EIS 19.69

LAND PLANNING & DESIGN

CUNNANE STRATTON REYNOLDS

An

Environmental Impact Statement

For the development of lands at

Back, Ballinasloe, Co. Galway

for the

provision of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m. The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Food Sales (including alcohol sales)and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit) first floor management suites and store areas, ancillary retail toilets and services, site level changes and re-grading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure.

For

Harte Holdings (Ballinasloe) Ltd.

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October 2007

EIS no: 1969

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Report No. HEL74501 v1.1

HYDROLOGICAL IMPACT ASSESSMENT FOR A PROPOSED MIXED USE DEVELOPMENT AT THE HILL OF BACK BALLINASLOE

On behalf of

Harte Holdings

October 2007

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HYDROLOGICAL IMPACT ASSESSMENT FOR A PROPOSED MIXED USE DEVELOPMENT AT THE HILL OF BACK BALLINASLOE

Job No.:	74501
Report No.:	HEL74501 v1.1
Prepared by:	Anthony Cawley BE, MEngSc, CEng MIEI
Date:	15th October 2007

DISCLAIMER

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TABLE OF CONTENTS

9.0 SUMMARY

The proposed Harte Holding's development site is located at the Hill of Back, Ballinasloe. The Hill of Bank is a raised fluvioglacial deposit forming a peninsula that is surrounded by the River Suck and its floodplain to the north, east and south. The development site is located approximately 400m upstream (north) of Ballinasloe Bridge, Dublin Road, Ballinasloe.

Surface Hydrology

The flood assessment study of the proposed site which is supported by monitoring data, a river channel survey and hydraulic modelling predicts a design flood level of 38.78m O.D. Malin. This design flood represents the 100year flood plus 20% climate change flow allowance. Such a flood level pre-development would inundate 0.98ha of the site area. To mitigate flooding the proposed minimum finish floor level for the development will be set to 39.5m O.D. Malin. This finish floor level provides a freeboard of 720mm above the estimated design flood level thereby protecting the development from flood events well in excess of 100year return period.

The proposed development of the site will involve infilling of the low lying northerly section of the site to facilitate the proposed access road to the development. At the estimated existing 100year flood level of 38.32m O.D. Malin (without climate change allowance) the floodplain storage that will be lost is estimated to be 7560m^3 representing a floodplain footprint area of 0.76ha. The impact of this encroachment on the flood flow conveyance and flood storage functions of the River suck and surrounding floodplain will have no perceptible impact on flood levels or downstream flow rates in the Suck River and thus will not result in causing flooding elsewhere. This was investigated using a calibrated hydraulic model running it for pre- and post development scenarios.

The discharge of storm water from the proposed 2.4ha of hardstanding area to the Suck River will have no perceptible negative impact on flows in the river as storm water attenuation is to be provided on-site through us of a permeable pavement with underlying porous stormwater storage layer beneath the car parking areas and the storm outflow to the river restricted to Greenfield runoff rates of 5l/s (2l/s per ha). Petrol interceptors and silt traps upstream of the proposed storm outfall are proposed in order to protect water quality in the receiving river.

During construction so as to avoid significant short-term negative water quality impact to the adjoining Suck River and floodplain area appropriate management of soiled water runoff from the construction site will be implemented. This management will ensure that all site runoff waters are

diverted through suitably sized, temporary, settlement lagoons for treatment prior to outfalling to the Suck River or outfalling to ground.

Hydrogeology

The underlying bedrock is a carboniferous limestone of Visean age and its associated bedrock aquifer is provisionally classified as a regionally important limestone bed rock aquifer with conduit flow. There are no nearby groundwater abstractions or source protections areas identified. There are no karst features are present on the site or in proximity to the site or Ballinasloe town. No rock outcropping is present at the site with bedrock formations reasonably deep, possibly exceeding 8m in overburden depth. The GSI vulnerability rating for the bedrock aquifer is classified as high with subsoil depths exceeding 3m and with a high permeability subsoil associated with the sand and gravel deposit. The quaternary of the site is free draining limestone sands and gravels with alluvium deposits along the active floodplain areas, which includes the proposed infill section along the north side of the site.

The proposed development will not involve any significant excavations below the water table level, as there are no proposed basements, with excavations being reasonably shallow and generally confined to within the quaternary and generally above the ambient watertable level. The proposed permeable pavement and stormwater infiltration area will increase the risk of contamination to the underlying aquifer. This potential impact to groundwater quality is considered to be a local minor impact given the nature of potential contaminants from car park and roof surface waters and the filtering effect available in the overlying subsoils. All potentially soiled areas such as loading bays will be separated and passed through grit removal and petrol interceptor and discharged directly to the River.

Residual Impacts

The longterm residual impacts arising from this development after mitigation are:

- An overall loss of flood storage to the Suck River as a result of raising the ground levels in a floodplain section on the north side of the site to accommodate a vehicular access road to the site. The impact of this flood storage loss on flooding will be imperceptible.

There are no perceived long-term negative impacts to the hydrogeology which includes groundwater, soils and bedrock geology, arising from the development.

9.1 INTRODUCTION

9.1.1 Preamble

This Section of the Environmental Impact Statement focuses on the existing hydrological environment in terms of surface and ground waters and addresses the potential hydrological impacts from the development along with the necessary mitigation measures and identifies any likely residual impacts.

9.1.2 Description of Proposed Development

The proposed Hill of Back development is a mixed use Retail / Commercial development with a total gross floor area of 10,075m^2. The development also includes surface car parking for 326 no spaces, ancillary hard and soft landscaping and vehicular access provision off Bank Road.
The proposed site is a Greenfield site, 2.41ha in area located upstream of the Dublin Road at the Hill of Back, Ballinasloe. The Hill of Back is a peninsula bounded by the River Suck and its floodplain to the north, east and south with land connection to the town from the west. The proposed development area is generally located on high ground above the River Suck flood limit and thus will not result in substantial infill of the site to achieve safe formation levels. The proposed minimum finish floor level for the development is 39.5m O.D. Malin. The main area of infill of floodplain land is the proposed access road from the west (from bank road). Such an access road and infill was previously granted planning permission as park of a Hotel Development on the Hill of Back by Mr. Jack Murray in 2005.

Water supply to the development will be from the Local Authority public water supply. Foul disposal from the development will be to the Local Authority public foul sewer which connects to the Ballinasloe Waste Water Treatment Plant located at Pollboy downstream of the site and town. This waste water treatment plant provides secondary treatment and phosphate removal and discharges the treated effluent to the River Suck midway between the Marina and the Pollboy Lock gates. Practically the entire site area will be paved (2.4ha of roads, pavement and roofs) and the surface water drainage will comprise combination of permeable pavements and gravity drains within the site. Disposal of all storm water from the site will be on site in accordance with accepted sustainable urban drainage system (SUDs) policy with a proposed storm overflow discharge to the River Suck via a single outfall and the peak outflow to the river restricted to a Greenfield runoff rate of 2l/s per ha (5l/s). Petrol interceptors will be provided upstream of the outflow (refer to Hayes Higgins Consulting Engineers services report and drawings for details).

9.2 METHODOLOGY

This section provides an assessment of the baseline surface and groundwater hydrology of the Study Area and subject site, the potential impacts from the proposed mixed-use development, appropriate mitigation measures and residual impacts.

This assessment was performed mainly by desktop review of published and unpublished information on the hydrology of the River Suck at Ballinasloe. The information used in the desk study includes the following sources:

- Office of Public Works (OPW) hydrometric data
- EPA water quality monitoring of River Suck
- Geological Survey of Ireland – Groundwater and bedrock Geology
- Met Eireann Rainfall Data
- Soils and Sub-soils by Spatial Analysis unit, Teagasc
- Hydro Environmental Flood Risk Study for Hotel Development at Hill of Back (August 2005)
- Hydro Environmental Flood Risk Study of N6 River Suck Road Bridge Crossing for the NRA (2004)
- Topographical Survey of the Site by Precise Control Ltd. (February 2007)

9.3 EXISTING ENVIRONMENT; HYDROLOGY AND HYDROGEOLOGY

9.3.1 Hydrology of the River Suck at Ballinasloe

9.3.1.1 General Hydrology

The Suck River is a major tributary of the River Shannon having a catchment area of some 1520km² to its confluence with the River Shannon at Shannonbridge. The Suck rises in Lough O'Flynn near Ballinalough, to the northwest of Castlerea and flows in a generally southeast direction to Athleague below which it flows southwards to Ballinasloe and east-southeast to the River Shannon. The Suck catchment overlies a mixture of Burren and Calp Limestone Bedrocks.

The Suck collects a number of important tributaries including Island River whose confluence with the Suck is at Ballymore, the Shiven River whose confluence is 3km north of Ballyforan and the Bunowen (or Ahascragh) River whose confluence is 1km north of Ballinasloe. The River Suck each winter inundates its low-lying expansive flood plain south of Ballinasloe which provides significant flood storage. The reach section downstream of Pollboy is subject to backwatering from the River Shannon during large winter floods and the bed gradient is very flat suggesting lake like conditions between Shannonbridge and Pollboy Ballinasloe.

Waterways Ireland control the section of river between Ballinasloe Marina and its Confluence with the River Shannon at Shannonbridge. This section of river is navigable and dredging operations were carried out between Pollboy and Ballinasloe resulting in the development of a lock gate and canal at Pollboy, a marina at Ballinasloe (downstream of the N6) and a river channel with a bed invert less than 35m OD Poolbeg (32.3m O.D. Malin) and a 20 to 30m wide navigation width for small pleasure craft. The river channel sections are reasonably regular with top width between river banks generally exceeding 40m. The bed gradient over the study reach is generally flat except for sudden rise and fall at Pollboy (thus the formation of the lock gates). Due to the Flat gradient the River channel meanders significantly between Ballinasloe and Pollboy and some bank erosion on the outer (concave) channel bank is evident.

9.3.1.2 Historical Flood Events at Ballinasloe

Based on gauged flood records at Bellagill since 1952 the most significant flood events that occurred over the past 50 year (1952 to present) are as follows:

Table 9.1 Recorded Maximum Floods at Bellagill Gauging Station

Date	Peak flood Flow at Bellagill gauge	Peak Flood Level at Bellagill gauge	Estimated Return Period (years)
5th November 1968	148 cumec	40.21 m O.D. Malin	94 year flood event
20th Oct 1954	137cumec	40.15m O.D. Malin	44 year flood event
29th December 1999	123 cumec	40.07m O.D. Malin	17 year flood event
8th February 1990	120 cumec	40.05m O.D. Malin	13 year flood event
6th February 2002	115 cumec	40.02m O.D. Malin	10 year flood event

Historical flood levels in the River Shannon at Shannonbridge which backwaters the lower reach of the River Suck as far as Pollboy is as follows:

Table 9.2 Recorded Maximum Floods at Shannonbridge Gauging Station

Date	Peak Flood Level at Shannonbridge gauge	Estimated Return Period (years)
28th December 1999	35.56m O.D. Malin	35 year flood event
30th January 1995	35.50m O.D. Malin	27 year flood event
13th February 2002	35.48m OD Malin	23 year flood event
10th December 1954	35.48m OD Malin	23 year flood event
12th February 1990	35.47m OD Malin	21 year flood event

Flow data are not available for this station as a flow rating relationship has not been derived

9.3.1.3 Anecdotal Flood Information for Ballinasloe

The following anecdotal information concerning flooding in the vicinity of the site and Ballinasloe Town Centre was compiled from a number of different sources:

1. Photographs of winter flooding taken on the 14th December 1994 give a flood level at canal walk of approximately 37.5m O.D. (flow at Bellagill gauging station on that date was 89cumec). Similar levels were observed in Feb 1997 by Gerry Dolan of Dolan and Associates Consulting Engineers (flow at Bellagill gauging station on those occasions was approximately 98cumec.

2. Mr. Michael McKiernan of Waterways Ireland observed a flood level of 37.06 mO.D. at the new Marina site based on photograph he took on the 26th December 1999 which was latter surveyed by him (recorded flood peak at Bellagill gauging Station occurred on the 26th Dec, refer to Figure 1). At that time Waterways Ireland were in the process of constructing the Ballinasloe Marina and Mr. McKiernan who was responsible for this project recorded the flood level in the vicinity of the walkway/footbridge. Other flood level measurements recorded by Waterways Ireland over approximately a 5-year period in the 1980's gave a maximum flood level of 36.6m O.D. (128.97 ft Poolbeg), measured at the East Bridge. Photo evidence taken at Pollboy lock gates on the 28th December 1999 shows the flood levels close to the top of lock wall level upstream of the lock gates giving a flood level of just below 36.51mOD Malin. It was also observed from photos taken that a water level drop between upper and lower locks possibly exceeded 0.8m (rough estimate arrived at from interpretation of photograph). This information confirms that Pollboy was not drowned by downstream floodwaters and suggests given the gradient that critical flow possibly occurred at the Pollboy rapids.

3. Since the N6 inner bypass road of the town centre has been constructed (at least 15years in existence) no flooding of the road from the River Suck has occurred to date with the lowest road level adjacent to the marina at 38.2m O.D. Malin.

4. A winter maximum watermark on the rock gabion protection at the new Marina in Ballinasloe gives a level of 36.3m O.D. This is likely to reflect the normal winter levels as opposed to extreme flood levels.

5. Unsubstantiated anecdotal information suggests that the historical maximum flood (possibly the 1968 flood) reached the steps / boundary wall to St. Michael's Church (no date available for this event and should be treated with caution). This suggests a flood level below 38.0m OD Malin in the canal area.

6. There is no anecdotal evidence from landowners to suggest that flood levels downstream of the Dublin Road Bridge at Ballinasloe have ever exceeded 37.5m O.D. Malin.

7. The Caretaker at Ballinasloe Wastewater Treatment Plant (WWTP) located downstream of the East Bridge and upstream of Pollboy Lock, has stated that flood waters have never reached the boundary fence of the WWTP in the 25years he has worked for Ballinasloe Town Council, including the December 1999 flood. The WWTP fence line is at approximately 38m O.D. Malin.

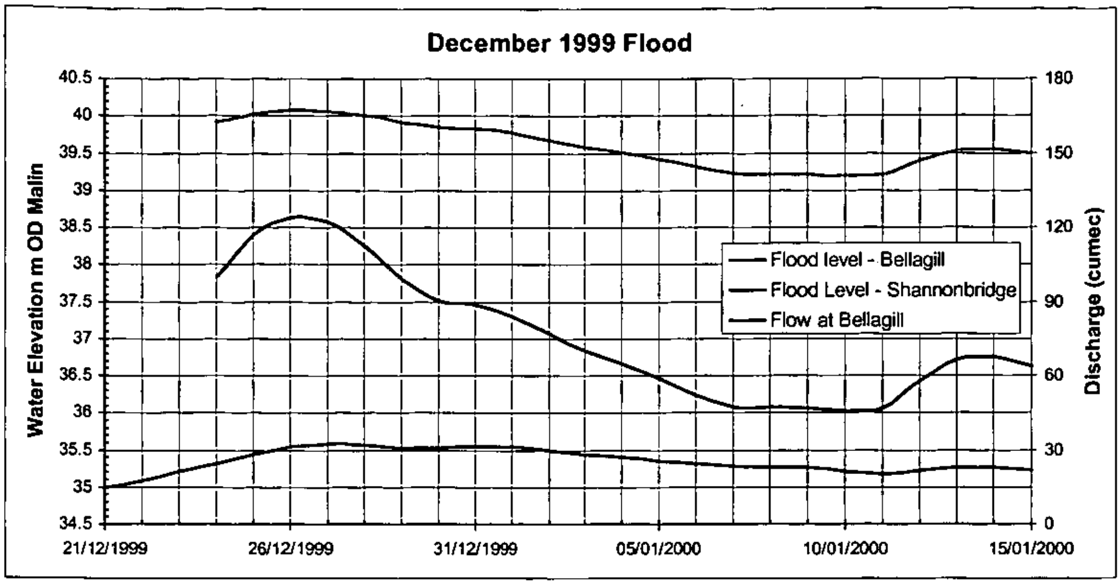

Figure 9.1 December 1999 Flood Hydrograph at Bellagill and Shannonbridge

9.3.1.4 Recent flooding

10th / 11th January 2005 Flood Event

As part of the hydraulic model data gathering exercise Hydro Environmental limited visited Ballinasloe between 12:00 and 14:00 hours on the 10th January 2005, which practically coincided with the peak of the flood event. Photographic evidence of the flooding was taken at Pollboy, Ballinasloe Marina, canal near St. Michaels, N6 Road Bridge, Hill of Back and Bellagill Bridge. These photographs were subsequently surveyed in to Malin Datum so as to provide flood level data.

The staff gauge reading at Bellagill gave a flood depth of 2.56m which is 39.97m OD Malin and translates based on the rating relationship to a flow rate of 108 cumec which represents a 6 year return period flood peak at Bellagill.

The following flood levels were observed during the site visit:

- the observed flood level downstream of the Pollboy Lock Gate was 35.51mO.D. Malin,
- the flood level immediately upstream of the Pollboy upper lock gate was 36.38mO.D. Malin,
- the flood level at Ballinasloe Marina Walkway was 36.89mOD Malin,
- the flood level at the N6 Road Bridge upstream face was 36.95m O.D. Malin (estimate based on a bridge survey carried out by Brendan Arrigan Ltd.)
- the flood level at the Hill of Back adjacent to the pump inlet chamber was 37.61m OD Malin

Figure 9.2 Photo taken by OPW on the 11th January 2005 showing the extent of flooding at the Hill of Back.

9.3.1.5 Hydrometric Gauging Stations

The following table presents hydrometric gauging stations in the Suck Catchment and a number of these stations are used in a pooled statistical flood frequency analysis presented latter in the section.

Table 9.3 *Hydrometric Gauging Sites*

Gauge No.	Gauge Site	River	Grid Location	Gauge Type	Authority	Period
26001	Ballinamore	Shiven	M757489	Automatic	OPW	1972 - 2001
26002	Rookwood	Suck	M806571	Automatic	OPW	1973 - 2001
26005	Derrycattle	Suck	M825424	Automatic	OPW	1954 - 2001
26006	Willsbrook	Suck	M692756	Automatic	OPW	1952 – 2002
26007	Bellagill	Suck	M841346	Automatic	OPW	1952 - 2004
26028	Shannonbridge	Shannon	M967254	Automatic	OPW	1954 - 2003

Table 9.4 Hydrometric Summary of Gauges

Gauge No.	Gauge Site	Area km²	Mean Flow (cumec)	Annual Max Flow (cumec)	99% low flow (cumec)	DWF (cumec)
26001	Ballinamore	230	N/A	N/A	N/A	N/A
26002	Rookwood	626	14.4	55.11	1.14	N/A
26005	Derrycattle	1050	N/A	92.11	N/A	1.4
26006	Willsbrook	182	3.6	28.84	0.22	.08
26007	Bellagill	1184	25.2	91.95	1.71	1.4
26028	Shannonbridge	4999	N/A	N/A	N/A	N/A

9.3.1.6 Water Level Monitoring at Ballinasloe

As part of data collection for calibration of the hydraulic river model two automatic water level recorders were deployed on the River Suck at Ballinasloe. Gauge A was deployed on the 14th November 2004 1100m upstream of the Dublin Road Bridge at the Waterways Ireland recently constructed canal intake pump chamber located on the right bank adjoining the subject site. Gauge B was deployed on the 6th December 2004 250m downstream of the N6 Road Bridge on the right bank at the entrance to the Marina Channel. These automatic water level gauges were OTT "Aquanaut" pressure transducer electronic recorders which measure temperature and pressure converting it to water level and store up to 3 months data at 10min recording intervals. Spot checks on water levels were carried out over the monitoring period and water level range to allow calibration / tuning of these instruments so as to minimise drift effects.

The water level hydrographs for the monitoring period November '04 to July '05 are presented in ***Figure 9.3*** and the recorded 10th January 2005 flood hydrograph is presented in ***Figure 9.4***. The water level records show a flood peak of 37.61m OD Malin at Gauge A (Hill of Back) and 36.905m O.D. at Gauge B (Marina approach channel) recorded at 6pm on the 10th January 05. The peak flood levels at these sites remained relatively constant for 24hours before slowly receding.

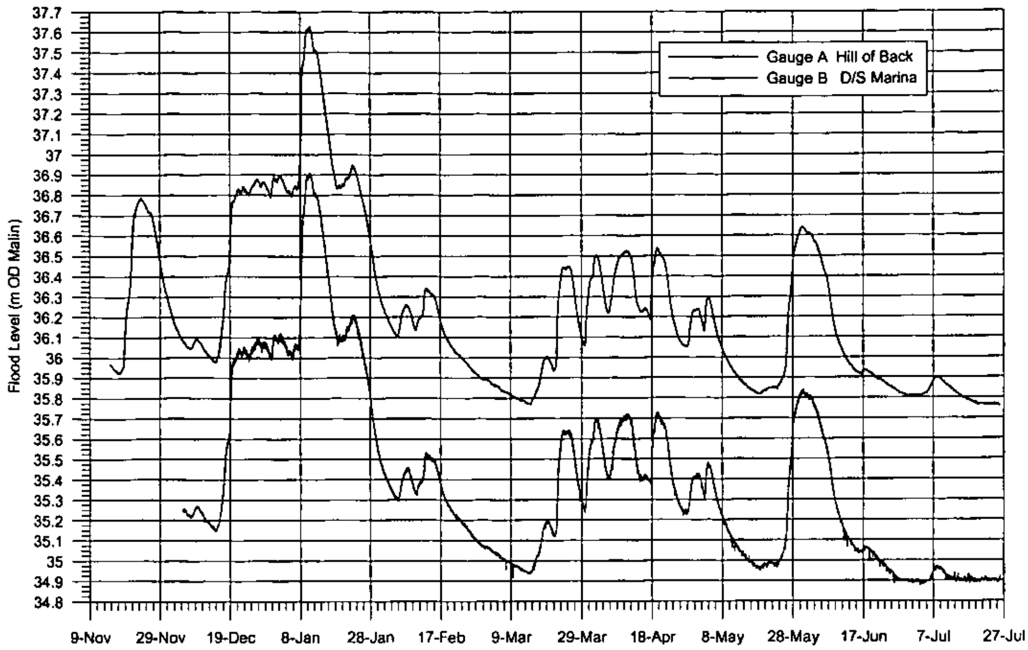

Figure 9.3 Flood level records at Ballinasloe Gauging sites from Nov '04 to July '05

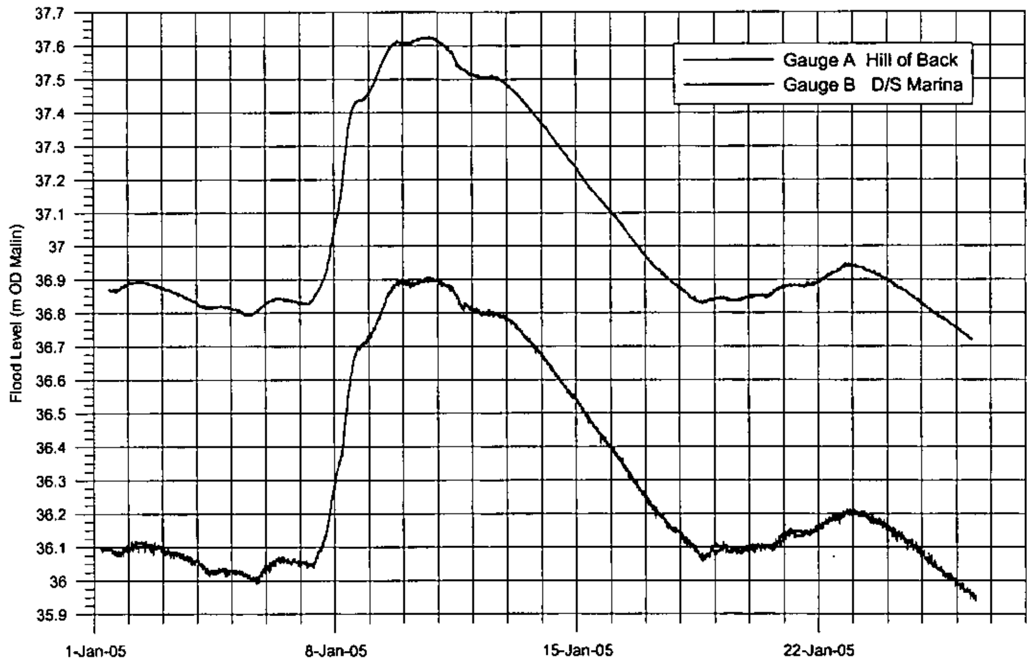

Figure 9.4 January 10th 2005 Flood hydrographs at Ballinasloe Gauging sites

Figure 9.5 Water Level Gauging Locations at Ballinasloe

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9.3.2 Flood Flow Analysis

9.3.2.1 Flood Flow Estimation - Introduction

A design flood may be determined by either of two broad categories of methods, these are:

- Methods based on statistical analysis of flood peak data from donor gauges
- Methods based on a design rainstorm and a rainfall-runoff model which converts the design rainstorm into a design flood.

A further distinction arises between gauged and ungauged catchment methods. The later use formulae which relate some key component of the method being used, such as mean annual flood (QBAR) or unit hydrograph time to peak (Tp), to catchment descriptors such as AREA, Slope (S1085), mean annual rainfall (SAAR), runoff coefficient (SOIL) among others.

The nearest OPW hydrometric gauging station to the subject site is located at Bellagill station (26007) located 7km upstream of The Dublin Road Bridge, Ballinasloe. The rating relationship for this station is considered to be very good for high flows, having a reliable rating for flood flows up to 150cumec. The catchment area to Bellagill is 1184 km^2, the catchment area to the N6 road bridge Ballinasloe is 1355km^2 and to the Pollboy lock gates is 1360km^2. The total catchment area of the River Suck to its confluence with the River Shannon at Shannonbridge is 1520km^2.

9.3.2.2 Statistical Analysis of gauged flood flows

Methods based on statistical analysis of flood peak data are usually used for determination of a 100year design flood, especially where a considerable amount of gauged data exists as is the case with Bellagill station. The statistical method may be used on a single site basis or on a pooled basis. In the latter, which is recommended by UK Flood Estimation Handbook (1999), the flood data from several river sites are in effect pooled together to provide an improved estimate of the required flood value. Pooled analysis is regarded as providing a more reliable estimate of the required flood, providing that catchments included in the "pooling" group are sufficiently similar in area, annual rainfall and soil/geology conditions.

The gauging station nearest the project location is Bellagill (26007) from which annual maximum flood data are available since 1952, 53 values in all are available with no missing years. The catchment area to this location is 1184km^2 whereas the catchment area to the project location is 1355km^2 which is 14.4% greater than the Bellagill value. Since floods are generally proportional to catchment area to a power of approximately 0.8 it is expected that the flood peak values at the project location are approximately 111.4% of the Bellagill values.

For pooled analysis the data of the three stations on the Suck whose catchment areas exceed 500km² will be used. A disadvantage of this pooling group is that it is too small when judged by the FEH criterion that recommends a minimum of 5T (T is the return Period) station years be included in the pool, in this case 5 x 100 = 500station years. The three stations concerned contain 149 station years.

Single site analysis using the Bellagill Gauge

The annual maximum flow series for Bellagill gauging station was obtained from the Hydrometric Office, Headford (hydrometric years 1952 to 2003). Including in this series the recently observed January 2005 flood peak as the annual maximum value for 2004 hydrometric year, 53 AM values for this station are available. These are plotted sequentially in ***Figure 9.6***.

Single site flood frequency analysis fitting a flat two-parameter extreme value type 1 (EV1 or Gumbel) distribution by the method of least squares to the 53 AM values was performed. A good fit to this data is achieved using the EV1 distribution. These 53 values are shown on probability plot along with the least Squares EV1 Fit in ***Figure 9.7***. The EV1 distribution is recognised as providing a good fit to flood statistics in Irish Rivers particularly the larger rivers.

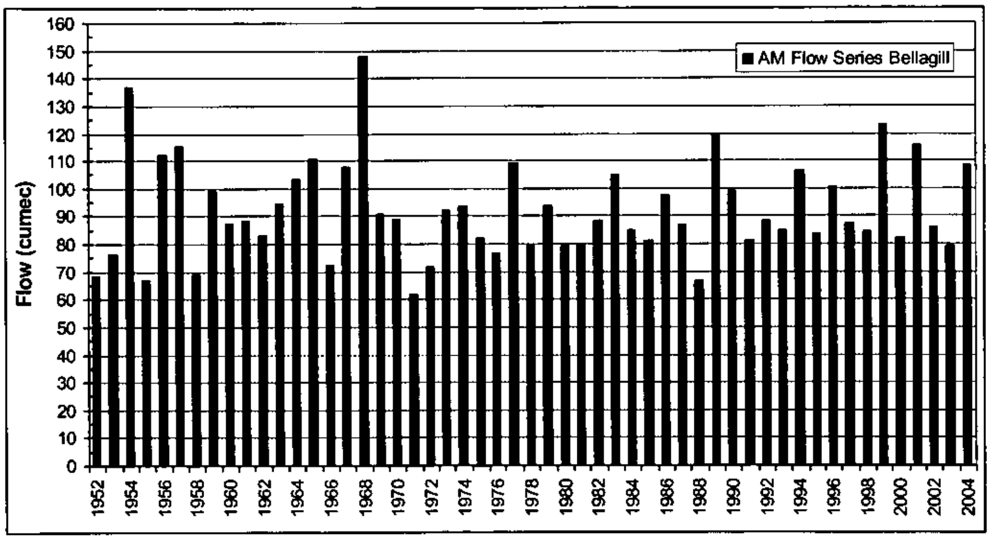

Figure 9.6 Sequential Plot of annual maximum flows for River Suck at Bellagill (26007)

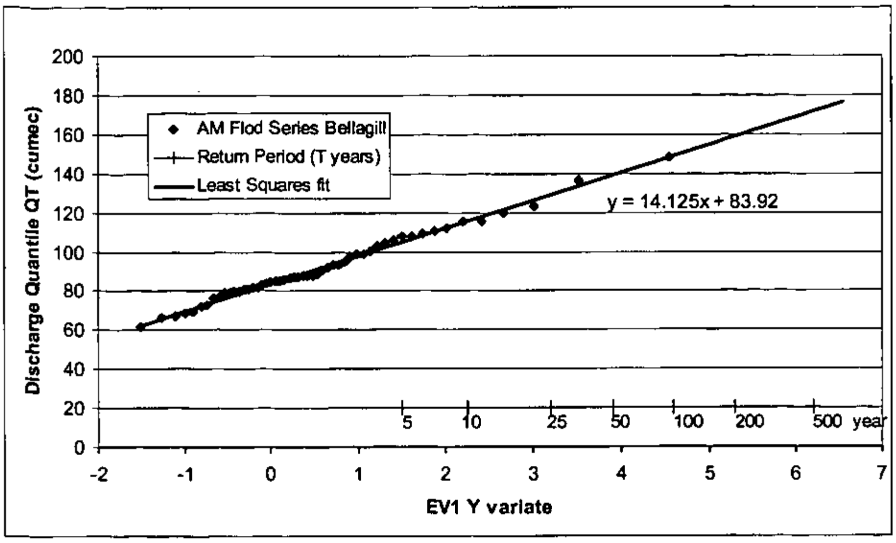

Figure 9.7 Flood frequency Analysis of OPW AM Flow Series at Bellagill (26007), (Showing excellent EV1 Fit to the A.M. data.)

The Q_{BAR} value (i.e. mean annual maximum flood flow) for this series is 92cumec having a standard deviation of 17.73cumec and a standard error of 2.33cumec. The return period flow estimates from the EV1 analysis are presented below in ***Table 9.5***.

The computed Bellagill flood statistics presents a considerably flatter growth curve than the National growth curve for Ireland derived in the 1975 Flood Study Report (NERC 1975) and is also flatter than the regional growth curve for the West Region derived by Cawley and Cunnane (2003), refer to ***Figure 9.9***.

Table 9.5 Flood Frequency Estimates for Bellagill

T (years)	EV1 Yvariate	QT (cumec)	s.e. (cumec)	Growth Factor XT
2	0.367	89.1	2.24	0.97
5	1.500	105.1	3.77	1.14
10	2.250	115.7	5.09	1.26
25	3.199	129.1	6.86	1.40
50	3.902	139.0	8.20	1.51
100	4.600	148.9	9.56	1.62
200	5.296	158.7	10.91	1.73

The Q_{100} from this analysis is 148.9cumec having a standard error of 9.56cumec. The QT estimate plus the addition of twice the standard error represents the 95percent upper confidence limit for the estimate which is 168cumec.

Given the excellent rating available for flood flows at Bellagill and the long series of AM flows available at the gauge (i.e. 1952 to present providing 53years) high confidence can be placed on the flood frequency results from the Bellagill single site analysis.

Pooled Analysis

The index flood method is used, in which

$$Q_T = Q_{BAR} * X_T$$

Where $X_T = Q_T/Q_{BAR}$ is the standardised regional growth curve ordinate and QBAR is the mean annual flood at the project location. The quantity X_T is the T-year quantile in the standardised flood distribution.

Three stations on the River Suck, Rookwood (26002), Derrycattle(26005) and Bellagill(26007) are included in the pooled analysis. Individual and combined (standardised by dividing AM values by respective QBAR values) statistical frequency analyses were carried out on this data fitting an EV1 probability distribution. All stations showed good fit to an EV1 distribution.

The individual and combined (pooled) growth curves for these stations are presented in ***Figure 9.8***. The pooled growth curve for the three stations is very similar to the Bellagill growth curve and considerably flatter that the National FSR and west Region growth curves, refer to ***Figure 9.9***.

Regional Growth Curve Flood Estimates

In the absence of sufficient pooled or single site data regional growth curves (FSR national Growth Curve, Cawley and Cunnane west region growth curve) can be used with the site estimate QBAR rate to yield return period flow estimates. The return period estimates from this method using West region and FSR National Growth curves along with the previous estimates from the single and pooled gauging methods are presented below in ***Table 9.6***.

Table 9.6 Comparison of Flood estimates using the various Flood Growth Curves

Return Period T years	Bellagill Single Site	Pooled (26002, 26005, 26007)	West Region (Cawley & Cunnane 2003)	FSR National (NERC 1975)
2	89.1	89.0	88.3	88.3
5	105.1	105.5	108.5	110.3
10	115.7	116.4	122.3	126.9
25	129.1	130.2	138.8	147.1
50	139.0	140.4	150.8	162.8
100	148.9	150.6	163.7	180.2
200	158.7	160.7	175.6	196.8

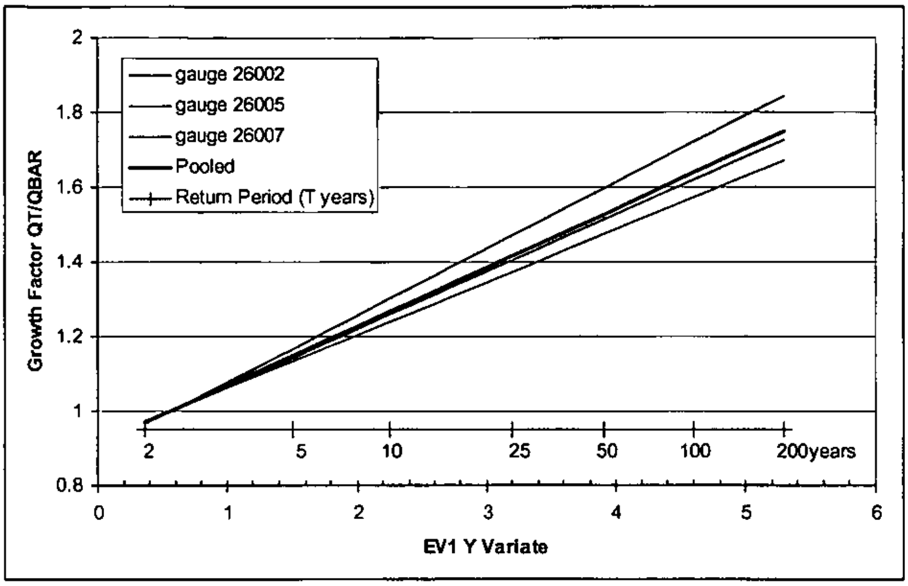

Figure 9.8 Individual and combined station growth curves for the River Suck

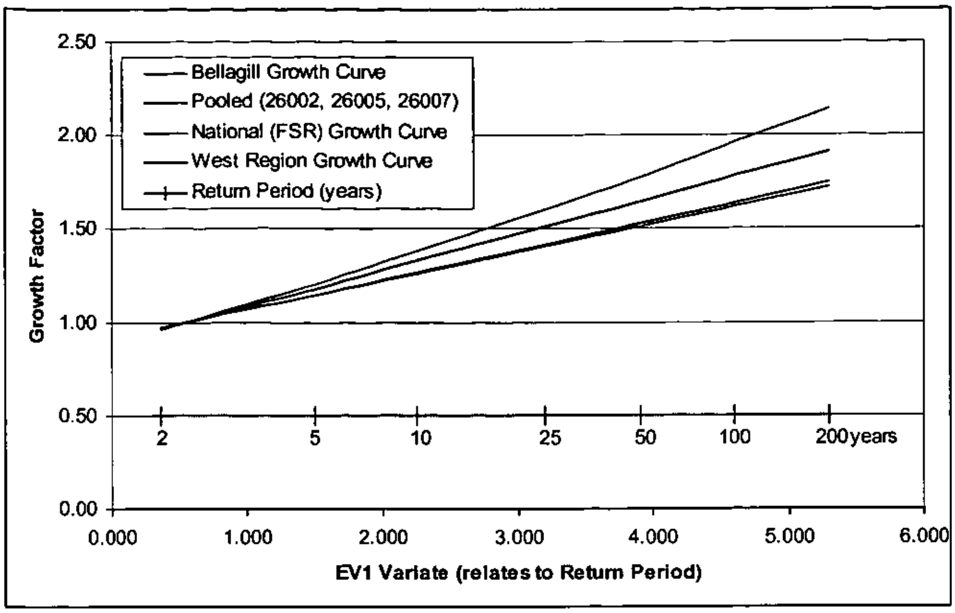

Figure 9.9 Comparison between Bellagill, Pooled (26002, 26005, 26007), National and West Region Flood Growth Curves

9.3.2.3 Climate Change Allowance

The OPW have recently produced draft guidelines in respect to design considerations of possible climate change for flood risk management practice. The recommended design allowances to be used for increases in flood flows during the sensitivity and / or design process are given by region in ***Table 9.7.***

Table 9.7 Regional Flood Peak Allowances

	Allowances (% increase) in Flood Flows	
Region	**Summer (and Autumn) Floods**	**Winter (and Spring) Floods**
North	10	20
North West	10	15
West	25	10
South West	10	15
South	15	25
South East	15	20
East	10	20
Midlands	25	20

In the UK research is ongoing to assess regional variations flood allowances and the rate of future change. Current research thus far does not provide any evidence for the rate of future change let alone consider regional variations in such a rate. As a pragmatic approach it is suggested that 10% should be applied up to 2025, rising to 20% beyond 2025, refer to ***Table 9.8*** (DEFRA, 2006).

Table 9.8 The UK Flood and Coastal Defence Appraisal Guidance (DEFRA, 2006) gives the following sensitivity climate change ranges

Parameter	1990 - 2025	2025 - 2055	2055 - 2085	2085 - 2115
Peak rainfall intensity (preferably for small catchments)	+5%	+10%	+20%	+30%
Peak river flow (preferably for larger catchments)	+10%	+20%		

9.3.2.4 Recommended Design Flow Rate at Ballinasloe

The flood frequency analysis of the Bellagill Annual maximum Flow data multiplied by the pooled flood growth curve is the preferred method for estimating the design flows in the Suck at Ballinasloe. High confidence can be placed on the flood frequency results because of a very reliable flood rating relationship (reliable up to 150cumec) at Bellagill, the close proximity of the gauge to Ballinasloe, the excellent EV1 fit to the annual maximum flood flow series, the long continuous series of AM flows (53years currently available), and the close agreement obtained between single site and pooled growth curves.

To convert from Bellagill having a catchment area of 1184km^2 to Ballinasloe with a catchment of 1355km^2 a scaling factor of 1.114 is used which is obtained using the ratio of catchment areas to the power of 0.8 (NERC, 1975).

