour plume extent-graphically map odour area using mapping	***Please append to this record***		

Plant operation synopsis *Please append odour abatement plant overview*			
WW flow into plant ($m^3\ s^{-1}$)		**pH of influent WW flow**	
Temperature of flow (^{0}C)		**Are there any MRTF upsets (Y/N)**	
Describe upsets			
Are all odour abatement plant operating accordingly	**Please refer to *Section 4.4* for verification procedure.**		
Notes:			

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9.10. Olfactometry

Olfactometry using the human sense of smell is the most valid means of measuring odour (Dravniek et al, 1986) and at present is the most commonly used method to measure the concentration of odour in air (Hobbs et al, 1996). Olfactometry is carried out using an instrument called an olfactometer. Three different types of dynamic dilution olfactometers exist:

- Yes/No Olfactometer
- Forced Choice Olfactometer
- Triangular Forced Choice Olfactometer.

In the dynamic dilution olfactometer, the odour is first diluted and is then presented to a panel of screened panellists of no less than four (CEN, 2003). Panellists are previously screened to ensure that they have a normal sense of smell (Casey et al., 2003). According to the CEN standard this screening must be performed using a certified reference gas *n*-butanol. This screening is applied to eliminate anosmia (low sensitivity) and super-noses (high sensitivity). The odour analysis has to be undertaken in a low odour environment such as an air-conditioned odour free laboratory. Analysis should be performed preferably within 6 to 8 hours of sampling.

9.11. What is an odour unit?

The odour concentration of a gaseous sample of odourant is determined by presenting a panel of selected screened human panellists with a sample of odourous air and varying the concentration by diluting with odourless gas, in order to determine the dilution factor at the 50% detection threshold. The Z_{50} value (threshold concentration) is expressed in odour units (Ou_E m^{-3}).

SIMPLY, ONE ODOUR UNIT IS THE CONCENTRATION OF AN ODOURANT, WHICH INDUCES AN ODOUR SENSATION TO 50% OF A SCREEN PANEL

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Although odour concentration is a dimensionless number, by analogy, it is expressed as a concentration in odour units per cubic metre (Ou_E m^{-3}), a term which simplifies the calculation of odour emission rate. The European odour unit is that amount of odourant(s) that, when evaporated into one cubic metre of neutral gas (nitrogen), at standard conditions elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM) evaporated in one cubic meter of neutral gas at standard conditions. One EROM is that mass of a substance (n-butanol) that will elicit the Z_{50} physiological response assessed by an odour panel in accordance with this standard. *n*-Butanol is one such reference standard and is equivalent to 123ug of n-butanol evaporated in one cubic meter of neutral gas at standard conditions (CEN, 2003).

Typically domestic sewage sludge contains 3-6 mg L^{-1} organic sulphur, mainly arising from proteinaceous material, approximately 4 mg L^{-1} from sulphonates contained in household detergents and 30-60 mg L^{-1} inorganic sulphur (as sulphonates) (Burgess et al. 2001).

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9.12. Odour treatment Systems to be employed at the facility

The following technologies may be considered as best available techniques not exceeding excessive cost for odour abatement facility design:

- Negative air extraction followed by single stage carbon filtration for the MSW handling area only as this area will handle the predominant volumes of organic waste.

Engineering and operational design are outside the scope of this document. It may be assumed that a minimum volumetric air flow rate of 92,124 m^3 h^{-1} will be required to be treated for the proposed MSW handling area design. This is based on a air exchange rate of 4 AC/hr. This can be reduced if other mitigating factors as discussed in *Section 9.9* are implemented into the overall design for the MSW handling area. The assessment of the handling of this volume of air will also take account of the potential worst-case odour emission rate to be generated by the facility when odour mitigation is implemented. If overall treatment volume of air is reduced below this calculated figure, the predicted overall impacts of odours in the vicinity of the surrounding facility will always be less.

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APPENDIX 8

Noise Baseline & Impact Assessment

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Project			
Noise impact assessment: Proposed waste management facility at Enniscorthy			
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0. Executive summary

0.1 The proposed development site consists of an approximately 2.5 ha plot 3 km north of Enniscorthy town centre. Noise sensitive locations (NSLs) in the vicinity of the study site are located along a third class road corridor which runs along the eastern boundary of the site. A private residence situated to the south of the site, 110 m beyond the proposed boundary, is the nearest house to the south. There are no NSLs within 500 m to the east or west of the site. A cluster of NSLs, comprised of approximately 15 dwellings, is located to the northeast. The nearest of these is a detached cottage situated 80 m from the northeast corner of the proposed development site. The cottage lies opposite the entrance of a business park adjoining the northern boundary of the development site.

0.2 The local noise environment is entirely dominated by traffic noise. N11 traffic noise along the western boundary of the site is incessant throughout the day. Background noise data recorded indicate relatively high noise levels in the local environment, with daytime $L_{A90\ 30\ min}$ levels ranging from 45 to 58 dB.

0.3 It is proposed to develop a waste management facility at the study site. The facility will consist of a materials recovery facility building within which sorting, compacting and baling of several non-hazardous waste streams will be undertaken. Ancillary infrastructure will include offices, weighbridge and hardstanding areas. All waste management activities will be undertaken internally within the proposed building. Waste delivery and transfer will be carried out using trucks which will enter and leave the facility through a weighbridge near the site entrance. It is proposed to locate this entrance near the northeast corner of the site. Operational noise emissions will arise from four sources: building services, in-building plant, vehicles on external yard areas, and traffic associated with the facility.

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0.4 Noise levels arising from continuous operations in the building will be negligible at receptor **NSL1**, and by extension will be negligible at all receptors to the northeast of the site. Due to the proposed location of eight roller shutter doors on the southern façade of the proposed building, offsite receptor **NSL2** will be more vulnerable than NSL1 to noise emissions arising internally within the building. Noise levels calculated with respect to both receptors will be satisfactory in the context of limits typically applied by the EPA and local authorities (55 dB during the period 0800-2200 and 45 dB at other times). The 55 dB daytime limit will not be exceeded by onsite emissions. The night-time 45 dB limit will also be met where a barrier is installed on the southern boundary of the site, and where operation of a yard sweeper is confined to daytime hours.

0.5 Noise levels predicted at the site boundaries will be generally satisfactory. Short term increases will arise from passing trucks and the yard sweeper. There are no NSLs adjoining the site boundary.

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Contents

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1. Introduction

1.1 DixonBrosnan Environmental Consultants were commissioned by O'Callaghan Moran & Associates, on behalf of their client Greenstar, to carry out a noise impact assessment with respect to a site at Enniscorthy, Co. Wexford. Greenstar proposes to develop a waste management facility at the site. Planning permission from Wexford County Council and a waste licence from the Environmental Protection Agency will be required.

1.2 A glossary of noise terms used in this report is provided in Appendix 1.

2. Existing noise environment

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2.1 The proposed development site consists of an approximately 2.5 ha plot 3 km north of Enniscorthy town centre. The site is located on a relatively level plain, although the site itself falls gently towards the west. The plot is currently under grass. The site location is indicated in Appendix 2.

2.2 The development site is rectangular in shape. The northern boundary adjoins an existing business park with several commercial units. On completion, the southern boundary of the site will adjoin a similarly sized field, beyond which is located a private residence. There are scattered houses and commercial premises located beyond this residence to the south. The east and west boundaries of the site adjoin a third class road and national route N11 respectively, and these roads completely define the local noise environment. The local stretch of the N11 runs along a raised embankment and is therefore elevated above the site.

2.3 Noise sensitive locations (NSLs) in the vicinity of the study site are located along the third class road corridor. As noted above, a private residence is situated to the south of the site, 110 m beyond the proposed boundary. This dwelling is the nearest house to the south of the site. While scattered NSLs are located further south along this road, the local area quickly becomes quite commercial in character as one approaches Ennsicorthy, and development here generally consists of commercial parks and light industrial facilities.

2.4 There are no NSLs within 500 m to the east or west of the site. A cluster of NSLs, comprised of approximately 15 dwellings, is located to the northeast. The nearest of these is a detached cottage situated 80 m from the northeast corner of the proposed development site. The cottage lies opposite the entrance to the business park adjoining the northern boundary of the development site.

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2.5 The local noise environment is entirely dominated by traffic noise. N11 traffic noise is incessant throughout the day, from early morning until late evening/night. The N11 alignment here is straight, wide and almost level, and consequently traffic noise consists chiefly of tyre noise audible for some distance along the corridor. In contrast, noise emissions from traffic using the third class road to the east of the site consist chiefly of engine and transmission noise. This road also sees much traffic throughout the day. A significant percentage of vehicles using the road are heavy commercial vehicles. During site inspections undertaken in August 2007 it was noted that a large number of agricultural tractors use this road to draw grain to a local drying facility. Impulsive banging emissions from returning empty trailers on the poor road surface were noted to be particularly intrusive.

2.6 In order to quantify existing noise levels in the vicinity of the study site, a noise survey was undertaken on 28.08.07. Measurements were recorded at three onsite stations (N1-N3) and adjacent to two NSLs (NSL1-NSL2) as indicated in Appendix 2. Survey methodology, weather conditions and equipment specification are presented in Appendix 3. Noise levels recorded are presented in Appendix 4. Frequency spectra as one third octave bands are presented in Appendix 5.

2.7 Noise data presented in Appendix 4 indicate relatively high noise levels in the local environment, with $L_{A90\ 30\ min}$ levels ranging from 45 to 58 dB. The lowest levels were recorded at NSL1, where some shielding from the N11 is provided by existing commercial units. While the L_{A90} parameter is not typically influenced by traffic noise, the local environment is continuously affected by traffic noise with consequent impacts on L_{A90} levels. Noise data recorded at all five stations reflect the total dominance of traffic noise.