Table 9.9 Return Period Flood Flow Estimates for the River Suck at Ballinasloe

T Return Period	Estimated Flow Rate at Ballinasloe without Climate Change Allowance	Estimated Flow Rate at Ballinasloe With 20% Climate Change Allowance
2	99.2	119
5	117.5	141
10	129.7	156
25	145.0	174
50	156.0	188
100	168.0	201
200	179.0	215

The recommended best estimate of the 100year design flood flow with climate change allowance to Ballinasloe is 201cumec based on the pooled analysis. The single site analysis gives a flood flow to Ballinasloe of 199cumec. The FSR index flood method using the national flood growth curve gives a 100year estimate with climate change allowance of 241cumec (20% higher) and using the west region flood growth curve gives a 100year estimate with climate change of 219cumec (10% higher). These larger flood estimates will also be examined in respect to flood levels at the subject site and flood risk for the proposed development.

9.3.2.5 Estimation of Flood Levels Downstream of Pollboy Lock Gates

Statistical Frequency analysis of flood levels at Shannonbridge gauge (26028) and Bellagill gauge (26007) are carried out so as to provide a rational for establishing return period flood levels downstream of Pollboy lock gates which are necessary as boundary conditions to the hydraulic model. The Shannonbridge gauge is located just upstream of the confluence between the River Suck and River Shannon having a catchment area of 4999 km^2. It has a slow time to peak resulting in a damped hydrograph and is generally a least 24hours latter than the flood peak in the River Suck at Ballinasloe. Refer to ***Figure 9.1*** for flood hydrographs corresponding to the 1999 flood event.

The estimated flood level at Pollboy lock gates is 35.5m O.D. based on a measure reference point (flood levels reached the 7th step on the 10th January 2005).

Applying an EV1 probability distribution to the flood level data at Shannonbridge and Bellagill stations the following return period flood level estimates are obtained. These estimates are expected to error on the conservative side as the AM series curves downwards away from the EV1 Least Squares best fit line at both stations thus over estimating the higher return period flood levels.

Table 9.10 Flood Frequency results at Bellagill and Shannonbridge

Return Period	AM Flood Level Bellagill (26007) (m O.D. Malin)	AM Flood Level Shannonbridge (26028) (m O.D. Malin)
2	39.80	34.99
5	39.94	35.23
10	40.03	35.39
25	40.15	35.58
50	40.24	35.73
100	40.32	35.88

Both the 1999 and 2005 flood event produced peak flood levels downstream of the lock gates of approximately 35.6 and 35.5m O.D. Malin respectively based on surveying in photographic evidence taken during both events.

The January 2005 flood has an estimated return period at Bellagill of 6 years and thus it is reasonable to assume that the downstream flood level at Pollboy is of the same order of magnitude. At Bellagill the difference in flood level between a 5year and 100year flood is 0.38m and at Shannonbridge it is 0.65m. It is therefore reasonable to assume that the 100year downstream flood level at Pollboy is of the order of 36.1m O.D. (i.e. 0.6m difference between 5 and 100year flood levels).

A 20% increase in flood flow on account of climate change (equivalent to a 100year event becoming a 25year event) is likely to produce a flood level increase at Shannonbridge of 0.2m and at Bellagill of 0.1m. Therefore the recommended 100year design flood level with climate change downstream of Pollboy lock gates is 36.3mO.D.

9.3.3 Predicted Flood Levels

9.3.3.1 Introduction

Hydro Environmental Ltd. have previously developed a HEC-RAS mathematical hydraulic model of the River Suck through Ballinasloe (HEL, 2005,). This model was developed to accurately predict flood levels in the river through the town and downstream to Pollboy Lock Gates.

The selected hydraulic modelling software used is HEC-RAS by the US Army Corp of Engineers. HEC-RAS implements a 1-dimensional model of river flow in the longitudinal direction and takes account of the conveyance and storage within the main river channel and on its adjoining floodplain overbanks. This software is recognised as the industry standard software for such applications.

The model reach is 6.2km long extending from 300m downstream of the Railway bridge river crossing in Ballinasloe to 500m downstream of Pollboy Lock Gates (refer to ***Figure 9.10***). Full details of the model and is set-up and calibration are available in the Flood Risk Assessment report of the Hill of Back, that accompanied planning permission for a hotel Development in 2005.

9.3.3.2 Design Flood Simulations

The design flows considered in this study are as follows:

1. 2 year return period flood event (median (50percentile) flood condition)
2. 100year return period flood event without C.C.
3. 100year return Period Flood Event with C.C.

Table 9.11 Model Boundary Conditions Specified in Hydraulic Simulations

Run	Description	Downstream Flood level m O.D.	Upstream Flow Rate (cumec)
1	2 year return period Flood event	35.3	99
2	100year return period flood event without C.C.	36.1	168
3	100year return Period Flood Event with C.C.	36.3	201

9.3.3.3 Hydraulic Results

The River Suck HEC-RAS hydraulic model was run in steady state mode for the boundary conditions specified above in ***Table 9.11***. The computed longitudinal flood profiles for the three flood conditions are presented in ***Figure 9.12***. The flood levels predicted in the river adjacent to the site are summarised below in ***Table 9.13*** for Sections 10, 16 and 20 with Section 10 (the most upstream section) used to establish the flood risk to development.

Table 9.12 Flood Level Predictions In River Adjacent to site for Flood Simulation Events.

Flood Event	Estimated Flow Rate at Ballinasloe (cumec)	Computed Flood Level Section 20 m. O.D.	Computed Flood Level Section 16 m. O.D.	Computed Flood Level Section 10 m. O.D.
2yr Flood	99	37.05	37.16	37.27
100yr Flood without C.C.	168	38.11	38.22	38.32
100yr flood with C.C.	201	38.59	38.69	38.78

Refer to ***Figure 9.11*** for model section locations in the vicinity of the subject site, ***Figure 9.12*** for computed longitudinal flood profile and ***Figure 9.13*** the computed flood inundation map of site and Hill of Back.

Model Sensitivity

Model simulations were carried out to investigate the effect of 10% and 20% increases in the 100year design flow (i.e. design flow of 201cumec increasing to 221 and 242cumec with a flood level downstream of Pollboy of 36.3m O.D.) as a result of possible error in the flow prediction. These increases in the 100year peak flow were found to increase flood levels in the river at the subject site (River Section 10) by 0.27m and 0.57m respectively.

A sensitivity analysis of the Manning's n was also carried out and this showed that for the 100year flow simulation an increase in roughness of 0.005 increases (15% increase in roughness) the flood level at the project site by 0.21m.

A 500mm increase in the downstream flood level at Pollboy from 36.3 to 36.8m O.D. Malin will only increase the flood level at the site (Section 10) by 0.09m for the 201cumec design flow.

The above analyses show the model predictions at the site to be reasonably robust and that the provision of a freeboard of 600mm on top of the predicted 100year flood level should protect against significant variations in roughness, downstream flood levels and flow rate.

9.3.4 Flood Risk to the Proposed Development

9.3.4.1 Discussion

The proposed minimum finish floor level for the development is to be set at 39.5m O.D. Malin. Such a floor level provides a freeboard of 1180mm over the predicted present day 100year flood level (without climate change) and 720mm freeboard over the design flood which includes a 20% climate change flow allowance.

The flood levels at the site are sensitive to the accuracy of the flow estimate with a 10% increase in flow rate increasing the flood level at the site by the order of 270mm and a 20% increase by 570mm. These relatively dramatic increases in upstream flood level is due to the limited capacity of the existing N6 road bridge and its approach channel.

The proposed minimum finish floor level of 39.5m O.D. provides a generous level of protection against flooding under extreme conditions. At the design flood of 201cumec (which includes

climate change) a freeboard allowance of 720mm is available which represents for an additional flow rate of c. 30% to the design flow of 201cumec.

Freeboard is a design consideration quantified as an additional height above the computed / predicted flood level to account for the uncertainties in the hydraulic analysis. Minimum Freeboards of 0.3m are often adopted for low velocity channels in primarily rural areas. Freeboards of 0.5 to 0.75 are often used for other types of channel and flow conditions.

The proposed flood risk to the development has been minimised through the selection of a minimum finish floor level of 39.5m O.D. Malin. This finish level provides protection well in excess of the 100year flood event and includes the recommended provision against future climate change increases.

9.3.5 Low Flows and Water Quality in River Suck

9.3.5.1 Low Flows

The OPW in their hydrometric web site give a flow duration curve for the River Suck at Bellagill station as presented below. This duration curve give the 95 and 99% low flow rates of 2.6cumec and 1.72cumec respectively. Extrapolating to Ballinasloe using catchment areas gives low flow rates of 2.89 and 1.89 cumec respectively. The EPA low flow database gives a 98percentile low flow rate of 1.4cumec which when adjusted for Ballinasloe is 1.56cumec. The historical driest summer occurred in September 1976 and is recognised by the EPA as having a low flow return period of approximately 50years (98-percentile Dry Weather Flow) (McCarthaigh, 2002).

Table 9.13 Flow and water level duration data for River suck at Bellagill

GENERAL STATION DETAILS			
Station Name: Bellagill	Station No: 26007	Watercourse: Suck	NGR: M 841 346
Catchment Area (km²): 1184	Catchment: Suck	Gauge Type: AR	Datum: Malin

SUMMARY HYDROMETRIC STATISTICS
Annual Average Rainfall (mm)[1]: 1050
Est'd Annual Losses (mm)[1]: 447
Mean Annual Flow (m^3/s): 25.202
(Data derived for the period 1972 to 2005)

STATION HISTORY
1952 to 2005
Period of Digitised Record: 1972 to 2003

DURATION PERCENTILES							
Flows equalled or exceeded for the given percentage of time (m^3/s) (Data derived for the period 1972 to 2005)							
1%	5%	10%	50%	80%	90%	95%	99%
87.1	71.2	58.4	17.9	5.85	3.64	2.6	1.72
Levels equalled or exceeded for the given percentage of time (mAOD Poolbeg) (Data derived for the period 1972 to 2003)							
1%	5%	10%	50%	80%	90%	95%	99%
39.81	39.59	39.4	38.44	38.11	38.03	37.98	37.9

The summer water level adjacent to the site at the OPW Pump intake point is typically 35.6 to 35.8m O.D. Malin.

9.3.5.1 *River Quality*

The EPA measure the chemical and biological status of the river at a number of monitoring stations along the River Suck and its various tributaries. The relevant stations to the subject site are Bellagill(26S071200), Ballinasloe Bridge (26S071300) and Pollboy (26S071400) The Q value and chemical results are available from the EPA web site for these stations. The Q value system describes the relationship between water quality and the macroinvertebrate community in numerical terms and is considered a reasonably robust method of evaluating water quality in a river system. Q5 waters have high diversity and considered of very good water quality, while Q1 have little or no macroinvertebrate diversity and classified as bad water quality.

Q4-5, Q5	high status
Q4	good status
Q3-4	moderate status
Q2-3, Q3	poor status
Q1, Q1-2, Q2	Bad status

Table 9.14 EPA Q Value Data for River Suck at Ballinasloe

Station	2002	2003	2004	2005
Bellagill -26S071200	4	-	-	4
Ballinasloe Br - 26S071300	4	-	-	3
Pollboy - 26S071400	3-4	-	-	3

The above Q value results indicate that Ballinasloe Town and environs is having a significant impact on the water quality in the river, even upstream of the Ballinasloe WWTP outfall as indicated by the Q results for Ballinasloe Bridge.

9.3.6 Local Site Drainage

The subject site has no natural drains, being founded on reasonably free draining sand and gravel glaciofluvial deposit. The site is a Hillock falling to the north, south and east with top elevations of 42m O.D. Malin decreasing to floodplain levels of 36.5m O.D. Malin. Lands below 37.0m O.D. Malin will flood regularly each winter.

Crossing from north to south is a pumped water supply pipeline which was installed recently by OPW / Waterways Ireland to supply the canal system at Canal Walk with dry weather flow from

the River Suck during summer low flow periods. This supply will have to be maintained as the canal system can dry out completely in the summer drought periods, thus impacting on the amenity value of the Canal Walk area.

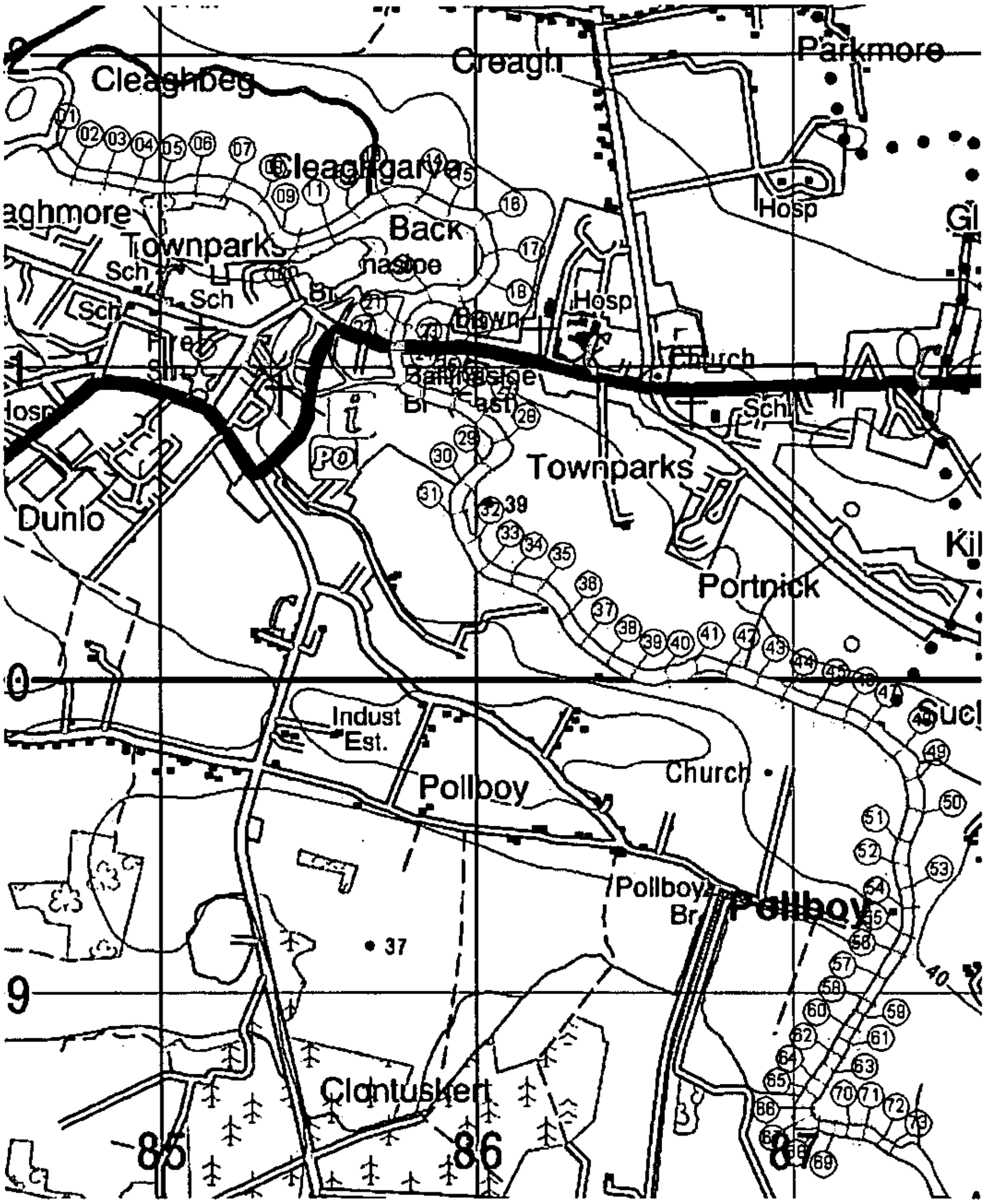

Figure 9.10 Site location and River Suck Hydraulic Model extent

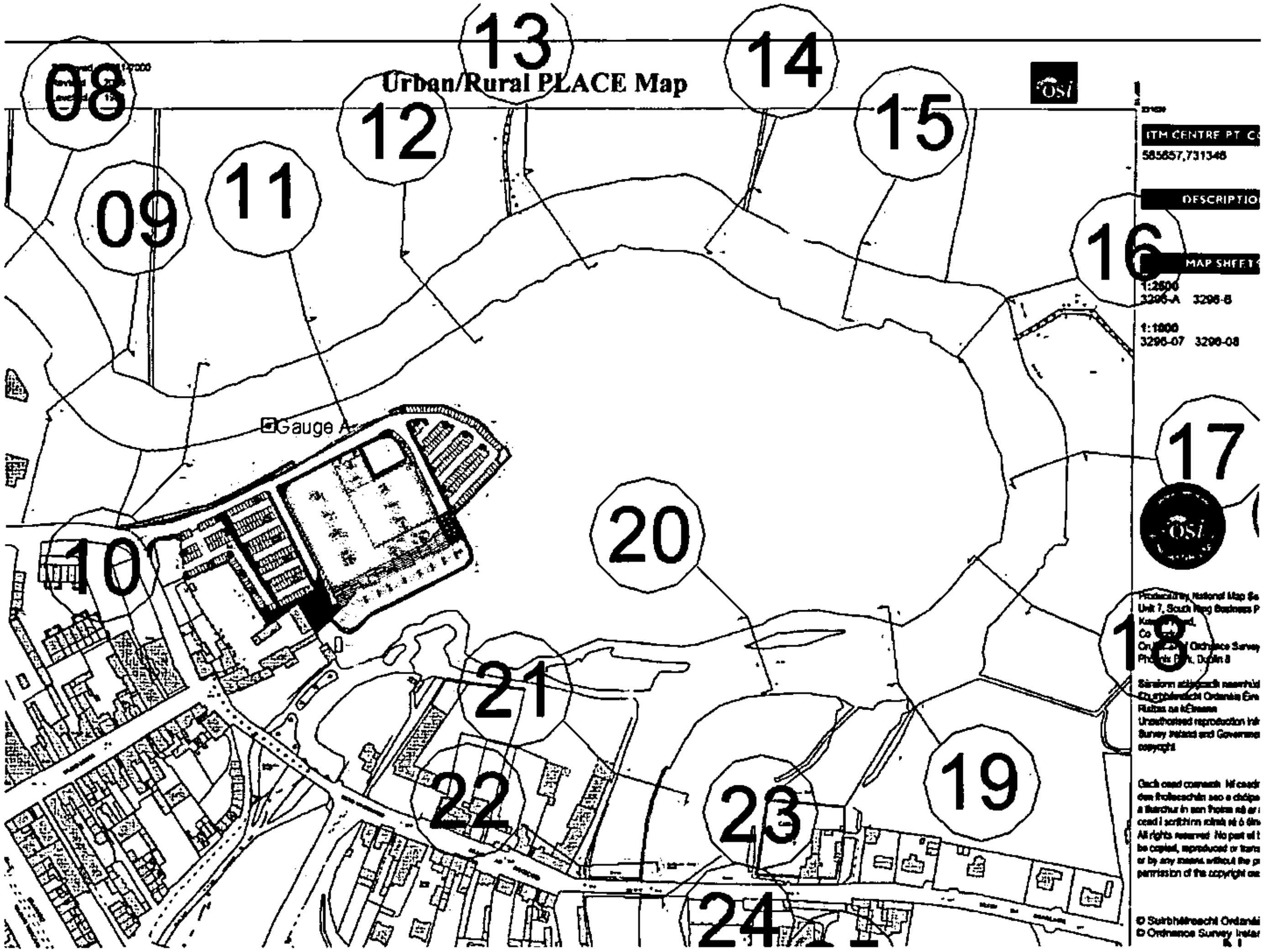

Figure 9.11 Location of Model River Sections adjacent to Proposed Site

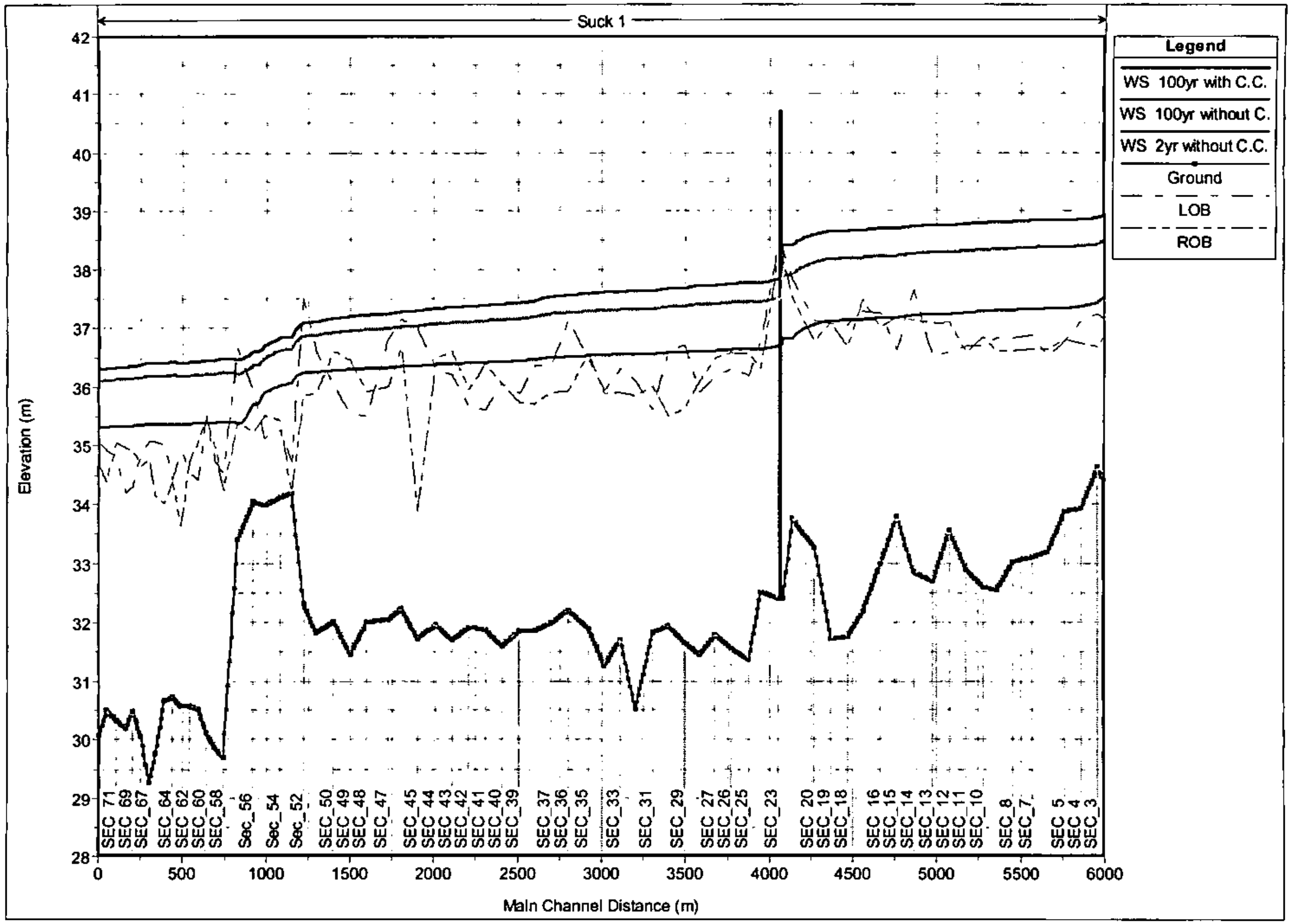

Figure 9.12 Computed Longitudinal Flood Profiles in Study Reach

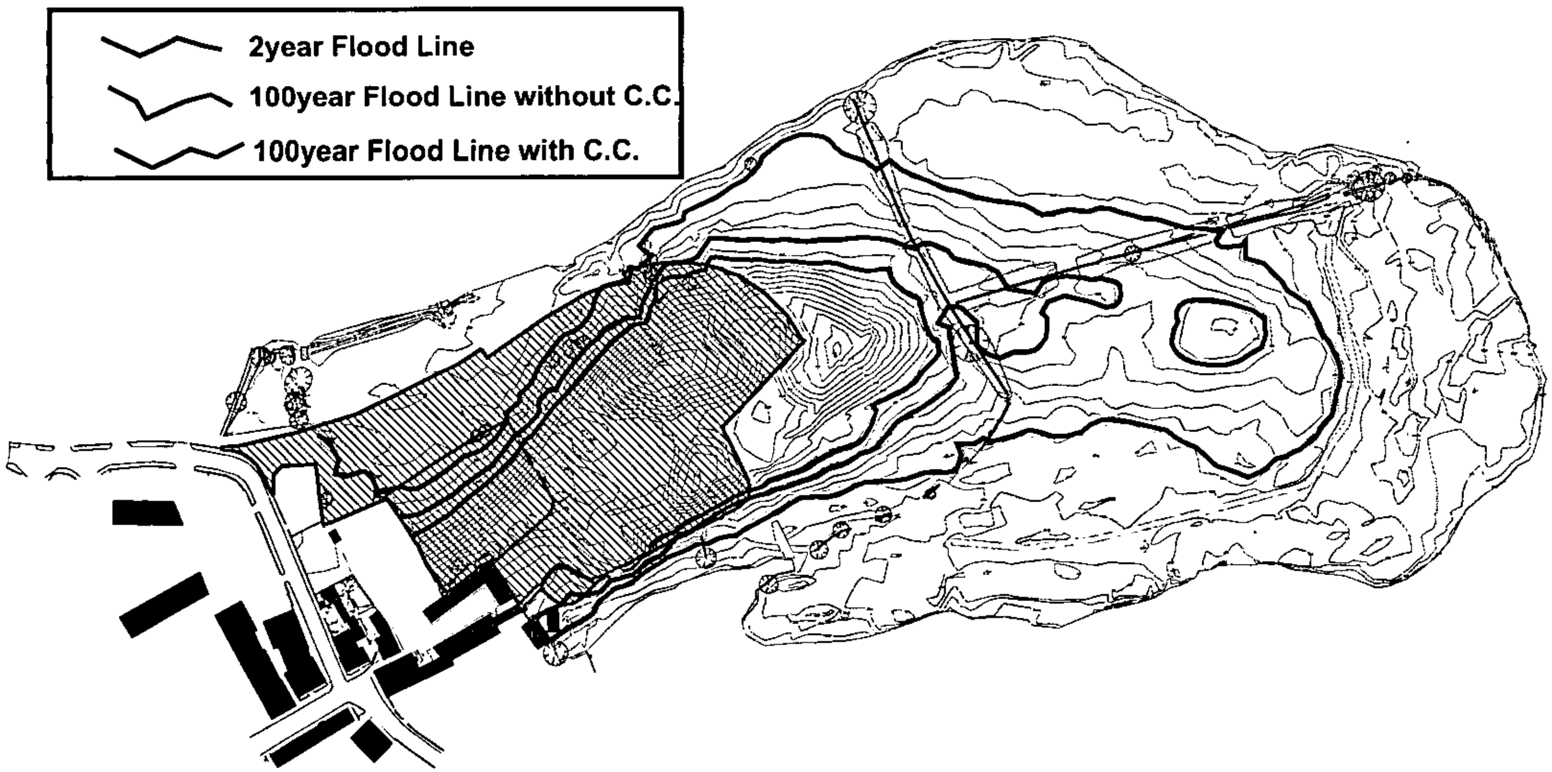

Figure 9.13 Flood Inundation Map of the Hill of Back including Development Site

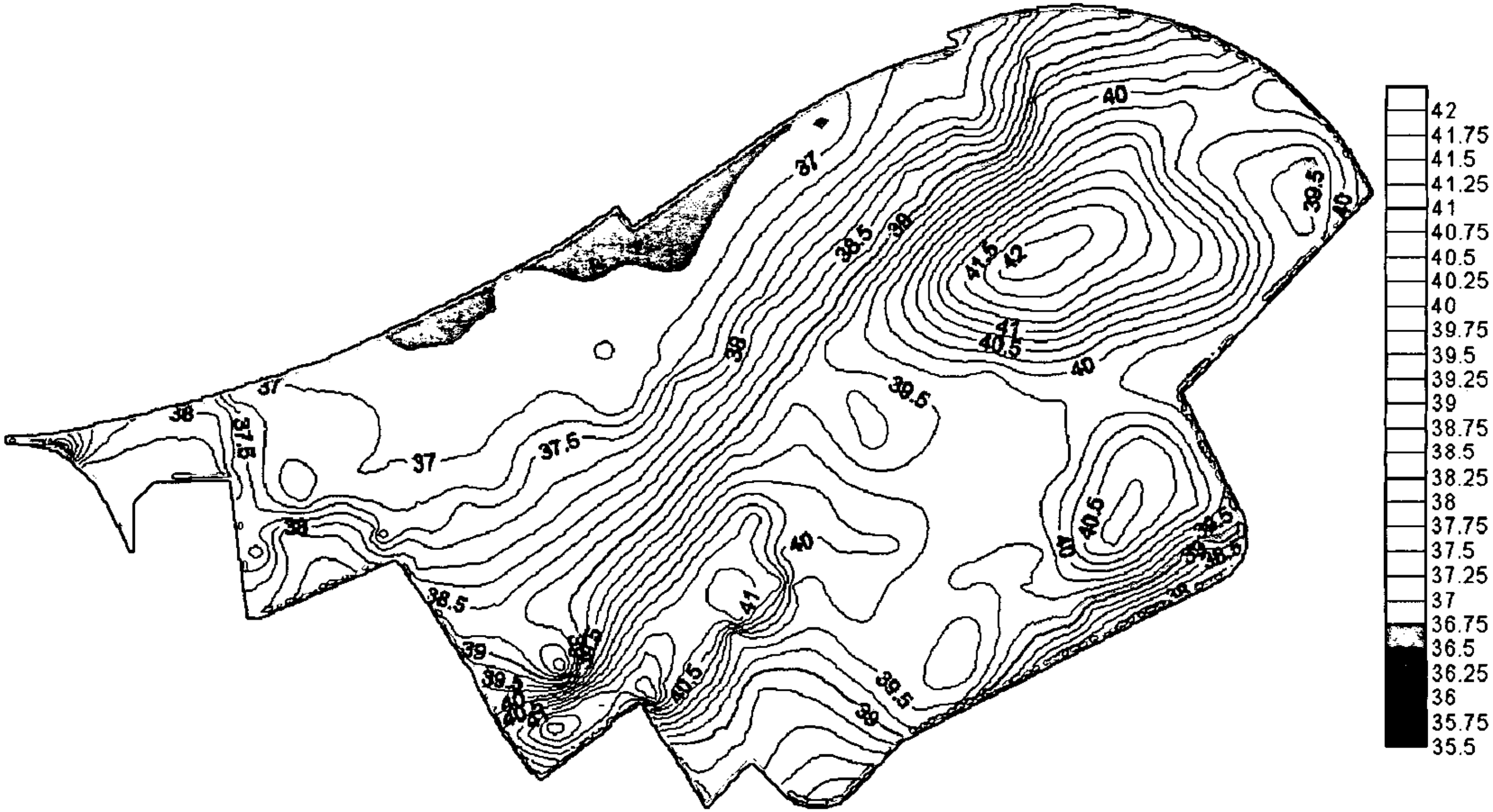

Figure 9.14 Site Contour Map generated for flood storage loss calculations

9.3.7 Hydrogeology

9.3.7.1 Introduction

The hydrogeology of the development site was assessed by means of desk study of pertinent literature. This included available geological and hydrogeological information and maps from the Geological Survey of Ireland. Soils, subsoils and landuse information was obtained from the EPA environmental mapping web site which includes the Teagasc Soils Database and GIS mapping.

9.3.7.2 Bedrock Aquifer

The site and Ballinasloe town is underlain by Carboniferous Limestone bedrock of Visean Age, classified by the Geological Survey of Ireland as being a "Regionally Important Aquifer" that is karstified with conduit permeability (Rk_c). To the east of Ballinasloe the bedrock is a Waulsortion Mudbank limestone and to the south the bedrock formation is an Argillaceous (muddy) "Calp" Limestone of Visean Age. Both formations are classified by the GSI as being Locally Important Aquifers (LI) which are moderately productive only in local Zones. There are no karst bedrock features on the site or within the vicinity of the site with bedrock on the site located at depth (possibly exceeding 8m). ***Figure 9.16*** shows the bedrock geology and Figure ***9.17*** shows these aquifer locations relevant to the site.

9.3.7.3 Sub-soil Geology

The GSI and EPA have mapped the site subsoil using Teagasc data as being a localised deposit (Hill of Back) Limestone Sands and gravels . The surrounding town centre is on a limestone till consisting of sand and gravels with some clay. Some esker sand and gravels underlies small linear areas to the west and southeast of Ballinasloe town. The Subsoils in the Ballinasloe are presented in ***Figure 9.15***.

9.3.7.4 Groundwater Flow and Levels

There are no borehole and groundwater monitoring data available for the site but given its proximity to the River Suck and free-draining nature of its sub-soils the water table level is likely to be strongly influenced by the river level which has a typical seasonal range from 34.5 to 37.5 m O.D. The flow direction is most probably from north to south with the general direction of the river and the upstream and downstream river levels dictating the gradient for groundwater flow.

9.3.7.5 *Groundwater Vulnerability*

The Geological Survey of Ireland guidelines given in their Groundwater Protection Schemes publication can be combined with site investigation data (geological and hydrogeological characteristics – primarily permeability and depth of overburden) to obtain appropriate vulnerability ratings for the underlying bedrock aquifer. Given that the bedrock is at depths possibly exceeding 8m, sub-soil is sandy and depth to watertable 3 to 4m, the general vulnerability of the site is considered to be high to moderate.

Interim classification has been carried out by the Geological Survey of Ireland for this region as presented in ***Figure 9.17***. The site and surrounding region is given a classification of high to low Vulnerability based on only an interim study. Combining this rating with the aquifer classification as shown in the vulnerability matrix (***Table 9.16***) the full classification is Rk/H.

Table 9.15 Groundwater Protection Scheme vulnerability classification

Vulnerability Rating	HYDROGEOLOGICAL CONDITIONS				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat))	(Sand/gravel aquifers only)	(< 30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	n/a
High (H)	> 3.0m	3.0 – 10.0m	3.0 – 5.0m	> 3.0m	n/a
Moderate (M)	n/a	> 10.0m	5.0 – 10.0m	n/a	n/a
Low (L)	n/a	n/a	> 10.0m	n/a	n/a
Notes:	n/a = not applicable. Precise permeability values cannot be given at present. Release point of contaminants is assumed to be 1-2m below ground surface.				

Table 9.16 Vulnerability rating matrix

VULNERABILITY RATING	RESOURCE PROTECTION ZONES					
	Regionally Important Aquifers (R)		Locally Important Aquifers (L)		Poor Aquifers (P)	
	Rk	**Rf/Rg**	**Lm/Lg**	**Ll**	**Pl**	**Pu**
Extreme (E)	Rk/E	Rf/E	Lm/E	Ll/E	Pl/E	Pu/E
High (H)	Rk/H	Rf/H	Lm/H	Ll/H	Pl/H	Pu/H
Moderate (M)	Rk/M	Rf/M	Lm/M	Ll/M	Pl/M	Pu/M
Low (L)	Rk/L	Rf/L	Lm/L	Ll/L	Pl/L	Pu/L

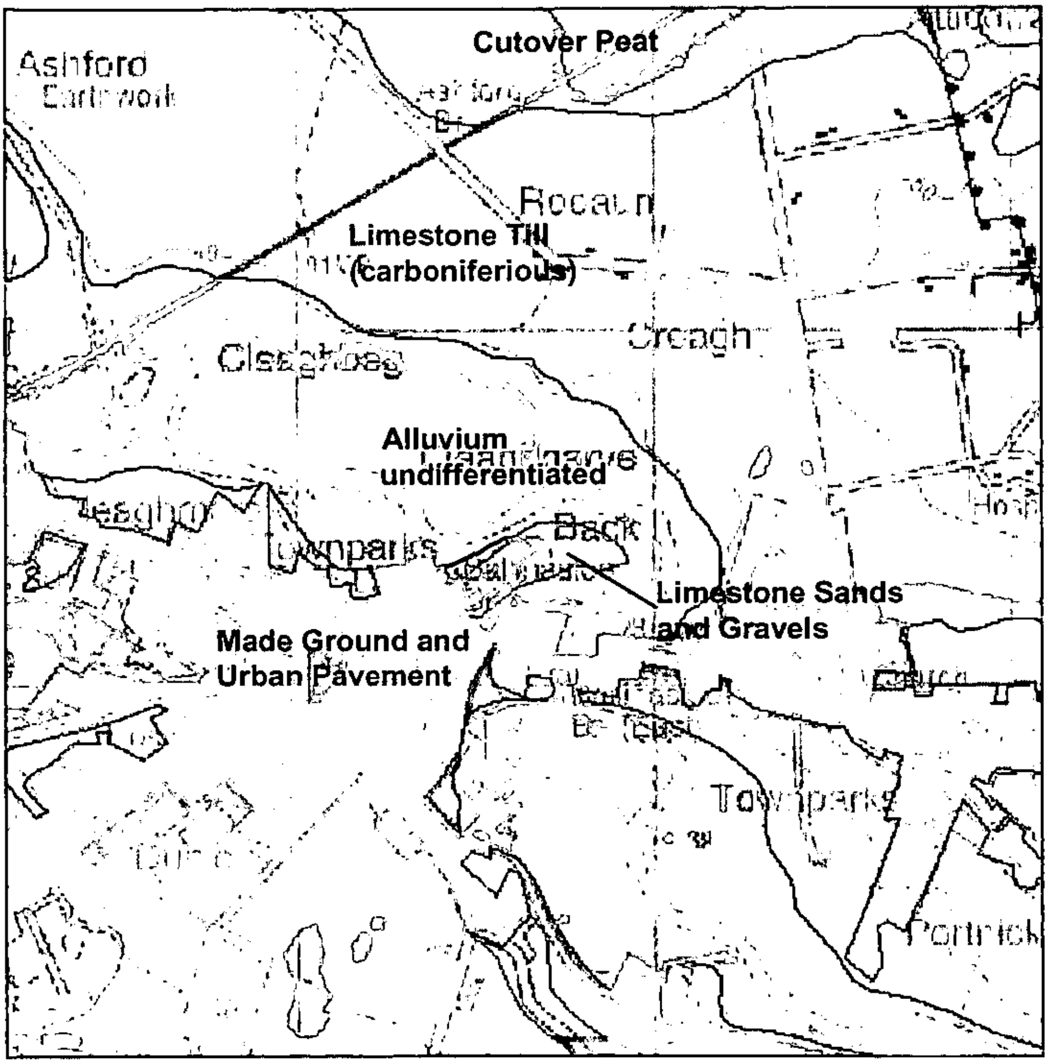

Figure 9.15 EPA Quaternary Geology Map of Ballinasloe Region

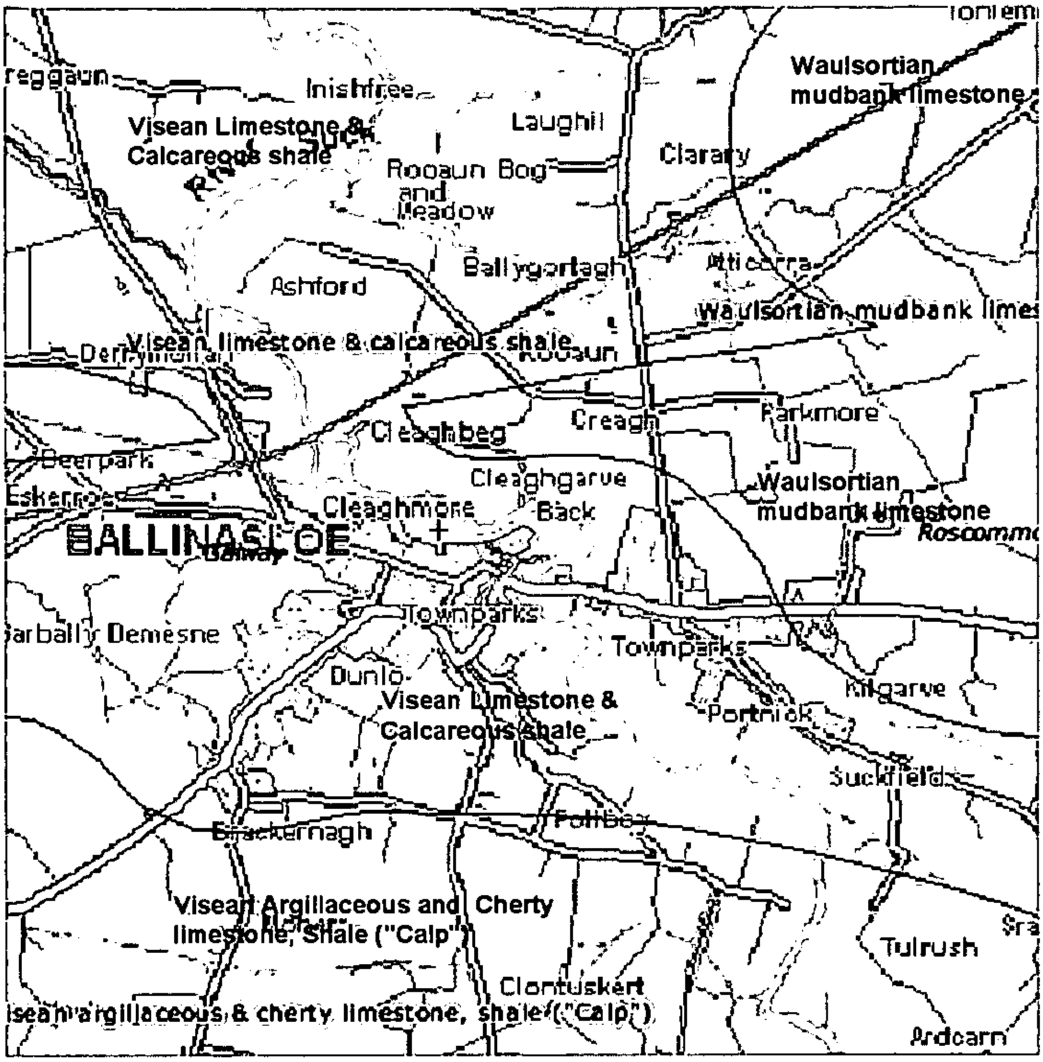

Figure 9.15 GSI Bedrock Geology Map of Ballinasloe Region

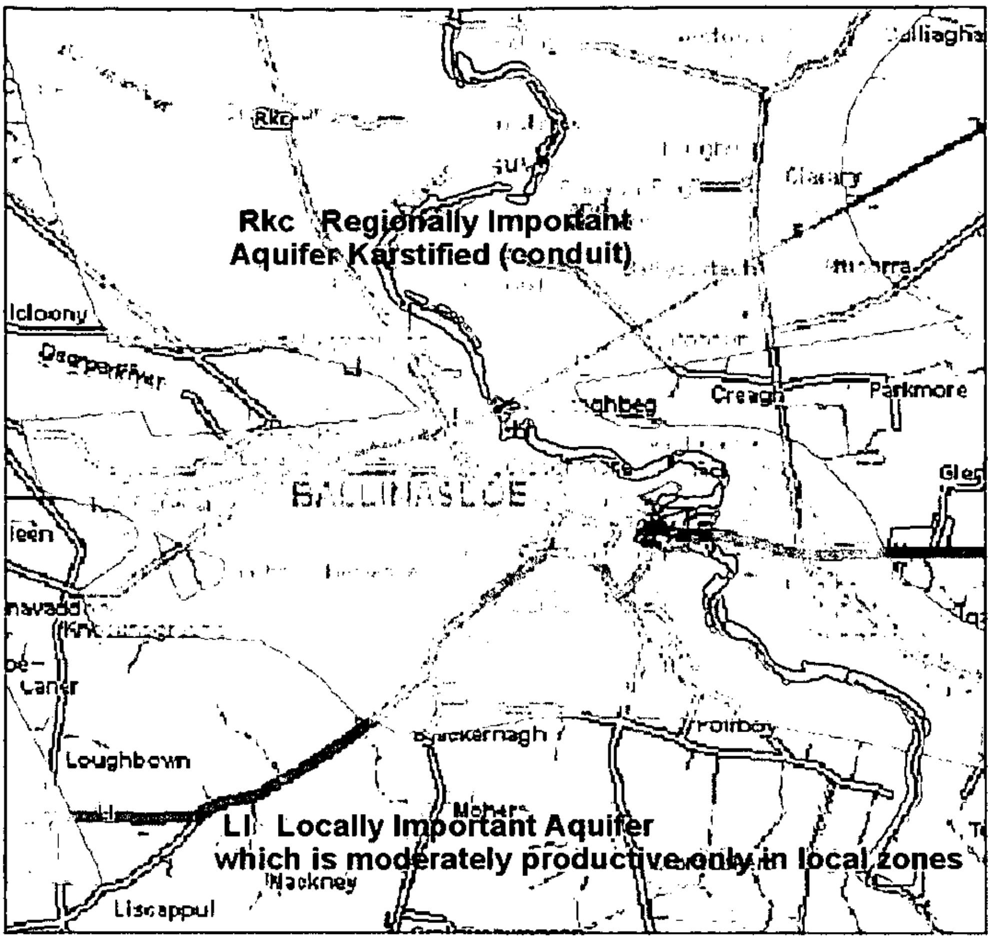

Figure 9.16: GSI Bedrock Aquifer Map of Ballinasloe Region

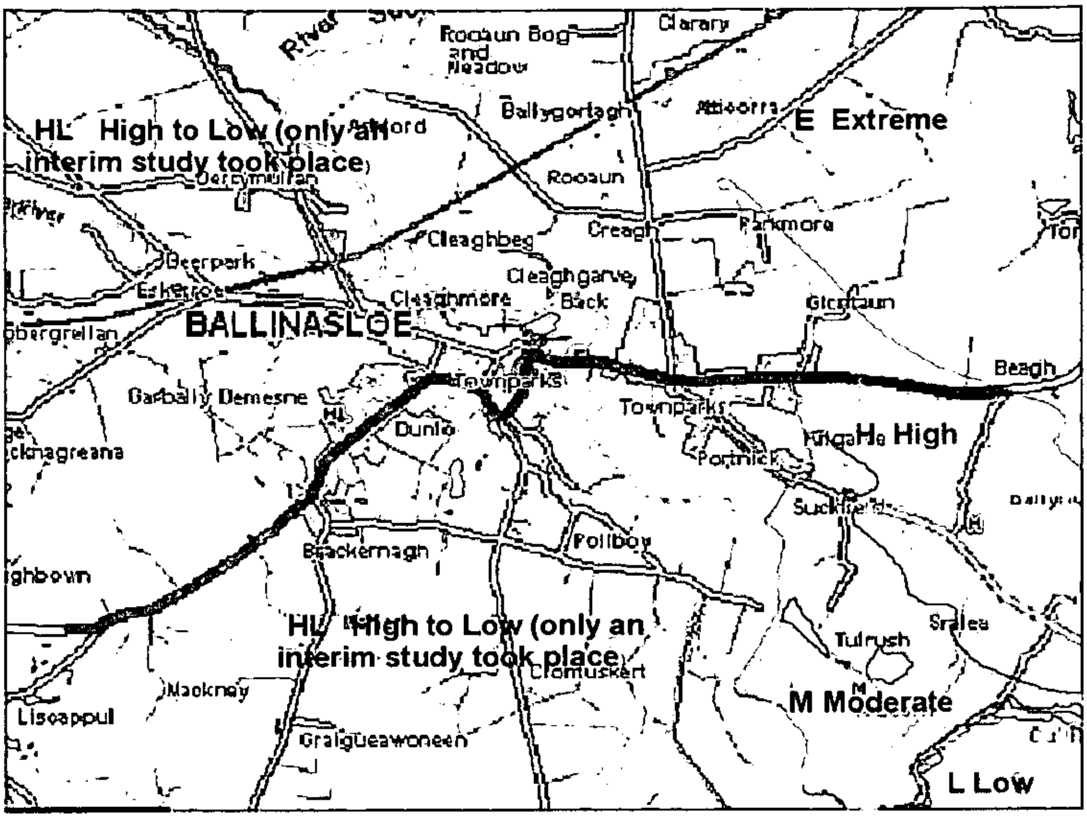

Figure 9.17 GSI Interim Aquifer Vulnerability Map of Ballinasloe Region

9.4 POTENTIAL IMPACTS AND MITIGATION

9.4.1 Surface Hydrology

9.4.1.1 Introduction

The potential hydrological impacts caused by the developments of this nature on the hydrological regime are outlined as follows:

- Impact on flood levels in rivers, drains and surrounding lands due to interference with channel and overbank conveyance
- Impact on flood levels in rivers and surrounding lands due to removal of flood storage as a result of infill
- Flood risk due to developing in / close to flood prone areas
- Increased flow rate in receiving river/stream/drain as a result of increased surface runoff from the developed site
- Impact of storm water runoff on receiving river water quality
- Constructional phase impacts

The proposed development is shown to encroach into the floodplain of the River Suck along the northern aspect of the site where the access road connecting the site to Bank Road is to be located, refer to ***Figure 9.18***. A floodplain performs two functions: a conveyance function and a flood storage function which control flood levels.

9.4.1.2 Impact to Flood Conveyance

The conveyance section is that width of floodplain in which floodwaters are moving under the available hydraulic gradient. Such lands are important in respect to flood levels and any encroachment by infill development can result in increases in the upstream flood levels due to a reduction in flow width / flow area and the generation of local energy losses at the contraction and expansion of the river flow around such encroachments.

Depending on the topographical characteristics of the floodplain area the conveying width of the floodplain / overbanks is generally confined to the bank section closest to the river channel with the more remote floodplain lands being occupied by standing / pooled flood waters which are not conveying. The conveying section of a floodplain is often referred to as the active floodplain area.

To simulate the impact of the proposed access road and surrounding proposed infill on flood flow conveyance the hydraulic model simulations were carried out with and without overbank flow conveyance available between model sections 10, 11 and 12 (i.e. model sections adjacent to the Access Road and represents a generous allowance for the proposed infill footprint). This was achieved by using the ineffective flow width option in the HEC-RAS model. The simulation results for the 100year design flood show no discernable difference in flood levels adjoining or upstream of the development resulting from the removal of overbank conveyance at these sections. In reality the proposed development will not encroach right up to the channel bank leaving an overbank width at the tightest pinch point of 20m and generally the development footprint will be set back 30m or more.

Site visits by Hydro Environmental Ltd. during the flood events of the 10th January 2005 and the more recent December 2006 event showed no discernable overbank conveyance of flood waters at the proposed infill location.

It can be concluded based on sensitivity modelling of the overbank conveyance function at the site that the proposed encroachment of the low-lying section o will have negligible impact on flood flow conveyance in the river and thus on local flood levels. This represents an imperceptible impact on the flooding regime.

Proposed mitigation

The encroachment of the development into the floodplain area will have negligible effect on flood conveyance and thus no mitigation is proposed.

9.4.1.3 Loss of Floodplain Storage

Developments within a flood plain will result in the displacement of floodplain storage through infill. Reduction of floodplain storage if in significant amount can lead to reduced flood attenuation capacity and the subsequent increase in the downstream flood peak. The storage function of a floodplain allows a certain amount of water to be stored on the floodplain as the flood wave in the river passes downstream and releases it slowly back to the river with the receding / falling river stage. The significance of floodplain storage on reducing/dampening down the peak of the flood (i.e. flood attenuation) will depend on the flood storage volume available and the characteristics of the flood wave, (i.e. whether it is a rapidly rising flood wave or a dampened slow rising flood wave depending on the catchment characteristics). The River Suck flood hydrograph presented in ***Figure 9.1*** is relatively sluggish given the large size of catchment area and thus requires vast flood storage lands to dampen the flood peak.

The proposed development footprint will remove 7,560m³ of flood storage at the predicted present day (without flood storage) 100year flood level of 38.32m O.D. Malin. This represents a loss in floodplain area of 0.76ha. At the median (2 year) flood level (37.3m O.D.) the flood storage loss will be 1540 m³ and represents a loss of floodplain area of 4180 m².

The River Suck has a relatively sluggish response to rainfall with the flood hydrograph having a slow rise, a prolonged peak and a slower recession (refer to December 1999 recorded flood hydrograph at Bellagill shown in Figure 9.1). The existing 100year runoff rate for the catchment to Ballinasloe is of the order of 0.125cumec / km² (or 1.25 l/s) which is quite low indicating a reasonably damped catchment with the river flood peak well attenuated by the time it reaches Ballinasloe.

It is estimated that the total flood plain area available from Pollboy Lock gates upstream to Bellagill is of the order of 4 to 5 km² at the 100year flood level and is of similar magnitude downstream of Pollboy to Correen. The proposed development will remove 0.76ha of this flood plain which represents 0.08% of the estimated floodplain area between Bellagill and Correen This is a very small fraction of the overall storages particularly when considering the total flood plain area available downstream to Shannonbridge.

The loss of flood storage as a result of the proposed development is negligible in comparison to the flood volume flowing in the river. The characteristics of the River Suck flood hydrograph is a very gradual rise occurring over a number of days 3 to 4 days, a flat peak of approximately 2 days duration and gradual recession. The 100year flood at Ballinasloe will produce a flood peak of the order of 168cumec lasting for at least 24hours before slowly receding. One day at 168cumec produces a flood volume of 14.5mllion m³ this would fill the infill storage loss 2300 times over (0.05% of the 1 day volume). The computed flood storage loss of 7,560m³ would completely fill within 45seconds at a flow rate of 168cumec. During the December 1999 flood the flow rate exceed 120 cumec for close to 48 hours (refer to Figure 1) based on the Bellagill flood record.

In reality the majority of the site's storage will fill with the rising river stage well in advance of the arrival of the flood peak and consequently will no longer serve for flood peak attenuation once filled.

The December 1999 flood hydrograph at Bellagill was converted for Ballinasloe by multiplying it by the areal factor of 1.114 was routed through the hydraulic model, running it in its unsteady mode with and without the floodplain storage included. The model results showed no discernable difference in flood level or the computed flow hydrographs between the existing and proposed scenarios.

It can be concluded that the loss of 7560m³ of flood storage at the present day 100year flood level will have negligible impact on flood peak attenuation and thus on downstream flooding given the characteristics in terms of the scale and duration of the River Suck Flood Hydrograph, the attenuated nature of the flood hydrograph at Ballinasloe and the ample availability of floodplain storage between Bellagill and Shannonbridge.

Proposed mitigation

The loss of flood storage as a result of infill will have negligible effect on flooding and thus no mitigation is proposed.

9.4.1.4 Flood Risk to Development

The proposed development is located on and adjacent to flood prone lands, a portion of which (20%) is liable to flooding, primarily located on the north side of the site. A detailed Flood Risk Assessment study of the site which is supported by monitoring data and hydraulic modelling predicts a design flood level of 38.78m O.D. Malin which includes for a climate change allowance of 20%. Such a flood level would pre-development, inundate 0.98ha of the site area. Therefore a quantifiable flood risk is associated with developing the site which could potentially have a significant socio economic long-term impact and thus requires mitigation.

Proposed Mitigation

A proposed minimum finish floor level of 39.5m O.D. Malin will mitigate such a flood risk providing protection against river flooding well in excess of 100year return period.

9.4.1.5 Storm Flow Contribution

The conditions required to generate peak flood flow in the receiving river are winter wet antecedent conditions followed by a 24 hour duration extreme storm event. Such meteorological conditions are associated with winter depressional (cyclonic) precipitation.

The peak storm flows generated from the proposed development having a paved area of 2.4ha are produced by short duration storm events. The runoff rates and volumes for such events are presented in ***Table 9.17*** for a 100year return period storm event. Short duration high intensity storms are associated with convectional precipitation events (i.e. summer thunderstorm events) and not with the depressional precipitation that is required to generate winter flooding in the river.

Table 9.17 Potential 100year Storm Runoff from 2.4ha Paved/Roof Area

Storm Duration (minutes)	Rainfall (mm)	Runoff Rate (cumec)	Runoff Volume (m^3)
15	19	0.51	456
30	25	0.33	600
45	28	0.25	672
60	31	0.21	744

These short duration 100year storm flows should only be considered in isolation and not combined with the river flow as they are not produced by the same type of precipitation event. In isolation these storm peaks generated by the proposed development are easily accommodated within the river channel and will not produce overbank flooding at the site or in the downstream reaches.

For the majority of storm events the storm peak runoff from the site will have passed downstream well before the river flood peak arrives (which has a time to peak of approximately 18 to 24hrs to Ballinasloe) availing of the ample spare flow capacity in the river channel. The critical storm event in terms of potential flood impact is when both the river flood peak and the site storm runoff coincide. Typically a 24hour duration or greater storm event is required to facilitate such an event. Within such a storm event the rainfall pattern is generally not uniform and spikes of higher intensity for shorter durations can occur but will not be of the same order of magnitude as the thunderstorm downpours presented in the ***Table 9.17*** above. With frontal depressions higher intensities have a tendency to occur near the start of the storm event with a tapering off of intensities towards the end of the storm.

The impact of the proposed stormwater discharge to the River Suck on flooding will be negligible given the difference in scale of the storm and river discharges and timing of the respective flood peaks. The provision of stormwater attenuation for the development will be of no benefit in respect to flooding in the River Suck and is therefore is not required for this particular site.

Surface water from the impervious surfaces (roof, roads and pathways, car parking, yards/driveways) will have the potential to impact the water quality of the receiving water by potentially introducing silt laden runoff waters and hydrocarbons from petrol and fuel oils spilt on the road and car parking surfaces. This impact during summer low flows is likely to produce a minor to moderate negative impact.

Proposed mitigation

The stormwater system for the development will be designed with SUDs in mind so as to maximise the treatment efficiency of storm water collection system. It is proposed to attenuate the peak stormwater flows to a Greenfield runoff rate of 2l/s per ha notwithstanding the ample capacity available in the receiving water body to receive such flows.

This will be achieved through the use of petrol / oil separators upstream of the proposed storm outfall, a hydrobreak on the outfall to restrict flows to the river and the use of permeable pavements to store and infiltrate the collected surface water through the stone sub-strata and underlying free-draining sand and gravel subsoil. The permeable pavement and sub-strata have been designed to attenuate through storage the 100year storm event and discharge it in a controlled manner to the River Suck via a proposed outfall at a maximum outflow rate of 5l/s.

9.4.1.6 Impact of storm water runoff on receiving river and groundwater quality

The stormwater from the proposed development will for the majority of the runoff areas be infiltrated to ground beneath the permeable pavement areas. These areas will be allowed to overflow to the receiving water via an overflow pipe with a petrol interceptor. All surface waters from identified loading areas will be passed separately through a petrol interceptor and sediment grit removal prior to discharging to the river. Given the proposed treatment of storm water on site through use of natural sub-soil infiltration and petrol interceptor the potential impact on the receiving waters of the River Suck is considered to represent a local minor negative impact not requiring any further mitigation than that proposed above.

9.4.1.7 **Constructional Impacts**

Large construction sites such as housing developments if not properly managed can lead to significant impact on surface quality. The main source of contamination is suspended sediment in runoff waters from the work site and accidental spillage of liquid cement, fuel oils and lubricants from construction. These runoff waters if not adequately controlled could potentially impact negatively on the water quality of the nearby watercourse. The River Suck is an important amenity and fishery river requiring appropriate protection against constructional impacts .

The following identifies the main potential impacts that may be caused by the construction phase of the proposed development scheme.

- Silty/soiled water can arise from excavations, exposed ground, stockpiles of soil and excess material, plant and wheel washings, site roads and disturbance of drains and streambeds (i.e. in-drain construction of culverts and channel diversions/improvement works), topsoil placing and landscaping of fill embankments
- Liquid cement due to its high alkalinity and corrosive nature is highly polluting and in the past has given rise to major fish kills. The accidental spillage of oils and hydraulic fluids can have significant water quality consequences on watercourse and fisheries.
- Generation of soiled runoff waters through pumped dewatering of excavations particularly during the winter period

The constructional phase has the potential to locally pollute the underlying vulnerable aquifer through accidental spillages of fuel oils, diesel, liquid cement and other construction chemicals. This impact could represent a significant local long term impact.

During construction there will be a requirement in the winter months to protect the construction site form flood waters through either filling or bunding the flood prone section of the site.

Mitigation During Construction

Good site works practice in accordance to the NRA guideline, the Department of the Marine, Communication and Natural resources, CIRI and EPA guidelines should reduce such environmental impacts arising from large construction sites.

- National roads Authority (2000) – Design Manuals for Roads and Bridges
- CIRIA Report 142: Control of Pollution from Highway Discharges
- CIRIA Report C648: Control of water pollution from linear construction projects

The following mitigation measures should be implemented during the construction period.

1. To avoid soil erosion during construction provision should be made for the protection of open soil surfaces from rainfall erosion. Appropriate stockpiling of topsoil material and aggregate/unconsolidated material heaps will minimise the surface area exposed to rainfall erosion. Such stockpiles and spoil heaps will be located well away from watercourses.
2. It is essential to ensure the use of cement and wet concrete in or close to any watercourse is carefully controlled.

3. A wheel wash system should be in place for all heavy construction vehicles so as to prevent excess sediment being carried out of the site and deposited on the public roads in the town.
4. Foul drainage from temporary site offices and lavatories should be connected either directly to the nearby public foul sewer or removed from the site for suitable treatment and disposal.
5. Storage of fuels and oils on-site should be situated on an impervious base protected by a bund. Refuelling of plant will be undertaken away from excavation areas and water courses in a designated bunded area. Any spillages will be immediately contained and appropriate clean-up operations implemented.
6. A buffer area of existing vegetation should be retained alongside watercourses where possible and the site boundary fenced off .
7. There should be no direct surface discharges from the works site to the nearby streams. Runoff will be diverted away from excavated areas; and sediment-laden wash down from aggregate heaps and dust control should be directed to and contained within a settlement area before being discharged to nearby watercourse.

9.4.2 Hydrogeology

9.4.2.1 Operational impacts

There may be a reduction in the quality of groundwater locally as a result of the proposed large permeable pavement area and the associated stormwater infiltration system located beneath the proposed surface car parking areas. During rainfall events, runoff from the road pavement that is likely to contain some degree of silt/dust and pollutants from atmospheric deposition, vehicle emission, litter and general road maintenance, as well as from possible accidental road spillage incidents will infiltrate into the underlying sub-soil and could potentially migrate to the groundwater. The potentially soiled areas associated with loading bay areas will be separated from the infiltration system and its surface water passed through a grit removal unit and a petrol interceptor after which it will gravity feed directly to the river.

Given that the underlying sub-soil is a sandy gravel of reasonable thickness, the particulate nature of the contaminants in the surface runoff and the fact that there are no nearby groundwater source protection schemes located in the Ballinasloe area the potential impact to the groundwater and the regionally important bedrock aquifer is considered to represents a slight local impact not requiring mitigation.

There are no proposed discharges directly to or abstractions from groundwater on the site with both foul and water supply to and from the public system.

Mitigation Measures

There are no mitigation measures proposed as the potential impact to groundwater quality from surface water infiltration is considered to represent a slight local impact.

9.4.2.2 Constructional impacts

Given the proposed formation levels for the development, the fact that foundations are to be piled, and the reasonably shallow depths of excavation to achieve formation level, dewatering of the watertable is unlikely to be an issue for the excavation works.

The potential risk of the leaching of concrete during the construction of bored piles is considered to be slight given the nature of the soils and subsoils present.

The removal of the overburden during construction will increase the vulnerability of the underlying aquifer. Where the depth above the underlying aquifer is reduced to less than 3m, an extreme vulnerability rating will result. Given the reasonably deep depth of subsoil overlying the bedrock aquifer such impacts are expected to be short term slight negative impacts. In the longer term the development will replace the overburden by putting in place landscaped grassed areas and impervious paved areas.

Groundwater will be potentially impacted by various activities involving spillages and leakages from construction plant and at refuelling and any storage depots located on site. These generally represent temporary to short-term, slight to moderate negative impacts.

Mitigation - *Protection of Groundwater*

Site clearing works and excavation of the formation level will reduce the protective soil cover, increasing the vulnerability of the underlying aquifers to pollution. As a reduction mitigation measure guidelines associated with the operation of constructional sites, designed to minimise adverse water quality and fisheries impacts (CIRIA 2001 and Dept of the Marine and Natural Resources, 1998), should be implemented.

- Provision should be made for the protection of soil surfaces from rainfall erosion.

- The use of cement and wet concrete in or close to any exposed excavation areas must be carefully controlled.

- Storage of fuels, oils and chemicals if necessary on site should be situated on an impervious base protected by a bund. Refuelling of plant should be undertaken well away from excavation areas, and any spillages should immediately be contained on site and the contaminated soil removed from the site for suitable treatment and disposal.

- Foul drainage from site offices and temporary lavatories should either be directly connected into the nearby public foul sewer or removed to a suitable treatment facility.

9.5 RESIDUAL IMPACTS

The long-term residual impacts arising from this development after mitigation are;

- An overall loss of flood storage to the River Suck as a result of raising the ground levels in a flood plain section on the north side of the site so as to accommodate a vehicular access road to the site. The impact of this flood storage loss on flood levels and flow rates in the River Suck will be imperceptible.

- There are no perceived long-term residual impacts to the hydrogeology which includes groundwater, soils and bedrock geology, arising from the proposed development.

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EIS NO: 1969

HAYES HIGGINS

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& Building Services Engineers

Engineering Services Report

for

Mixed Use Development

At

Ballinasloe,

Co. Galway

September 2007

ISSUE REGISTRATION:

Project: Eng. Services Report **Project No:** 06KK059

Rev.	Date	Purpose of Issue/Nature of Revision	Prepared by.	Issue Authorised by.
PL1	27.09.07	DRAFT	S.P.	N.P.
PL2	17.10.07	PLANNING ISSUS	S.P.	N.P.

This report takes into account the particular instructions and requirements of our Client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Contents

1. EXECUTIVE SUMMARY

1.1 Surface Water Drainage

Surface water drainage comprise of a system of permeable pavements and gravity drains provided within the site. Drainage lines are located in the public road, footpath/verge, car parking or open areas. The minimum diameter of surface water sewers are 225mm. All sewers have been designed to achieve a minimum of self cleaning velocity of 0.75m/sec with an additional 10% capacity provided for climate change.

Disposal of all surface water from the site shall be in accordance with Galway County Council, Water Services Department, Foul and Surface Water Requirements, Greater Dublin Strategic Drainage Study (GDSDS), Sustainable Urban Drainage Systems Report Series C521 and the Guide for Development of Drainage of Development Sites Report SR574 by HR Wallingford.

To reduce the impact of the development on the site we aim to mimic the green field runoff response at source through the use of effective source control measures and sustainable drainage practices. As such we have divided the site into a number of sub-catchments, each designed with its own method of Storm Water disposal.

A number of SUDS components are provided for storm water disposal within our site which will maximise the treatment efficiency of a wide range of pollutants.

a) ***Petrol/Oil Separators:*** will contain serious pollution events and are also used to manage sediment, hydrocarbons and other debris upstream of SUDS devices

b) ***Permeable Pavements:*** will limit concentration of pollutants by immediate localised interception and can further reduce concentration of pollutants by:

   a. Filtration
   b. Retention within the pavement
   c. Biodegrading hydrocarbons and other hydrocarbons trapped in the upper pavement layers
   d. Settlement and retention of solids

The 100 year flood level (including increase in flows for climate change) has been determined by the hydrologist to be approximately 38.250m (See separate Hydrologist Report for details).
Protection against river flooding is catered as follows:

- Protection zones of 1250mm for all buildings (39.500m) and 1100mm for hard-standing areas (39.350m) is provided to the 100 year flood level with climate change
- Attenuation storage designed with limiting discharge rate of 2l/s/ha provided for 100 year storm event, as per the GDSGS policy

The permeable pavement and subgrade have been designed to attenuate the 100 year storm event and discharge in a controlled manner to the river Suck via the drainage system. The attenuation system has also been designed with no infiltration as the highest expected water table level is within 1000mm of the formation level.

1.2 Foul Water Drainage

All foul lines are located in the roads, footpath, verge or open space areas. The minimum diameter of foul sewers is 150mm at a gradient of 1 in 150, where possible 225mm pipes are provided at head of pipelines. All sewers have been designed to achieve a self-cleaning velocity of 0.75m per second.

The foul drainage system is gravity feed to a pumping station complete with holding tank capable of storing 24 hours effluent discharge from the development located at the rear of our site. From the storage location it will be pumped to the local authority sewer some 90 meters south west of the site on Main Street, via a 100mm diameter rising main.

The existing local authority sewer comprises of a 225mm pipeline. We propose to connect to the sewer at an existing manhole located adjacent to our site on Main Street, a monitoring point including air vent stack will be provided prior to connecting to the existing Local Authority manhole. Foul water will subsequently be conveyed from the sewer to the Local Authority Wastewater treatment plant.

1.3 Watermain

A 150mm diameter watermain will service the development. The watermain will be connected to the public watermain that adjoins the site at Main Street. Supply to the development will be measured by a magma flow meter complete with power supply and kiosk to Local Authority specifications.

An existing Local Authority watermain that traverses the site will also be diverted to facilitate the development.

2. INTRODUCTION

This following contains information on the particular design of the storm and foul water drainage systems for the proposed mixed use development at Ballinasloe, Co. Galway

The design of the storm systems has been carried out in accordance with the Modified Rational Method and the Colebrook-White Equations. The foul sewer system has been designed taking account of the Modified Rational Method, the Colebrook-White Equations, current Building Regulations and BS 8301: 1985, Building Drainage.

The storm water system proposed for the development is gravity feed storage system. The storm water run-off from the site will be attenuated on site prior to being discharged to the River Suck via a hydrobrake devise. Storm water runoff will be limited to a runoff rate of 2 litres/sec/hectare.

The proposed foul system is gravity feed system that discharges to an on site pumping station. From the storage location it will be pumped to the local authority sewer on Main Street, via a 100mm diameter rising main. The sewerage will subsequently be conveyed to the Local Authority municipal wastewater treatment plant.

3. Foul Sewer

The foul sewer has been designed in accordance with the Colebrook-White formulas, B.S. 8301: 1985, BS5572: 1994, Building Regulations 2000 (Technical Guidance Document H) and the Department of the Environment and Local Enterprise Recommendations for site development works for housing areas. Calculations of design flows were carried out using the Probability Method of Discharge in accordance with BS 8301.

The system will be gravity fed to a sump with 24 hour storage capacity located to the south west of the site as shown on the Foul drainage Layout drawing.

Storage capacity has been calculated as follows:

Retail Area	=	8500m^2
Occupancy	=	1 person/20m^2
Loading	=	15 l/s/person
Total	=	6375 l/day
Total storage provided for 24 hrs	=	6.5m^3

The proposed pumping station includes for :

- Overflow facility from pumping station to holding tank capable of storing 24 hours effluent discharge from the development
- Suitable washing, lighting and lifting facilities
- A suitable flow recorder
- Suitable vehicle access to pumping station
- Robust vandal proof electrical panels and access covers
- Back up power supply (provided from standby generator for main building)
- Dosing facility to prevent smell/odour
- Comply with Galway County Council specification for pumping station

From the storage location effluent will be pumped via a 100mm diameter rising main to the Local Authority Sewer on Main Street. The rising main is designed such that self-cleansing velocities are achieved and that septicity will not arise. The maximum allowable retention time in the rising main is 3 hours with a velocity of 0.75m/s at minimum flow rate and 3m/s at maximum flow. The rising main terminates at a stand off manhole located adjacent to Main

Street. Effluent is then discharged by gravity to the existing Local Authority manhole/sewer via a monitoring manhole/chamber. The monitoring facilities include:

- Manhole with permanent access
- Discharge pipeline into the manhole/chamber of at least 10 pipeline diameters straight upstream of the discharge point to ensure hydraulic conditions suitable for flow measurement
- Manhole/chamber suitable for installation of in-sewer flow measurement equipment
- Manhole/chamber suitable for taking samples of the discharge effluent

The drawings included with the submission show the proposed foul sewer layouts. The pipe sizes for the foul sewerage system consist of 150mm pipelines laid at a gradient of 1 in 150, where possible 225mm pipes are provided at head of pipelines. All sewers have been designed to achieve a self-cleaning velocity of 0.75m per second. All foul pipelines are located in the road/footpath/verge/on-street parking or open space.

As can be seen in Appendix A, on site both the full bore & partial velocities for pipes all lie above the accepted limit. (i.e. > 0.75m/s).

The full bore & partial velocities were designed in accordance with the Colebrook-White formulas (ref.: Wavin sewer Systems, Design information, page 21). It can also be seen in Appendix A that the capacities of the pipes provided throughout the scheme are sufficient to cope with the estimated peak flows from the proposed development.

The onsite drainage system discharges to the existing 225mm diameter local authority sewer on Main Street. We propose to connect to the sewer at an existing manhole located at Main Street. Foul water will subsequently be conveyed from the sewer to the Local Authority Wastewater treatment plant.
(See Appendix A for Design Calculations)

4. Storm Water

4.1 General

The storm sewer system has been designed in accordance with the Colebrook-White formulas, BS 8301:1985 and the Greater Dublin Strategic Drainage Study (GDSDS).
(See Appendix B for Design Calculations)

The areas taken into account in the design include the total area of the roofs and the total area of paving contributing to the pipe system and shall use a constant rate of rainfall intensity of 50mm/hr for all sections of the sewer.

We have design a sustainable drainage gravity feed storage system within the development to discharge via attenuation storage devices and hydro-brake's to the River Suck that bounds our site.

All storm pipelines are located in the road/footpath/verge/on-street parking or open space. The storm water system proposed for the development is gravity feed storage system. The minimum diameter surface water sewers are 225mm.

A number of SUDS components are provided for storm water disposal within our site which will maximise the treatment efficiency of a wide range of pollutants.

c) ***Petrol/Oil Separators:*** will contain serious pollution events and are also used to manage sediment, hydrocarbons and other debris upstream of SUDS devices

d) ***Permeable Pavements:*** will limit concentration of pollutants by immediate localised interception and can further reduce concentration of pollutants by:
   a. Filtration
   b. Retention within the pavement
   c. Biodegrading hydrocarbons and other hydrocarbons trapped in the upper pavement layers
   d. Settlement and retention of solids

Permeable pavement is provided in all car parking and public open spaces. There is a concrete finish to the service area, runoff from this area is collected by road gullies and is treated by a Petrol/Oil separator prior to connecting to the main drainage system.

4.2 Storm Sewer System

The pipe network has been designed for a rainfall rate of 50mm/hr for all sections of sewer as recommended in the Greater Dublin Strategic Drainage Study (GDSDS).

The time of entry has been taken as 4 minutes (in accordance with Recommendations for Site Development Works) and appropriate pipe roughness coefficients have been taken from the pipe manufacturer's literature.

A number of drawings including storm sewer layout, rational design sheets and numbering systems have been submitted with this application as seen in the appendices.
(See Appendix B for Design Calculations)

4.3 Storm Water Attenuation Design

As part of our design process and to protect against flooding we have designed an impermeable attenuation system comprising of permeable pavements (type system C) with outflow limited to a discharge rate of 2l/s/ha. These systems have been designed to cater for the 100 year storm event with an additional 10% capacity provided for climate change.

Permeable Pavement with a total storage volume of 1588m^3 will be located in all car parking and public open spaces. These pavements have been designed for a voids ratio of 30% using crushed angular stone.

Typically for the 1 in 100 year event it is sufficient to allow the surface water drainage system to surcharge to the roads and hard standing areas with shallow ponding for a limited time. In this case however given the sites location to the River Suck and to protect against flooding it is not considered appropriate. As such the attenuation facilities have been designed to cater for the 100 year event thus preventing surcharging of the system.

Runoff of storm water is limited to a discharge rate of 2 litres/sec/hectare by use of hydro-brakes. An emergency overflow to cater for flows in excess of the 100 year storm event is provided from the attenuation chambers.

5. Watermain

A 150mm diameter watermain will service the development. The watermain will be connected to the public watermain that adjoins the site at Main Street. Supply to the development will be measured by a magma flow meter complete with power supply and kiosk to Local Authority specifications.

An existing Local Authority watermain that traverses the site will also be diverted to facilitate the development.

Air valves and scour valves will be provided around the site.

Screw down type fire hydrants complying with B.S. 750: 1984 will be provided in accordance with the Fire Certificate Drawings. All hydrants locations will be in accordance with the Technical Guidance Document B of the Building Regulations.

Appendix A

Foul Drainage Design

Appendix B

Storm Drainage Design

Appendix C

Storm Water Attenuation / Permeable Pavement Design

FOUL DRAINAGE DESIGN
DISCHARGE UNIT METHOD

TITLE MIXED USE DEVELOPMENT BALLINASLOE, CO GALWAY	Job Reference 06KK059	Calculations by M.C.	Drawing No. CS-020	Coefficient of Friction For uPVC Pipes (i.e. 375mm or less) Ks = 0.60 Coefficient of Friction For Conc Pipes (i.e. 450mm or greater) Ks = 1.50
SUBJECT Foul Water Drainage Design		Checked by N.P.	Date 24/9/07	

Pipe Section	Discharge Discharge Units	Total Discharge Units	Pipe Dia. D (mm)	U/S CL (m)	U/S IL (m)	D/S IL (m)	Length L_{pipe} (m)	Gradient 1 in	Cover to US Soffit (m)	Adequate Capacity	Self Cleansing	Prop Capacity (%)	Flow Q (l/s)	Pipe Cap. $Q_{capacity}$ (l/s)	Velocity V_{pipe} (m/s)	Prop. Velocity $V_{proportional}$ (m/s)
F1.0 to F1.1	14	14	150	39.350	37.700	37.190	30.5	60	1.50	✓	✓	11%	2.60	23.00	1.30	0.86
F1.1 to F1.2	30	44	150	39.350	37.190	36.450	74.0	100	2.01	✓	✓	19%	3.30	17.73	1.00	0.77
F1.2 to F1.3	124	168	150	39.350	36.450	36.150	37.0	123	2.75	✓	✓	27%	4.30	15.94	0.90	0.76
F1.3 to F1.4	62	230	225	39.350	36.150	35.850	32.5	108	2.98	✓	✓	10%	4.80	49.87	1.25	0.79
F1.4 to F1.5	0	230	225	39.350	35.850	35.650	21.0	105	3.28	✓	✓	9%	4.80	50.66	1.27	0.80
F1.5 to Pump Sump	0	1137	225	39.350	35.650	35.550	12.0	120	3.48	✓	✓	19%	8.83	47.35	1.19	0.91
F2.0 to F1.5	907	907	225	39.350	37.700	37.625	7.0	93	1.43	✓	✓	15%	7.90	53.77	1.35	0.96

PROPOSED FOUL DRAINAGE RISING MAIN

SITE COMPRISES

Retail 1 person per 20 m2 @ 15/p/d				
Area	No. of People			DWF L/d
8500	425			6375

DWF Litres per day	6375

Trunk Mains 4 * DWF	25500
Rising Mains 4* DWF(Qp,discharge l/day)	25500
Distribution Mains 6* DWF	38250

Hayes Higgins Partnership
Gas House Lane,Kilkenny
T: 056-7764710
F: 056-7723223

WET WELL SIZE

$V_u = 0.9 Q_p / Z$

V_u = Volume of sump
Q_p = Discharge
Z = No. of starts per hour 6 - 15 (Typical [illegible])

V_u = 0.08 m3

STORAGE VOLUME REQUIRED

Assumptions:
No backup generator on site
Duty & Standby Pumps installed

Allow for 3 hour storage in rising main

Vs = 3.19 m3 for 3 hours

RISING MAIN: DESIGN FOR PEAK FLOW

Peak Flow = 4 x DWF			
Therefore Peak Flow =		0.30	l/s
Minimum Velocity =		0.75	m/s
Area of Rising Main =	Q/v =	0.000393519	m2
Rising Main diameter =		0.022379494	m
		22	mm

Use 80mm diameter rising main to achieve self cleansing velocities

TITLE
MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
SUBJECT
Storm Water Drainage

Job Reference
06KK059

Calculations By:
M.C.

Checked by:
N.P.