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3. Proposed development

3.1 It is proposed to develop a waste management facility at the study site. The facility will consist of a materials recovery facility (MRF) building with a floor area of 2500 m^2 within which sorting, compacting and baling of several non-hazardous waste streams will be undertaken. Ancillary infrastructure will include offices, weighbridge and hardstanding areas. The total tonnage managed will be up to 90,000 tonnes per year.

3.2 Following approval to proceed, construction of the proposed facility will be undertaken in one phase expected to last approximately six months. Construction will involve site clearing and grading, pouring of floors and hardstanding areas, erection of building frame and cladding, and landscaping. Plant required during the construction phase will include excavators, articulated dump trucks, cranes and lifting platforms.

3.3 Following commissioning, all waste management activities will be undertaken internally within the proposed building. Waste delivery and transfer will be carried out using trucks which will enter and leave the facility through a weighbridge near the site entrance. It is proposed to locate this entrance near the northeast corner of the site.

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3.4 Wastes delivered to the site will be ferried directly into the proposed building. Each waste stream will be delivered to a different zone within the building where inspection, sorting, baling, trommelling, screening, compacting, storing and loading will be carried out as appropriate. Negative air pressure will be maintained in certain parts of the building using an air handling system. The plant proposed to undertake the foregoing operations are listed in Appendix 6.

3.5 The proposed building will consist of proprietary cladding panels over block/concrete walls, carried on a steel frame structure. For the purpose of this assessment, Kingspan insulated panels have been assumed with a sound transmission loss of 25 dB.

3.6 It is proposed that the facility will operate during the hours 0600-2200 Monday to Saturday. Normal waste acceptance hours will be 0600-2000 Monday to Saturday.

4. Relevant noise limits

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4.1 The proposed facility will require a waste licence from the Environmental Protection Agency (EPA). The licence will most likely include noise limits applicable to offsite NSLs. Limits specified by the EPA will most likely be taken from the EPA document *Guidance note for noise in relation to scheduled activities 2nd edition* (2006) which states that the noise level at a sensitive location should be kept below an L_{Ar} value of 55 dB during the hours 0800-2200 and below 45 dB outside of these hours, the L_{Ar} being equal to the L_{Aeq} plus a penalty applied where the noise is tonal or impulsive. The guidance states that at night-time there should be no clearly audible tonal or impulsive noise at any noise sensitive location.

4.2 Both EPA documents *Environmental noise survey guidance document* (2003) and *Guidance note for noise in relation to scheduled activities 2nd edition* (2006) recommend measurement intervals of 15-30 minutes during daytime hours. Daytime noise limits included in EPA waste licences typically refer to 30 minute intervals. The most pertinent noise limit applicable to operations at the proposed facility is therefore considered to be $L_{Aeq\ 30\ min}$ 55 dB during the hours 0800-2200, measured at any offsite noise sensitive location. This limit is not considered suitable with respect to construction phase emissions as construction operations will arise during the short term only.

4.3 The EPA guidance note defines a noise sensitive location as:

Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

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4.4 It follows that any such premises in the vicinity of the proposed development site is a noise sensitive location within the context of the guidance note. The nearest sensitive receptors are NSL1 and NSL2 as shown in Appendix 2.

5. Construction phase emissions

5.1 Construction of the proposed facility is expected to last approximately six months. The following works will be required:

A. Site clearing and grading.
B. Erection of steel MRF building frame.
C. Pouring of foundations, MRF building floor and hardstanding areas.
D. Erection of MRF building wall and roof cladding.
E. Installation of ancillary site services.
F. Installation of plant within MRF building.
G. Completion of site surfaces and landscaping.

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5.2 Plant required onsite will vary depending on requirements. Most sources will be small and localised eg. generators, lifting platforms, power floats, etc. During the initial stage, civil works will require the use of one or more excavators and dump trucks. The duration of this stage will be significantly reduced due to the easily accessible and level nature of the site. Erection of the building steelwork and cladding may require hammering on occasion. Materials including concrete will require an intensive period of deliveries to the site.

5.3 It is not considered practical to predict the level of construction noise emissions arising onsite for several reasons:

A. The timing, duration and amplitude of emissions associated with the above works will vary considerably.
B. Construction details, plant requirements, etc. may be modified on a daily basis as circumstances change.
C. There will be extensive periods when little or no construction noise emissions arise eg. during installation of internal services.
D. Each individual source may be relocated frequently eg. excavators.
E. The overall construction period will be relatively short. The duration of individual stages will be limited, lasting days or weeks at most eg. steelwork erection.
F. There are no recommended noise limits applicable to construction phase emissions.
G. The proposed site is located in an area with relatively high background noise levels due to road traffic.

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5.4 Rather than attempting to calculate noise emissions from a combination of such variable sources, it is considered more prudent to implement a series of mitigation measures specifically applicable to the construction phase. The mitigation measures are outlined in Section 7.

6. Operational noise emissions

6.1 Methodology

6.1.1 Following commissioning of the proposed facility, operational noise emissions will arise from four sources: building services, in-building plant, vehicles on external yard areas, and traffic associated with the facility. Each of the sources is addressed below.

6.1.2 Prediction of noise emissions was undertaken in accordance with *British Standard BS 5228:1997 Noise control on construction and open sites*. Due to the relatively large dimensions of the proposed building in comparison with the distances to the nearest noise sensitive receptors, the building cannot be treated as a single point source. It is therefore necessary to calculate noise breakout from the building before applying propagation modelling. Building breakout calculations are presented in Appendix 7.

6.1.3 Noise levels assessed by the model have been predicted with respect to the nearest sensitive receptors NSL1 and NSL2 indicated in Appendix 2. Levels have also been predicted with respect to the four boundaries of the proposed development site. The model output is presented in Appendix 9.

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6.2 Building services

6.2.1 Building services plant will include mechanical and electrical noise sources, including air handling units associated with the negative air pressure and odour abatement systems. Selection of the appropriate plant will be made during the tendering and construction phases. The client has indicated that all plant will be managed so as to ensure that noise emissions arising from same will not exceed 45 dB L_{Aeq} beyond 10 m from any façade of the MRF building, including the southern façade.

6.2.2 Noise impacts at both sensitive receptors attributable solely to emissions from the building services will be 18 dB, significantly less than existing background levels, and well below typically applied daytime or night-time noise limits. Thus no impacts will arise here. However, it will be necessary to ensure that all building services emissions do not contain tonal components.

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6.3 In-building plant

6.3.1 Several items of machinery and plant will be employed internally within the MRF building to manage the various waste streams delivered. Plant required and respective sound power data are presented in Appendix 6. The list presented in the appendix does not include building services plant such as compressors and air handling units; such plant has been included in the building services assessment in 6.2.

6.3.2 Most plant operated within the MRF building will be stationary. Mobile plant such as front end loaders will move around the building floor as required, but will at all times operate internally. For the purpose of this assessment, it is assumed that all in-building plant will operate continuously, thereby adopting a worst case approach. In practice, it is likely that certain machines will operate only as required, depending on waste stream fluctuations. The total sound power arising from plant within the building will be 109 dB as indicated in Appendix 6. Sound pressure levels across the building floor are unlikely to exceed 85 dB, and this value has been input to the building breakout calculations in Appendix 7 and noise model in Appendix 9.

6.3.3 Noise levels arising from the in-building plant will be 28 dB at NSL1 and 48 dB at NSL2. The higher levels calculated with respect to NSL2 will arise due to open doors on the southern façade (calculations assume that all roller shutter doors will be open at any time).

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6.4 Vehicles on external yard areas

6.4.1 Vehicles using external areas of the site will consist of staff cars, trucks delivering and transferring waste materials, and a yard sweeper truck. Given the dominant influence of existing traffic noise in the local area, emissions from staff cars will be negligible.

6.4.2 The number of trucks accessing the site will vary depending on demand and time of day. Trucks will enter and depart the site through a single site gate near the northeast corner. All trucks will be weighed at an onsite weighbridge. While onsite, trucks will enter and exit the proposed MRF building as required. Truck manoeuvres will also be associated with parking areas. For the purpose of assessing noise impacts arising from onsite trucks, it is assumed that, at any time, noise emissions from two moving trucks may be propagated offsite. While there may be more trucks onsite at that time, significant screening provided by the MRF building will limit offsite propagation. In order to maintain a worst case scenario, it is assumed that these trucks will be driving, and not idle.

6.4.3 With an individual sound power of 95 dB (provided by O'Callaghan Moran & Associates), the combined sound power of two trucks manoeuvring onsite will be 98 dB. This figure has been input into the noise model in Appendix 9. The model predicts an L_{Aeq} level of 43 dB attributable solely to truck movements onsite. At the site boundaries, these levels will increase to 58 dB, assuming the movement of two trucks onsite within line of sight.

6.4.4 A yard sweeper will be used occasionally around the site. *British Standard BS 5228: 1997 Noise and vibration control on construction and open sites Part 1: Code of practice for basic information and procedures for*

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noise and vibration control, as updated by *Update of noise database for prediction of noise on construction and open sites* (UK Department of Environment, Food and Rural Affairs, 2005), lists the L_{Aeq} at 10 m from a road sweeper at 76 dB. This value has been input to the model in Appendix 9, with an assumption that the sweeper will be operational for 10 minutes of any 30 minute period. Results from the model indicate noise levels of 46 dB at NSL1 and NSL2 specifically attributable to the yard sweeper.

6.5 Road traffic

6.5.1 Vehicles accessing the site will use the old N11 route along the eastern boundary of the site. In the context of existing traffic volumes on this road, car movements associated with site staff will be negligible.

6.5.2 It is expected that the number of truck movements to and from the site will be 14 per hour during a typical peak period. On the basis of this number, the resultant $L_{Aeq\ 30\ min}$ is determined in Appendix 8, and this value input to the model in Appendix 9.