Drawing No.
CS-010

Date
24/09/07

Coefficient of Friction For uPVC Pipes (i.e. 375mm or less) Ks = 0.06

Coefficient of Friction For Conc Pipes (i.e. 450mm or greater) Ks = 0.6

Pipe Section	US MH CL [mod]	US MH IL [mod]	DS MH IL [mod]	Length [m]	Gradient [1 in...]	Pipe Diameter [mm]	Cover to US Soffit [m]	Velocity [m/s]	Time of Flow [min]	Time of Conc. [min]	Rate of Rainfall [mm/hr]	% Imperv.	Imperv. Area [m²]	Cumul. Imperv. Area [m²]	Velocity Check	Prop Capacity Check	Partial Velocity Check	Prop Capacity Max 90% To Allow For Climate Change (%)	Actual Rate of Flow [L/s]	Allow. Rate of Flow [L/s]	Prop. Velocity	Partial Velocity [m/s]
• S1.0 to S1.1	39.350	38.375	37.745	73	116	225	0.750	1.51	0.807	4.807	50.00	100	800	800	✓	✓	✓	19%	11.1	60.0	0.78	1.17
S1.1 to S1.2	39.350	37.745	37.710	4.5	129	225	1.380	1.43	0.053	5.785	50.00	100	50	2770	✓	✓	✓	75%	42.9	56.8	1.08	1.54
S1.2 to S1.3	39.350	37.710	35.950	4	2	225	1.415	11.40	0.006	5.791	50.00	100	20	2790	✓	✓	✓	10%	43.2	453.4	0.61	6.98
• S1.3 to S1.4	36.750	35.950	35.870	24	300	300	0.500	1.10	0.365	6.156	50.00	100	0	3340	✓	✓	✓	66%	50.8	77.5	1.07	1.17
• S1.4 to Outfall	37.000	35.870	35.845	7	280	300	0.830	1.14	0.103	6.258	50.00	100	0	3340	✓	✓	✓	63%	50.8	80.4	1.06	1.21
• S2.0 to S2.1	39.200	38.200	38.110	16.5	183	225	0.775	1.18	0.232	4.232	50.00	100	225	225	✓	✓	✓	11%	5.1	47.1	0.65	0.77
• S2.1 to S1.1	39.350	38.100	37.745	79	223	225	1.025	1.07	1.233	5.733	50.00	100	795	1920	✓	✓	✓	67%	28.7	42.5	1.07	1.14
• S3.0 to S3.1	39.350	38.250	38.125	27	216	225	0.875	1.09	0.415	4.415	50.00	100	900	900	✓	✓	✓	29%	12.5	43.2	0.85	0.92
• S3.1 to S2.1	39.350	38.125	38.100	5.5	220	225	1.000	1.07	0.085	4.500	50.00	100	0	900	✓	✓	✓	29%	12.5	42.7	0.85	0.91
• S4.0 to S1.1	39.350	38.470	37.745	3	4	225	0.655	8.42	0.006	4.006	50.00	100	50	50	✓	✓	✓	1%	3.1	334.7	0.10	0.80
S5.0 to S5.1	38.840	37.115	37.025	10	111	225	1.500	1.54	0.108	4.108	50.00	100	550	550	✓	✓	✓	12%	7.6	61.3	0.69	1.06
• S5.1 to S5.2	37.700	37.025	36.200	49.25	60	225	0.450	2.14	0.384	4.492	50.00	100	0	550	✓	✓	✓	9%	7.6	84.9	0.59	1.27
• S5.2 to S1.3	36.800	36.200	35.950	50.75	203	225	0.375	1.12	0.754	5.247	50.00	100	0	550	✓	✓	✓	17%	7.6	44.6	0.76	0.86

NOTE: ATTN = Attenuation Tank
OUTFALL = Outfall to Stream
• = CONCRETE PROTECTION WILL BE PROVIDED OVER PIPES

PERMEABLE PAVING CALCULATION

TITLE	Job Reference	Calculations by	Drawing No.
MIXED USE DEVELOPMENT BALLINASLOE, CO. GALWAY	06KK059	M.C.	CS-010
		Checked by	Date
		N.P.	27/9/07

M5-60 (mm) 15.6 r = 0.31

T	z1	M5-T	z2	M10-T (mm)
15mins	0.60	9.36	1.98	16.1
30 min	0.77	12.012	1.93	19.7
60 min	1.0	15.60	1.89	26.3
120 min	1.24	19.34	1.85	32.3
240min	1.56	24.336	1.77	39.7
6hr	1.76	27.456	1.72	45.0
12hr	2.09	32.604	1.62	57.7
24hr	2.76	43.056	1.54	68.3

Area Drained 21000 m^2 (Carparking & roofs)

Wetted Peri (as^{50}); 100.80 m^2

Length 105 m
Width 105 m
Height 0.48 m

Permeability (m/s) 0.0E+00

Outflow (m^3/hr) 0.00

Void ratio 30% Granular material having 30% free volume

Storm (mins)	Inflow (m^3)	Outflow (m^3)	V
15	338.10	0.00	338.10
30	413.70	0.00	413.70
60	552.30	0.00	552.30
120	678.30	0.00	678.30
240	833.70	0.00	833.70
360	945.00	0.00	945.00
720	1211.70	0.00	1211.70
1440	1434.30	0.00	1434.30

Volume Required **1577.73** m^3
Volume Provided **1587.60** m^3

VOLUME LARGE ENOUGH

NOTE:
VOLUME CALCULATED ALLOWS 10% FOR CLIMATE CHANGE

peter brett associates

Proposed Mixed Use Development, Ballinasloe, Co. Galway

Transport Assessment

Project Ref: 518738

October 2007

Client:
Harte Holdings

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EIS NO: 1969

PBA Document Control Sheet

Project Title : Mixed Use Development, Ballinasloe, Co. Galway

Project Ref : 518738

Report Title : Transport Assessment

Report Ref : Ballinasloe TA F02

Date : October 2007

	Name	Position	Signature	Date
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Checked By	Phil Brady	Associate Director		01/10/07
Authorised for issue				
For and on behalf of Peter Brett Associates Ireland Ltd				

Issue	Revision	Description	Date	Signed

TABLE OF CONTENTS

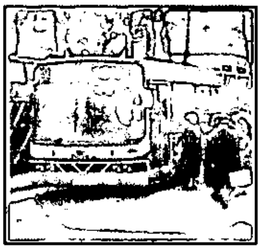
FIGURES

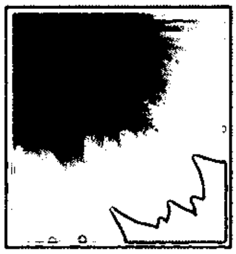
DRAWINGS

APPENDICES

CHAPTER 1

Introduction





CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

1.1.1 This Transport Assessment Report (TAR) has been prepared by Peter Brett Associates Ireland Ltd (PBA) on behalf of our client Harte Holdings and relates to a proposed Commercial Development in Ballinasloe, County Galway. The general location of the site is illustrated in **Figure 1**.

1.1.2 This report has been produced to address the potential concerns of the local planning authority pertaining to the level of influence generated by the proposed development upon the operational capacity of the off-site local road network. This report should therefore be considered in conjunction with the other reports and statements submitted in support of the same application.

1.1.3 During the development of this report, vehicle turning count surveys, commissioned specifically for this assessment, have been undertaken with the objective of providing background information relating to existing traffic movement patterns across the local road network. This information has been supplemented with data obtained from site audits of the local road network, subsequently enabling the identification of existing local travel characteristics.

1.2 SCOPE

1.2.1 The purpose of this Transport Assessment Report is to set out the methodology by which the potential level of any transport impact generated as a result of the proposed development has been calculated and subsequently assessed. The scope of the analysis covers transport and related sustainability issues including means of vehicular access, pedestrian and cycle movement and local public transport connections. The principal objective of the report is to quantify this level of impact across the local road network and subsequently ascertain the existing and future operational performance of the network.

1.3 METHODOLOGY

1.3.1 Our approach to the study accords with policy and guidance both at a national and local level. Furthermore the adopted methodology responds to best practices in addition to current and emerging guidance, exemplified by a series of publications, all of which advocate this method of analysis. Key publications consulted include;

- *'Traffic and Transport Assessment Guidelines' National Roads Authority (2005);*
- *'Traffic Management Guidelines' Dublin Transportation Office & Department of the Environment and Local Government (May 2003);*
- *'Guidelines for Traffic Impact Assessments' The Institution of Highways and Transportation;*
- *'DTO Advice Note: Retail and Leisure Development" Dublin Transportation Office (February 2003); and*
- *'Sustainable Development' Department of the Environment*

1.3.2 Our methodology incorporated a number of key inter related stages, including;

- **Site Audit**: A site audit was undertaken to quantify existing road network issues and to establish an appreciation of existing local traffic characteristics, in addition to establishing the level of accessibility to the site in terms of walking, cycling and public transport. An inventory of the local road network was also developed during this stage of the assessment.
- **Traffic Counts**: Junction turning counts have been undertaken across the local road network with the objective of establishing local traffic characteristics in the immediate area of the proposed development
- **Trip Generation**: A comprehensive trip generation exercise has been carried out to establish the potential level of vehicle trips generated by the different categories proposed in the mixed use development.
- **Trip Distribution:** Based upon existing traffic characteristics and the network layout in addition to the spatial / land use configuration and density of the urban structure across the catchment area of the development, a distribution exercise has been undertaken to assign site generated vehicle trips across the local road network.
- **Network Impact:** Ascertain the specific level of influence generated by the proposed development upon the local road network and subsequently identify

which junctions need to be assessed in greater detail in accordance with the Institute of Highways and Transportation, Traffic Impact Assessment guidelines.

- **Network Assessment**: Drawing upon the findings of the previous stages, an operational assessment of the local road network has been undertaken to evaluate the performance of key junctions both prior to and following the implementation of the proposed development.

1.4 STRUCTURE

1.4.1 As introduced above, this TAR seeks to clarify the potential level of influence generated by the proposed development across the local road network and subsequently ascertain the existing and future operational performance of the local Transport system. The structure of the report responds to the various stages of this exercise as detailed below.

1.4.2 **Chapter Two** outlines the key information pertaining to the proposed development and of relevance to this transport appraisal. A review of local policy objectives is also summarised within this assessment.

1.4.3 The existing transport conditions across the local area network are presented in **Chapter Three**, including accessibility by sustainable modes of travel and current vehicle traffic patterns.

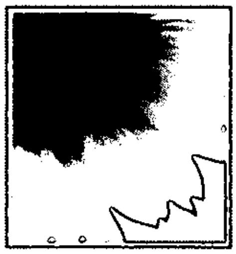
1.4.4 In **Chapter Four** a summary of the vehicle trip generation, vehicle distribution, and network assignment exercise is detailed, in addition to quantifying the potential level of impact upon key junctions across the local road network.

1.4.5 The operational performance of key local junctions for a range of different scenarios both prior to and after the commissioning of the proposed development is investigated and reported within **Chapter five**.

1.4.6 Finally a summary of our appraisal together with the main conclusions of the assessment are provided in **Chapter Six**.

CHAPTER 2

Proposed Development



CONTENTS

2 PROPOSED DEVELOPMENT

2.1 LOCATION

Strategic

2.1.1 The town of Ballinasloe, located in the mid-west region, lies approximately 31km west of Athlone and 68km east of Galway City. It is the second largest urban centre in County Galway and occupies a strategic location on the N6 National Primary route corridor linking Dublin and Galway subsequently performing one of the principal 'gateways' to the west of Ireland.

Local

2.1.2 As illustrated in **Figure 1**, the proposed development site is located less than 200m east of Ballinasloe Town centre. Effectively located on a peninsula, the River Suck forms the sites northern, eastern and south-eastern boundary. The town centre lies immediately to the west forming the sites south-western boundary.

2.1.3 Access to the site is gained via River View which currently forms a Cul-De-Sac and services the partially developed lands located between the Main St / Society St corridors to the south and the River Suck to the north. River View connects to the town centres road network via a priority junction with Main Street and Bridge Street which are classified as a regional route (R348).

2.2 EXISTING SITE FACILITIES

2.2.1 The subject site does not currently accommodate any existing structures or significant areas of hard standing. The topography of the development site and immediate adjoining roads are generally flat with small trees and hedgerows sparsely distributed along the subject site. The site currently benefits from a 'gated' access directly onto River View.

Hotel Planning Permission

2.2.2 A planning application on the subject site for a 100 bedroom hotel with ancillary facilities was granted permission in July 2005 by the local planning authority.

2.3 PROPOSED DEVELOPMENT

2.3.1 The development schedule for the proposed mixed use commercial development is detailed below in Table 2.1.

Table 2.1 Development Schedule

Developments Elements	GFA	Notes
Anchor Retails Unit	6,410m^2 (69,000ft^2)	Comprising food and non-food sales elements
Ancillary Retails Units	3,846m^2 (69,000ft^2)	-
Management Suit	185m^2 (2,000ft^2)	Assumed to be office element
Medical Retail	102m^2 (1,100ft^2)	-

Site Access

2.3.2 As introduced previously, a single access for both pedestrians and vehicles is to be provided to the subject site. A 'ghost island' junction arrangement is proposed on River View. The layout is illustrated in Hayes Higgins Partnership drawing 06KK059 CS005 PL1 which is included with the planning application.

2.3.3 The site access junction will accommodate both patrons and staff of the development in addition to delivery vehicles accessing / egressing the dedicated on-site service area.

Parking

2.3.4 As illustrated on the architect's site layout a total number of 326 car parking spaces are provided for both patrons and staff of the development. This number includes the provision of conveniently located dedicated disabled bays and 'parent and children' spaces.

2.3.5 **Table 2.2** below summarises the car parking standards as detailed within the Ballinasloe Development Plan (*Chapter 11, Table 11.4*).

TABLE 2.2: Ballinasloe Town Council Car Parking Standards

Land Use / Location	Town Centre[1]	Other area[2]
Shopping: (Retail Floor Space)	30-50m^2	10-30m^2
Offices (GFA)	100m^2	35-50m^2

1 – C1 and C2 Zones,
2 – All other Zones reference to Ballinasloe Development Plan – Map 7: Zoning

2.3.6 According to Map 7 (Zoning) of the Ballinasloe Development Plan, the subject development site is located within an area zoned as Town Centre (C1). As a result, referencing **Table 2.2** above, the proposed development should provide the following minimum number of car parking spaces in order to comply with the development plan standards.

TABLE 2.3: Proposed Development Car Parking Requirements.

Land Use	Area	Car Parking Number
Anchor Retail Unit (Retail Floor Space)	$4645m^2$	92 – 154
Ancillary Retail Units (Retail Floor Space)	$3159\ m^2$	63 – 105
Offices (GFA)	$102m^2$	2
Medical / Retail*	$306m^2$	6 – 10
Total		163 – 271

* - Ancillary Retail car parking requirement is applied for this development element

2.3.7 From the results summarised within **Table 2.3** above, the provision of 326 car parking spaces complies with the local authorities' development standards. This level of car parking above the development plan requirements will benefit the neighbouring town centre's commercial enterprises. In addition it will ensure that during peak periods such as Christmas, the level of any potential parking overflow onto the surrounding road network will be minimised should such a significant demand arise in parallel with a reduction in existing car parking provision across the town centre.

Off-Site Network Enhancements

2.3.8 During the initial master planning stage a sensitivity analysis of the existing road networks ability to accommodate a range of different development permutations on the subject site was undertaken. This sensitivity analysis of the networks operational performance demonstrated that further to the significant benefits achieved following the implementation of the N6 Ballinasloe by-pass, mitigation measures at a number of off-site junctions would be required to address both vehicle queuing issues and future capacity constraints. It also identifies measures to enhance safety levels for vulnerable road users particularly pedestrians.

2.3.9 The sensitivity analysis concluded that enhancement measures to the following two existing off-site junctions' arrangements would significantly mitigate the impact as potentially generated by the subject development proposals. Optimum balances between the various conflicting demands of all road users travelling through and across the following two key junctions were also established.

- Main St / Bridge St / River View priority junction
- Existing N6 corridor / Bridge St. priority junction

2.3.10 With the objective of maximising free flow traffic characteristics between Main St. and Bridge St a 'ghost island' arrangement has been identified which also enables a formal pedestrian crossing facility to be implemented on Main St. The proposed junction arrangement is illustrated in PBA drawing **518738/100/005**.

2.3.11 Whilst the priority junction between the existing N6 corridor and Bridge Street will benefit significantly following the completion of the Ballinasloe by-pass, the sensitivity analysis indicated that during the PM peak period there was the potential for vehicle queuing on Bridge St. (West). As a result the junction arrangement illustrated in PBA Drawing ***518738/100/003*** has been identified to enhance the capacity of the junction's performance and reduce the generation of excessive vehicle queues. An option to introduce a controlled pedestrian crossing as part of the enhancement works subject to the local authorities' specific requirements is also available.

Mobility Management Plan

2.3.12 Mobility Management Plans (MMPs) as defined in the Traffic Management Guidelines are usually required for developments considered to have a potential to generate significant trips. Information on the preparation of Mobility Management Plans is now widely published including the Dublin Transportation Office (DTO) publications such as the *DTO Advice Note: Mobility Management Plans* (http://www.dto.ie/mmp.pdf.) and *The Route to Sustainable Commuting Employers guide to Mobility Management Plans* (http://www.dto.ie/com.pdf) amongst others.

2.3.13 MMPs are normally prepared for commercial developments and large centres of employment at which an employer has a "level" of control or influence over the travel habits of employees, patrons, visitors etc. Examples include large office, industrial developments and large shopping centres. In order to encourage people to use sustainable modes of transport, certain physical facilities in addition to information must be available at the subject development.

2.3.14 The ability to draw up a co-ordinated plan for the proposed development will be dependant on a significant number of variables, including the mix of tenants (1 retail anchor plus additional independent retail units) and the management structure adopted at the proposed development. Clearly customers and shoppers will make up

the majority of trips to and from the proposed development. It can be appreciated that in the case of customers and indeed visitors to Ballinasloe, the development operator will have only limited influence on travel behaviour, particularly for short to medium duration trips.

2.3.15 It is considered premature to prepare a MMP for employees at this planning stage, nonetheless it is envisaged that, if thought necessary, a plan can be formulated and agreed with the Local Authority prior to or shortly after the opening of the proposed development.

2.4 POLICY REVIEW

2.4.1 It is considered prudent that the proposed development reflects the policy objectives of both the local Balinasloe Development Plan in addition to the strategic policy guidance within the Galway County Development Plan.

Ballinasloe Development Plan 2003 - 2009

2.4.2 The purpose the Balinasloe Development Plan is to set out the local specific development framework and supporting strategy for the future growth and development of the town and its environs. The identified strategy is supplemented by a series of policy statements, which outline the aspirations of the Local Authority with respect to specific development types and geographic locations. Key policies are reinforced by specific development objectives, which generally relate to specific works or activities, which the local authority intend to carry out or require to be implemented as part of the development control process.

2.4.3 Under **Section 2.1 Transportation,** the development plan details the objectives and policy with relation to transport. The plan states that improving the standard of transportation infrastructure is of primary importance to the Council.

2.4.4 The plan indicates that the emerging N6 bypass will alleviate the pressure placed on the existing N6 through Ballinasloe, subsequently creating a safer environment for pedestrians and enabling easier local travel.

2.4.5 The Balinasloe Development Plan reveals that it is policy of the authority to:

- Encourage, strengthen, and expand the pedestrian network of streets and spaces, which support the activity of the town centre.

- To develop a coherent structure of pedestrian walkways and cycle tracks utilising natural desire lines in the interest of providing a permeable and sustainable circulation pattern.
- Introduce traffic management measures within the town centre to facilitate pedestrian movement, cycling and public transport initiatives.
- Adopt short stay parking (2 hours or less), with the use of a pay for parking scheme within the town core; that is Dunlo Street, Society Street, and St. Michael's Square.
- Reserve lands for road improvement proposals by means of acquisition and development control.
- Develop and support public right of way.
- Encourage and support the establishment of public transport initiatives,
- Explore the possibility of a one way system at Main Street.
- Carry out road and footpath improvement schemes within the town centre area.
- Require traffic/movement management plans be submitted for large scale residential, commercial or industrial development.
- Improve access and safety for cyclists and pedestrians through the introduction of cycle routes, pedestrianised streets, and park and walk schemes.
- Work with public transport operators, including C.I.E / Iarnrod Eireann / Bus Eireann and any other relevant bodies, in the improvement of the public transport system in Ballinasloe.
- Ensure that any new or proposed pedestrian routes are sufficiently monitored by natural surveillance (i.e. ensure overlooking of open space through the design and orientation of buildings).
- Explore the possibility of different road surfaces and traffic calming within the town core to slow traffic and create a safe environment for pedestrians.

- Explore the possibility of an off street cycle/pedestrian route adjacent to the river from the railway station area to the proposed linear park, and a continuing link to the neighbourhood centre in Creagh.

- Encourage the development of cycle routes to areas of focal activity (as direct as feasibly possible) in all new residential developments.

- Encourage that the new link road complements housing layouts, which prevent regimented rows of housing on higher ground.

- Explore the possibility of increasing awareness of pedestrian safety and slowing traffic where the N6 enters the town centre (where Dunlo Street and the N6 meet) with the use of different road paving and traffic claming.

- Ensure the provision of greater accessibility to backland areas of Main Street, Society Street, and Dunlo street

2.4.6 In addition to the above policy goals the Ballinasloe Development Plan details the following 14 transport specific objectives:

T1 – Improve road junctions at the following locations:

T1.1 River Street and Main Street (adjacent to the Bank of Ireland)

T1.2 Harris Road and N6 / Dunlo Street

T1.3 Portumna Road and N6

T1.4 Roscommon Road and N6

T1.5 Dunlon Street and N6/Dunlo Hill

T1.6 Relief Road and proposed link road (objective **T9**) to include rounadabout

T2 – Provide a new bus interchange facility in the vicinity of the Fair Green and Town Hall car park

T3 – Provide bike parking / lock up facilities at the following locations:

T3.1 The new bus interchange (see objective **T2**)

T3.2 The railway Station

T3.3 The town centre / St. Michael's Square

T3.4 The new linear park adjacent to the river

T3.5 Playing Field near Hymany

T3.6 At all proposed Neighbourhood centres

T4 – Provide a cycling/pedestrian network to include:

T4.1 A route along the proposed River Suck Linear Park that will connect to Station Road and Hill O'Back

T4.2 From Ard Mhuire Housing Estate to Sarsfield Road

T4.3 From Beechlawn to the Inner Relief Road, serving new residential developments in this area. As part of this Objective the Local Authority will explore the possible provision of this route in connection with objective **T9** or alternatively, as a separate, segregated route associated with an open space network.

T5 – Develop pedestrian links from Main Street and Society Street to associated backlands.

T6 – Develop a pedestrian link from the Lidl site through to St. Micheal's Square

T7 – Monitor the current parking regime in the town centre to ensure that there is an adequate supply of short term car parking and if this is not being achieved consider a pay-for-parking scheme on certain street and car parks.

T8 – Introduce pedestrian crossing and traffic calming at the following locations

T8.1 On the N6 at the junction with Dunlo Street

T8.2 At the junction of the N6 and the Roscommon Road

T8.3 On the Shannonbridge Road in the vicinity of Creagh National School, should car parking be provided on the opposite side of the road.

T8.4 Upper Brackernagh Road

T9 – Provide a link road that runs from Beechlawn Road to the town centre inner relief road and another link from Brackernagh to Poolboy (as indicated on Map 8) – exact alignment to be addressed through a route feasibility study (route shown on Objectives Map 8 is indicative)

T10 – Increase, where possible, the number of public car parking spaces within the town core

T11 – Explore the possibility of providing footbridge over the River Suck linking the proposed linear park (Objective **T1**) with the proposed neighbourhood centre / mixed use zone at Creagh

T12 – Provide a new link road from Bank of Ireland (at the junction of Main Street and River Street) to connect with the Scarsfield Road via the access road adjacent to Tesco's or the swimming pool site

T13 – To provide a public car park opposite Creagh National School or in the vicinity of the junction and at the railway station

T14 – Reserve an access point to backlands on the Shannonbridge Road, opposite Creagh National School.

Galway County Council Development Plan

2.4.7 The aim of the Galway County Council Development Plan is to establish a framework for the sustainable development of County Galway and for the conservation and enhancement of its natural and appropriate man made environments.

2.4.8 Whilst Galway County Council Development plan does not include the administrative area of Ballinasloe Urban District Council, as it is a separate planning authority, it nevertheless provides the strategic context supplementing the local framework governed by the Ballinasloe Development Plan.

2.4.9 The county Plan indicates that while Ballinasloe is classified as a successful and self-sufficient town, it needs to be supported by policies at county level promoting its continued growth. Directing new growth to established towns underpins the economic role of the towns to provide a good quality of life, not just for townspeople but also for families living in the surrounding countryside. The plan classifies self-sufficient towns

as urban centres where a large proportion of the population living in the town and the surrounding countryside are able to live, work, shop, go to school and enjoy their recreation, without the need for constant travel.

2.4.10 An increase of 1,550 households in Ballinasloe is projected over the Plan period. Ballinasloe is the largest urban area in the County outside of Galway City and is strategically located on the Galway Dublin national primary route and the Galway Dublin railway line.

Economic Infrastructure

2.4.11 To achieve the principles of sustainable development, Galway County Council seek to develop a suitable balance between the use of private vehicular transport and alternative modes of transport. In development of any Transport Policy account will be taken of government policy, in particular Transport 21 and its impacts. Progress on the opening of the Western Rail Corridor and the implications for development will be closely monitored.

2.4.12 Under **Section 3.2.6 Traffic Management Section,** the County Council seeks to achieve an efficient, effective usage of the transportation infrastructure so that people can travel safely by various means, which minimises environmental impact and reduces traffic congestion. The main policy tools promoted included traffic calming, parking Byelaws, improved public transport and pedestrian/cyclist priority measures

2.4.13 Policies and objectives in the context of Roads and Transportation include;

Policies

- **Policy 26**: Facilitate the safe and efficient movement of people and goods in the interests of the economy.
- **Policy 27:** Preserve the visual amenity and rural character of the roadside environment.
- **Policy 30**: Reduce the congestion on public roads caused by the existing commuting movements to and from the City, by consolidating existing towns and villages and providing a more rational and better quality public transport system.

- **Policy 31:** Help develop a more integrated policy on rural transport in line with Government intent.

- **Policy 34:** Co-operate with the establishment of an Integrated Transportation Coordinating Group.

- **Policy 35:** Provide a safe road system throughout the County through Road Safety Schemes, which will include the continuation of the Low Cost Safety Measure Programme, Signage and Delineation, Traffic Calming, Safety Features in the vicinity of schools. Other measures deemed necessary by safety audits will be considered.

- **Policy 36:** Provide adequate access for people with disabilities such as through the provision of parking facilities, and disability access facilities, which are incorporated into existing/new development.

- **Policy 37:** Ensure, where possible, that adequate off-street parking and loading/unloading facilities are provided as part of each development, to ensure that parked vehicles do not cause a traffic hazard, obstruct vehicle or pedestrian movement or create a negative visual impact. Where this cannot be provided on site it shall be provided by payment of a levy to the county council for such a provision off-site.

- **Policy 39:** Promote Road Safety and seek to avoid the creation of traffic hazards by:

  - Supporting the Road Safety Committee and the promotion of safety at school level.
  - Continuing the process of improvements to sub-standard junctions on all roads.
  - Ensuring that the National Standards for Roads are complied with in all developments, as appropriate.
  - Ensuring that Safety Audits are conducted for all future Road schemes as appropriate.
  - Ensuring that pedestrians and cyclists are provided for adequately in all new developments.

- **Policy 41:** Co-operate with the establishment of integrated transport depot in all relevant towns and settlements.

- **Policy 42:** Apply the current National Roads Authority Policy Statement on Development, Management and Access to National Roads, May 2006.

- **Policy 43:** Recognise and preserve the strategic, social and economic importance of existing roads now designated as the National Road network.

Objectives

- **Objective 10:** Facilitate the development of the N6 as part of the Eastern Route Corridor. This includes the construction of the dual carriageway/motorway for the Galway City Outer By pass along a new alignment, the construction of dual carriageway/motorways under the Galway to Ballinasloe scheme with a single carriageway link to the Loughrea By pass and the Ballinasloe to Athlone scheme. Both schemes are along new alignments.

- **Objective 19:** Continue with the strengthening and improvements of the Local Road network and to improve strategic sections on those roads servicing aquaculture/forestry/agriculture/ industry and tourism.

- **Objective 20:** Continue with the strengthening and improvements of the Regional Road network.

- **Objective 21:** Develop service and link roads within towns and village areas to open up lands within settlements and reduce the necessity for ribbon development.

- **Objective 22:** Implement Parking Byelaws for the County.

- **Objective 23:** Provide car parks for the control of on-street and off-street car parking, adequate to meet short-term shopping and business requirements and for the needs of local residents.

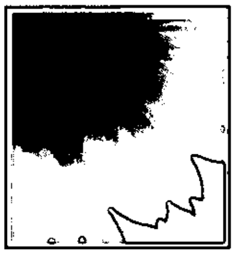
- **Objective 24:** Carry out Traffic and Transportation Studies in Oranmore, Tuam, Athenry, Oughterard, Ballinasloe, Clifden and Loughrea. On completion of these studies, the towns of Craughwell, Gort, Headford, Portumna and An Spidéal will be studied.

- **Objective 30:** Secure a safe comprehensive road system to cater for the commercial, agricultural, tourist and industrial needs of the county.

- **Objective 33:** Develop and improve roads in all areas

CHAPTER 3

Existing Transport Framework



CONTENTS

3 EXISTING TRANSPORT FRAMEWORK

3.1 BACKGROUND

3.1.1 A significant stage in the development of a transport assessment is the identification and appreciation of the local networks existing transport conditions and vehicle movement characteristics. It is also important that the appraisal considers the potential effects of all existing and committed developments across the local road network. The layout of the existing local road network is illustrated in **Figure 1**.

3.1.2 A site audit of the local road network was undertaken during both the peak and off traffic peak periods. Carried out on Monday 6th March 2007, the principal objectives of the audit included:

- Establishing the existing vehicle movement patterns across the local network
- Quantifying the level and quality of transport infrastructure currently provided on the approach to the proposed development site

3.2 SUSTAINABLE MODES OF TRANSPORT

Pedestrians

3.2.1 Facilities for pedestrians across the town centre predominately consist of footpaths which are generally provided on both sides of the local road networks carriageways. The width and quality of the pedestrian footpaths vary from location to location however supplementary facilities such as dropped kerbs, tactile paving and road carriageway crossing facilities are absent at a number of key locations.

3.2.2 The principal pedestrian routes leading to the subject development site include Main Street, River View and Bridge Street. With the exception of the river crossing on Bridge Street pedestrian footpaths are provided on both sites of these key links. Street lighting is also provided across the town centres and access routes leading to the development site.

Cycling

3.2.3 The site audit observed that there are currently no dedicated cycle facilities across the immediate area / approach to the subject development site.

Public Transport

3.2.4 Ballinasloe benefits from the provision of both rail and bus based public transport services. The town's railway station, located to the western extreme of the urban area, is beyond the recognised walking thresholds for the town centre and subsequently the subject site. Located on the main Dublin to Galway corridor train services to Galway and Dublin call at Ballinasloe station approximately 8 times for both eastbound and westbound destinations.

3.2.5 Public transport bus services in Ballinasloe are dominated by Bus Eireann who operate the following services which call at Ballinasloe;

Table 3.1 Bus Services Route

Provider	Route Number	Route Direction	Frequency
Bus Eireann	20	Ballinasloe - Dublin	Mon - Sun
	427	Ballinasloe - Galway	Thurs
	70	Ballinasloe - Galway	Mon - Sat
	20 & 70	Ballinasloe – Athlone	Mon - Sat

3.2.6 In addition to the above Bus Eireann services, a Galway City to Dublin Airport route operated as Nestor Link provides 7 additional two-way services calling at Ballinasloe. Nevertheless regional transport will continue to be dominated by the private motor car as evident by rising car ownership rates in the region.

3.3 TRAFFIC CHARACTERISTICS

3.3.1 PBAI commissioned a specialist survey company to undertake classified vehicle turning count surveys at a number of junctions across the town centre. The traffic surveys carried out between the hours of 07:00 to 10:00 and 16:00 to 19:00 were undertaken on Thursday 1st March 2007.

3.3.2 Analysis of the survey data identified the weekday AM and PM peak hour periods as being generated between 08:30 to 09:30 and 17:00 to 18:00 respectively. The observed 2007 peak hour traffic flows are illustrated in **Figure 2**.

3.3.3 The site audit established that the subject local area road network is subject to 50kph speed regulations in addition to benefiting from street lighting and pedestrian footpaths as previously detailed.

3.4 EMERGING TRANSPORT DEVELOPMENTS

3.4.1 Based on the Policy Review as detailed previously in **Section 2.5**, a number of key road infrastructure schemes have been identified which once implemented will significantly change existing traffic characteristics across Ballinasloe town centre. The most significant infrastructure proposals across the proposed developments immediate 'area of influence' include:

- N6 Dual Carriageway (Galway to East Ballinasloe bypass)
- New Link Road as detailed in the Ballinasloe Development Plan and identified as Transportation Objective **T12**. The scheme seeks to 'Provide a new link road from Bank of Ireland (at the junction of Main Street and River Street) to connect with the Scarsfield Road via the access road adjacent to Tesco's or the 'swimming pool site'

3.4.2 Based upon discussions with the National Roads Authority (NRA), and subsequently traffic data from the N6 Galway to East Ballinasloe schemes EIS (as provided by the NRA), we have calculated that the emerging N6 bypass, when complete and open to traffic in 2010, could potentially generate vehicle reassignments which would result in 37% lower traffic flows along the existing N6 alignment through the Ballinasloe urban area.

3.4.3 Due to the inherited constraints and potential difficulties in delivering the proposed 'link road' (Objective **T12** of the local development plan) from River View to Scarsfield Road, we have assumed for the purpose of this assessment, that this infrastructure proposal would not be implemented until 2024 at the earliest.

3.5 COMMITTED DEVELOPMENT

3.5.1 During the site audit it was observed that two number off-site developments, which are currently (March 2007) under construction, have the potential to generate additional traffic flows above and beyond the existing 'base' traffic that the commissioned traffic surveys would record on site. As a result we have incorporated the following two schemes within our appraisal as committed development.

Millrace Retirement Village

3.5.2 This application (06/029) for a Retirement Village was granted for planning permission on the site located immediately north of the existing N6 / Bridge Street priority junction. The application promotes a scheme consisting of 60 bed nursing home and 46 separate residential suites.

Shearwater Plaza Hotel

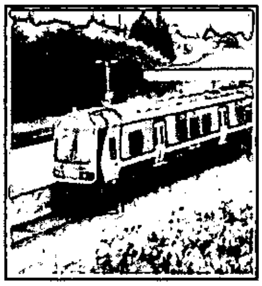
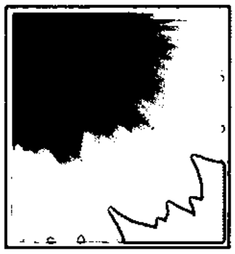
3.5.3 Further to telephone discussions with a representative of the town council, planning application 04/073 proposes a 60 bedroom hotel with conference and leisure facilities on a site fronting the existing N6 corridor and to the south of the existing N6 / Bridge Street priority junction.

CHAPTER 4

Traffic Generation






CONTENTS

4 TRAFFIC GENERATION

4.1 INTRODUCTION

4.1.1 The following paragraphs present the process by which the potential level of vehicle trips have been generated and assigned across the local road network for the proposed Mixed Use Development. The existing 2007 local road networks traffic movements have been detailed previously in **Chapter 3**.

4.1.2 Both the committed and proposed development is expected to follow closely the pattern of trip generation seen at other similar developments. As a result the traffic generation exercise has been predominately based upon the information available within the TRICS database.

4.2 TRAFFIC PERIODS

4.2.1 The on-site weekday traffic surveys undertaken in March 2007 identified that the local road networks morning and evening peak hour periods are currently generated between 08:30 to 09:30 and 17:00 to 18:00 respectively. Both of these peak periods are investigated within the scope of our appraisal.

4.3 COMMITTED DEVELOPMENT

4.3.1 As introduced in **Section 3.5**, we have incorporated the two identified off-site committed developments in our assessment with associated trips rates calculated employing the TRICS database (Version 2006b) for the most appropriate Land Use categories. The TRICS output data has been appended in **APPENDIX A** and **APPENDIX B.**

Retirement Home Trip Generation

4.3.2 In order to achieve a robust prediction for this development, we have employed trip rates from the TRICS sub land-use categories 'Health – Nursing Home' and 'Health – Retirement Flat'. These trip rates are expressed in terms of a calculation factor of 'per unit' of the surveyed sites. **Table 4.1a** presents the identified vehicle trip rates for each of these land use categories.

Table 4.1a: Retirement Village Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Nursing Home	0.085	0.055	0.14	0.04	0.07	0.11
Retirement Flat	0.04	0.055	0.095	0.06	0.03	0.09

Hotel Development Trip Generation

4.3.3 For the Hotel development of the committed development, we have adopted the category of *'Hotel, Food & Drink – Hotels'* to produce the vehicles trip rate, the parameter of this category applied is '*number of bedroom*'. The results of the trips rates are illustrated in **Table 4.1b**.

Table 4.1b: Hotel Development Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Hotel	0.145	0.185	0.33	0.17	0.12	0.29

4.3.4 Based on the above paragraph, a summary of total trips generated for the Committed Development are presented in **Table 4.2**.

Table 4.2: Committed Development Traffic Generation

Site Use	AM			PM		
	In	Out	Total	In	Out	Total
Retirement Village	7	5	12	6	5	11
Hotel	9	11	20	10	7	17

4.4 PROPOSED DEVELOPMENT

4.4.1 As introduced previously the proposed mixed use development consists of the following land use elements:

Table 4.4 Development Schedule

Developments Elements	GFA	Notes
Anchor Retail Unit	6,410m² (69,000ft²)	Comprising food and non-food sales elements
Ancillary Retail Units	3,846m² (69,000ft²)	-
Management Suit	185m² (2,000ft²)	Assumed to be office
Medical Retail	102m² (1,100ft²)	-

Anchor Retail Unit Trip Generation

4.4.2 For the anchor retail unit element we have applied a '*Donor Site*' methodology to establish 'local' trip rates for an anchor retail unit. The '*Donor* Site' method is performed by using an existing similar category development in the local area and employing a reverse process of calculating trip rates based upon the recorded vehicle movements travelling to / from the Donor site.

4.4.3 A traffic survey has been carried out at the existing Tesco retail development (predominately food sales only) in Ballinasloe town on the 4th April 2007. Comparing these vehicle movements to the size (GFA) of the Tesco store it has been possible to calculate the following trips:

Table 4.4: Anchor Retail Unit Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Traffic Survey Result	**53**	**28**	**81**	**155**	**151**	**306**
Donor Site Trip Rate (2674.5m^2)	**1.982**	**1.047**	**3.029**	**5.795**	**5.646**	**11.441**

Ancillary Retail Units Trip Generation

4.4.4 A search of the *"Shopping Centre – Local Shop"* section of the database was completed, including sites located within town centres, so that conditions forecast at the proposed development site could be replicated. All TRICS output data has been appended in **APPENDIX C.**

Table 4.5: Ancillary Retails Unit Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Retails Unit	**3.71**	**2.84**	**6.55**	**5.56**	**6.43**	**11.99**

Management Suite

4.4.5 Within this appraisal we have applied the trip rates for land use category *'Employment – Offices'* due to the limited database selection provide by TRICS data. However, in reality the management suite will not normally generate vehicles trip as high as 'Offices'. As a result, we believe employing this land use category represents a robust case for this development element. All TRICS output data has been appended in **APPENDIX D.**

Table 4.6: Management Suit (Offices) Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Management Suit (Offices)	2.725	0.7	3.41	0.5	3	3.5

Medical Retails

4.4.6 Within this appraisal we have applied the retail trip rates to represent the medical / retail element of the proposed development. The reason being is that medical / retail element could potentially constitute a chemist / pharmacy.

Table 4.7: Medical Retails Unit Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Medical Retails Unit	3.71	2.84	6.55	5.56	6.43	11.99

4.4.7 The proposed retail anchor unit element consists of both food sales and non food sales areas. This proportion will be approximately separated into 63% food sales and 37% non food retail sales. The anchor retail units GFA is accordingly separated into the following proportions:

Table 4.8: Retail Anchor Unit Floor Areas.

Total GFA	Food Sales GFA	Non-food Sales GFA
6410m^2	4,090m^2	2,320m^2

4.4.8 A summary of the potential total trips generated in isolation by the proposed commercial development are presented in **Table 4.9**.

Table 4.9: Proposed Mixed Use Development Traffic Generation

Site Use	AM			PM		
	In	Out	Total	In	Out	Total
Anchor Retail Unit – Food Sales (4090 m^2)	81	43	124	237	231	468
Anchor Retail Unit – non Food Sales (2320m^2)	86	66	152	129	149	278
Ancillary Retails Unit (3846 m^2)	143	109	252	214	247	641
Management Suit (185 m^2)	5	1	6	1	6	7
Medical Retails (102 m^2)	4	3	7	6	7	13
Total	319	222	541	586	640	1226

4.4.9 The TIA guidelines compiled by the IHT indicate that some 95 percent of car trips to a new foodstore are trips that are already travelling across the road network. Furthermore a research undertaken as part of the development of the TRICS database reveals that upwards of 85 percent of vehicle trips calling at a Retail Development are already on the network prior to the opening of any new store. Drawing upon the findings, we have assumed the following *'Diverted -Linked'* trip assumptions for the proposed development:

- 35% of Retail Units Cross-visitation Anchor Retails Unit
- 15% of Retail Unit Cross-visitation Existing Urban Environment
- 30% of Anchor Retails Unit Cross-visitation with Existing Urban Environment / on-site development
- 50% of Medical / Retail Cross-visitation with on-site Retails Units.

4.4.10 From the above *'Diverted - Link'* trip assumptions, an adjusted 'new' trip profile for the proposed commercial development is established as presented in **Table 4.10** below:

Table 4.10: Proposed Commercial Developments 'New' Traffic Generation

Site Use	AM			PM		
	In	Out	Total	In	Out	Total
Anchor Retail Unit – Food Sales ($4090\ m^2$)	**57**	**30**	**87**	**166**	**162**	**328**
Anchor Retail Unit – non Food Sales ($2320 m^2$)	**39**	**30**	**68**	**58**	**67**	**125**
Ancillary Retails Unit ($3846\ m^2$)	**64**	**49**	**113**	**96**	**111**	**208**
Management Suit ($185\ m^2$)	**5**	**1**	**6**	**1**	**6**	**6**
Medical Retails ($102\ m^2$)	**2**	**1**	**3**	**3**	**3**	**6**
Total	**167**	**112**	**278**	**324**	**349**	**673**

4.4.11 In relation to the Anchor Retail Unit, we have assumed 20 percent of the remaining trips to the proposed development, during the weekday AM and PM peak hour period, will consist of *'Pass-by' Trips*, which involves a diversion from their original route that would otherwise be followed.

4.5 TRIP DISTRIBUTION AND ASSIGNMENT

4.5.1 In this appraisal, we have split the development generated traffic into two network types:

- Local Network Distribution – This distribution assumes 45 percent of the 'new' development traffic is generated within the local area.

- Strategic Network Distribution – assumes 55 percent of the development traffic is generated outside Ballinasloe Town Centre.

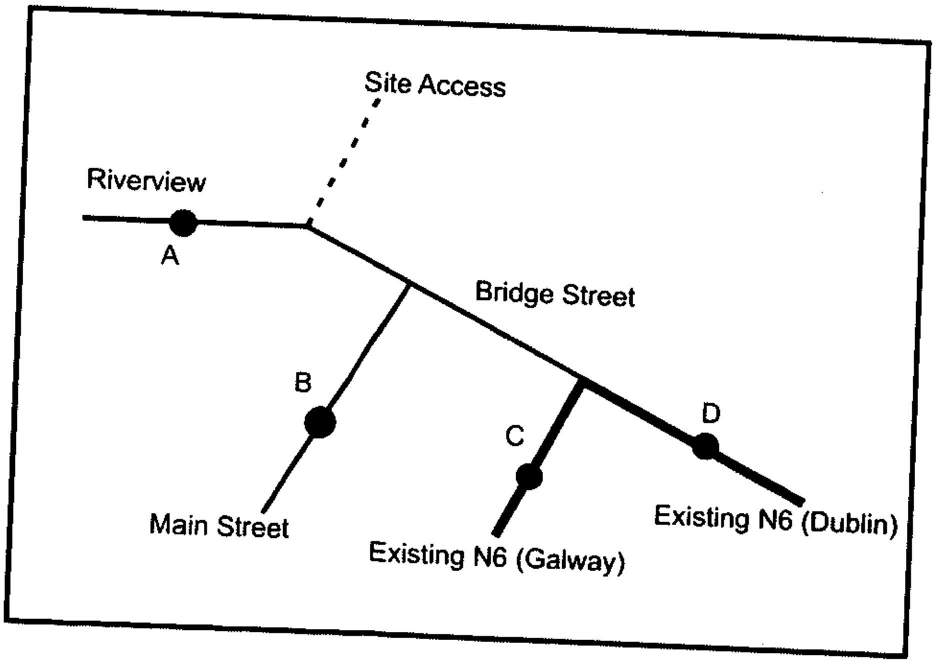
4.5.2 A cordon was identified encompassing the local road network. A total of four access / egress points have been adopted by which the developments generated vehicle trips can travel across the study areas road network on route to and from the road network outside of the cordon.

4.5.3 **Table 4.11** below illustrates the adopted origin / destination matrix for the proposed development. **Diagram 1** indicates the locations of each cordon.

Table 4.11: 2010 Opening Year Network Distribution

Network Cordon	Inbound			Outbound		
	Local	Strategic	Total	Local	Strategic	Total
(A) Riverview	0%	0%	0%	0%	0%	0%
(B) Main Street	25.3%	21.2%	46.5%	27.8%	24.2%	52%
(C) N6 South	8.45%	9.4%	17.85%	5.95%	6.4%	12.35%
(D) Bridge Street East	11.25	24.4%	35.65%	11.25%	24.4%	35.65%
Total	45%	55%	100%	45%	55%	100%

Diagram 1: Network Corridor Locations



4.5.4 According to **Section 3.4**, a link road (Policy Objective T12) is identified between Scarsfield Road to Riverview. Our assessment assumes that this link road will be in place by 2025. As a result a revised network distribution for the 2025 Future Design Year is applied within the appraisal. The revised origin / distribution matrix for 2025 Future Design Year is shown in **Table 4.12** below.

Table 4.12: 2025 Opening Year Network Distribution

Network Cordon	Inbound			Outbound		
	Local	Strategic	Total	Local	Strategic	Total
(A) Riverview	22.5%	18.3%	45%	22.5%	18.3%	40.8%
(B) Main Street	5.625%	6.1%	12.95%	7.325%	7.9%	15.225%
(C) N6 South	5.625%	6.2%	9.553%	3.925%	4.4%	8.325%
(D) Bridge Street East	11.25%	24.4%	22.5%	11.25%	24.4%	35.65%
Total	45%	55%	100%	45%	55%	100%

4.6 FUTURE TRAFFIC GROWTH

4.6.1 With the objective of providing a robust appraisal our assessment investigates the potential traffic impact that may be generated in both the adopted Opening Year and Future Design Year scenarios. Our assessment adopts a 2010 Opening Year and accordingly, based upon NRA guidelines, a 2025 Future Design Year.

4.6.2 Utilising 2010 Opening Year and 2025 Future Design Year network scenarios, the 2007 base network traffic flows can be converted to the appropriate base flows in respective of the future scenario. The growth of background traffic on the local road network has been estimated employing the growth factors set out in the NRA document "*Future Traffic Forecasts 2002-2040*" (August 2003).

4.6.3 The NRA derived growth factors for roads classified as 'Non National Road' and 'National Road' have been adopted to convert the 2007 base traffic flows to represent future network base flows within this assessment are presented in **Table 4.13** below:

Table 4.13 Growth Rate for Non-national Road

Period	Growth Rate	
	National Road	Non-national Road
2007- 2010	10.57%	5.41%
2007 - 2025	42.28%	21.61%

4.7

4.8 NETWORK IMPACT

4.8.1 The Institution of Highways and Transportation document 'Guidelines for Traffic Impact Assessments' states that the impact of a proposed development upon the local road network is considered material when the level of traffic it generates surpasses 10% and 5% on normal and congested networks respectively. When such levels of impact are generated a more detailed assessment should be undertaken to ascertain the specific impact upon the networks operational performance.

4.8.2 In accordance with the IHT guidelines we have undertaken an assessment to establish the potential impact upon the junction of the local road network. To enable this calculation to be undertaken we have based the analysis upon the 2010 opening year traffic scenario. The 2007 base flows have been converted to establish the base 2010 vehicle movements across the local road network. The analysis has demonstrated the proposed development will generate the following impacts at the local key junctions during the AM and PM peak hours.

Table 4.14: Network Impact

Junction/ Location	AM	PM
Site Access Junction	214%	339%
Riverview / Main Street Junction	53.56%	100.7%
N6 / Bridge Street Junction	10.1%	20.0%

4.8.3 In accordance with the IHT 'Guidelines for Traffic Impact Assessments', only the level of impact recorded at the location of the site access is considered material subsequently requiring a more detailed assessment of the operational performance. As a result we have undertaken a detailed investigation of the operational performance of all three of the above junctions as part of this transport assessment.

4.9 CONSTRUCTION TRAFFIC

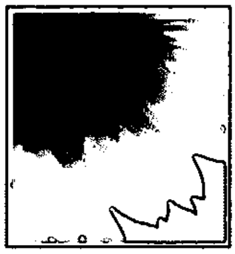
4.9.1 Due to the central location of the site it is considered important that consideration be given to the transportation implications generated during the construction phase of the development in order to minimise disruption to the networks traffic flows, pedestrian conflicts and the impact on the surrounding environment, particularly the residential and retail areas. It is recommended that a Construction Traffic Plan, developed in partnership with the local roads authority, is identified and agreed in response to the various construction stages of the proposed development.

4.9.2 A detailed construction traffic management plan can only be developed once the final schedule of construction works has been finalised and directly in response to the various key work stages which may include;

- Site set up and demolished stage
- Material extraction stage
- Substructure and retaining structures
- Superstructure
- Fitting Out.

CHAPTER 5

Network Assessments



CONTENTS

5 NETWORK ASSESSMENT

5.1 INTRODUCTION

Junctions

5.1.1 The following paragraphs summarise the results of detailed assessments, which have been undertaken to investigate the operational performance of key junctions across the development sites local network. The three key junctions identified for detailed assessment include:

- Site Access Junction with Riverview (three-arm priority junction)
- Riverview / Main Street / Bridge Street (three-arm priority junction)
- Bridge Street / N6 (three-arm mini – roundabout junction)

Assessment Scenarios

5.1.2 In accordance with best practice guidance the above three junctions have been assessed for the proposed schemes expected year of opening and a period of fifteen years thereafter. In this particular case it is anticipated, allowing time for the application to process through the planning procedures, construction and commissioning works, the proposed development may be open and fully operational in the second half of 2010. As a result, the years 2010 and 2025 have been adopted as our appraisals 'Year of Opening' and 'Future Design Year' respectively.

5.1.3 Two different traffic scenarios have been investigated, namely:

- '*Base plus Committed Development*', and
- '*Post Development".*

5.1.4 The *Post Development* traffic scenario takes into account the potential level of traffic that could be generated by the 'proposed development' and adds these 'new' flows to the networks *Base plus Committed Development*' traffic characteristics.

Traffic Periods

5.1.5 As discussed previously, both the morning and evening weekday peak hour traffic periods are both investigated within the scope of our appraisal. The on-site traffic surveys established the local networks existing AM and PM peak hours are currently generated between 08:30 to 09:30 and 17:00 to 18:00 respectively.

5.2 PROPOSED SITE ACCESS JUNCTION

5.2.1 In order to assess the operational capacity of the proposed site access junction on Riverview, the TRL developed PICADY (V4.2) software program which has been employed. The layout of this junction is illustrated on Hayes Higgins Partnership drawing 06KK059 CS005 PL1.

2010 Opening Year Traffic Flows

5.2.2 The principal modelling results for the 2010 Opening Year, AM and PM peak hour predicted traffic movements for the *Post Development* traffic scenario are summarised below in **Table 5.1**. The detailed PICADY output data has been appended in **Appendix E** and **Appendix F**.

TABLE 5.1: PICADY Results- 2010 Opening Year Post Development AM & PM

Junction Arm	AM Peak Hour		PM Peak Hour	
	RFC	Queue	RFC	Queue
Site Access	**0.152**	**<1**	**0.500**	**1**
Riverview Road (East)	**0.337**	**<1**	**0.683**	**2**

5.2.3 The output data of the junction simulation model, records a maximum ratio of demand to capacity (RFC) of only 0.683 during PM peak hour. The results demonstrate that the junction will operate well within capacity during the assessed peak periods with a maximum queue of 2 vehicles on the site access arm.

2025 Future Year Traffic Flows

5.2.4 The principal results for the 2025 Future Design Year AM and PM peak hour predicted traffic movements, for the *Post Development* traffic scenario, are summarised in **Table 5.2**. The detailed PICADY output data has been appended as **Appendix G** and **Appendix H**.

TABLE 5.2: PICADY Results- 2025 Future Year Post Development

Junction Arm	AM Peak Hour		PM Peak Hour	
	RFC	Queue	RFC	Queue
Site Access	**0.134**	**<1**	**0.581**	**1**
Riverview Road (East)	**0.173**	**<1**	**0.457**	**1**

5.2.5 The output data of the junction simulation model, records a maximum ratio of demand to capacity (RFC) of only 0.581 in PM peak hour. The results demonstrate that the junction will operate well within capacity during this peak period with a corresponding maximum queue on the site access arm of only one vehicle.

5.2.6 The slight decrease in the recorded RFC value, compared to the corresponding 2010 results, is directly due to the implementation of the proposed Riverview 'link road' (Policy T12 of Ballinasloe Development Plan) to Scarsfield Road as detailed previously in **Chapter 3.0**.

5.3 RIVERVIEW / MAIN STREET / BRIDGE STREET JUNCTION

5.3.1 The enhanced junction arrangement at Riverview / Main Street / Bridge Street has been modelled using the software package PICADY. The proposed junction arrangement is illustrated in PBA drawing **518738/100/005**.

2010 Opening Year Traffic Scenario

5.3.2 The principal modelling results for the 2010 Opening Year are summarised below in **Table 5.3** and **Table 5.4** for the AM (08:30-09:30) and PM (17:00-18:00) perk periods respectively.

TABLE 5.3 PICADY Results: *2010 Opening Year* AM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	**0.014**	**0**	**0.138**	**<1**
Riverview (To Main Street)	**0.041**	**0**	**0.219**	**<1**
Bridge Street	**0.064**	**<1**	**0.247**	**<1**

TABLE 5.4 PICADY Results: *2010 Opening Year* PM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	**0.165**	**<1**	**0.638**	**2**
Riverview (To Main Street)	**0.143**	**<1**	**0.749**	**3**
Bridge Street	**0.052**	**<1**	**0.417**	**1**

5.3.3 The output data of the junction simulation model recorded a maximum ratio of demand to capacity (RFC) of 0.247 and 0.749 during the AM and PM *'Post Development'* traffic periods respectively. The results demonstrate that whilst the PM period is the most heavily trafficked, the junction will operate within capacity over the peak hour period. The detailed PICADY output data has been appended as **Appendix I** through to **L.**

2025 Future Year Traffic Flows

5.3.4 The principal results for the 2025 Future Design Year are summarised below in **Table 5.5** and **Table 5.6** for the AM (08:30-09:30) and PM (17:00-18:00) periods respectively. The detailed PICADY output data is appended in **Appendix M** to **P**.

TABLE 5.5 PICADY Results: *2025 Future Design Year* AM Peak Traffic Scenario

Traffic Scenario / Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	**0.011**	**0**	**0.106**	**<1**
Riverview (To Main Street)	**0.000**	**0**	**0.061**	**<1**
Bridge Street	**0.059**	**<1**	**0.222**	**<1**

TABLE 5.6 PICADY Results: *2025 Future Design Year* PM Peak Traffic Scenario

Traffic Scenario / Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	**0.183**	**<1**	**0.520**	**1**
Riverview (To Main Street)	**0.123**	**<1**	**0.350**	**1**
Bridge Street	**0.053**	**<1**	**0.376**	**1**

5.3.5 The junction simulation model recorded a maximum ratio of demand to capacity (RFC) of 0.059 and 0.183 for the AM and PM *'Base plus Committed Development'* traffic scenarios respectively. Comparing these results to the *'Post Development'* scenario, the maximum RFC recorded increases slightly due to the additional traffic generated by the subject development proposals. Whilst the maximum RFC increases to 0.222 and 0.520 (AM and PM respectively) the junction continues to benefit from a significant amount of reserve capacity.

5.3.6 The junction simulation results demonstrate that the marginal impact generated by the proposed development will give rise to any capacity constraints due in part to the enhancement measures identified at this key junction.

5.4 BRIDGE STREET / N6 MINI – ROUNDABOUT JUNCTION

5.4.1 The existing N6 corridor / Bridge Street junction incorporates a three arm priority junction with opportunities to enhance this layout, which is adversely constrained by both the proximity and 'nature' of the adjoining bridge and private third party lands. Nevertheless, as detailed in **Chapter 3**, enhancement measures in the form of a mini-roundabout are proposed to mitigate the potential impact of the proposed development at this particular junction. The proposed junction arrangement is illustrated in PBA Drawing **518738/100/003**.

2010 Opening Year Traffic Flows

5.4.2 The enhanced junction arrangement has been modelled using the software package ARCADY. **Table 5.7** and **5.8** presents the principal simulation results for the 2010 AM (08:30-09:30) and PM (17:00-18:00) peak hours respectively.

TABLE 5.7 ARCADY Results: *2010 Opening Year* AM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Bridge Street	**0.342**	**1**	**0.514**	**1**
N6 (East)	**0.401**	**1**	**0.438**	**1**
N6 (South)	**0.314**	**<1**	**0.340**	**1**

TABLE 5.8 ARCADY Results: *2010 Opening Year* PM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Bridge Street	**0.498**	**1**	**0.768**	**6**
N6 (East)	**0.456**	**1**	**0.526**	**1**
N6 (South)	**0.333**	**<1**	**0.380**	**1**

5.4.3 The output data of the junction simulation model, recorded a maximum *Post Development* ratio of demand to capacity (RFC) of 0.514 and 0.768 during the AM and PM Peak hour assessments respectively demonstrating that the junction will be operating within capacity over the peak hours. The detailed ARCADY output data has been appended as **Appendix Q, R, S** and **T**.

2025 Future Year Traffic Flows

5.4.4 The principal results for the 2025 Future Design Year AM and PM peak hour predicted traffic movements are summarised below in **Table 5.9** and **Table 5.10**. The detailed ARCADY output data has been appended as **Appendix U, V, W** and **X**.

TABLE 5.9 ARCADY Results: *2025 Future Design Year* AM Peak

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Bridge Street	**0.417**	**1**	**0.502**	**1**
N6 (East)	**0.463**	**1**	**0.499**	**1**
N6 (South)	**0.361**	**1**	**0.382**	**1**

TABLE 5.10 ARCADY Results: *2025 Future Design Year* PM Peak

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Bridge Street	**0.611**	**2**	**0.875**	**6**
N6 (East)	**0.525**	**1**	**0.593**	**1**
N6 (South)	**0.386**	**1**	**0.425**	**1**

5.4.5 The simulation results indicate that for the *2025* Future Design Year *Post Development* scenario, the maximum RFC recorded would be 0.502 and 0.875 in the AM and PM peak hours respectively. While the modelling exercise demonstrates that the junction will operate well within capacity during the AM period, it will be approaching capacity for a short period over the PM peak hour in 2025. Nevertheless this level of operation is compatible to what would be expected should no enhancement works be carried out on the subject junction in a '*base plus committed'* development traffic scenario.

5.5 SUMMARY

5.5.1 The junction simulation results reveal that the proposed site access junction at Riverview would operate well within capacity in both the *2010 Opening Year* and *2025 Future Design Year 'Post Development'* traffic scenarios.

5.5.2 The most significant operational impacts are potentially generated at the two off-site junctions, the existing N6 / Bridge Street Junction and the Main St / Bridge St / Riverview junction. Nevertheless, due to the identified junction enhancement works at each of these locations, the '*Post Development'* traffic movements can be accommodated within acceptable operational levels with minimum delays to road users.

CHAPTER 6

Summary & Conclusion









CONTENTS

6 SUMMARY AND CONCLUSIONS

6.1 SUMMARY

6.1.1 This TAR has been undertaken to quantify the potential influence of the proposed commercial development upon the operational performance of the off-site local area road network. Our methodology incorporated a number of key inter related stages, including;

- Site Audit,
- Traffic Count Surveys,
- Trip Generation, Distribution and Assignment exercises,
- Sensitivity Analysis,
- Network Impact analysis, and
- Network Assessment.

6.1.2 While the subject site does not currently accommodate any existing structures it does benefit from planning permission for a 100 bedroom hotel with ancillary facilities as granted in 2005 by the local planning authority.

6.1.3 During the initial master planning stage, a sensitivity analysis of the existing road networks ability to accommodate a range of different development permutations on the subject site was undertaken. This sensitivity analysis of the networks operational performance demonstrated that further to the significant benefits achieved following the implementation of the N6 Ballinasloe by-pass, mitigation measures at a number of off-site junctions would be required.

6.1.4 The sensitivity analysis concluded that enhancement measures to the Main St. / Riverview junction and the Bridge St. / N6 (existing alignment) corridor would significantly mitigate the impact as potentially generated by the subject development proposals and strike an optimum balance between the various conflicting demands of all road users travelling through and across these two key junctions.

6.1.5 The principal findings of the assessment, as detailed in the previous chapters of this report can be summarised as follows;

- The proposed development would provide a key facility within convenient walking distance of the existing town centre and adjoining urban environs.

- Sufficient car parking is proposed on site to comply with local development standards and to ensure that no overspill onto the adjoining road network is generated during peak seasonal demands.

- The identified off-site infrastructure enhancements return the networks '*Post Development*' operational parameters to compatible levels for '*Base plus committed*' traffic characteristics in the absence of the proposed junction works.

- The network assessment represents a worst case assessment of future traffic characteristics. It also incorporates the completed committed developments construction traffic flows associated with its construction works.

- The junction assessments reveal that the proposed site access junction will operate with a significant amount of reserve capacity in both the 2010 and 2015 Post Development traffic scenarios.

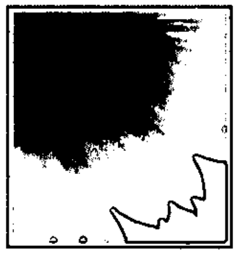
- Similarly the junction enhancements to the Main St. / Riverview junctions ensures that this key junction will also operate within capacity in both the 2010 and 2015 Post Development traffic scenarios.

- The junction analysis at the N6 / Bridge St. junction demonstrates that while the junction will operate well within capacity during the AM period, it will be approaching capacity for a short period over the PM peak hour in the 2025 Future Design Year. Nevertheless this level of operation is compatible to what would be expected should no enhancement works be carried out on the subject junction in a '*base plus committed*' development traffic scenario.

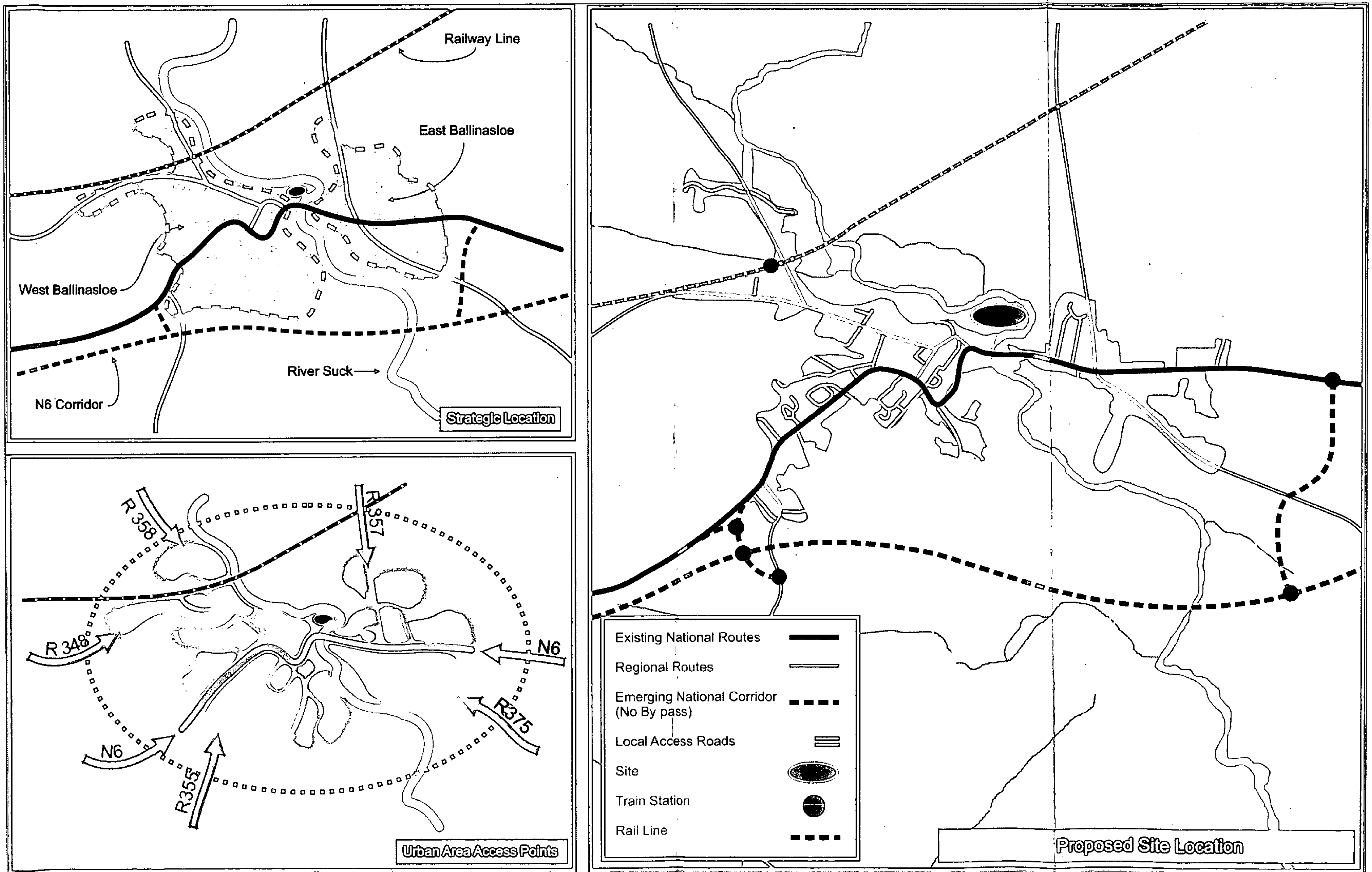
6.2 CONCLUSIONS

6.2.1 In conclusion, this TAR demonstrates that the proposed commercial development, in addition to the parallel implementation of the identified off-site junction enhancement works, can be accommodated on the subject site with no significant adverse impact upon the operational capacity of the local road network.

FIGURES



CONTENTS



PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
SITE LOCATION

CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD, WATERFORD CITY, IRELAND TEL: +353 5184 5447
FAX: +353 5184 5401 Email: info@pbai.ie Website: www.pbai.ie

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DRAWN BY. GW	DATE. 22.05.07	FIGURE 1
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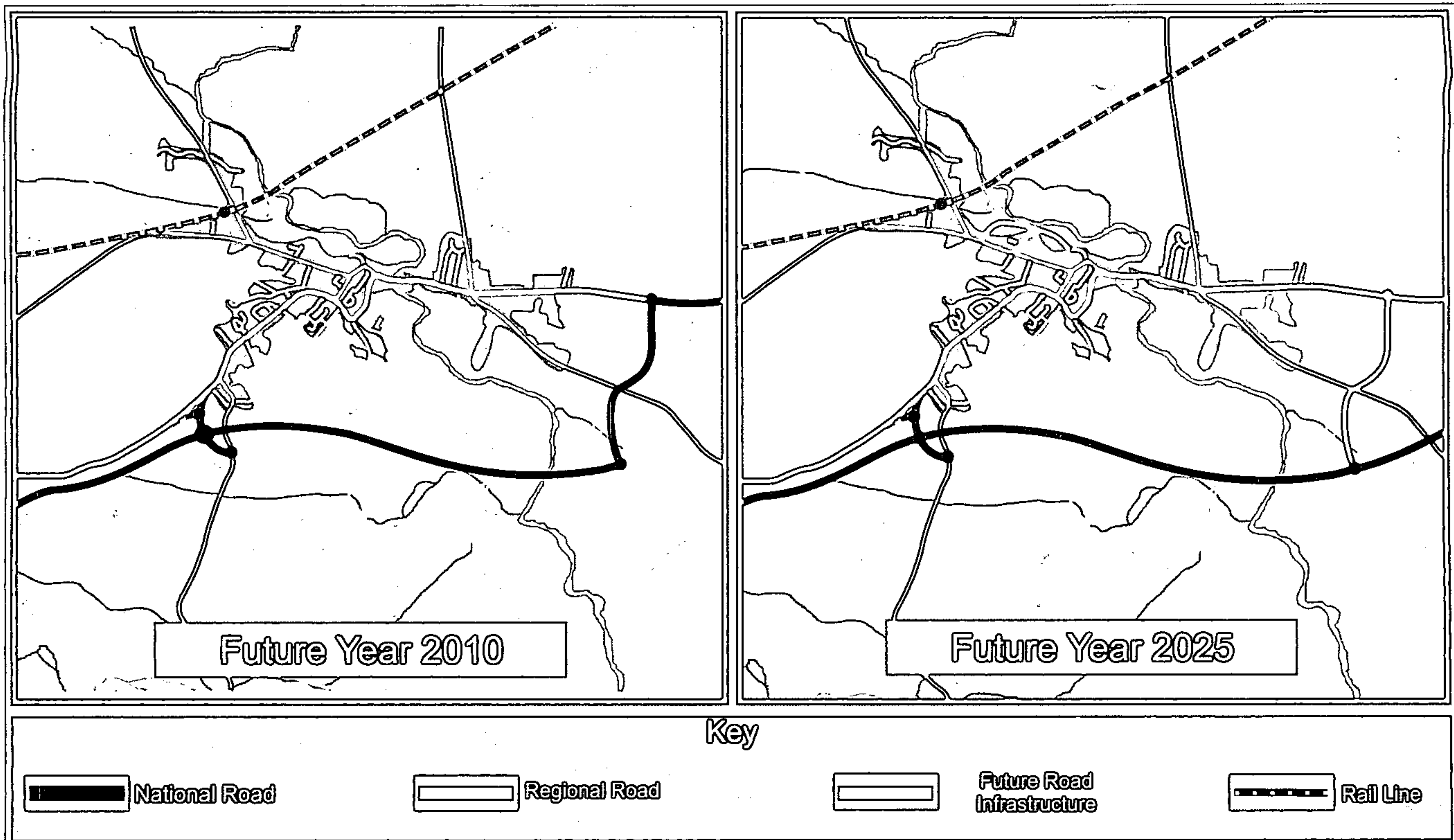

PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO. GALWAY

EMERGING ROAD NETWORK

CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD, WATERFORD CITY, IRELAND TEL: +353 5184 5447
FAX: +353 5184 5401 Email: info@pbai.ie Website: www.pbai.ie

J:\518738\001\07 DWG& Figures\Corel\Figure2_Emerging Road Network

DRAWN BY: GW	DATE: 23.05.07	FIGURE 2
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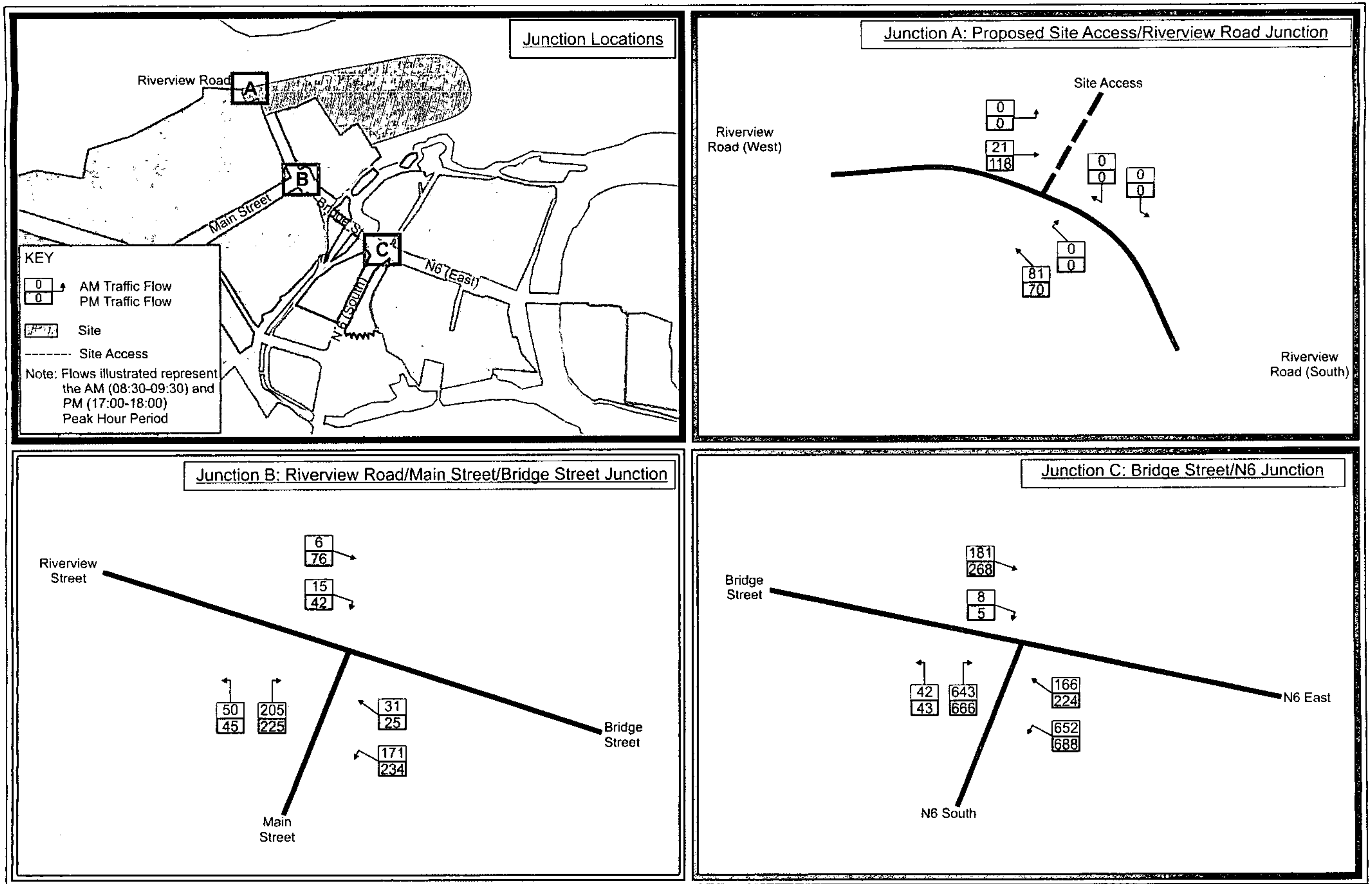

PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
2007 EXISTING TRAFFIC NETWORK FLOWS

CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD, WATERFORD CITY, IRELAND TEL +353 5184 5447 FAX +353 5184 5401			-
DRAWN BY: GW	DATE: 23.05.07	FIGURE 3	
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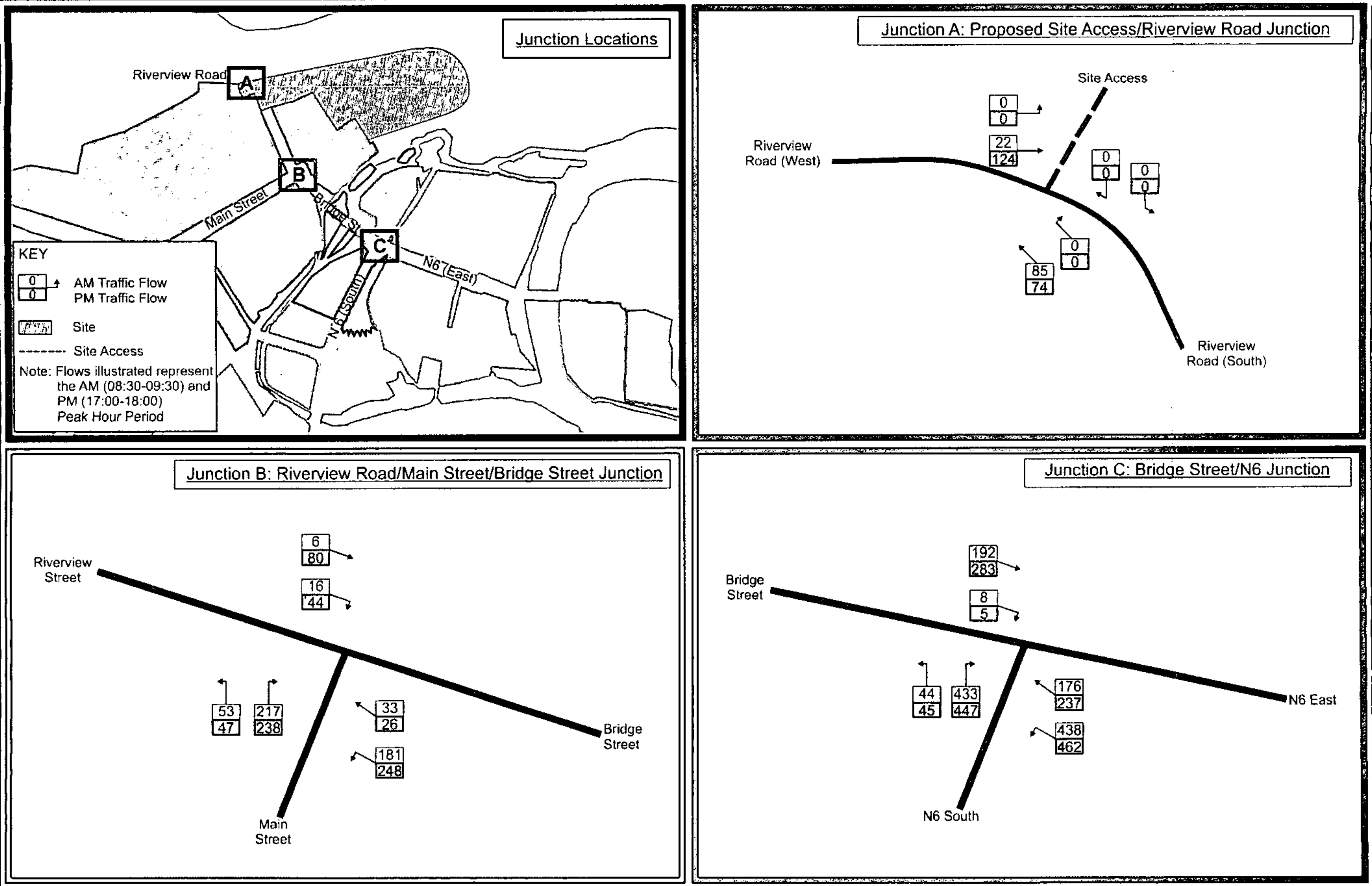

PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
2010 OPENING YEAR BASE + COMMITTED DEVELOPMENT TRAFFIC NETWORK FLOWS

CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD, WATERFORD CITY, IRELAND

DRAWN BY GW	DATE 23.05.07	FIGURE 4	
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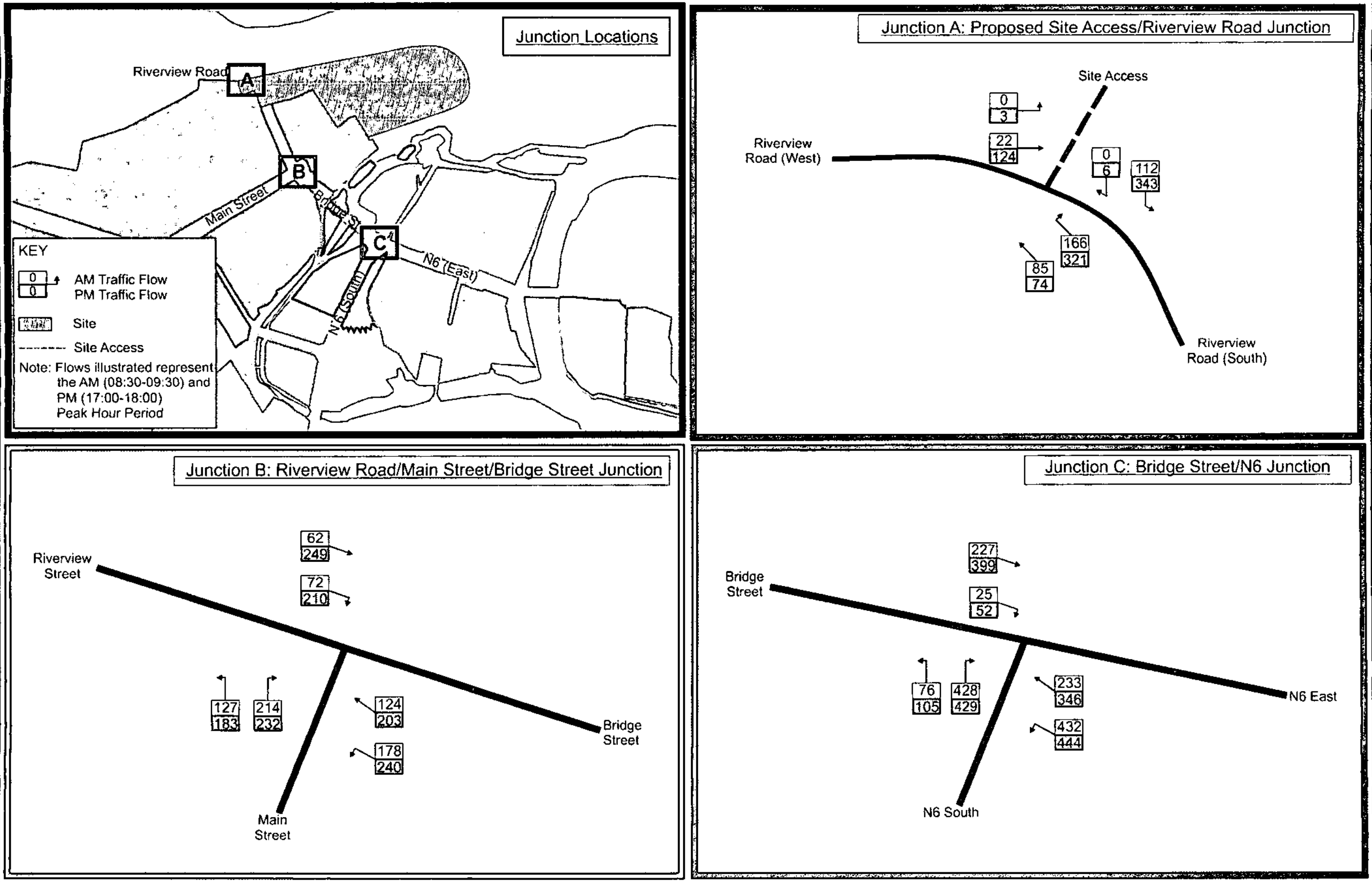

pba

PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
2010 OPENING YEAR POST DEVELOPMENT TRAFFIC NETWORK FLOWS

CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD, WATERFORD CITY, IRELAND

DRAWN BY GW	DATE 25.06.07	FIGURE 5		A
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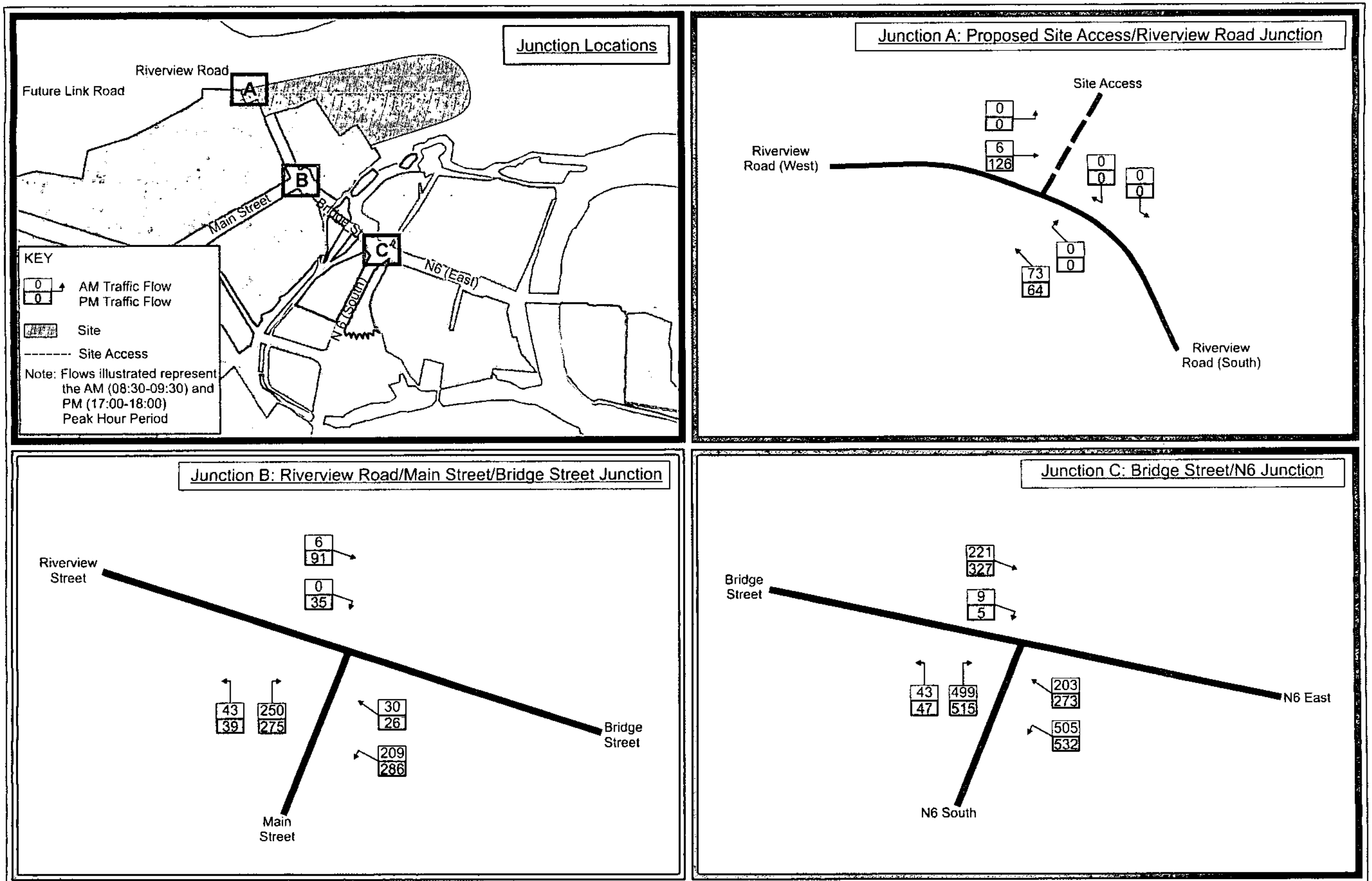
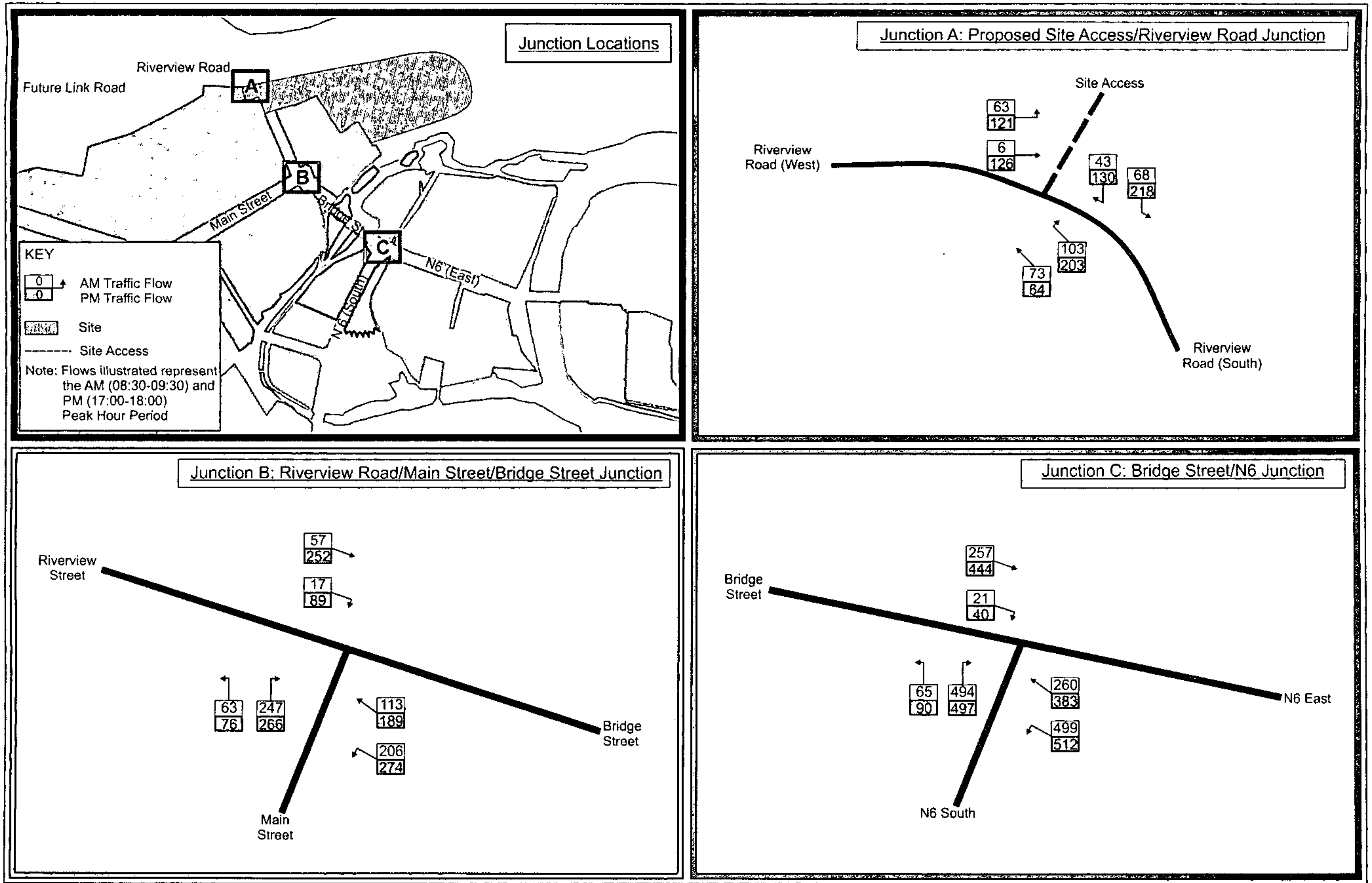


PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
2025 FUTURE DESIGN YEAR BASE + COMMITTED DEVELOPMENT TRAFFIC NETWORK FLOWS

DRAWN BY: GW | DATE: 23.05.07
A3 SCALE: N.T.S | CHECKED: LC

FIGURE 6



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PROPOSED MIXED USE DEVELOPMENT
BALLINASLOE, CO GALWAY
2025 FUTURE DESIGN YEAR POST DEVELOPMENT TRAFFIC NETWORK FLOWS

CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD, WATERFORD CITY, IRELAND

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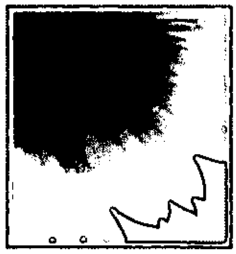
DRAWINGS



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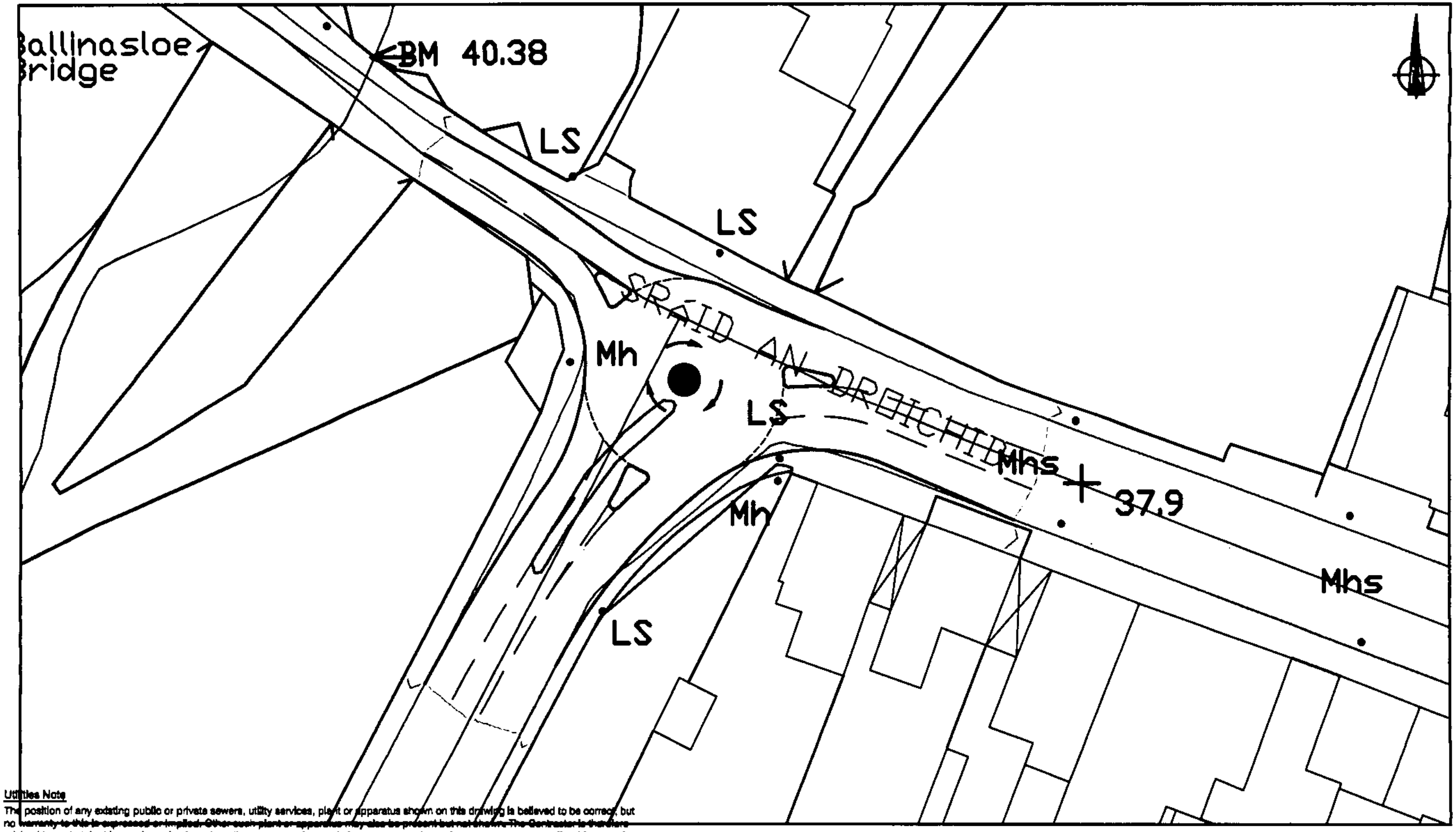

Utilities Note

The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no ~~warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore~~ advised to undertake his own investigation where the presence of any existing sewers, services, plant or apparatus may affect his operations.

Client: Harte Holdings	Proposed Mixed Use Development N6 - Bridge Street Potential Mini-Roundabout Layout	

PETER BRETT ASSOCIATES IRELAND LTD
CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD WATERFORD CITY
Tel: +353 5184 8447 Fax: +353 5184 8401 E-mail: info@pbai.ie Website: www.pbai.ie © Peter Brett Associates

Mark	Revision	Drawn	Date	Chkd

Drawing Status	For Planning
Date	26-04-07
A4 Scale	1:500
Drawn	DT
Checked	PB
Drawing Number	518738-100-003
Revision	-

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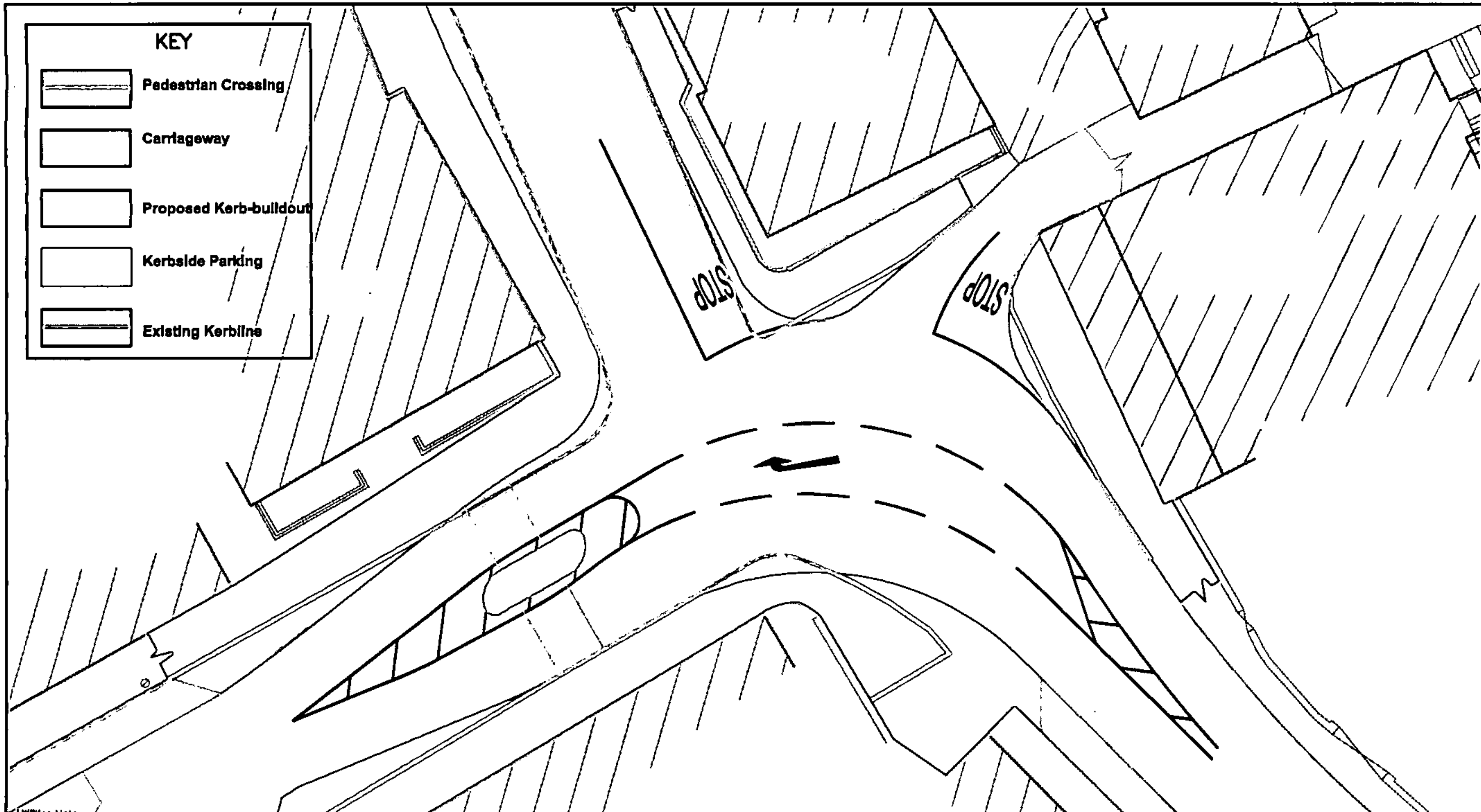


Utilities Note
The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake his own investigation where the presence of any existing sewers, services, plant or apparatus may affect his operations.

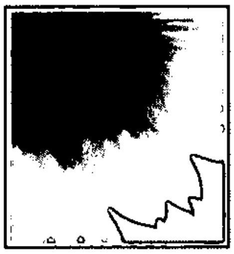
PETER BRETT ASSOCIATES IRELAND LTD CITY ENTERPRISE CENTRE WATERFORD BUSINESS PARK CORK ROAD WATERFORD CITY Tel: +353 5184 8447 Fax: +353 5184 8401 E-mail: info@pbai.ie Website: www.pbai.ie © Peter Brett Associates	Client Harte Holdings	Proposed Mixed Use Development Ballinasloe, Co. Galway Proposed Riverview Junction Layout		

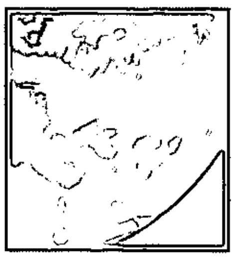
Mark	Revision	Drawn	Date	Chkd

Drawing Status: For Planning

Date	25/06/07	Drawing Number	Revision
A4 Scale	1:250	518738/100/005	-
Drawn	LC		
Checked	TJ		

APPENDICES





CONTENTS

Appendix G **PICADY Output Data - Site Access Junction;**
2025 Post Development AM Peak Scenarios

Appendix H **PICADY Output Data - Site Access Junction;**
2025 Post Development PM Peak Scenarios

Appendix I **PICADY Output Data – Riverview Road / Main Street Junction;**
2010 Base plus Committed Development Traffic AM Peak Scenarios

Appendix J **PICADY Output Data – Riverview Road / Main Street Junction;**
2010 Post Development Traffic AM Peak Scenarios

Appendix K **PICADY Output Data – Riverview Road / Main Street Junction;**
2010 Base plus Committed Development Traffic PM Peak Scenarios

Appendix L **PICADY Output Data – – Riverview Road / Main Street Junction;**
2010 Post Development Traffic PM Peak Scenarios

Appendix M **PICADY Output Data - – Riverview Road / Main Street Junction;**
2025 Base plus Committed Development AM Peak Scenarios

Appendix N **PICADY Output Data - Riverview Road / Main Street Junction;**
2025 Post Development AM Peak Scenarios

Appendix O **PICADY Output Data - – Riverview Road / Main Street Junction;**
2025 Base plus Committed Development PM Peak Scenarios

Appendix P **PICADY Output Data - Riverview Road / Main Street Junction;**
2025 Post Development PM Peak Scenarios

Appendix Q **ARCADY Output Data – N6 / Bridge Street Junction;**
2010 Base plus Committed Development Traffic AM Peak Scenarios

Appendix R **ARCADY Output Data – N6 / Bridge Street Junction;**
2010 Post Development Traffic AM Peak Scenarios

Appendix S **ARCADY Output Data – N6 / Bridge Street Junction;**
2010 Base plus Committed Development Traffic PM Peak Scenarios

Appendix T **ARCADY Output Data – N6 / Bridge Street Junction;**
2010 Post Development Traffic PM Peak Scenarios

Appendix U **ARCADY Output Data - N6 / Bridge Street Junction;**
2025 Base plus Committed Development AM Peak Scenarios

Appendix V **ARCADY Output Data - N6 / Bridge Street Junction;**
2025 Post Development AM Peak Scenarios

Appendix W **ARCADY Output Data - N6 / Bridge Street Junction;**

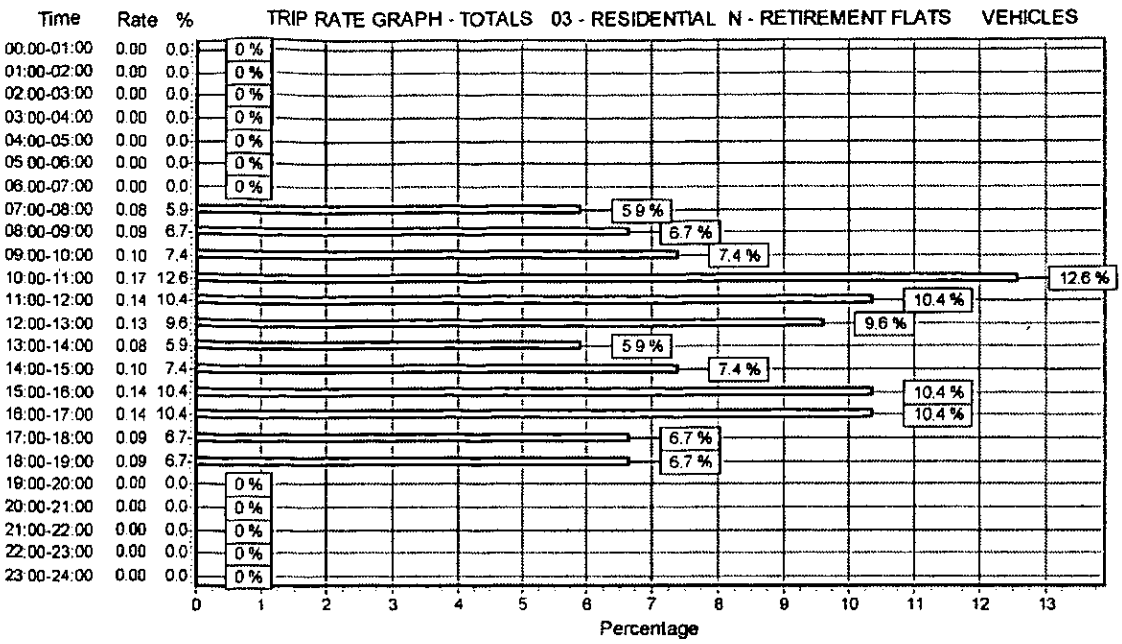
2025 Base plus Committed Development PM Peak Scenarios

Appendix X **ARCADY Output Data - N6 / Bridge Street Junction;**

2025 Post Development PM Peak Scenarios

Appendix A

TRICS Data- Committed Development- Retirement Home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04:00-05:00 0.00 0.0 0 %
05:00-06:00 0.00 0.0 0 %
06:00-07:00 0.00 0.0 0 %
07:00-08:00 0.08 5.9 5.9 %
08:00-09:00 0.09 6.7 6.7 %
09:00-10:00 0.10 7.4 7.4 %
10:00-11:00 0.17 12.6 12.6 %
11:00-12:00 0.14 10.4 10.4 %
12:00-13:00 0.13 9.6 9.6 %
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14:00-15:00 0.10 7.4 7.4 %
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23:00-24:00 0.00 0.0 0 %
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Percentage

TRIP RATE GRAPH - ARRIVALS 03 - RESIDENTIAL N - RETIREMENT FLATS VEHICLES

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04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.00	0.0
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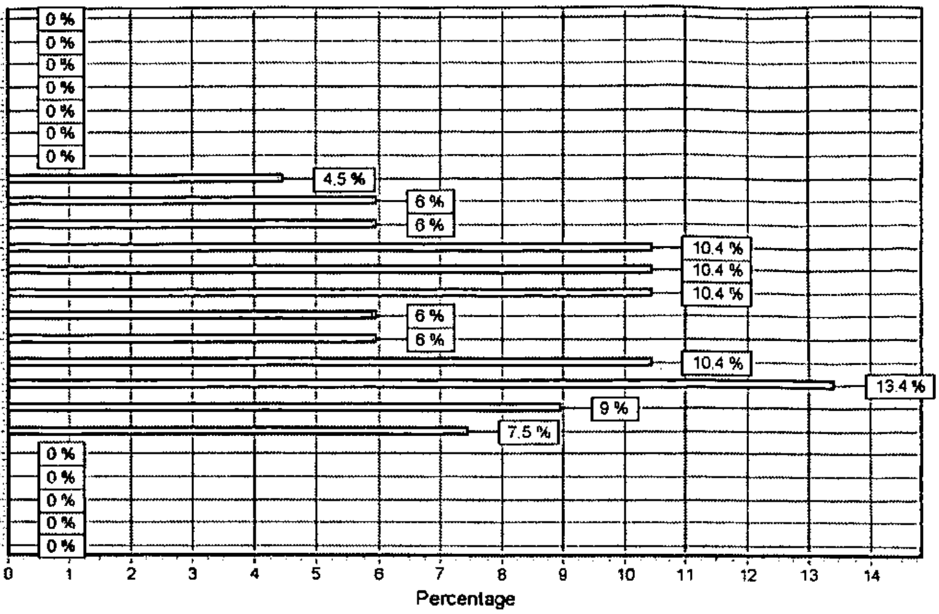

TRIP RATE GRAPH - DEPARTURES 03 - RESIDENTIAL N - RETIREMENT FLATS VEHICLES

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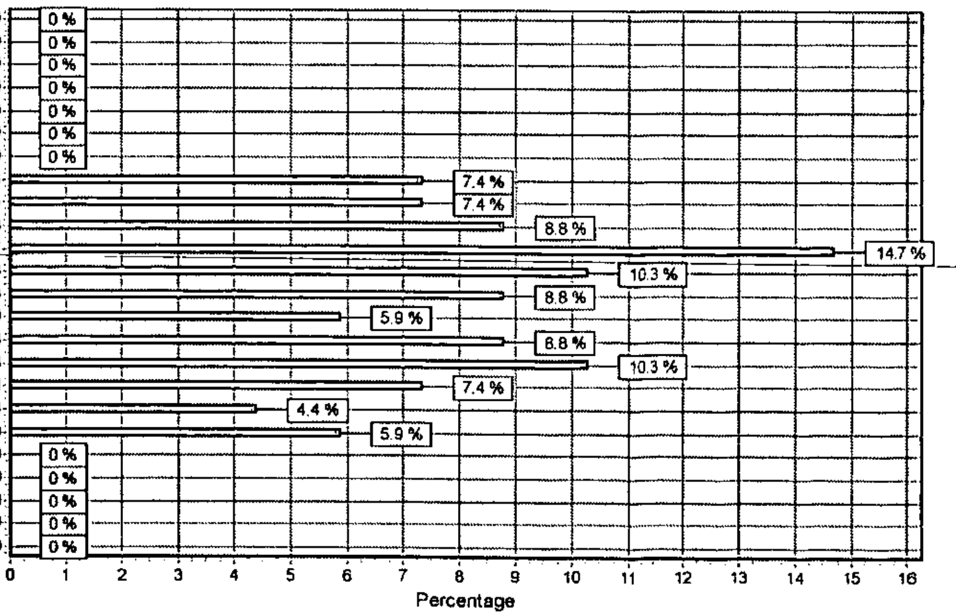


LIST OF SITES relevant to selection parameters

1 **DH-03-N-01** **RETIREMENT FLATS, DURHAM** **DURHAM**
CLAYPATH ROAD

DURHAM
Total Number of households: 43 ******
Survey date: TUESDAY *10/06/03* *Survey Type: MANUAL*

2 **KC-03-N-01** **GRAVESEND FLATS** **KENT**
WEST STREET
NTH G'SEND RIVERSIDE
GRAVESEND
Total Number of households: 46 ******
Survey date: THURSDAY *26/11/98* *Survey Type: MANUAL*

3 **KC-03-N-02** **GRAVESEND FLATS** **KENT**
WEST STREET
NTH G'SEND RIVERSIDE
GRAVESEND
Total Number of households: 66 ******
Survey date: THURSDAY *26/11/98* *Survey Type: MANUAL*

4 **KC-03-N-03** **GRAVESEND FLATS** **KENT**
WEST STREET
NTH G'SEND RIVERSIDE
GRAVESEND
Total Number of households: 66 ******
Survey date: THURSDAY *27/11/03* *Survey Type: MANUAL*

5 **KC-03-N-04** **GRAVESEND FLATS** **KENT**
WEST STREET
NTH G'SEND RRIVERSIDE
GRAVESEND
Total Number of households: 46 ******
Survey date: THURSDAY *27/11/03* *Survey Type: MANUAL*

6 **SH-03-N-01** **RETIREMT FLATS, SHREWSBURY** **SHROPSHIRE**
LONGDEN ROAD
BELLE VUE
SHREWSBURY
Total Number of households: 57 ******
Survey date: THURSDAY *09/06/05* *Survey Type: MANUAL*

7 **WS-03-N-01** **RETIREMENT FLATS, BOGNOR** **WEST SUSSEX**
BELMONT STREET

BOGNOR REGIS
Total Number of households: 76 ******
Survey date: TUESDAY *11/12/01* *Survey Type: MANUAL*

TRIP RATE for Land Use 03 - RESIDENTIAL/N - RETIREMENT FLATS
VEHICLES
Calculation factor: 1 HHOLDS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. HHOLDS	Trip Rate	No. Days	Ave. HHOLDS	Trip Rate	No. Days	Ave. HHOLDS	Trip Rate
00:00 - 01:00	0	0	0.00	0	0	0.00	0	0	0.00
01:00 - 02:00	0	0	0.00	0	0	0.00	0	0	0.00
02:00 - 03:00	0	0	0.00	0	0	0.00	0	0	0.00
03:00 - 04:00	0	0	0.00	0	0	0.00	0	0	0.00
04:00 - 05:00	0	0	0.00	0	0	0.00	0	0	0.00
05:00 - 06:00	0	0	0.00	0	0	0.00	0	0	0.00
06:00 - 07:00	0	0	0.00	0	0	0.00	0	0	0.00
07:00 - 08:00	7	57	0.03	7	57	0.05	7	57	0.08
08:00 - 09:00	7	57	0.04	7	57	0.05	7	57	0.09
09:00 - 10:00	7	57	0.04	7	57	0.06	7	57	0.10
10:00 - 11:00	7	57	0.07	**7**	**57**	**0.10**	7	**57**	**0.17**
11:00 - 12:00	**7**	57	0.07	7	57	0.07	7	57	0.14
12:00 - 13:00	7	57	0.07	7	57	0.06	7	57	0.13
13:00 - 14:00	7	57	0.04	7	57	0.04	7	57	0.08
14:00 - 15:00	7	57	0.04	7	57	0.06	7	57	0.10
15:00 - 16:00	7	57	0.07	7	57	0.07	7	57	0.14
16:00 - 17:00	**7**	**57**	**0.09**	7	57	0.05	7	57	0.14
17:00 - 18:00	7	57	0.06	7	57	0.03	7	57	0.09
18:00 - 19:00	7	57	0.05	7	57	0.04	7	57	0.09
19:00 - 20:00	0	0	0.00	0	0	0.00	0	0	0.00
20:00 - 21:00	0	0	0.00	0	0	0.00	0	0	0.00
21:00 - 22:00	0	0	0.00	0	0	0.00	0	0	0.00
22:00 - 23:00	0	0	0.00	0	0	0.00	0	0	0.00
23:00 - 24:00	0	0	0.00	0	0	0.00	0	0	0.00
Daily Trip Rates:			0.66			0.69			1.35

Parameter summary

Trip rate parameter range selected:	43 - 76 (units:)
Survey date date range:	01/01/98 - 09/06/05
Number of weekdays (Monday-Friday):	7
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	NO
Surveys manually removed from selection:	0

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : N - RETIREMENT FLATS
VEHICLES

Selected regions and areas:

02	**SOUTH EAST**	
KC	KENT	4 days
WS	WEST SUSSEX	1 days
06	**WEST MIDLANDS**	
SH	SHROPSHIRE	1 days
09	**NORTH**	
DH	DURHAM	1 days

Main parameter selection:

Parameter: Number of households
Range: 43 to 76 (units:)

Date Range: 01/01/98 to 09/06/05

Selected survey days:
Tuesday 2 days
Thursday 5 days

Selected survey types:
Manual count 7 days
Directional ATC Count 0 days

Optional parameter selection:

Use Class:
C3 7 days

Location: *Location Sub Category:*
Town Centre 1 days
Suburban Area (PPS6 Out of Centre) 1 days
Edge of Town Centre 5 days

Population within 1 mile:
1,001 to 5,000 1 days
15,001 to 20,000 5 days
20,001 to 25,000 1 days

Population within 5 miles:
50,001 to 75,000 1 days
75,001 to 100,000 2 days
125,001 to 250,000 4 days

Car ownership within 5 miles:
0.6 to 1.0 5 days
1.1 to 1.5 2 days

Optional parameter selection (Cont.):

Buses/Trains per day (both directions):

Frequency	Per Hour	Per Day	Surveys
Not Known			0 days
0	0	0	0 days
<20 per day	1	20	0 days
20-39 per day	2	40	0 days
40-59 per day	3	60	0 days
60-79 per day	4	80	0 days
80+ per day	> 4	> 80	6 days

Travel Plan:
Not Known 3 days
No 4 days

LIST OF SITES relevant to selection parameters

1 **AS-05-F-01 NURSING HOME, ABERDEEN ABERDEENSHIRE**
FONTHILL ROAD
FERRYHILL
ABERDEEN
Total Number of residents: 53 ******
Survey date: THURSDAY 26/05/05 Survey Type: MANUAL

2 **DC-05-F-01 NURSING HOME, WIMBORNE DORSET**
WIMBORNE ROAD WEST

WIMBORNE
Total Number of residents: 27 ******
Survey date: WEDNESDAY 29/04/98 Survey Type: MANUAL

3 **DG-05-F-01 NURSING HOME, LOCHMABEN DUMFRIES & GALLOWAY**
BRUCE STREET (A709)

LOCHMABEN
Total Number of residents: 32 ******
Survey date: TUESDAY 09/06/98 Survey Type: DIRECTIONAL

4 **ES-05-F-01 NURSING HOME, EASTBOURNE EAST SUSSEX**
WILLINGDON ROAD

EASTBOURNE
Total Number of residents: 54 ******
Survey date: THURSDAY 12/07/01 Survey Type: MANUAL

5 **GM-05-F-01 NURSING HOME, MANCHESTER GREATER MANCHESTER**
TRAFFORD ROAD
ECCLES
MANCHESTER
Total Number of residents: 110 ******
Survey date: FRIDAY 18/06/04 Survey Type: MANUAL

6 **GM-05-F-02 NURSING HOME, BOLTON GREATER MANCHESTER**
BRIDGEMAN STREET
ROSE HILL
BOLTON
Total Number of residents: 180 ******
Survey date: TUESDAY 22/06/04 Survey Type: MANUAL

7 **LC-05-F-01 GRIMSARGH MANOR NURSING H. LANCASHIRE**
WHITTINGHAM LANE
GRIMSARGH
PRESTON
Total Number of residents: 26 ******
Survey date: FRIDAY 23/10/98 Survey Type: MANUAL

8 **NY-05-F-03 NURSING HOME, TADCASTER NORTH YORKSHIRE**
LEEDS ROAD

TADCASTER
Total Number of residents: 33 ******
Survey date: TUESDAY 19/04/05 Survey Type: MANUAL

9 **TW-05-F-01 NURSING HOME, FELLING TYNE & WEAR**
CROWHALL LANE

FELLING
Total Number of residents: 68 ******
Survey date: WEDNESDAY 04/05/05 Survey Type: MANUAL

LIST OF SITES relevant to selection parameters (Cont.)