6.5.3 The model output indicates that the $L_{Aeq\ 30\ min}$ at NSL1 attributable to truck movements associated with the development will be 54 dB, and 48 dB at NSL2. With existing $L_{Aeq\ 30\ min}$ levels of 58-67 dB at NSL1, and 60-61 dB at NSL2, noise emissions arising from truck movements on the public road as a result of the proposed development will be negligible.

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6.6 Total noise impacts

6.6.1 Calculated noise levels are presented in Appendix 9. The calculations show that noise levels will vary at each of the receptor points chosen, depending on operations. The predicted values are summarised in Table 1. Specific details of assumptions applied in the calculations are presented in Appendix 9.

Table 1. Summary of calculated noise levels in decibels ($L_{Aeq\ 30\ min}$ dB).

Receptor	Building services	In-building plant		2 trucks on yard	Yard sweeper	Trucks on road
		No screen	Screen			
NSL1	18	28	-	43	46	54
NSL2	18	48	42	43	46	48
N boundary	35	49	-	58	71	-
W boundary	32	42	-	58	71	-
E boundary	33	39	-	58	71	-
S boundary	33	65	55	58	71	-

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6.6.2 Noise levels arising from continuous operations in the building will be negligible at receptor **NSL1**, and by extension will be negligible at all receptors to the northeast of the site. Combined noise levels attributable to building services and in-building plant will be 28 dB, significantly less than background noise levels recorded locally (45-47 dB). Emissions from trucks manoeuvring in the yard and from operation of the yard sweeper will result in $L_{Aeq\ 30\ min}$ levels of 43-46 dB at NSL1, marginally lower than existing background levels.

6.6.3 Movement of trucks on the public road in association with the proposed development will result in $L_{Aeq\ 30\ min}$ levels of approximately 54 dB at **NSL1**. These levels will not be significant in the context of existing noise levels, particularly existing $L_{A10\ 30\ min}$ values of 53-69 dB measured at NSL1.

6.6.4 Due to the proposed location of eight roller shutter doors on the southern façade of the proposed building, offsite receptor **NSL2** will be more vulnerable than NSL1 to noise emissions arising internally within the building. While emissions from building services will be negligible, those from in-building processing plant will result in an $L_{Aeq\ 30\ min}$ level of 48 dB at NSL2. This calculation assumes no screening of emissions being propagated through eight open roller shutter doors. These emissions may be screened by the installation of an acoustic barrier along the southern boundary of the site. Calculations in Appendix 9 indicate that a barrier of height 4 m along the boundary, opposite the roller shutter doors, will reduce the $L_{Aeq\ 30\ min}$ level attributable to processing plant to 42 dB. Existing background noise levels at NSL2 are significantly higher (53-55) dB.

6.6.5 Manoeuvring of trucks on the site apron and operation of the yard sweeper will result in $L_{Aeq\ 30\ min}$ noise levels of 43-46 dB at **NSL2**, significantly lower than current background levels. $L_{Aeq\ 30\ min}$ levels arising from truck movements on the public road will be 48 dB, lower than all parameters measured during the background noise survey at NSL2.

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6.6.6 Noise levels calculated with respect to receptors **NSL1** and **NSL2** will be satisfactory in the context of limits typically applied by the EPA and local authorities. The limits (55 dB during the period 0800-2200 and 45 dB at other times) have been discussed in paragraph 4.1. The 55 dB daytime limit will not be exceeded by onsite emissions. The night-time 45 dB limit will be met where a barrier is installed on the southern boundary as discussed above, and where operation of the yard sweeper is confined to daytime hours.

6.6.7 Noise levels predicted at the **northern**, **eastern and western boundaries** will be generally satisfactory. Building services and process plant noise emissions will not exceed 49 dB at these boundaries. Truck movements on the open yard will understandably result in short term increases, resulting in expected $L_{Aeq\ 30\ min}$ levels of 58 dB. Short term emissions from the yard sweeper will result in increases in the $L_{Aeq\ 30\ min}$ parameter to 71 dB when operating. As there are no noise sensitive locations on the north, east or west boundaries, these levels will be satisfactory.

6.6.8 On the **southern boundary**, noise impacts attributable to truck movements and operation of the yard sweeper will be similar to those described in paragraph 6.6.7. Due to the proposed location of eight roller shutter doors on the southern façade of the building, the $L_{Aeq\ 30\ min}$ level predicted to arise from in-building plant will be 65 dB. Installation of an acoustic barrier opposite the doors will see a reduction in this level to 55 dB.

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7. Mitigation

7.1 The following mitigation measures are recommended with respect to the construction phase:

A. It is recommended that hours of construction works are confined to 0700-1800 hours Mondays to Fridays and 0700-1600 hours Saturdays. It is recommended that the use of potentially noisy plant is restricted before 0800 hours.
B. It is recommended that general construction work at the site is not undertaken on Sundays or public holidays.
C. It is recommended that delivery of materials is timed where practical to avoid AM/PM peaks in order to minimise traffic disruption and consequent noise impacts.
D. Delivery times and site access clearance should be arranged so that trucks do not congregate outside the site entrance.
E. It is recommended that, where it is necessary to operate plant close to the site boundaries for extended periods, only relatively quiet plant should be used.
F. It is recommended that all mobile plant used onsite during the construction phase is maintained in a satisfactory condition and in accordance with manufacturer's recommendations. In particular, exhaust silencers should be fitted and operating correctly at all times. Defective silencers should be immediately replaced. Where relevant, plant used onsite should comply with the EC (Construction Plant and Equipment) (Permissible Noise Levels) Regulations 1988 (S.I. No. 320 of 1988) as amended.

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7.2 Noise prediction calculations assume that all building services plant will be installed/managed so as to maintain resulting noise levels below 45 dB at 10 m from the building façade. It is recommended that all plant is selected and installed so as to ensure compliance with this objective. It is also recommended that plant emissions be assessed for tonal and impulsive noise components. Such components should be addressed where required.

7.3 Where it is proposed to undertake site processing operations during the period 2200-0800 hours, it is recommended that an acoustic barrier of height 4 m is installed on the southern boundary of the site, opposite the roller shutter doors. The barrier should extend 10 m east of a straight line linking the eastern shutter door to NSL2.

7.4 It is recommended that operation of the yard sweeper is confined to daytime hours only.

7.5 It is recommended that any plant introduced to the site should not be excessively noisy. Where possible, noise data provided by the supplier should be consulted.

7.6 It is recommended that plant used onsite during the operational phase is maintained in a satisfactory condition. The recommendation outlined in 7.1 F above may also be applied here.

7.7 It is recommended that use of vehicle horns is prohibited onsite.

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Appendix 1: Glossary

Note: Not all terms have been used in this report.

Ambient	The total noise environment at a location, including all sounds present.
Amplitude	The parameter which indicates the loudness of a noise measured in decibels.
A-weighting	The weighting or adjustment applied to sound level recordings to approximate the non-linear frequency response of the human ear. The A-weighting is denoted by the suffix A in the parameters listed below such as L_{Aeq}, L_{A10}, etc.
Background noise	The A-weighted sound pressure level of the residual noise in decibels exceeded for 90% of a given time interval. The L_{A90}.
Decibel (dB)	The units of the noise measurement scale. Based on logarithmic scale so cannot be simply added or subtracted. A 3 dB difference is the smallest change perceptible to the human ear. A 10 dB difference is perceived as a doubling or halving of the sound level. Throughout this report noise levels are presented as decibels relative to $2x10^{-5}$Pa. Examples of decibel levels are as follows: 20 Very quiet room; 35 Rural environment at night; 65 Conversation; 80 Busy pub; 100 Nightclub; 120 Jet take-off; 140 Threshold of pain
Frequency	The number of cycles per second of a sound or vibration wave. An example of a low frequency noise is a hum, while a whine represents a higher frequency. The range of human hearing approaches 20-20,000 Hz.
Hertz (Hz)	The unit of frequency measurement.
Impulse	A noise which is of short duration, typically less than one second, the sound pressure level of which is significantly higher than the background.
Interval	The time period t over which noise monitoring is conducted. May be 5-60 minutes, depending on the standard applied. The interval is usually denoted by t as in $L_{Aeq\,t}$, $L_{A90\,t}$, etc.
$L_{Aeq\,t}$	The equivalent continuous sound level during a measurement interval, effectively representing the average A-weighted noise level.
L_{AIeq}	The A-weighted sound pressure level at a particular instant, measured using an impulse time weighting on the sound level meter. May be used in the assessment of impulse noise.
$L_{An\,t}$	The A-weighted sound level which is exceeded for n% of the measurement interval.

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L_{Apk}	The peak A-weighted sound pressure level recorded during the measurement interval. The highest peak on the sound pressure wave before any time constant is applied.
$L_{Ar\,t}$	The $L_{Aeq\,t}$ plus specified adjustments (usually +5 dB) for tonal and impulsive characteristics.
L_{den}	A description of the day-evening-night noise level. Calculated from separate daytime, evening and night-time noise levels using a specified formula.
L_{WA}	The sound power generated by a noise source due to the conversion of work energy into noise energy. Measured with A-weighting.
$L_{A10\,t}$	The A-weighted sound level which is exceeded for 10% of the measurement interval, usually used to quantify traffic noise.
$L_{A90\,t}$	The A-weighted sound level which is exceeded for 90% of the measurement interval, usually used to quantify background noise. May also be used to describe the noise level from a continuous steady or almost-steady source, particularly where the local noise environment fluctuates.
Noise sensitive location	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
1/3 octave band analysis	Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit in Hertz.
Rated noise level	The $L_{Ar\,t}$ described above.
Residual noise	The noise level remaining at a given position in a given situation when the specific noise source is absent or does not contribute to the noise level.
Sound exposure level	A measure of the total sound energy in an event. Usually applied to short term event such as aircraft fly-by. Essentially the L_{Aeq} normalised to 1 second.
Specific noise	The noise source under investigation for assessing the likelihood of complaints.
Tone	A character of the noise caused by the dominance of one or more frequencies which may result in increased noise nuisance.
Z-weighting	Standard weighting applied by sound level meters to represent linear scale.