10 **WS-05-F-01 NURSING HOME, CHICHESTER WEST SUSSEX**
WHYKE ROAD
WHYKE
CHICHESTER
Total Number of residents: 19 ******
Survey date: FRIDAY 07/12/01 Survey Type: DIRECTIONAL
Survey date: TUESDAY 11/12/01 Survey Type: DIRECTIONAL
Survey date: WEDNESDAY 12/12/01 Survey Type: DIRECTIONAL
Survey date: THURSDAY 13/12/01 Survey Type: DIRECTIONAL

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 05 - HEALTH
Category : F - NURSING HOMES
VEHICLES

Selected regions and areas:

02	**SOUTH EAST**	
ES	EAST SUSSEX	1 days
WS	WEST SUSSEX	4 days
03	**SOUTH WEST**	
DC	DORSET	1 days
07	**YORKSHIRE & NORTH LINCOLNSHIRE**	
NY	NORTH YORKSHIRE	1 days
08	**NORTH WEST**	
GM	GREATER MANCHESTER	2 days
LC	LANCASHIRE	1 days
09	**NORTH**	
TW	TYNE & WEAR	1 days
11	**SCOTLAND**	
AS	ABERDEENSHIRE	1 days
DG	DUMFRIES & GALLOWAY	1 days

Main parameter selection:

Parameter: Number of residents
Range: 19 to 180 (units:)

Date Range: 01/01/98 to 26/05/05

Selected survey days:

Tuesday	4 days
Wednesday	3 days
Thursday	3 days
Friday	3 days

Selected survey types:

Manual count	8 days
Directional ATC Count	5 days

Optional parameter selection:

Use Class:

C2	13 days

Location:	*Location Sub Category:*	
Neighbourhood Centre (PPS6 Local Centre)		2 days
Suburban Area (PPS6 Out of Centre)		5 days
Edge of Town		6 days

Optional parameter selection (Cont.):

Population within 1 mile:

1,001 to 5,000	4 days
5,001 to 10,000	1 days
15,001 to 20,000	6 days
20,001 to 25,000	1 days
25,001 to 50,000	1 days

Population within 5 miles:

5,001 to 25,000	2 days
75,001 to 100,000	4 days
100,001 to 125,000	2 days
125,001 to 250,000	2 days
250,001 to 500,000	3 days

Car ownership within 5 miles:

0.6 to 1.0	6 days
1.1 to 1.5	7 days

Buses/Trains per day (both directions):

Frequency	*Per Hour*	*Per Day*	*Surveys*
Not Known			0 days
0	0	0	1 days
<20 per day	1	20	0 days
20-39 per day	2	40	0 days
40-59 per day	3	60	0 days
60-79 per day	4	80	1 days
80+ per day	> 4	> 80	8 days

Travel Plan:

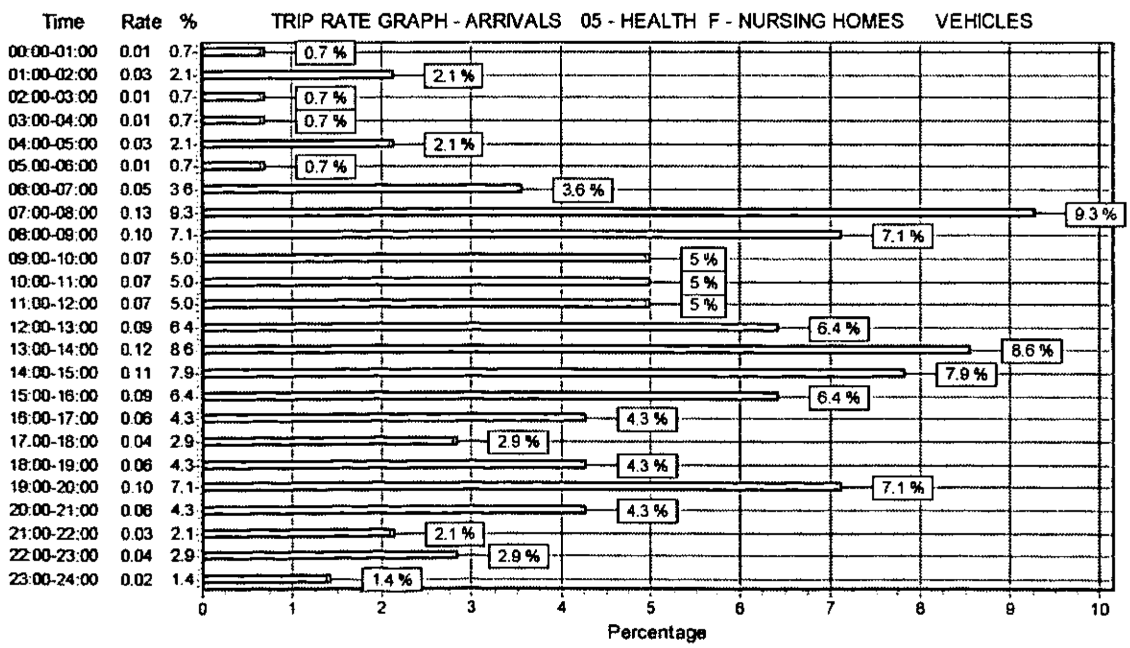
Not Known	8 days
No	5 days

TRIP RATE for Land Use 05 - HEALTH/F - NURSING HOMES
VEHICLES
Calculation factor: 1 RESIDE
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. RESIDE	Trip Rate	No. Days	Ave. RESIDE	Trip Rate	No. Days	Ave. RESIDE	Trip Rate
00:00 - 01:00	5	22	0.01	5	22	0.01	5	22	0.02
01:00 - 02:00	5	22	0.03	5	22	0.01	5	22	0.04
02:00 - 03:00	5	22	0.01	5	22	0.02	5	22	0.03
03:00 - 04:00	5	22	0.01	5	22	0.00	5	22	0.01
04:00 - 05:00	5	22	0.03	5	22	0.04	5	22	0.07
05:00 - 06:00	5	22	0.01	5	22	0.00	5	22	0.01
06:00 - 07:00	6	22	0.05	6	22	0.04	6	22	0.09
07:00 - 08:00	**13**	**51**	**0.13**	13	51	0.06	13	51	0.19
08:00 - 09:00	13	51	0.10	13	51	0.06	13	51	0.16
09:00 - 10:00	13	51	0.07	13	51	0.05	13	51	0.12
10:00 - 11:00	13	51	0.07	13	51	0.06	13	51	0.13
11:00 - 12:00	13	51	0.07	13	51	0.10	13	51	0.17
12:00 - 13:00	13	51	0.09	13	51	0.08	13	51	0.17
13:00 - 14:00	13	51	0.12	13	51	0.10	13	51	0.22
14:00 - 15:00	13	51	0.11	**13**	**51**	**0.13**	**13**	**51**	**0.24**
15:00 - 16:00	13	51	0.09	13	51	0.12	13	51	0.21
16:00 - 17:00	13	51	0.06	13	51	0.10	13	51	0.16
17:00 - 18:00	13	51	0.04	13	51	0.07	13	51	0.11
18:00 - 19:00	13	51	0.06	13	51	0.06	13	51	0.12
19:00 - 20:00	7	27	0.10	7	27	0.13	7	27	0.23
20:00 - 21:00	7	27	0.06	7	27	0.08	7	27	0.14
21:00 - 22:00	7	27	0.03	7	27	0.04	7	27	0.07
22:00 - 23:00	5	22	0.04	5	22	0.05	5	22	0.09
23:00 - 24:00	5	22	0.02	5	22	0.04	5	22	0.06
Daily Trip Rates:			1.43			1.45			2.86

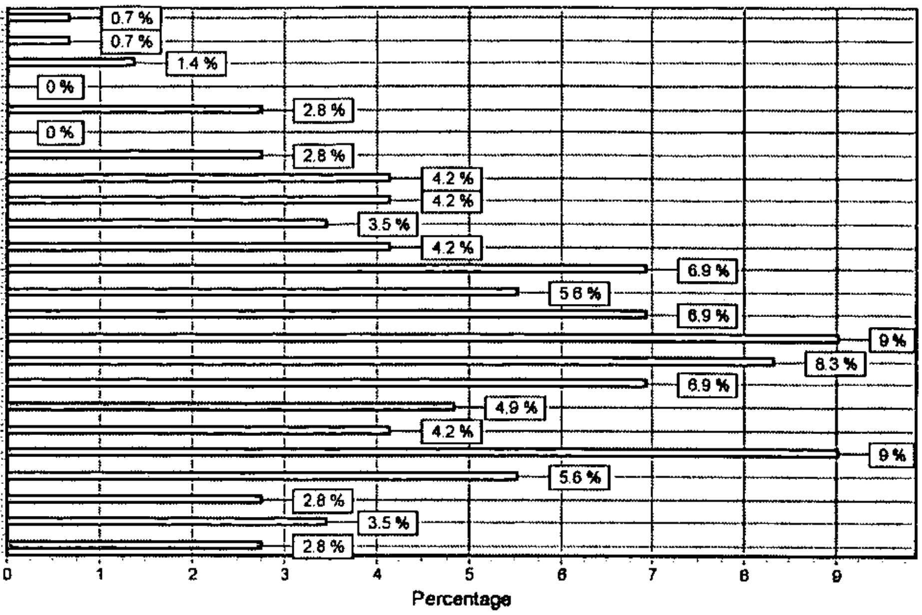
Parameter summary

Trip rate parameter range selected:	19 - 180 (units:)
Survey date date range:	01/01/98 - 26/05/05
Number of weekdays (Monday-Friday):	13
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	NO
Surveys manually removed from selection:	0



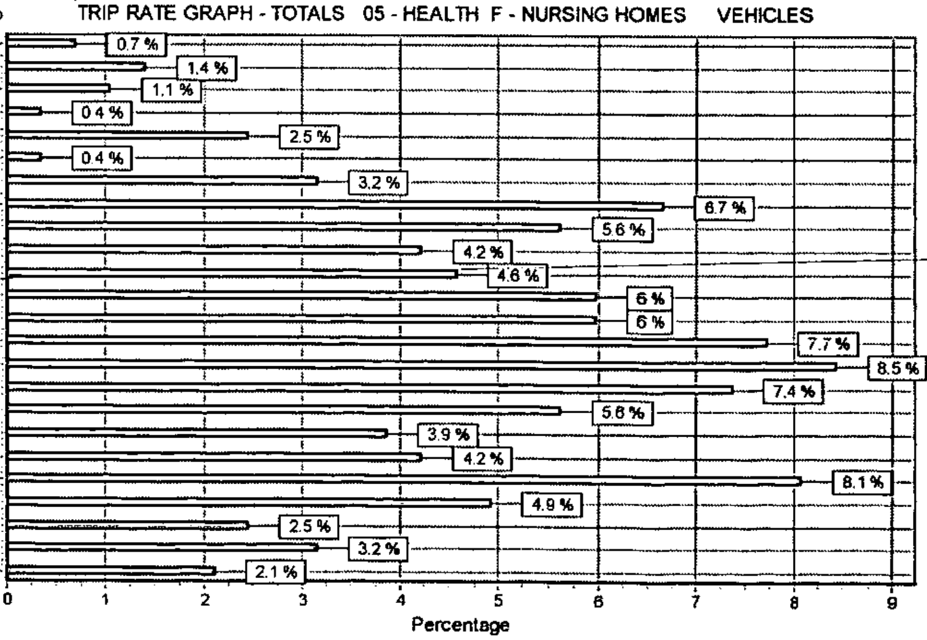
TRIP RATE GRAPH - DEPARTURES 05 - HEALTH F - NURSING HOMES VEHICLES

Time	Rate	%
00:00-01:00	0.01	0.7
01:00-02:00	0.01	0.7
02:00-03:00	0.02	1.4
03:00-04:00	0.00	0.0
04:00-05:00	0.04	2.8
05:00-06:00	0.00	0.0
06:00-07:00	0.04	2.8
07:00-08:00	0.06	4.2
08:00-09:00	0.06	4.2
09:00-10:00	0.05	3.5
10:00-11:00	0.06	4.2
11:00-12:00	0.10	6.9
12:00-13:00	0.08	5.6
13:00-14:00	0.10	6.9
14:00-15:00	0.13	9.0
15:00-16:00	0.12	8.3
16:00-17:00	0.10	6.9
17:00-18:00	0.07	4.9
18:00-19:00	0.06	4.2
19:00-20:00	0.13	9.0
20:00-21:00	0.08	5.6
21:00-22:00	0.04	2.8
22:00-23:00	0.05	3.5
23:00-24:00	0.04	2.8



TRIP RATE GRAPH - TOTALS 05 - HEALTH F - NURSING HOMES VEHICLES

Time	Rate	%
00:00-01:00	0.02	0.7
01:00-02:00	0.04	1.4
02:00-03:00	0.03	1.1
03:00-04:00	0.01	0.4
04:00-05:00	0.07	2.5
05:00-06:00	0.01	0.4
06:00-07:00	0.09	3.2
07:00-08:00	0.19	6.7
08:00-09:00	0.16	5.6
09:00-10:00	0.12	4.2
10:00-11:00	0.13	4.6
11:00-12:00	0.17	6.0
12:00-13:00	0.17	6.0
13:00-14:00	0.22	7.7
14:00-15:00	0.24	8.5
15:00-16:00	0.21	7.4
16:00-17:00	0.16	5.6
17:00-18:00	0.11	3.9
18:00-19:00	0.12	4.2
19:00-20:00	0.23	8.1
20:00-21:00	0.14	4.9
21:00-22:00	0.07	2.5
22:00-23:00	0.09	3.2
23:00-24:00	0.06	2.1



Appendix B

TRICS Data- Committed Development- Hotel

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 06 - HOTEL, FOOD & DRINK
Category : A - HOTELS
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	GL	GREATER LONDON	4 days
02	**SOUTH EAST**		
	HF	HERTFORDSHIRE	2 days
	KC	KENT	1 days
03	**SOUTH WEST**		
	DV	DEVON	1 days
	WL	WILTSHIRE	1 days
04	**EAST ANGLIA**		
	CA	CAMBRIDGESHIRE	1 days
05	**EAST MIDLANDS**		
	DS	DERBYSHIRE	1 days
	NT	NOTTINGHAMSHIRE	1 days
06	**WEST MIDLANDS**		
	WO	WORCESTERSHIRE	1 days
08	**NORTH WEST**		
	GM	GREATER MANCHESTER	1 days
09	**NORTH**		
	TW	TYNE & WEAR	1 days
10	**WALES**		
	CF	CARDIFF	1 days

Main parameter selection:

Parameter: Number of bedrooms
Range: 82 to 200 (units:)

Date Range: 01/01/97 to 07/07/05

Selected survey days:

Monday	1 days
Tuesday	6 days
Wednesday	3 days
Thursday	3 days
Friday	3 days

Selected survey types:

Manual count	16 days
Directional ATC Count	0 days

Optional parameter selection:

Use Class:

C1	16 days

Optional parameter selection (Cont.):

Location:	*Location Sub Category:*	
Town Centre		1 days
Neighbourhood Centre (PPS6 Local Centre)		1 days
Suburban Area (PPS6 Out of Centre)		4 days
Suburban Area (PPS6 Out of Centre)	Development Zone	2 days
Edge of Town		2 days
Edge of Town Centre		5 days
Free Standing (PPS6 Out of Town)		1 days

Population within 1 mile:

1,001 to 5,000	3 days
5,001 to 10,000	1 days
10,001 to 15,000	2 days
15,001 to 20,000	3 days
20,001 to 25,000	3 days
25,001 to 50,000	2 days
50,001 to 100,000	2 days

Population within 5 miles:

50,001 to 75,000	1 days
75,001 to 100,000	1 days
100,001 to 125,000	3 days
125,001 to 250,000	2 days
250,001 to 500,000	5 days
500,001 or More	4 days

Car ownership within 5 miles:

0.5 or Less	1 days
0.6 to 1.0	10 days
1.1 to 1.5	5 days

Buses/Trains per day (both directions):

Frequency	*Per Hour*	*Per Day*	*Surveys*
Not Known			0 days
0	0	0	2 days
<20 per day	1	20	0 days
20-39 per day	2	40	1 days
40-59 per day	3	60	0 days
60-79 per day	4	80	1 days
80+ per day	> 4	> 80	8 days

Travel Plan:

Not Known	7 days
No	9 days

LIST OF SITES relevant to selection parameters

1 **CA-06-A-01 HOTEL, CAMBRIDGE** **CAMBRIDGESHIRE**
REGENT STREET

CAMBRIDGE
Total Number of bedrooms: 118 ******
Survey date: TUESDAY *10/09/02* *Survey Type: MANUAL*

2 **CF-06-A-01 HANOVER INT. HOTEL, CARDIFF** **CARDIFF**
SCHOONER WAY
ATLANTIC WHARF
CARDIFF
Total Number of bedrooms: 156 ******
Survey date: MONDAY *21/10/02* *Survey Type: MANUAL*

3 **DS-06-A-01 DAYS INN, DERBY** **DERBYSHIRE**
SIR FRANK WHITTLE RD

DERBY
Total Number of bedrooms: 100 ******
Survey date: WEDNESDAY *23/06/04* *Survey Type: MANUAL*

4 **DV-06-A-01 PREMIER TRAVEL INN, PLYMOUTH** **DEVON**
SUTTON ROAD
SUTTON HARBOUR
PLYMOUTH
Total Number of bedrooms: 107 ******
Survey date: THURSDAY *07/07/05* *Survey Type: MANUAL*

5 **GL-06-A-02 TRAVELODGE, MILL HILL** **GREATER LONDON**
M1 JUNCTION 2

MILL HILL
Total Number of bedrooms: 101 ******
Survey date: TUESDAY *19/09/00* *Survey Type: MANUAL*

6 **GL-06-A-04 HOLIDAY INN, BRENT CROSS** **GREATER LONDON**
TILLING ROAD

BRENT CROSS
Total Number of bedrooms: 153 ******
Survey date: FRIDAY *30/04/04* *Survey Type: MANUAL*

7 **GL-06-A-05 HOLIDAY INN, HAMPSTEAD** **GREATER LONDON**
HAVERSTOCK HILL

HAMPSTEAD
Total Number of bedrooms: 140 ******
Survey date: WEDNESDAY *21/04/04* *Survey Type: MANUAL*

8 **GL-06-A-06 HOTEL, STRATFORD** **GREATER LONDON**
ROMFORD ROAD

STRATFORD
Total Number of bedrooms: 108 ******
Survey date: TUESDAY *30/03/04* *Survey Type: MANUAL*

9 **GM-06-A-07 TRAVELODGE, MANCHESTER** **GREATER MANCHESTER**
BLACKFRIARS STREET
SALFORD
MANCHESTER
Total Number of bedrooms: 181 ******
Survey date: TUESDAY *25/05/04* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

10 **HF-06-A-02 PREMIER LODGE, WATFORD** **HERTFORDSHIRE**
WATER LANE
TIMMS MEADOW
WATFORD
Total Number of bedrooms: 105 ******
Survey date: WEDNESDAY *13/03/02* *Survey Type: MANUAL*

11 **HF-06-A-03 NOVOTEL, STEVENAGE** **HERTFORDSHIRE**
A1(M)
KNEBWORTH PARK
STEVENAGE
Total Number of bedrooms: 100 ******
Survey date: THURSDAY *08/07/04* *Survey Type: MANUAL*

12 **KC-06-A-01 RAMADA HOTEL, NR MAIDSTONE** **KENT**
ASHFORD ROAD
HOLLINGBOURNE
NEAR MAIDSTONE
Total Number of bedrooms: 126 ******
Survey date: FRIDAY *14/06/02* *Survey Type: MANUAL*

13 **NT-06-A-01 HOLIDAY INN, NOTTINGHAM** **NOTTINGHAMSHIRE**
CASTLE MARINA PARK

NOTTINGHAM
Total Number of bedrooms: 128 ******
Survey date: THURSDAY *25/04/02* *Survey Type: MANUAL*

14 **TW-06-A-01 PREMIER TRAV. INN, NEWCASTLE** **TYNE & WEAR**
CITY ROAD
QUAYSIDE
NEWCASTLE
Total Number of bedrooms: 82 ******
Survey date: TUESDAY *26/04/05* *Survey Type: MANUAL*

15 **WL-06-A-01 THISTLE, SWINDON** **WILTSHIRE**
ISLINGTON STREET

SWINDON
Total Number of bedrooms: 95 ******
Survey date: FRIDAY *09/07/04* *Survey Type: MANUAL*

16 **WO-06-A-01 HILTON, NEAR BROMSGROVE** **WORCESTERSHIRE**
BIRMINGHAM ROAD
UPPER CATSHILL
NEAR BROMSGROVE
Total Number of bedrooms: 148 ******
Survey date: TUESDAY *28/05/02* *Survey Type: MANUAL*

TRIP RATE for Land Use 06 - HOTEL, FOOD & DRINK/A - HOTELS

VEHICLES

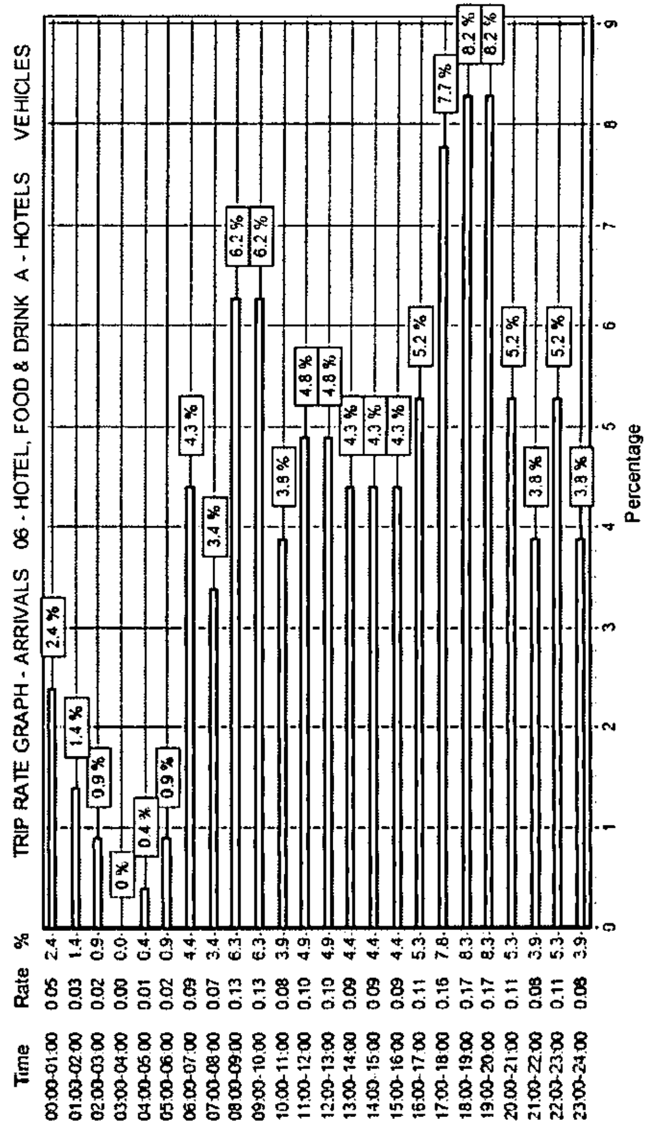
Calculation factor: 1 BEDRMS

BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. BEDRMS	Trip Rate	No. Days	Ave. BEDRMS	Trip Rate	No. Days	Ave. BEDRMS	Trip Rate
00:00 - 01:00	1	101	0.05	1	101	0.04	1	101	0.09
01:00 - 02:00	1	101	0.03	1	101	0.03	1	101	0.06
02:00 - 03:00	1	101	0.02	1	101	0.04	1	101	0.06
03:00 - 04:00	1	101	0.00	1	101	0.01	1	101	0.01
04:00 - 05:00	1	101	0.01	1	101	0.01	1	101	0.02
05:00 - 06:00	1	101	0.02	1	101	0.01	1	101	0.03
06:00 - 07:00	3	125	0.09	3	125	0.11	3	125	0.20
07:00 - 08:00	16	122	0.07	16	122	0.16	16	122	0.23
08:00 - 09:00	16	122	0.13	**16**	**122**	**0.19**	**16**	**122**	**0.32**
09:00 - 10:00	16	122	0.13	16	122	0.14	16	122	0.27
10:00 - 11:00	16	122	0.08	16	122	0.09	16	122	0.17
11:00 - 12:00	16	122	0.10	16	122	0.08	16	122	0.18
12:00 - 13:00	16	122	0.10	16	122	0.09	16	122	0.19
13:00 - 14:00	16	122	0.09	16	122	0.09	16	122	0.18
14:00 - 15:00	16	122	0.09	16	122	0.10	16	122	0.19
15:00 - 16:00	16	122	0.09	16	122	0.10	16	122	0.19
16:00 - 17:00	16	122	0.11	16	122	0.11	16	122	0.22
17:00 - 18:00	16	122	0.16	16	122	0.12	16	122	0.28
18:00 - 19:00	**16**	**122**	**0.17**	16	122	0.11	16	122	0.28
19:00 - 20:00	11	123	0.17	11	123	0.12	11	123	0.29
20:00 - 21:00	11	123	0.11	11	123	0.09	11	123	0.20
21:00 - 22:00	7	119	0.08	7	119	0.07	7	119	0.15
22:00 - 23:00	2	125	0.11	2	125	0.15	2	125	0.26
23:00 - 24:00	2	125	0.08	2	125	0.10	2	125	0.18
Daily Trip Rates:			2.08			2.16			4.25

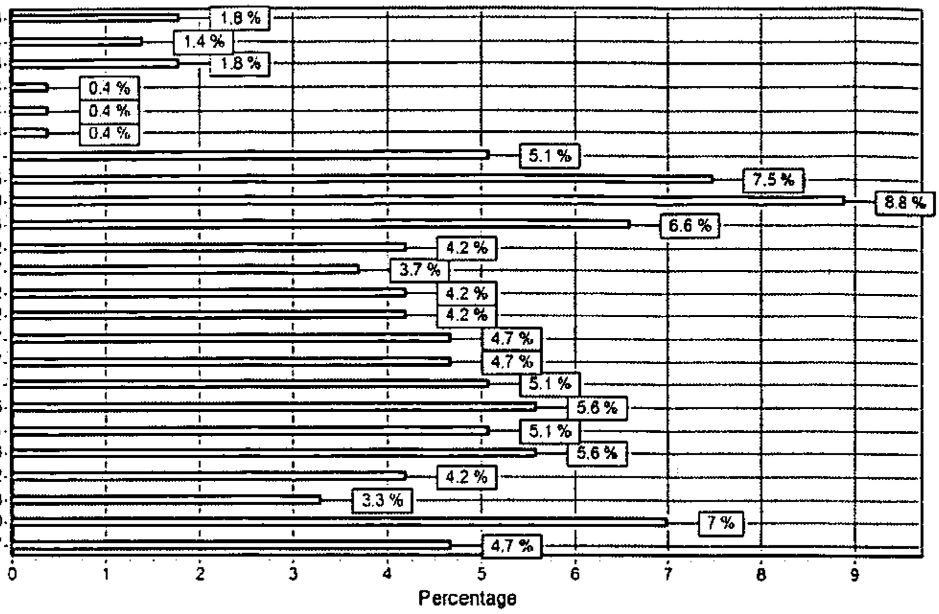
Parameter summary

Trip rate parameter range selected:	82 - 200 (units:)
Survey date date range:	01/01/97 - 07/07/05
Number of weekdays (Monday-Friday):	16
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	NO
Surveys manually removed from selection:	0



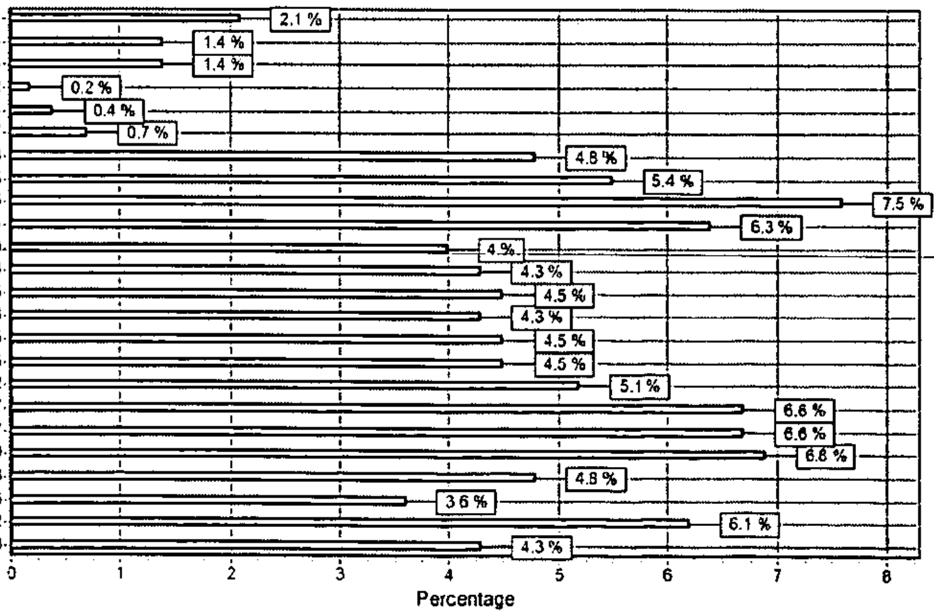
TRIP RATE GRAPH - DEPARTURES 06 - HOTEL, FOOD & DRINK A - HOTELS VEHICLES

Time	Rate	%
00:00-01:00	0.04	1.8
01:00-02:00	0.03	1.4
02:00-03:00	0.04	1.8
03:00-04:00	0.01	0.4
04:00-05:00	0.01	0.4
05:00-06:00	0.01	0.4
06:00-07:00	0.11	5.1
07:00-08:00	0.16	7.5
08:00-09:00	0.19	8.9
09:00-10:00	0.14	6.6
10:00-11:00	0.09	4.2
11:00-12:00	0.08	3.7
12:00-13:00	0.09	4.2
13:00-14:00	0.09	4.2
14:00-15:00	0.10	4.7
15:00-16:00	0.10	4.7
16:00-17:00	0.11	5.1
17:00-18:00	0.12	5.6
18:00-19:00	0.11	5.1
19:00-20:00	0.12	5.6
20:00-21:00	0.09	4.2
21:00-22:00	0.07	3.3
22:00-23:00	0.15	7.0
23:00-24:00	0.10	4.7



TRIP RATE GRAPH - TOTALS 06 - HOTEL, FOOD & DRINK A - HOTELS VEHICLES

Time	Rate	%
00:00-01:00	0.09	2.1
01:00-02:00	0.06	1.4
02:00-03:00	0.06	1.4
03:00-04:00	0.01	0.2
04:00-05:00	0.02	0.4
05:00-06:00	0.03	0.7
06:00-07:00	0.20	4.8
07:00-08:00	0.23	5.5
08:00-09:00	0.32	7.6
09:00-10:00	0.27	6.4
10:00-11:00	0.17	4.0
11:00-12:00	0.18	4.3
12:00-13:00	0.19	4.5
13:00-14:00	0.18	4.3
14:00-15:00	0.19	4.5
15:00-16:00	0.19	4.5
16:00-17:00	0.22	5.2
17:00-18:00	0.28	6.7
18:00-19:00	0.28	6.7
19:00-20:00	0.29	6.9
20:00-21:00	0.20	4.8
21:00-22:00	0.15	3.6
22:00-23:00	0.26	6.2
23:00-24:00	0.18	4.3



Appendix C

TRICS Data- Proposed Development- Retails Units

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 01 - RETAIL
Category : 1 - SHOPPING CENTRE - LOCAL SHOPS
VEHICLES

Selected regions and areas:

02	**SOUTH EAST**	
	WS WEST SUSSEX	1 days
03	**SOUTH WEST**	
	DC DORSET	1 days
06	**WEST MIDLANDS**	
	WO WORCESTERSHIRE	1 days
08	**NORTH WEST**	
	MS MERSEYSIDE	1 days
11	**SCOTLAND**	
	FA FALKIRK	1 days
14	**REPUBLIC OF IRELAND**	
	IR REPUBLIC OF IRELAND	1 days

Main parameter selection:

Parameter: Gross floor area
Range: 599 to 84009 (units: sqm)

Date Range: 01/01/98 to 18/10/05

Selected survey days:

Tuesday	1 days
Wednesday	2 days
Friday	3 days

Selected survey types:

Manual count	6 days
Directional ATC Count	0 days

Optional parameter selection:

Use Class:

Not Known	6 days

Location:	*Location Sub Category:*	
Neighbourhood Centre (PPS6 Local Centre)		4 days
Suburban Area (PPS6 Out of Centre)		1 days
Edge of Town		1 days

Population within 1 mile:

1,001 to 5,000	1 days
5,001 to 10,000	1 days
15,001 to 20,000	1 days
20,001 to 25,000	1 days
25,001 to 50,000	2 days

Optional parameter selection (Cont.):

Population within 5 miles:

100,001 to 125,000	1 days
125,001 to 250,000	4 days
250,001 to 500,000	1 days

Car ownership within 5 miles:

0.6 to 1.0	4 days
1.1 to 1.5	2 days

Buses/Trains per day (both directions):

Frequency	*Per Hour*	*Per Day*	*Surveys*
Not Known			0 days
0	0	0	0 days
<20 per day	1	20	0 days
20-39 per day	2	40	0 days
40-59 per day	3	60	0 days
60-79 per day	4	80	0 days
80+ per day	> 4	> 80	5 days

Petrol filling station:

Excluded from count or no filling station	6 days
Included in the survey count	0 days

Travel Plan:

Not Known	4 days
No	2 days

LIST OF SITES relevant to selection parameters

1 **DC-01-I-03** **LOCAL SHOPS, CHRISTCHURCH** **DORSET**
MARLOW DRIVE
ST CATHERINES HILL
CHRISTCHURCH
Total Gross floor area: 906 sqm
Survey date: FRIDAY *18/05/01* *Survey Type: MANUAL*

2 **FA-01-I-03** **SHOPPING CENTRE, FALKIRK** **FALKIRK**
RONADES ROAD
CARRON
FALKIRK
Total Gross floor area: 5117 sqm
Survey date: WEDNESDAY *02/06/99* *Survey Type: MANUAL*

3 **IR-01-I-02** **SUPERSTORE/SHOPS, DUBLIN** **REPUBLIC OF IRELAND**
MAIN STREET
BLANCHARDSTOWN
DUBLIN
Total Gross floor area: 4650 sqm
Survey date: FRIDAY *11/07/03* *Survey Type: MANUAL*

4 **MS-01-I-01** **LOCAL SHOPS, LIVERPOOL** **MERSEYSIDE**
HUNTS CROSS AVENUE

LIVERPOOL
Total Gross floor area: 1890 sqm
Survey date: TUESDAY *18/10/05* *Survey Type: MANUAL*

5 **WO-01-I-01** **LOCAL SHOPS, WORCESTER** **WORCESTERSHIRE**
AMBLESIDE DRIVE
WARNDON
WORCESTER
Total Gross floor area: 599 sqm
Survey date: FRIDAY *15/03/02* *Survey Type: MANUAL*

6 **WS-01-I-01** **TILGATE PARADE, CRAWLEY** **WEST SUSSEX**
TILGATE PARADE
TILGATE
CRAWLEY
Total Gross floor area: 2461 sqm
Survey date: WEDNESDAY *17/10/01* *Survey Type: MANUAL*

TRIP RATE for Land Use 01 - RETAIL/I - SHOPPING CENTRE - LOCAL SHOPS
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

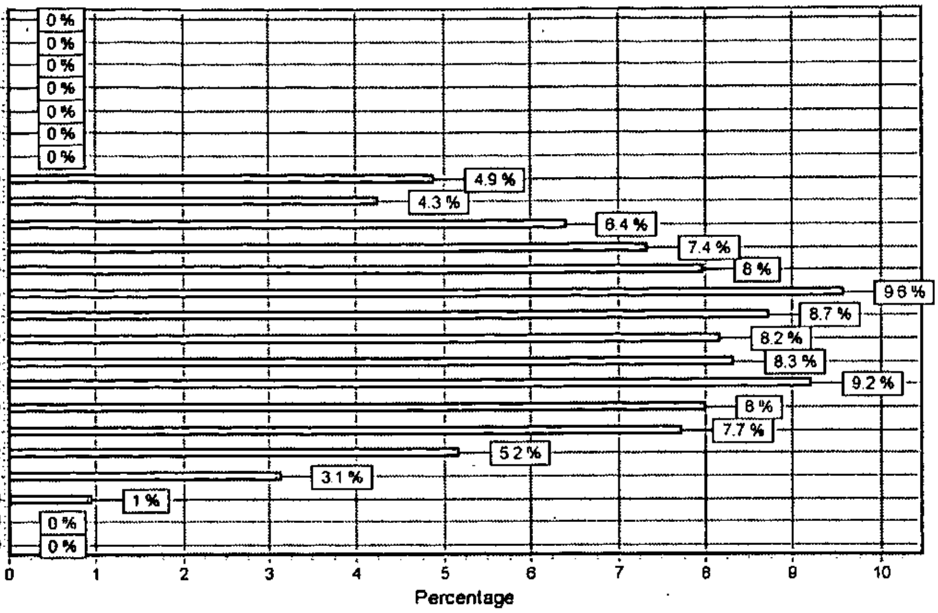
	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00	0	0	0.00	0	0	0.00	0	0	0.00
01:00 - 02:00	0	0	0.00	0	0	0.00	0	0	0.00
02:00 - 03:00	0	0	0.00	0	0	0.00	0	0	0.00
03:00 - 04:00	0	0	0.00	0	0	0.00	0	0	0.00
04:00 - 05:00	0	0	0.00	0	0	0.00	0	0	0.00
05:00 - 06:00	0	0	0.00	0	0	0.00	0	0	0.00
06:00 - 07:00	0	0	0.00	0	0	0.00	0	0	0.00
07:00 - 08:00	4	1464	3.40	4	1464	3.04	4	1464	6.44
08:00 - 09:00	6	2604	2.96	6	2604	2.34	6	2604	5.30
09:00 - 10:00	6	2604	4.46	6	2604	3.34	6	2604	7.80
10:00 - 11:00	6	2604	5.11	6	2604	4.65	6	2604	9.76
11:00 - 12:00	6	2604	5.54	6	2604	5.29	6	2604	10.83
12:00 - 13:00	**6**	**2604**	**6.66**	6	2604	6.42	**6**	**2604**	**13.08**
13:00 - 14:00	6	2604	6.07	**6**	**2604**	**6.43**	6	2604	12.50
14:00 - 15:00	6	2604	5.68	6	2604	5.81	6	2604	11.49
15:00 - 16:00	6	2604	5.79	6	2604	5.58	6	2604	11.37
16:00 - 17:00	6	2604	6.41	6	2604	6.27	6	2604	12.68
17:00 - 18:00	6	2604	5.56	6	2604	6.43	6	2604	11.99
18:00 - 19:00	6	2604	5.38	6	2604	5.79	6	2604	11.17
19:00 - 20:00	4	3141	3.60	4	3141	3.96	4	3141	7.56
20:00 - 21:00	4	3141	2.18	4	3141	2.84	4	3141	5.02
21:00 - 22:00	1	5117	0.66	1	5117	0.98	1	5117	1.64
22:00 - 23:00	0	0	0.00	0	0	0.00	0	0	0.00
23:00 - 24:00	0	0	0.00	0	0	0.00	0	0	0.00
Daily Trip Rates:			69.46			69.16			138.63

Parameter summary

Trip rate parameter range selected: 599 - 84009 (units: sqm)
Survey date date range: 01/01/98 - 18/10/05
Number of weekdays (Monday-Friday): 6
Number of Saturdays: 0
Number of Sundays: 0
Optional parameters used in selection: NO
Surveys manually removed from selection: 0

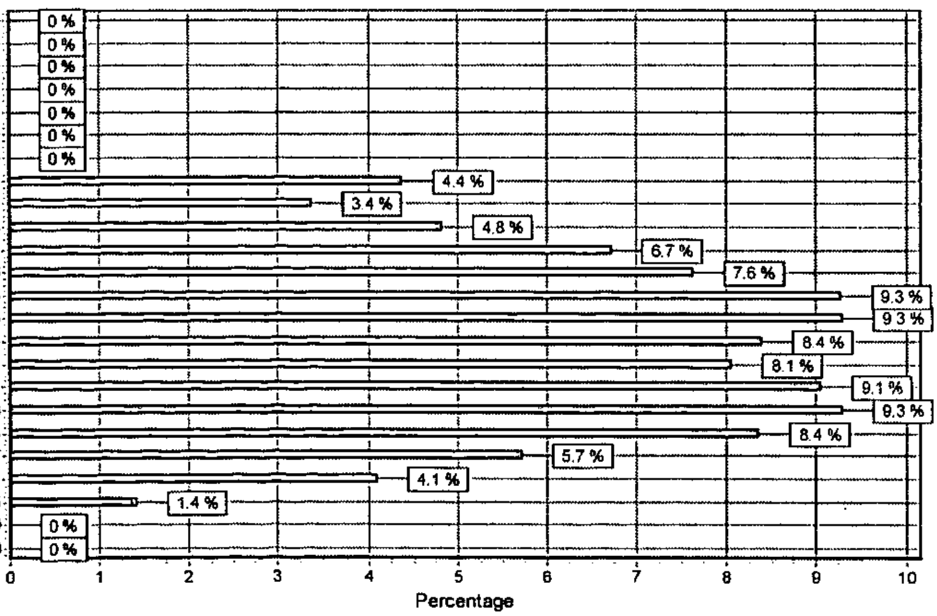
TRIP RATE GRAPH - ARRIVALS 01 - RETAIL I - SHOPPING CENTRE - LOCAL SHOPS VEHICLES

Time	Rate	%
00:00-01:00	0.00	0.0
01:00-02:00	0.00	0.0
02:00-03:00	0.00	0.0
03:00-04:00	0.00	0.0
04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.00	0.0
07:00-08:00	3.40	4.9
08:00-09:00	2.96	4.3
09:00-10:00	4.46	6.4
10:00-11:00	5.11	7.4
11:00-12:00	5.54	8.0
12:00-13:00	6.68	9.6
13:00-14:00	6.07	8.7
14:00-15:00	5.68	8.2
15:00-16:00	5.79	8.3
16:00-17:00	6.41	9.2
17:00-18:00	5.56	8.0
18:00-19:00	5.38	7.7
19:00-20:00	3.60	5.2
20:00-21:00	2.18	3.1
21:00-22:00	0.66	1.0
22:00-23:00	0.00	0.0
23:00-24:00	0.00	0.0