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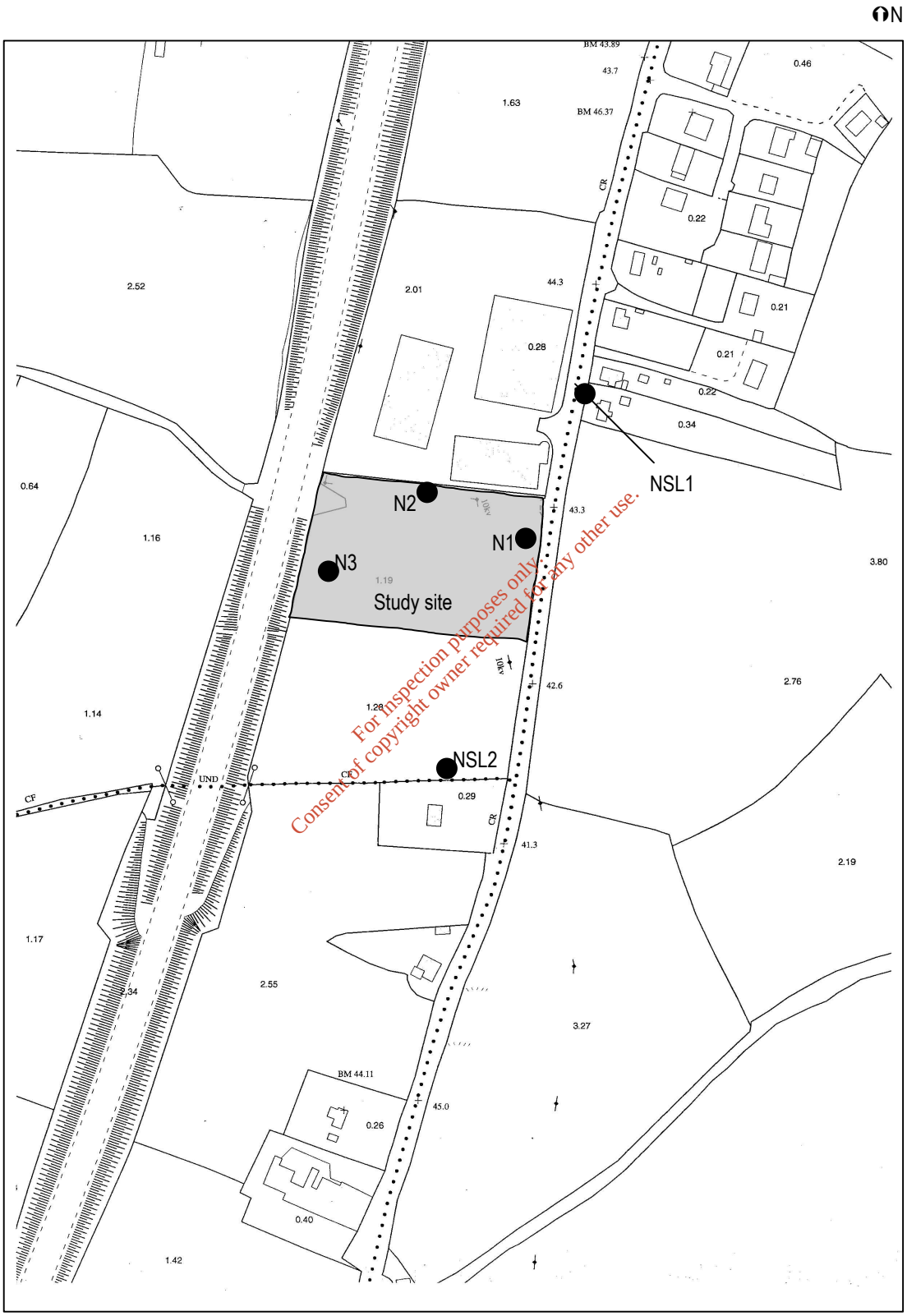
Appendix 2: Site location



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Appendix 3: Background survey methodology

Survey	Project ref.	07031
	Purpose	Background survey
	Locations	N1-N3 NSL1-NSL2
	Comment	
Event	Date	28.08.07
	Day	Tuesday
	Time	Early morning to evening
Operator	On behalf of DixonBrosnan	Damian Brosnan
Conditions	Sky	Partly clear
	Precipitation	0
	Temperature	11-21 ^{0}C
Wind	Speed	0-1 m/s
	Direction	NW
	Measurement	Anemo anemometer 2 m above ground level
Sound level meter	Instrument	Bruel & Kjaer Type 2250-L
	Instrument serial no.	2566801
	Microphone serial no.	2571655
	Application	BZ7130 Version 2.0
	Bandwidth	Broadband
	Max input level	142.66 dB
	Broadband (excl. peak)	Time: FSI Frequency: AC
	Broadband peak	Frequency: C
	Windscreen correction	UA-0237
	Sound Field correction	Free-field
	UKAS calibration	16.01.07
	UKAS calibration certificate	Available on request
Onsite calibration	Time	08/28/2007 06:13:10
	Calibration type	External
	Sensitivity	40.95 mV/Pa
	Post measurement check	Passed
Onsite calibrator	Instrument	Bruel & Kjaer Type 4231
	Instrument serial no.	2342544
	UKAS calibration	18.04.07
	UKAS calibration certificate	Available on request
Monitoring methodology	International Standard ISO 1996	*Acoustics: Description and measurement of environmental noise Parts 1-3 1982-1987*
	Exceptions	
	Intervals	30 min

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Appendix 4: Background noise levels

Station	Time	$L_{Aeq\ 30\ min}$ dB	$L_{A10\ 30\ min}$ dB	$L_{A90\ 30\ min}$ dB	Noise audible
NSL1	0615-0645	61	53	45	Traffic continuously audible on N11, dominant. Sporadic traffic on old N11 intrusive when present. Birdsong.
NSL1	0646-0716	58	53	46	
NSL2	0722-0752	60	63	54	N11 entirely dominant, continuous and intrusive. Sporadic traffic on old N11. Pigeons cooing.
NSL2	0756-0826	61	63	54	
N1	0847-0917	58	61	50	N11 traffic dominant, continuous and intrusive. Old N11 traffic intermittent and significant, particularly tractors drawing grain.
N1	0922-0952	60	62	47	
N2	1000-1030	55	58	47	N11 traffic dominant, continuous and intrusive. Old N11 traffic intermittent and significant, particularly tractors drawing grain. Sporadic vehicle movements audible at adjacent commercial park.
N2	1030-1100	55	59	47	
N3	1104-1134	68	72	56	N11 traffic continuous, intrusive and dominant. Old N11 traffic sporadic, not significant. Occasional birdsong.
N3	1136-1206	68	72	57	
NSL1	1330-1400	66	66	46	Intermittent traffic on old N11 intrusive when passing, particularly frequent tractors drawing grain. N11 traffic audible continuously in background, significant. Sporadic vehicles accessing local sites, particularly commercial park across road. Birdsong. Trees slightly rustling nearby. Music audible at low volume from nearby commercial unit from 1440.
NSL1	1400-1430	67	69	47	
NSL2	1444-1514	60	63	53	Intermittent old N11 traffic significant. New N11 continuously dominant and intrusive. Birdsong not audible due to absence of traffic lulls.
NSL2	1514-1544	61	63	55	
N1	1547-1617	61	64	53	N11 continuously dominant and intrusive. Traffic volume increasing. Old N11 traffic intermittent, significant when present.
N1	1618-1648	61	63	52	
N2	1651-1721	60	63	54	N11 continuous, dominant and intrusive. Old N11 traffic intermittent. Sporadic vehicle movements at adjacent commercial park.
N2	1722-1752	61	64	55	
N3	1758-1828	70	73	58	N11 continuously dominant and intrusive. Old N11 traffic barely audible due to dominance of new N11. Tractor occasionally audible at 200 m spreading fertiliser during second interval.
N3	1828-1858	68	71	55	

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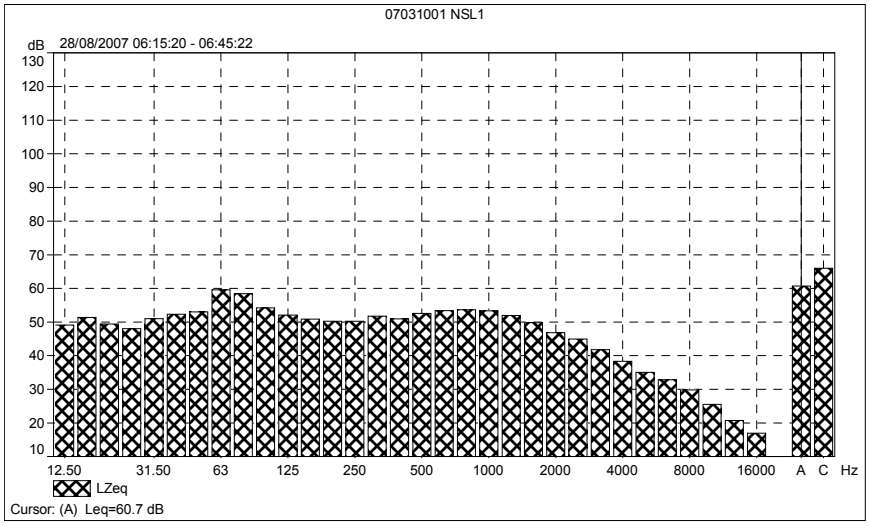

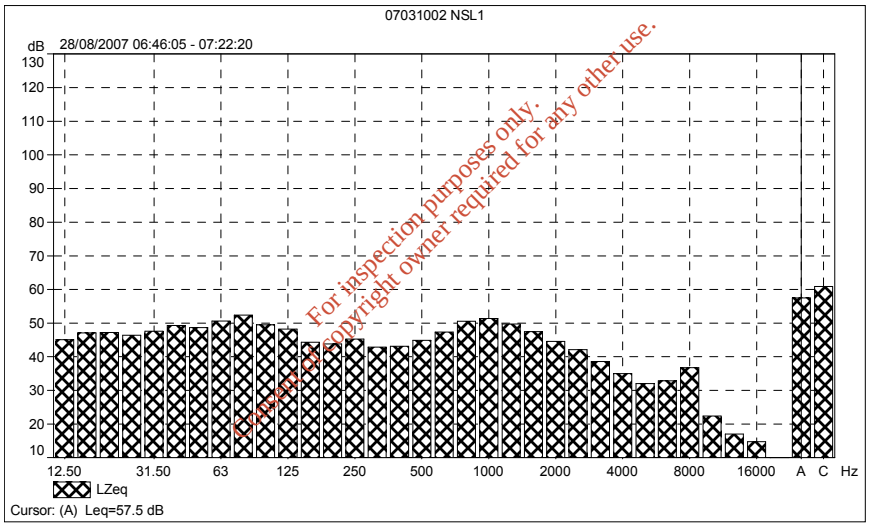

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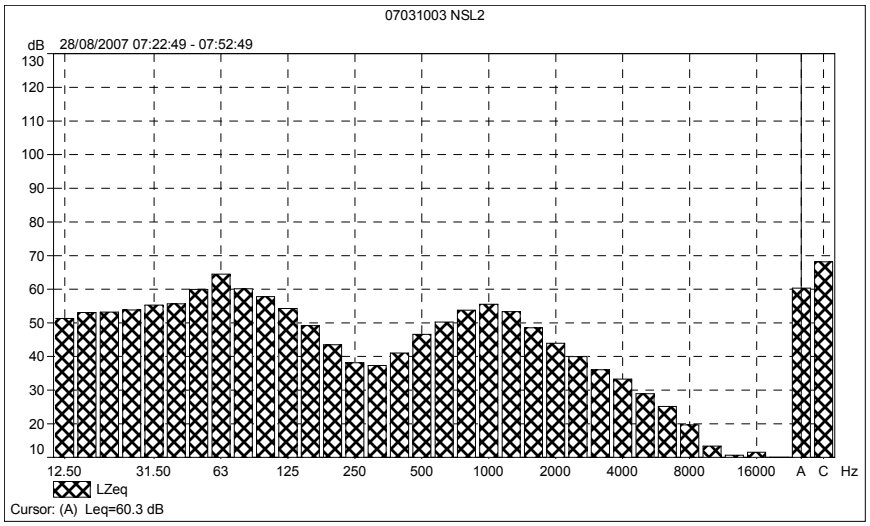

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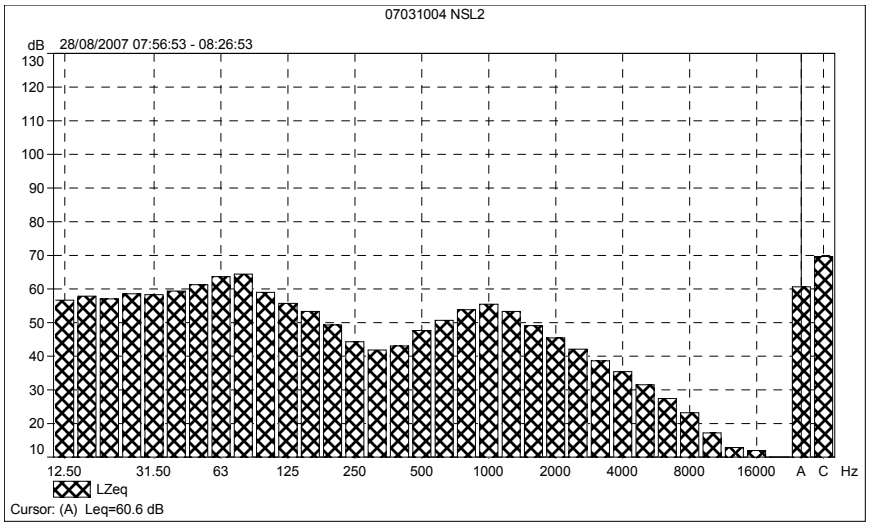

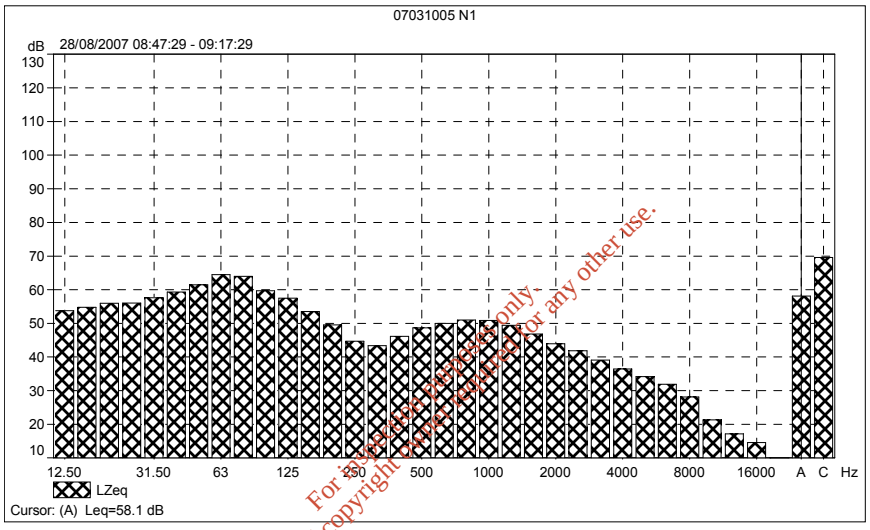

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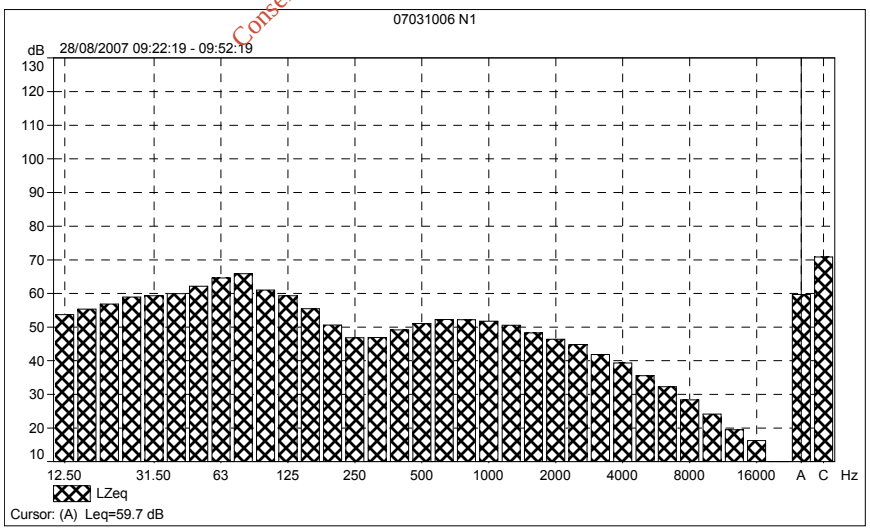

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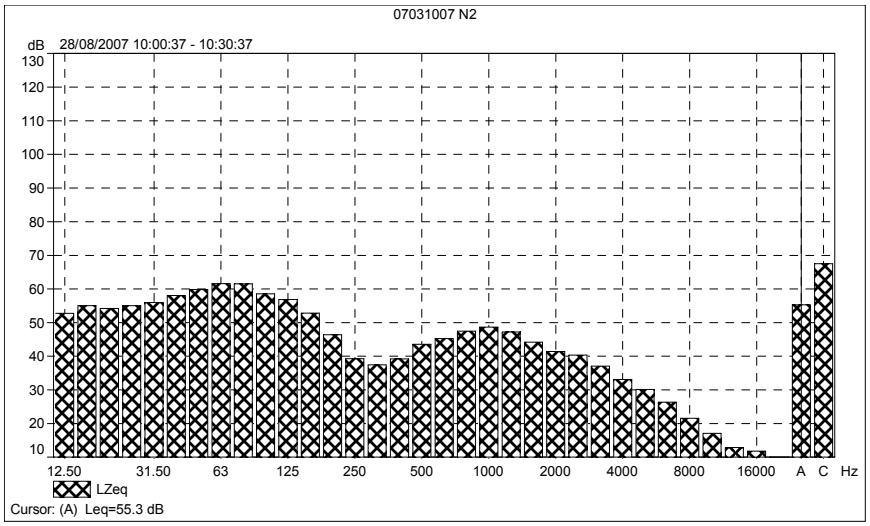

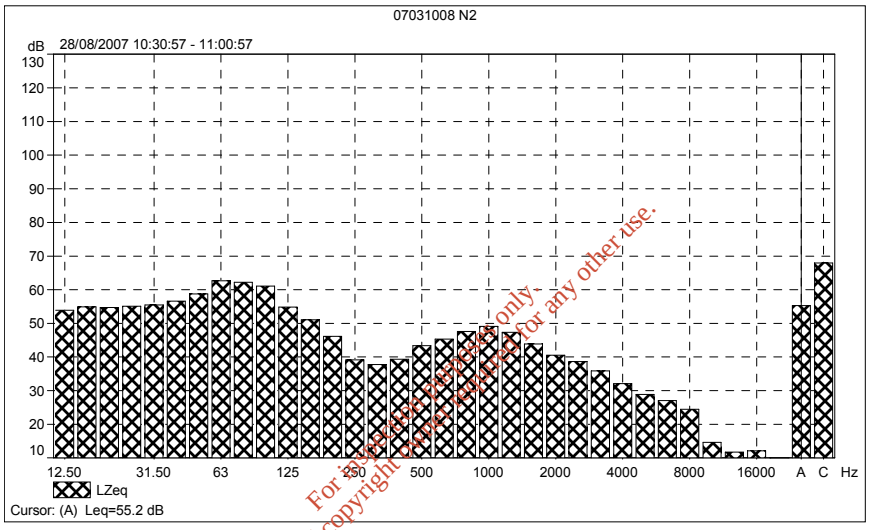

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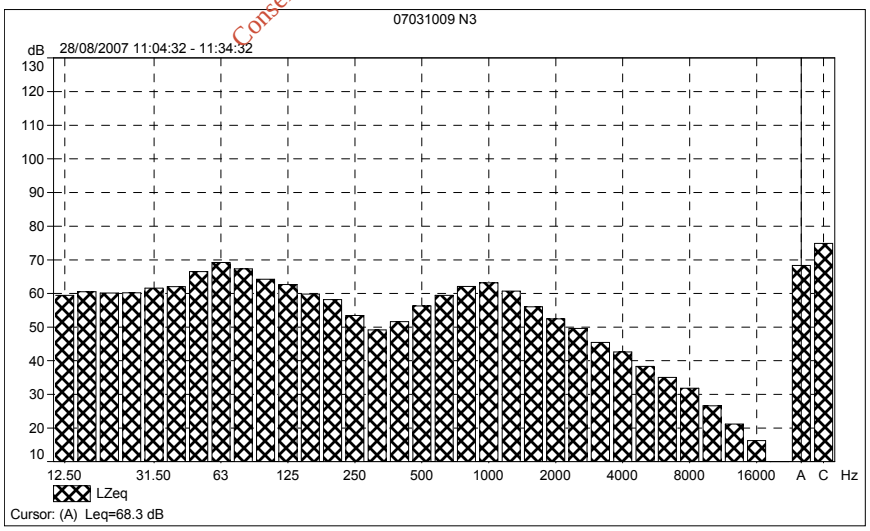

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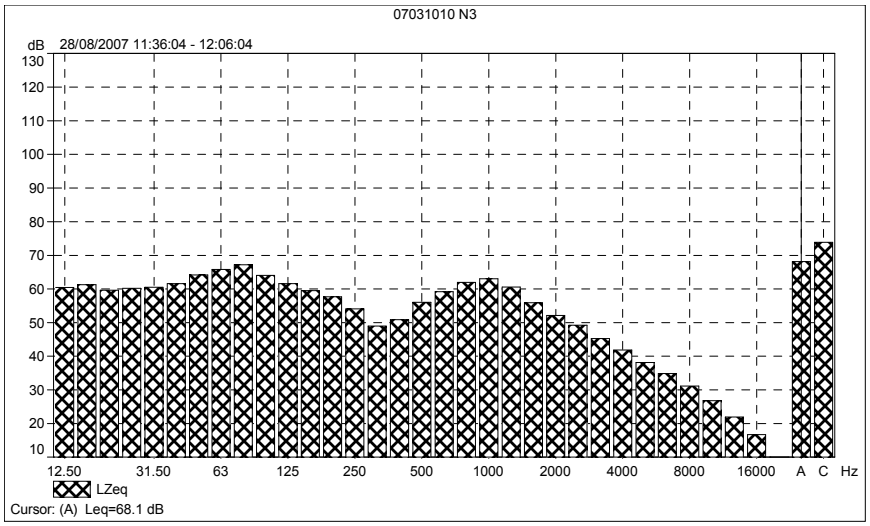

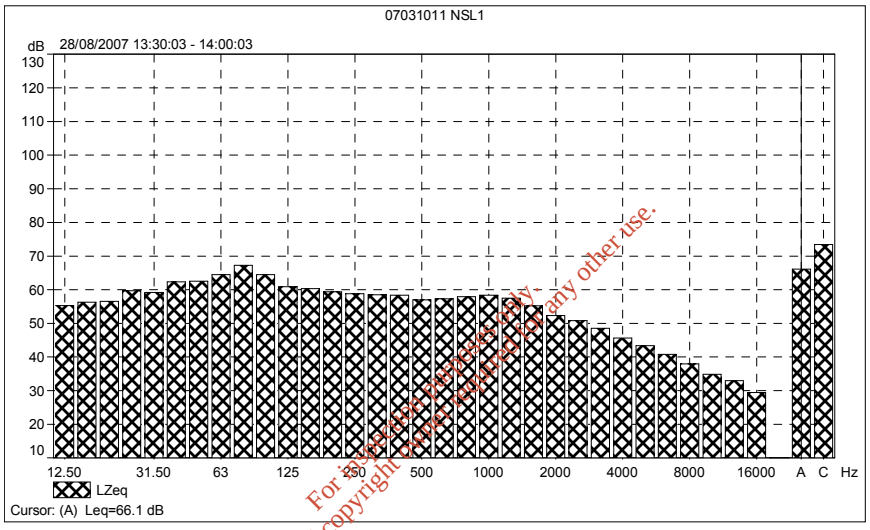

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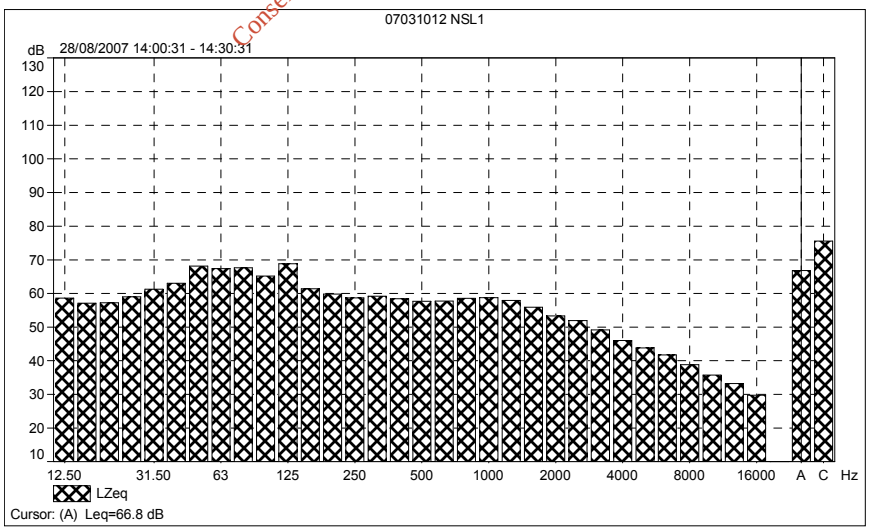

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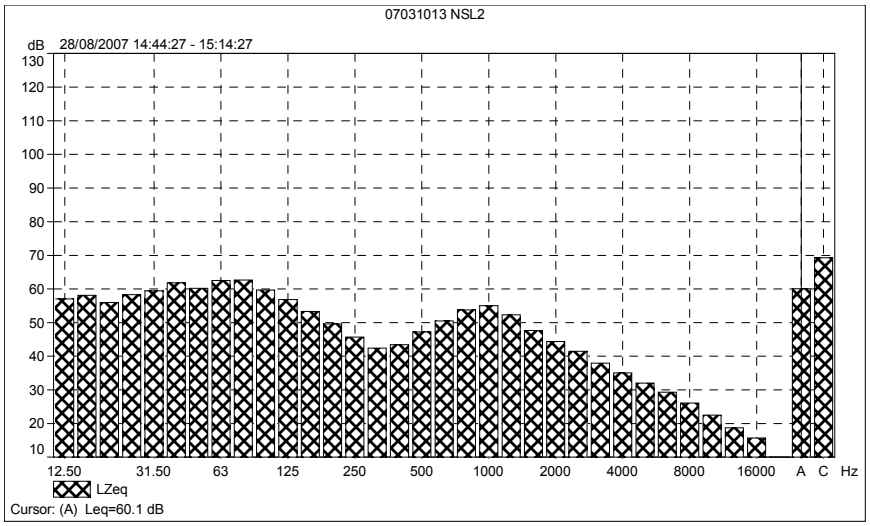

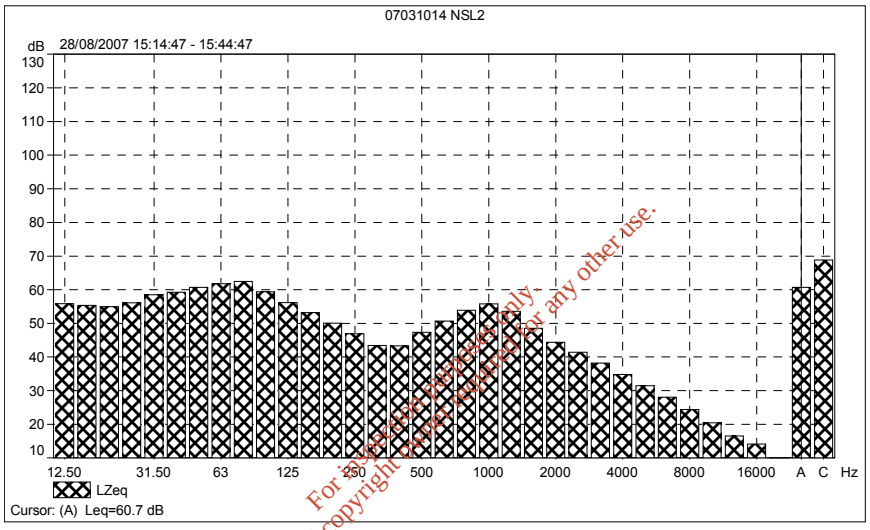

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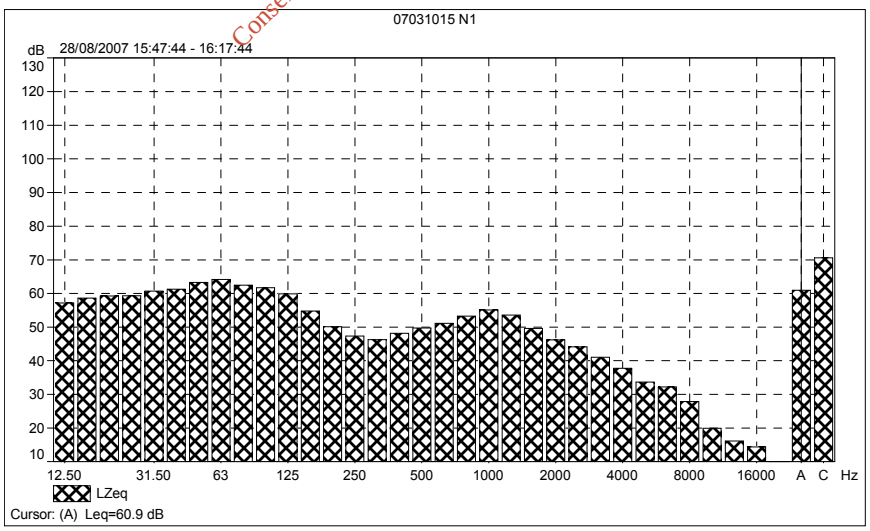

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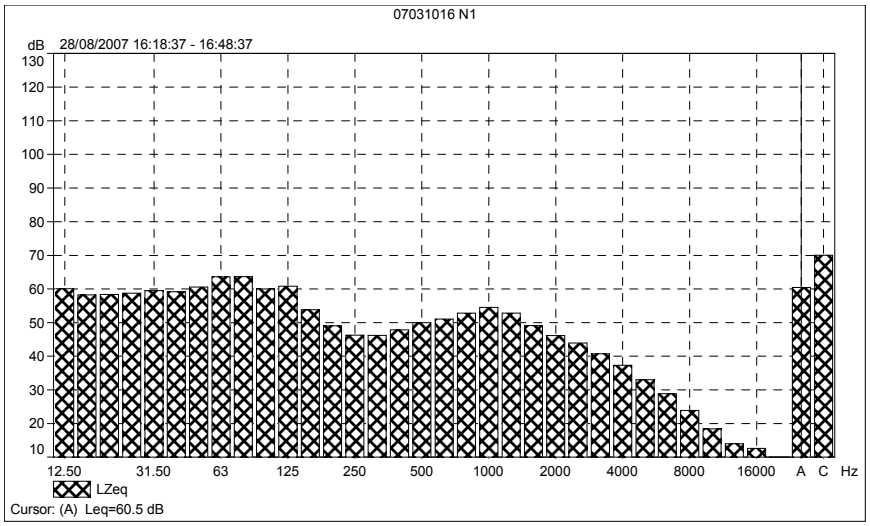

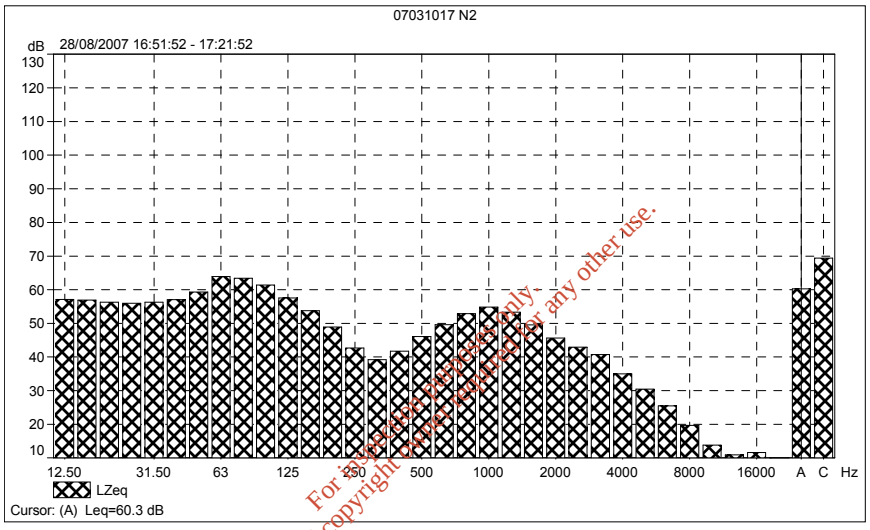

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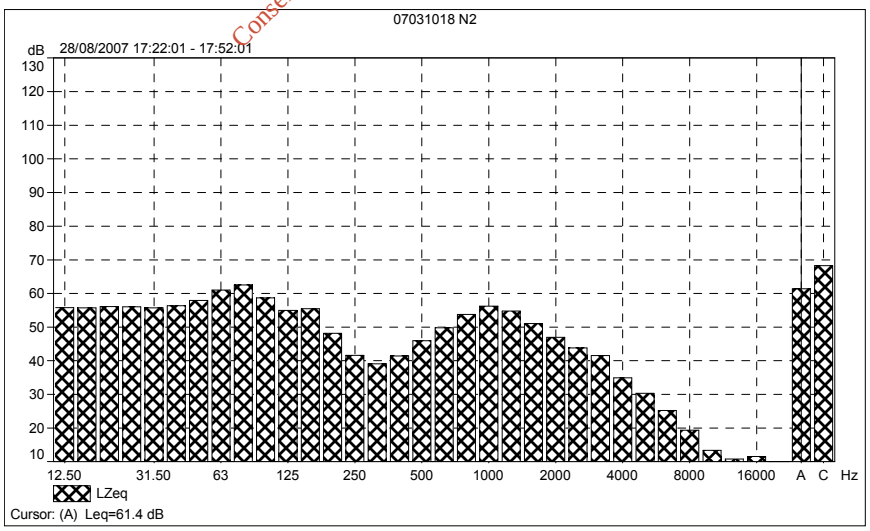

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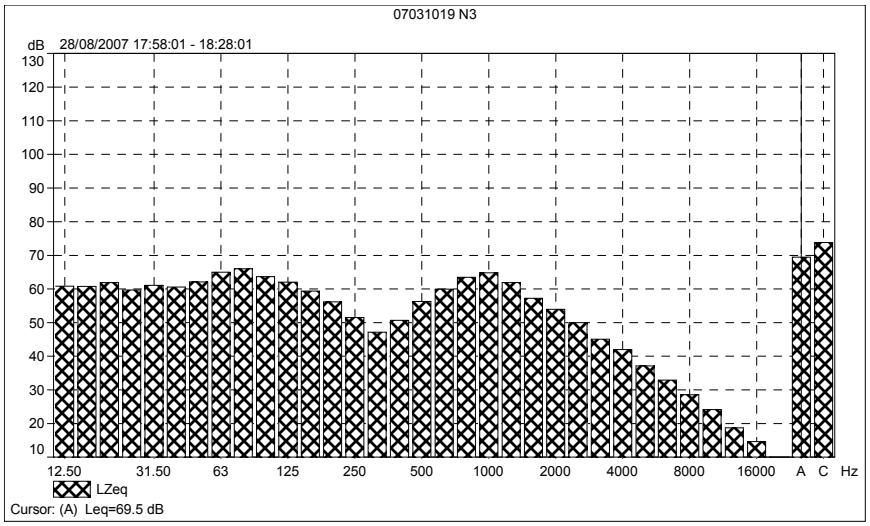

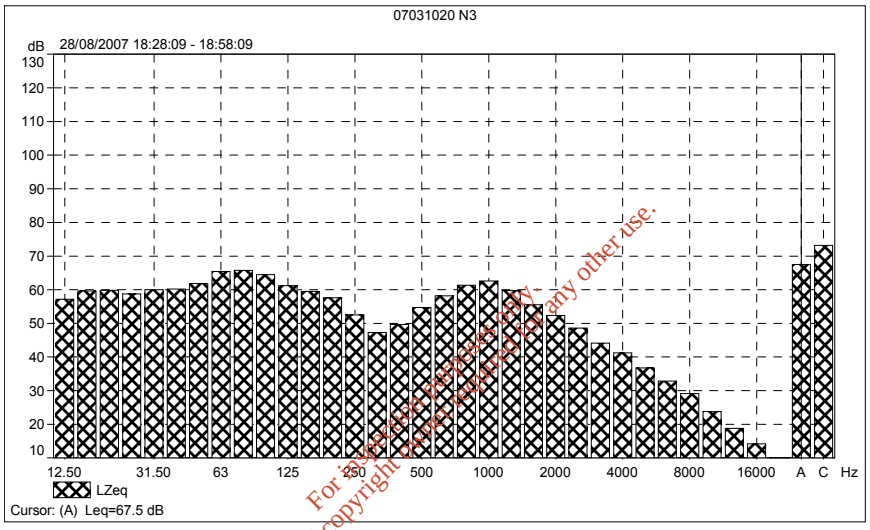

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Plant	Quantity	Sound power L_{WA} dB*	Combined sound power L_{WA} dB
Front end loader	2	98[1]	103
Trommel	2	70[1]	73
Baler	1	97[1]	97
Grab	1	96[1]	96
Shredder	1	106[1]	106
Conveyor	2	<70[2]	<70
Bag opener	1	<60[2]	<60
Forklift	1	100[3]	100
		Total	109

*Sound power data presented as dB relative to 10^{-12} W.

Sources:

[1]O'Callaghan Moran & Associates.

[2]Estimated.

[3]Measurement.

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With a combined sound lower level of 109 dB, overall sound pressure levels in the building, away from localised noise sources such as the shredder, are unlikely to exceed 85 dB due to internal distance attenuation, screening, directivity, etc. With a view to meeting occupational noise limits, site management will implement necessary modifications to ensure that internal noise levels across the building floor remain below 85 dB. Therefore internal sound pressure levels of 85 dB are assumed in Appendix 7.

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Noise breakout may be calculated through each façade using:

$L_{out} = L_{in} – R + 10\log(A) – 20\log(d) – 14$

where:

L = sound pressure level, 85 dB internally

R = sound reduction provided by building fabric, in this case applied across the frequency spectrum

A = façade area

d = distance to point of relevance, in this 10 m.

A sound transmission loss of 25 dB in the building fabric is assumed for the purpose of the model as described in 3.5 of the report. The southern façade of the building will include eight roller shutter doors. For the purpose of this assessment, it is assumed that all doors will be open during operational hours.

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Facade	Cladding		Doors		L_{Aeq} 10 m dB
	Dimensions m	Area m²	Dimensions m	Area m²	
North	76x10[1]	760	0	0	55
East	41x8.5[1]	221[2]	0	0	49
West	42x11.8[1]	496	0	0	53
South	76x11.5	586[3]	5x7.2 x8	288	54[4]
	-	-	5x7.2 x8	288	75[5]

[1]Average height.

[2]Area excludes façade screened by office building 15x 8.5[1] m (127.5 m²).

[3]Cladding area excludes open door area.

[4]Breakout though cladding only, not including doors.

[5]Reduction of 10 dB assumed through open doors.

On the southern façade, the combined breakout figures of 54 and 75 dB through cladding and open doors respectively will result in an overall noise level of 75 dB at 10 m from the façade.

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It is assumed that car movements associated with site staff will be negligible in the context of existing traffic volumes. Thus only emissions from trucks using the local road adjacent to the site are considered here. Noise levels attributable to short term events such as passing truck movements may be calculated using the Sound Exposure Level (SEL), a measure of the total noise energy in a noise event. The SEL may be used to calculate L_{Aeq} over a reference time interval using:

$L_{Aeq\ Tref} = SEL + 10\log(N) - 10\log(T_{ref})$

where

N = number of times event occurs in reference period

T_{ref} = reference time interval in seconds.

From 6.5.2 in the report, the number of truck movements is expected to be 14 per hour during a typical peak period. Data provided by O'Callaghan Moran & Associates indicate that the SEL attributable to each truck is 78 dB at the road edge (5 m). Using this value, the $L_{Aeq\ 30\ min}$ is calculated at 54 dB at the road edge. This level is input to the model in Appendix 9 in order to assess the resulting noise impact at both NSLs.

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Model input parameters

Parameter	Description
Building services	45 dB L_{Aeq} 10 m from MRF building façade, including S facade
In-building plant	L_{Aeq} 10 m from MRF building façade, taken from Appendix 7.
In-building plant	Distance to receptor point reduced by 10 m as 10 m stand off already incorporated in building breakout noise calculations (Appendix 7).
In-building plant	Noise breakout potential arises from nearest façade only with respect to NSL1, NSL2 and boundaries.
Onsite trucks	Up to 2 manoeuvring trucks on external yards may result in offsite propagation at any time. Emissions from other trucks will be screened by the MRF building. Combined sound power 98 dB assumed, arising from and average of 40 m inside boundary.
Yard sweeper	76 dB L_{Aeq} 10 m. Activity period: 10 min out of any 30 min (33%). Operation zone 10 m inside boundary.
Road truck movements	14 movements during typical 1 hour peak period, equivalent to $L_{Aeq\ 30\ min}$ 54 dB at road edge (from Appendix 8).
Screen	For purposes of additional calculations re in-building plant noise re NSL2 and S boundary, an acoustic barrier of height 4 m has been assumed, to be positioned on the S boundary opposite the 8 roller shutter doors on the S façade. An insertion loss of 10 dB across the frequency spectrum has been assumed.
Calculated levels	Noise levels are calculated as shown. These levels have not been added to existing background levels.

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DixonBrosnan Project: 07031

BS 5228 prediction method (stationary sources)

Location	Distance	Noise source	L_{WA}	To L_{Aeq}	L_{Aeq}	Ground type (if mixed see BS 5228)			Screening	Adjustment				Façade	Adjusted	Time correction		Activity LAeq			Cumulative L_{Aeq}
	m		dB	m	L_{WA}-(20logD-8)	Hard/Soft	Kh=20logR/10	Ks= 25(logR/10)-2	0,5,10	Kh+Screen	Ks+Screen	Ks only	Applied	0,3	L_{Aeq}	% on	Kt (BS 5228 figD5)	dB	minutes	$10^{L/10}$	$10\log\Sigma 10^{L/10}$
NSL1	125	Building services		10	45	Hard	21.9382	25.4227503	5	26.9	30.4	25.4	27	0	18	100	0	18	30	63.096	
	115	In-bldg plant E façade		10	49	Hard	21.21396	24.517446	0	21.2	24.5	24.5	21	0	28	100	0	28	30	630.96	
	120	2 external trucks	98	10	70	Hard	21.58362	24.9795312	5	26.6	30.0	25.0	27		43	100	0	43	30	19953	
	100	Yardsweeper		10	76	Hard	20	23	5	25.0	28.0	23.0	25	0	51	33	5	46	30	39811	
	10	Trucks on road		5	54	Hard	0	-2	0	0.0	-2.0	-2.0	0	0	54	100	0	54	30	251189	
																				311646	55
NSL2	150	Building services		10	45	Soft	23.52183	27.4022815	0	23.5	27.4	27.4	27	0	18	100	0	18	30	63.096	
	140	In-bldg plant S façade		10	75	Soft	22.92256	26.6532009	0	22.9	26.7	26.7	27	0	48	100	0	48	30	63096	
	150	2 external trucks	98	10	70	Soft	23.52183	27.4022815	0	23.5	27.4	27.4	27	0	43	100	0	43	30	19953	
	120	Yardsweeper		10	76	Soft	21.58362	24.9795312	0	21.6	25.0	25.0	25	0	51	33	5	46	30	39811	
	20	Trucks on road		5	54	Soft	6.0206	5.52574989	0	6.0	5.5	5.5	6	0	48	100	0	48	30	63096	
																				186018	53
	140	In-bldg plant with screen		10	75	Soft	22.92256	26.6532009	10	32.9	36.7	26.7	33	0	42	100	0	42	30	15849	42
N bndry	30	Building services		10	45	Hard	9.542425	9.92803137	0	9.5	9.9	9.9	10	0	35	100	0	35	30	3162.3	
	20	In-bldg plant N façade		10	55	Hard	6.0206	5.52574989	0	6.0	5.5	5.5	6	0	49	100	0	49	30	79433	
	40	2 external trucks	98	10	70	Hard	12.0412	13.0514998	0	12.0	13.1	13.1	12	0	58	100	0	58	30	630957	
	10	Yardsweeper		10	76	Hard	0	-2	0	0.0	-2.0	-2.0	0	0	76	33	5	71	30	1E+07	
																				1E+07	71
W bndry	45	Building services		10	45	Hard	13.06425	14.3303128	0	13.1	14.3	14.3	13	0	32	100	0	32	30	1584.9	
	35	In-bldg plant W façade		10	53	Hard	10.88136	11.6017011	0	10.9	11.6	11.6	11	0	42	100	0	42	30	15849	
	40	2 external trucks	98	10	70	Hard	12.0412	13.0514998	0	12.0	13.1	13.1	12	0	58	100	0	58	30	630957	
	10	Yardsweeper		10	76	Hard	0	-2	0	0.0	-2.0	-2.0	0	0	76	33	5	71	30	1E+07	
																				1E+07	71
E bndry	40	Building services		10	45	Hard	12.0412	13.0514998	0	12.0	13.1	13.1	12	0	33	100	0	33	30	1995.3	
	30	In bldg plant E façade		10	49	Hard	9.542425	9.92803137	0	9.5	9.9	9.9	10	0	39	100	0	39	30	7943.3	
	40	2 external trucks	98	10	70	Hard	12.0412	13.0514998	0	12.0	13.1	13.1	12	0	58	100	0	58	30	630957	
	10	Yardsweeper		10	76	Hard	0	-2	0	0.0	-2.0	-2.0	0	0	76	33	5	71	30	1E+07	
																				1E+07	71
S bndry	40	Building services		10	45	Hard	12.0412	13.0514998	0	12.0	13.1	13.1	12	0	33	100	0	33	30	1995.3	
	30	In-bldg plant S façade		10	75	Hard	9.542425	9.92803137	0	9.5	9.9	9.9	10	0	65	100	0	65	30	3E+06	
	40	2 external trucks	98	10	70	Hard	12.0412	13.0514998	0	12.0	13.1	13.1	12	0	58	100	0	58	30	630957	
	10	Yardsweeper		10	76	Hard	0	-2	0	0.0	-2.0	-2.0	0	0	76	33	5	71	30	1E+07	
																				2E+07	71
	30	In-bldg plant with screen		10	75	Hard	9.542425	9.92803137	10	19.5	19.9	9.9	20	0	55	100	0	55	30	316228	55

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APPENDIX 9

Archaeology Record Wexford

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NAT_MON	NM_DESCRPT	TLANDNAME	COUNTY	FILE_NO	LEG_STATUS	
133	Monastery (Aug.), Church	Ferns Upper	WX		O	
192	Abbey (Cist.)	Dunbrody	WX		O	
229	Castle	Rathumney	WX		O	
375	Motte	Ballymoty More	WX	C94:318/1/38	O	17/10/1938
392	Windmill on Vinegar Hill	Templeshannon	WX	C94:230/1/37	G	18/07/1940
429	Castle	Slade	WX	C94:492/1/41	G	01/06/1943
434	Castle	Rathmackee Great	WX	C94:465/1/40	G	
443	St. Mary's Church	New Ross	WX	C94 646/1/45	G	14/05/1947
445	St. Selsker's Church	Wexford Town	WX	C94 680/1/46	G	11/09/1947
457	Tacumshane	Windmill	WX	F94 755/1/48	G	07/12/1949
506	Abbey (Cist.)	Tintern	WX	F94:366/1	O	20/11/1963
516	Castle	Ballyhack	WX	F94/634/1	B	29/09/1966

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