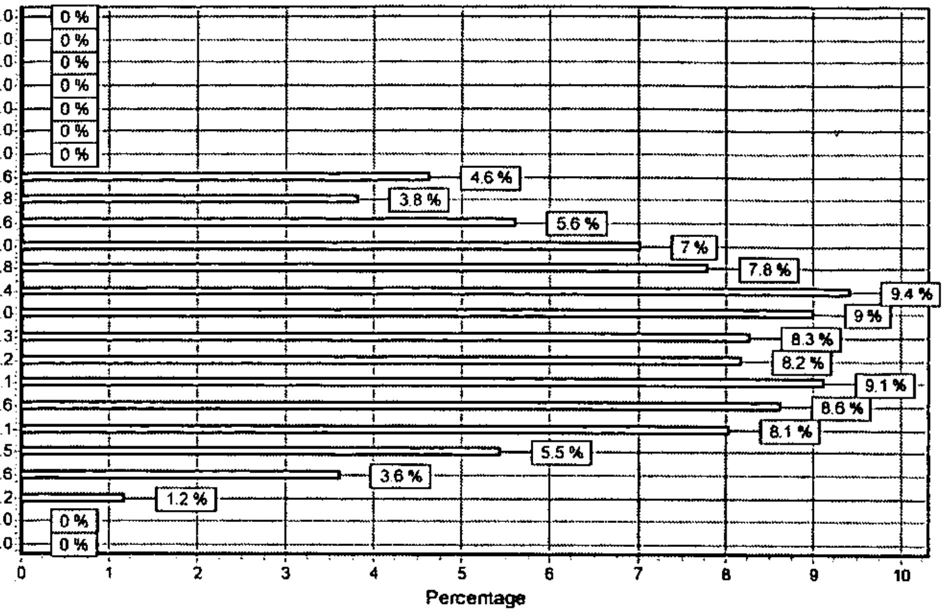
TRIP RATE GRAPH - DEPARTURES 01 - RETAIL I - SHOPPING CENTRE - LOCAL SHOPS VEHICLES

Time	Rate	%
00:00-01:00	0.00	0.0
01:00-02:00	0.00	0.0
02:00-03:00	0.00	0.0
03:00-04:00	0.00	0.0
04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.00	0.0
07:00-08:00	3.04	4.4
08:00-09:00	2.34	3.4
09:00-10:00	3.34	4.8
10:00-11:00	4.65	6.7
11:00-12:00	5.29	7.6
12:00-13:00	6.42	9.3
13:00-14:00	6.43	9.3
14:00-15:00	5.81	8.4
15:00-16:00	5.58	8.1
16:00-17:00	6.27	9.1
17:00-18:00	6.43	9.3
18:00-19:00	5.79	8.4
19:00-20:00	3.96	5.7
20:00-21:00	2.84	4.1
21:00-22:00	0.98	1.4
22:00-23:00	0.00	0.0
23:00-24:00	0.00	0.0



TRIP RATE GRAPH - TOTALS 01 - RETAIL I - SHOPPING CENTRE - LOCAL SHOPS VEHICLES

Time	Rate	%
00:00-01:00	0.00	0.0
01:00-02:00	0.00	0.0
02:00-03:00	0.00	0.0
03:00-04:00	0.00	0.0
04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.00	0.0
07:00-08:00	6.44	4.6
08:00-09:00	5.30	3.8
09:00-10:00	7.80	5.6
10:00-11:00	9.76	7.0
11:00-12:00	10.83	7.8
12:00-13:00	13.08	9.4
13:00-14:00	12.50	9.0
14:00-15:00	11.49	8.3
15:00-16:00	11.37	8.2
16:00-17:00	12.68	9.1
17:00-18:00	11.99	8.6
18:00-19:00	11.17	8.1
19:00-20:00	7.56	5.5
20:00-21:00	5.02	3.6
21:00-22:00	1.64	1.2
22:00-23:00	0.00	0.0
23:00-24:00	0.00	0.0



Appendix D

TRICS Data- Proposed Development- Offices

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : A - OFFICE
VEHICLES

Selected regions and areas:

03	**SOUTH WEST**	
	CW CORNWALL	1 days
04	**EAST ANGLIA**	
	CA CAMBRIDGESHIRE	2 days
	NF NORFOLK	1 days
05	**EAST MIDLANDS**	
	LE LEICESTERSHIRE	3 days
08	**NORTH WEST**	
	LC LANCASHIRE	2 days
09	**NORTH**	
	CB CUMBRIA	1 days
	TV TEES VALLEY	1 days
10	**WALES**	
	WR WREXHAM	1 days
11	**SCOTLAND**	
	AS ABERDEENSHIRE	2 days
	FI FIFE	1 days
	HI HIGHLAND	1 days
	PK PERTH & KINROSS	2 days

Main parameter selection:

Parameter: Gross floor area
Range: 462 to 175000 (units: sqm)

Date Range: 01/01/98 to 27/09/05

Selected survey days:

Monday	4 days
Tuesday	4 days
Wednesday	2 days
Thursday	6 days
Friday	2 days

Selected survey types:

Manual count	17 days
Directional ATC Count	1 days

Optional parameter selection:

Use Class:

A2	1 days
B1	17 days

Optional parameter selection (Cont.):

Location:	*Location Sub Category:*	
Town Centre		6 days
Neighbourhood Centre (PPS6 Local Centre)		1 days
Suburban Area (PPS6 Out of Centre)		6 days
Edge of Town	Commercial Zone	1 days
Edge of Town	Industrial Zone	1 days
Edge of Town Centre		2 days
Edge of Town Centre	Commercial Zone	1 days

Population within 1 mile:

1,001 to 5,000	2 days
5,001 to 10,000	3 days
15,001 to 20,000	4 days
20,001 to 25,000	4 days
25,001 to 50,000	4 days
50,001 to 100,000	1 days

Population within 5 miles:

5,001 to 25,000	2 days
25,001 to 50,000	2 days
50,001 to 75,000	4 days
75,001 to 100,000	1 days
100,001 to 125,000	2 days
125,001 to 250,000	7 days

Car ownership within 5 miles:

0.5 or Less	1 days
0.6 to 1.0	11 days
1.1 to 1.5	6 days

Buses/Trains per day (both directions):

Frequency	*Per Hour*	*Per Day*	*Surveys*
Not Known			2 days
0	0	0	0 days
<20 per day	1	20	0 days
20-39 per day	2	40	1 days
40-59 per day	3	60	0 days
60-79 per day	4	80	0 days
80+ per day	> 4	> 80	7 days

Travel Plan:

Not Known	9 days
No	9 days

LIST OF SITES relevant to selection parameters

1 **AS-02-A-01** **CLYDESDALE BANK, WESTHILL** **ABERDEENSHIRE**
PEREGRINE ROAD
WESTHILL INDUSTRIAL EST
WESTHILL
Total Gross floor area: 1200 sqm
Survey date: WEDNESDAY *01/09/99* *Survey Type: DIRECTIONAL*

2 **AS-02-A-02** **COUNCIL OFFICES, ABERDEEN** **ABERDEENSHIRE**
WESTBURN ROAD
WESTBURN
ABERDEEN
Total Gross floor area: 18363 sqm
Survey date: THURSDAY *18/03/99* *Survey Type: MANUAL*

3 **CA-02-A-01** **DEMETER HOUSE, CAMBRIDGE** **CAMBRIDGESHIRE**
STATION ROAD
NEWTOWN
CAMBRIDGE
Total Gross floor area: 4344 sqm
Survey date: FRIDAY *24/11/00* *Survey Type: MANUAL*

4 **CA-02-A-02** **SUGAR HQ, PETERBOROUGH** **CAMBRIDGESHIRE**
OUNDLE ROAD

PETERBOROUGH
Total Gross floor area: 12500 sqm
Survey date: THURSDAY *13/05/04* *Survey Type: MANUAL*

5 **CB-02-A-01** **BBC RADIO CUMBRIA, CARLISLE** **CUMBRIA**
ANNETWELL STREET

CARLISLE
Total Gross floor area: 999 sqm
Survey date: MONDAY *24/06/02* *Survey Type: MANUAL*

6 **CW-02-A-01** **COUNCIL OFFICES, CAMBORNE** **CORNWALL**
DOLCOATH AVENUE

CAMBORNE
Total Gross floor area: 5400 sqm
Survey date: MONDAY *04/07/05* *Survey Type: MANUAL*

7 **FI-02-A-01** **BSKYB,DUNFERMLINE** **FIFE**
CASTLE DRIVE
PITREAVIE
DUNFERMLINE
Total Gross floor area: 8361 sqm
Survey date: THURSDAY *19/03/98* *Survey Type: MANUAL*

8 **HI-02-A-01** **COUNCIL OFFICES, INVERNESS** **HIGHLAND**
HIGH STREET

INVERNESS
Total Gross floor area: 462 sqm
Survey date: TUESDAY *31/05/05* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

9 **LC-02-A-06** **TOWN HALL, BLACKBURN** **LANCASHIRE**
KING WILLIAM STREET

BLACKBURN
Total Gross floor area: 11225 sqm
Survey date: THURSDAY *17/06/04* *Survey Type: MANUAL*

10 **LC-02-A-07** **COUNCIL OFFICES, BLACKPOOL** **LANCASHIRE**
SOUTH PROMENADE

BLACKPOOL
Total Gross floor area: 6678 sqm
Survey date: FRIDAY *13/05/05* *Survey Type: MANUAL*

11 **LE-02-A-01** **COUNCIL OFFICES, M. MOWBRAY** **LEICESTERSHIRE**
NOTTINGHAM ROAD

MELTON MOWBRAY
Total Gross floor area: 3251 sqm
Survey date: THURSDAY *29/06/00* *Survey Type: MANUAL*

12 **LE-02-A-02** **COUNCIL OFF., LOUGHBOROUGH** **LEICESTERSHIRE**
SOUTHFIELD ROAD
CHARNWOOD
LOUGHBOROUGH
Total Gross floor area: 6913 sqm
Survey date: THURSDAY *30/11/00* *Survey Type: MANUAL*

13 **LE-02-A-03** **COUNCIL OFFICES, M. MOWBRAY** **LEICESTERSHIRE**
NOTTINGHAM ROAD

MELTON MOWBRAY
Total Gross floor area: 3251 sqm
Survey date: WEDNESDAY *04/05/05* *Survey Type: MANUAL*

14 **NF-02-A-01** **ANGLIA TELEVISION** **NORFOLK**
ROSE LANE

NORWICH
Total Gross floor area: 8375 sqm
Survey date: TUESDAY *27/09/05* *Survey Type: MANUAL*

15 **PK-02-A-01** **COUNCIL OFFICES, PERTH** **PERTH & KINROSS**
WHITEFRIARS CRESCENT
WHITEFRIARS BUS. PARK
PERTH
Total Gross floor area: 1020 sqm
Survey date: TUESDAY *26/05/98* *Survey Type: MANUAL*

16 **PK-02-A-02** **COUNCIL OFFICES, PERTH** **PERTH & KINROSS**
WHITEFRIARS CRESCENT
WHITEFRIARS BUS. PARK
PERTH
Total Gross floor area: 1020 sqm
Survey date: TUESDAY *26/05/98* *Survey Type: MANUAL*

17 **TV-02-A-02** **BUILDING SOCIETY, DARLINGTON** **TEES VALLEY**
LINGFIELD WAY
MORTON PARK
DARLINGTON
Total Gross floor area: 3500 sqm
Survey date: MONDAY *25/04/05* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

18 WR-02-A-01 COUNCIL OFFICES, WREXHAM WREXHAM
RHOSDDU ROAD

WREXHAM
Total Gross floor area: 2500 sqm
Survey date: MONDAY 05/07/04 *Survey Type: MANUAL*

TRIP RATE for Land Use 02 - EMPLOYMENT/A - OFFICE
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

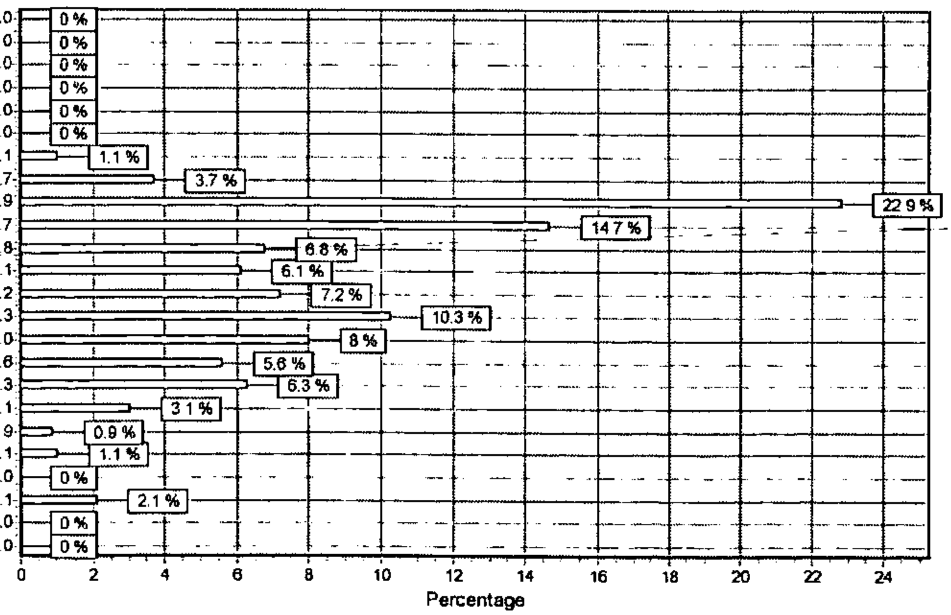
	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 00:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
00:30 - 01:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
01:00 - 01:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
01:30 - 02:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
02:00 - 02:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
02:30 - 03:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
03:00 - 03:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
03:30 - 04:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
04:00 - 04:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
04:30 - 05:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
05:00 - 05:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
05:30 - 06:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
06:00 - 06:30	1	1200	0.08	1	1200	0.08	1	1200	0.16
06:30 - 07:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
07:00 - 07:30	16	5000	0.07	16	5000	0.03	16	5000	0.10
07:30 - 08:00	16	5000	0.21	16	5000	0.04	16	5000	0.25
08:00 - 08:30	**17**	**5786**	**0.87**	17	5786	0.09	17	5786	0.96
08:30 - 09:00	17	5786	0.84	17	5786	0.09	17	5786	0.93
09:00 - 09:30	18	5520	0.64	18	5520	0.17	18	5520	0.81
09:30 - 10:00	18	5520	0.46	18	5520	0.23	18	5520	0.69
10:00 - 10:30	18	5520	0.26	18	5520	0.22	18	5520	0.48
10:30 - 11:00	18	5520	0.25	18	5520	0.22	18	5520	0.47
11:00 - 11:30	18	5520	0.22	18	5520	0.24	18	5520	0.46
11:30 - 12:00	18	5520	0.24	18	5520	0.23	18	5520	0.47
12:00 - 12:30	18	5520	0.24	18	5520	0.38	18	5520	0.62
12:30 - 13:00	18	5520	0.30	18	5520	0.43	18	5520	0.73
13:00 - 13:30	18	5520	0.40	18	5520	0.37	18	5520	0.77
13:30 - 14:00	18	5520	0.37	18	5520	0.29	18	5520	0.66
14:00 - 14:30	18	5520	0.35	18	5520	0.26	18	5520	0.61
14:30 - 15:00	18	5520	0.25	18	5520	0.24	18	5520	0.49
15:00 - 15:30	18	5520	0.20	18	5520	0.27	18	5520	0.47
15:30 - 16:00	18	5520	0.22	18	5520	0.27	18	5520	0.49
16:00 - 16:30	18	5520	0.22	18	5520	0.44	18	5520	0.66
16:30 - 17:00	18	5520	0.25	18	5520	0.55	18	5520	0.80
17:00 - 17:30	17	5786	0.13	**17**	**5786**	**0.94**	**17**	**5786**	**1.07**
17:30 - 18:00	17	5786	0.10	17	5786	0.50	17	5786	0.60
18:00 - 18:30	16	5716	0.04	16	5716	0.24	16	5716	0.28
18:30 - 19:00	16	5716	0.03	16	5716	0.12	16	5716	0.15
19:00 - 19:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
19:30 - 20:00	1	1200	0.08	1	1200	0.08	1	1200	0.16
20:00 - 20:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
20:30 - 21:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
21:00 - 21:30	1	1200	0.08	1	1200	0.08	1	1200	0.16
21:30 - 22:00	1	1200	0.08	1	1200	0.08	1	1200	0.16
22:00 - 22:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
22:30 - 23:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
23:00 - 23:30	1	1200	0.00	1	1200	0.00	1	1200	0.00
23:30 - 24:00	1	1200	0.00	1	1200	0.00	1	1200	0.00
Daily Trip Rates:			7.50			7.17			14.66

Parameter summary

Trip rate parameter range selected:	462 - 175000 (units: sqm)
Survey date date range:	01/01/98 - 27/09/05
Number of weekdays (Monday-Friday):	18
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	YES
Surveys manually removed from selection:	0

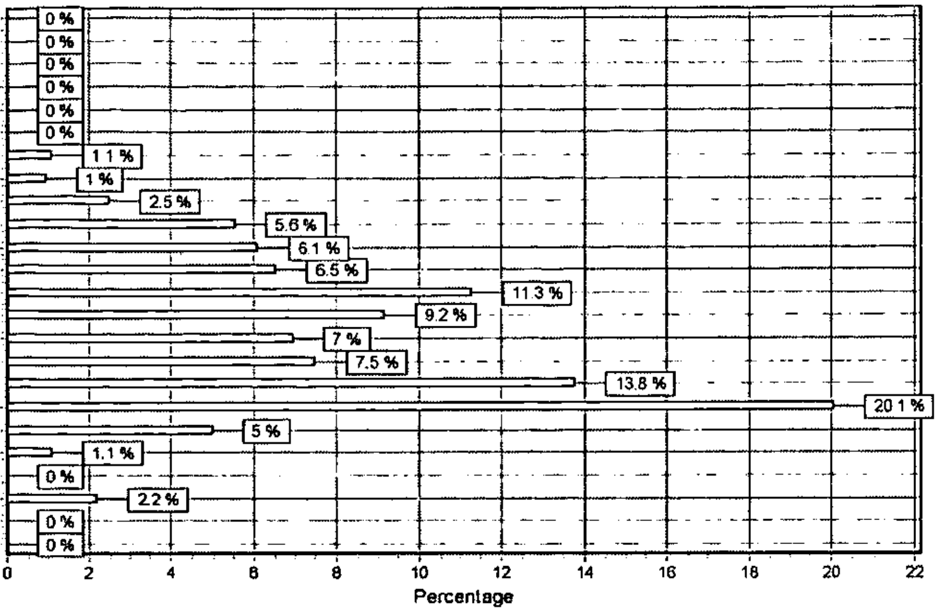
TRIP RATE GRAPH - ARRIVALS 02 - EMPLOYMENT A - OFFICE VEHICLES

Time	Rate	%
00:00-01:00	0.00	0.0
01:00-02:00	0.00	0.0
02:00-03:00	0.00	0.0
03:00-04:00	0.00	0.0
04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.08	1.1
07:00-08:00	0.28	3.7
08:00-09:00	1.71	22.9
09:00-10:00	1.10	14.7
10:00-11:00	0.51	6.8
11:00-12:00	0.46	6.1
12:00-13:00	0.54	7.2
13:00-14:00	0.77	10.3
14:00-15:00	0.60	8.0
15:00-16:00	0.42	5.6
16:00-17:00	0.47	6.3
17:00-18:00	0.23	3.1
18:00-19:00	0.07	0.9
19:00-20:00	0.08	1.1
20:00-21:00	0.00	0.0
21:00-22:00	0.16	2.1
22:00-23:00	0.00	0.0
23:00-24:00	0.00	0.0



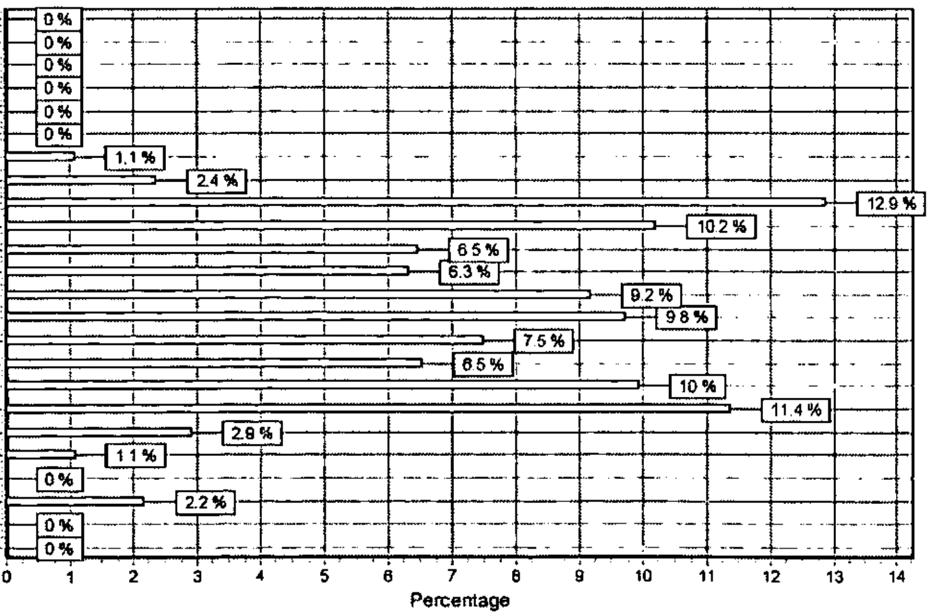
TRIP RATE GRAPH - DEPARTURES 02 - EMPLOYMENT A - OFFICE VEHICLES

Time	Rate	%
00:00-01:00	0.00	0.0
01:00-02:00	0.00	0.0
02:00-03:00	0.00	0.0
03:00-04:00	0.00	0.0
04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.08	1.1
07:00-08:00	0.07	1.0
08:00-09:00	0.18	2.5
09:00-10:00	0.40	5.6
10:00-11:00	0.44	6.1
11:00-12:00	0.47	6.5
12:00-13:00	0.81	11.3
13:00-14:00	0.66	9.2
14:00-15:00	0.50	7.0
15:00-16:00	0.54	7.5
16:00-17:00	0.99	13.8
17:00-18:00	1.44	20.1
18:00-19:00	0.36	5.0
19:00-20:00	0.08	1.1
20:00-21:00	0.00	0.0
21:00-22:00	0.16	2.2
22:00-23:00	0.00	0.0
23:00-24:00	0.00	0.0



TRIP RATE GRAPH - TOTALS 02 - EMPLOYMENT A - OFFICE VEHICLES

Time	Rate	%
00:00-01:00	0.00	0.0
01:00-02:00	0.00	0.0
02:00-03:00	0.00	0.0
03:00-04:00	0.00	0.0
04:00-05:00	0.00	0.0
05:00-06:00	0.00	0.0
06:00-07:00	0.16	1.1
07:00-08:00	0.35	2.4
08:00-09:00	1.89	12.9
09:00-10:00	1.50	10.2
10:00-11:00	0.95	6.5
11:00-12:00	0.93	6.3
12:00-13:00	1.35	9.2
13:00-14:00	1.43	9.8
14:00-15:00	1.10	7.5
15:00-16:00	0.96	6.5
16:00-17:00	1.46	10.0
17:00-18:00	1.67	11.4
18:00-19:00	0.43	2.9
19:00-20:00	0.16	1.1
20:00-21:00	0.00	0.0
21:00-22:00	0.32	2.2
22:00-23:00	0.00	0.0
23:00-24:00	0.00	0.0



Appendix E

PICADY Output Data - Site Access Junction;

2010 Post Development AM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS IN NO WAY RELIEVED OF HIS RESPONSIBILITY FOR THE CORRECTNESS OF THE SOLUTION

Run with file:-
"c:\WORK\luna\08 Reports\Picady\Picady\TA Sept07\2010 Opening Year Post Dev AM.vpi"
(drive-on-the-left) at 21:31:36 on Friday, 21 September 2007

RUN TITLE

Site Access_Riverview Road 2010 Opening Year Post Development AM

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

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

ARM A IS Riverview Road (West)
ARM B IS Site Access
ARM C IS Riverview Road (South)

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	7.79 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.40 M.
- VISIBILITY	(VC-B)	22.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	250.0 M.
- VISIBILITY TO RIGHT	(VB-A)	250.0 M.
- LANE 1 WIDTH	(WB-C)	4.50 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 08.15 AND ENDS 09.45

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.28	0.41	0.28
ARM B	15.00	45.00	75.00	1.40	2.10	1.40
ARM C	15.00	45.00	75.00	3.14	4.71	3.14

```
-------------------------------------------------------------
I                  I         TURNING PROPORTIONS              I
I                  I         TURNING COUNTS (VEH/HR)          I
I                  I         (PERCENTAGE OF H.V.S)            I
I                  ------------------------------------------
I       TIME       I FROM TO I  ARM A I  ARM B I  ARM C I
-------------------------------------------------------------
I  08.15 - 09.45   I         I        I        I        I
I                  I  ARM A  I  0.000 I  0.000 I  1.000 I
I                  I         I    0.0 I    0.0 I   22.0 I
I                  I         I (  0.0)I ( 10.0)I ( 10.0)I
I                  I         I        I        I        I
I                  I  ARM B  I  0.000 I  0.000 I  1.000 I
I                  I         I    0.0 I    0.0 I  112.0 I
I                  I         I ( 10.0)I ( 10.0)I ( 10.0)I
I                  I         I        I        I        I
I                  I  ARM C  I  0.339 I  0.661 I  0.000 I
I                  I         I   55.0 I  166.0 I    0.0 I
I                  I         I ( 10.0)I ( 10.0)I (  0.0)I
I                  I         I        I        I        I
-------------------------------------------------------------
```

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

```
.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                                 (RFC)     (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.15-08.30
I
 I   B-AC       1.40     13.53     0.103                 0.0    0.1        1.7
I
 I   C-A        1.06
I
 I   C-B        2.08      9.02     0.230                 0.0    0.3        4.2
I
 I   A-B        0.00
I
 I   A-C        0.28
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY             I
 I      MARGINAL    LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I       CHANGE:      (.1M)       (.1M)       (.1M)         (M)              (M)
I
```

```
 I
I
 I      B-AC        0.170      0.004      0.015      0.007          0.010
I
 I      C-B         0.106      0.000                 0.010
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND     PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
 I                                 (RFC)     (PEDS MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.30-08.45
I
 I   B-AC       1.67     13.51     0.124                 0.1    0.1        2.1
I
 I   C-A        1.27
I
 I   C-B        2.48      9.01     0.275                 0.3    0.4        5.5
I
 I   A-B        0.00
I
 I   A-C        0.33
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY             I
 I      MARGINAL    LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I       CHANGE:      (.1M)       (.1M)       (.1M)         (M)              (M)
I
 I
I
 I      B-AC        0.166      0.005      0.018      0.007          0.009
I
 I      C-B         0.106      0.000                 0.010
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                                 (RFC)     (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
```

```
 I 08.45-09.00
I
 I  B-AC      2.05     13.49    0.152                  0.1     0.2        2.6
I
 I  C-A       1.55
I
 I  C-B       3.03      9.00    0.337                  0.4     0.5        7.3
I
 I  A-B       0.00
I
 I  A-C       0.40
I
 I
I
 I               EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY             I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)             (M)
I
 I
I
 I       B-AC          0.160      0.006       0.015      0.006           0.009
I
 I       C-B           0.105      0.000                  0.010
I
--------------------------------------------------------------------------------
------------------

.-------------------------------------------------------------------------------
------------------
 I TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I  B-AC      2.05     13.49    0.152                  0.2     0.2        2.7
I
 I  C-A       1.55
I
 I  C-B       3.03      9.00    0.337                  0.5     0.5        7.5
I
 I  A-B       0.00
I
 I  A-C       0.40
I
 I
I
 I               EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY             I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)             (M)
I
 I
I
 I       B-AC          0.160      0.006       0.018      0.006           0.009
I
 I       C-B           0.105      0.000                  0.010
I
--------------------------------------------------------------------------------
------------------

.-------------------------------------------------------------------------------
------------------
 I TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I  B-AC      1.67     13.51    0.124                  0.2     0.1        2.2
I
 I  C-A       1.27
I
 I  C-B       2.45      9.01    0.275                  0.5     0.4        5.9
I
 I  A-B       0.00
I
 I  A-C       0.33
I
 I
I
 I               EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY             I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)             (M)
I
 I
I
 I       B-AC          0.166      0.005       0.018      0.007           0.009
I
 I       C-B           0.106      0.000                  0.010
I
--------------------------------------------------------------------------------
------------------

.-------------------------------------------------------------------------------
------------------
 I TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
```

```
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN    I
 I                              (RFC)     (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.30-09.45
I
 I   B-AC      1.40     13.53    0.103                 0.1    0.1        1.8
I
 I   C-A       1.06
I
 I   C-B       2.08      9.02    0.230                 0.4    0.3        4.7
I
 I   A-B       0.00
I
 I   A-C       0.29
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                               MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)        (.1M)       (.1M)        (M)              (M)
I
 I
I
 I       B-AC        0.170       0.004       0.018      0.007            0.010
I
 I       C-B         0.106       0.000                  0.010
I
 ---------------------------------------------------------------------------------
------------------

QUEUE FOR STREAM   B-AC
-------------------------
TIME SEGMENT    NO. OF
  ENDING       VEHICLES
               IN QUEUE
  08.30           0.1
  08.45           0.1
  09.00           0.2
  09.15           0.2
  09.30           0.1
  09.45           0.1

QUEUE FOR STREAM   C-B
-------------------------
TIME SEGMENT    NO. OF
  ENDING       VEHICLES
               IN QUEUE
  08.30           0.3
  08.45           0.4
  09.00           0.5   *
  09.15           0.5   *
  09.30           0.4
  09.45           0.3
```

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-AC	153.6	102.4	13.0	0.08	13.0	0.08
C-A	116.6	77.7				
C-B	227.6	151.7	35.1	0.15	35.1	0.15
A-B	0.0	0.0				
A-C	30.2	20.1				
ALL	527.9	351.9	48.1	0.09	48.1	0.09

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

END OF JOB

****** PICADY 4 run completed.

Appendix F

PICADY Output Data - Site Access Junction;

2010 Post Development PM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

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PROGRAM ADVICE AND MAINTENANCE CONTACT:
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EMAIL: SoftwareBureau@trl.co.uk

THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS IN NO WAY RELIEVED OF HIS RESPONSIBILITY FOR THE CORRECTNESS OF THE SOLUTION

Run with file:-
"c:\WORK\luna\08 Reports\Picady\Picady\TA Sept07\2010 Opening Year Post Dev PM.vpi"
(drive-on-the-left) at 21:34:59 on Friday, 21 September 2007

RUN TITLE
****
Site Access_Riverview Road 2010 Opening Year Post Development PM

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

INPUT DATA

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

ARM A IS Riverview Road (West)
ARM B IS Site Access
ARM C IS Riverview Road (South)

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM	MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W) 7.73 M.
CENTRAL RESERVE WIDTH	(WCR) 0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B) 3.40 M.
- VISIBILITY	(VC-B) 22.0 M.
- BLOCKS TRAFFIC	NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C) 250.0 M.
- VISIBILITY TO RIGHT	(VB-A) 250.0 M.
- LANE 1 WIDTH	(WB-C) 4.50 M.
- LANE 2 WIDTH	(WB-A) 0.00 M.

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	1.59	2.38	1.59
ARM B	15.00	45.00	75.00	4.36	6.54	4.36
ARM C	15.00	45.00	75.00	4.94	7.41	4.94

TIME	FROM / TO	ARM A	ARM B	ARM C
		TURNING PROPORTIONS TURNING COUNTS (VEH/HR) (PERCENTAGE OF H.V.S)		
16.45 - 19.15	ARM A	0.000 0.0 (0.0)	0.024 3.0 (10.0)	0.976 124.0 (10.0)
	ARM B	0.017 6.0 (10.0)	0.000 0.0 (0.0)	0.983 343.0 (10.0)
	ARM C	0.187 74.0 (10.0)	0.813 321.0 (10.0)	0.000 0.0 (0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ SEGMENT)
16.45-17.00								
B-AC	4.36	13.03	0.335		0.0	0.5	7.2	
C-A	0.93							
C-B	4.01	5.74	0.459		0.0	0.8	11.6	
A-B	0.04							
A-C	1.55							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-AC	0.149	0.008	0.015	0.006	0.008
C-B	0.102	0.002		0.009	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ SEGMENT)
17.00-17.15								
B-AC	5.21	12.91	0.403		0.5	0.7	9.7	
C-A	1.10							
C-B	4.79	8.68	0.552		0.8	1.2	16.9	
A-B	0.04							
A-C	1.55							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-AC	0.140	0.010	0.018	0.006	0.009
C-B	0.102	0.002		0.009	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ SEGMENT)

```
 I 17.15-17.30
I
 I  B-AC      6.38    12.76   0.500                 0.7    1.0       14.1
I
 I  C-A       1.35
I
 I  C-B       5.87     8.59   0.683                 1.2    2.0       27.7
I
 I  A-B       0.05
I
 I  A-C       2.27
I
 I
I
 I              EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.   CENT RES  VIS TO LEFT
VISIBILITY              I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)         (M)            (M)
I
 I
I
 I         B-AC        0.129     0.013      0.015     0.005          0.007
I
 I         C-B         0.101     0.003                0.009
I
 ------------------------------------------------------------------------------
------------------

.-----------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/    I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I  B-AC      6.39    12.75   0.500                 1.0    1.0       14.8
I
 I  C-A       1.35
I
 I  C-B       5.87     8.59   0.683                 2.0    2.1       30.9
I
 I  A-B       0.05
I
 I  A-C       2.27
I
 I
I
 I              EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.   CENT RES  VIS TO LEFT
VISIBILITY              I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)         (M)            (M)
I
 I
I
 I         B-AC        0.129     0.013      0.018     0.005          0.007
I
 I         C-B         0.101     0.003                0.009
I
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------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/    I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I  B-AC      5.21    12.91   0.403                 1.0    0.7       10.7
I
 I  C-A       1.10
I
 I  C-B       4.79     5.68   0.552                 2.1    1.3       20.5
I
 I  A-B       0.04
I
 I  A-C       1.85
I
 I
I
 I              EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.   CENT RES  VIS TO LEFT
VISIBILITY              I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)         (M)            (M)
I
 I
I
 I         B-AC        0.140     0.010      0.018     0.006          0.008
I
 I         C-B         0.102     0.002                0.009
I
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------------------

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------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
```

```
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN    I                                
 I                              (RFC)     (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 18.00-18.15
I
 I   B-AC      4.36     13.03     0.335                 0.7    0.5        7.9
I
 I   C-A       0.93
I
 I   C-B       4.01      5.74     0.459                 1.3    0.9       13.7
I
 I   A-B       0.04
I
 I   A-C       1.55
I
 I
I
 I                  EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                 MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                  I
 I     MARGINAL   LANE WIDTH     WIDTH        WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:     (.1M)        (.1M)        (.1M)         (M)             (M)
I
 I
I
 I       B-AC         0.148        0.009       0.018        0.006            0.008
I
 I       C-B          0.102        0.002                    0.009
I
```

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.5	
17.15	0.7	*
17.30	1.0	*
17.45	1.0	*
18.00	0.7	*
18.15	0.5	*

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.5	*
17.15	1.2	*
17.30	2.0	**
17.45	2.1	**
18.00	1.3	*
18.15	0.9	*

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-AC	478.6	319.0	64.3	0.13	64.3	0.13
C-A	101.5	67.6				
C-B	440.2	293.4	121.3	0.28	121.3	0.28
A-B	4.1	2.7				
A-C	170.0	113.4				
ALL	1194.3	796.2	185.6	0.16	185.6	0.16

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

END OF JOB

****** PICADY 4 run completed.

Appendix G

PICADY Output Data - Site Access Junction;

2025 Post Development AM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"c:\WORK\luna\08 Reports\Picady\Picady\TA Sept07\2025 Future Year Post Dev AM.vpi"
(drive-on-the-left) at 21:40:14 on Friday, 21 September 2007

RUN TITLE
****
Site Access_Riverview Road 2025 Future Design Year Post Development AM

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

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

ARM A IS Riverview Road (West)
ARM B IS Site Access
ARM C IS Riverview Road (South)

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	7.79 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.40 M.
- VISIBILITY	(VC-B)	22.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	250.0 M.
- VISIBILITY TO RIGHT	(VB-A)	250.0 M.
- LANE 1 WIDTH	(WB-C)	4.50 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 08.15 AND ENDS 09.45

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN) BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.86	1.29	0.56
ARM B	15.00	45.00	75.00	1.39	2.08	1.39
ARM C	15.00	45.00	75.00	2.20	3.30	2.20

```
-------------------------------------------------------------
I                    I         TURNING PROPORTIONS          I
I                    I         TURNING COUNTS (VEH/HR)      I
I                    I         (PERCENTAGE OF H.V.S)        I
I                    -----------------------------------------
I        TIME        I FROM TO I  ARM A I  ARM B I  ARM C I
-------------------------------------------------------------
I  08.15 - 09.45     I         I        I        I        I
I                    I  ARM A  I  0.000 I  0.913 I  0.087 I
I                    I         I    0.0 I   83.0 I    6.0 I
I                    I         I (  0.0)I ( 10.0)I ( 10.0)I
I                    I         I        I        I        I
I                    I  ARM B  I  0.387 I  0.000 I  0.613 I
I                    I         I   43.0 I    0.0 I   68.0 I
I                    I         I ( 10.0)I (  0.0)I ( 10.0)I
I                    I         I        I        I        I
I                    I  ARM C  I  0.415 I  0.585 I  0.000 I
I                    I         I   73.0 I  103.0 I    0.0 I
I                    I         I ( 10.0)I ( 10.0)I (  0.0)I
I                    I         I        I        I        I
-------------------------------------------------------------

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

.-------------------------------------------------------------------------------
------------------
 I TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)     (PEDS/MIN)  (VEHS)  (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 08.15-08.30
I
 I   B-AC      1.39     12.50     0.111                 0.0     0.1        1.8
I
 I   C-A       0.91
I
 I   C-B       1.29      5.90     0.145                 0.0     0.2        2.4
I
 I   A-B       0.79
I
 I   A-C       0.08
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                 MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                      I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:     (.1M)        (.1M)       (.1M)         (M)            (M)
I
```

```
I
I
 I      B-AC         0.176      0.003      0.015      0.007         0.010
I
 I      C-B          0.104      0.001                 0.010
I
-------------------------------------------------------------------------------
------------------

.-------------------------------------------------------------------------------
------------------
 I TIME      DEMAND  CAPACITY  DEMAND     PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
 I                              (RFC)     (PEDS MIN)  (VEHS)  (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 08.30-09.45
I
 I   B-AC      1.66     12.39     0.134                 0.1     0.2        2.3
I
 I   C-A       1.09
I
 I   C-B       1.54      8.86     0.173                 0.2     0.2        3.0
I
 I   A-B       0.94
I
 I   A-C       0.09
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                 MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                      I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:     (.1M)        (.1M)       (.1M)         (M)            (M)
I
 I
I
 I      B-AC         0.173      0.004      0.018      0.007         0.010
I
 I      C-B          0.104      0.001                 0.010
I
-------------------------------------------------------------------------------
------------------

.-------------------------------------------------------------------------------
------------------
 I TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)     (PEDS/MIN)  (VEHS)  (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
```

```
 I 08.45-09.00
I
 I  B-AC      2.03     12.25   0.166                  0.2   0.2        2.9
I
 I  C-A       1.33
I
 I  C-B       1.88      8.51   0.214                  0.2   0.3        3.9
I
 I  A-B       1.15
I
 I  A-C       0.11
I
 I
I
 I               EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)            (M)
I
 I
I
 I       B-AC         0.169       0.004      0.018     0.007           0.010
I
 I       C-B          0.103       0.001                0.010
I
 ---------------------------------------------------------------------------
-----------------

.---------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I        (VEH/MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)     (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I  B-AC      2.03     12.25   0.166                  0.2   0.2        3.0
I
 I  C-A       1.33
I
 I  C-B       1.88      8.81   0.214                  0.3   0.3        4.0
I
 I  A-B       1.15
I
 I  A-C       0.11
I
 I
I
 I               EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)            (M)
I
 I
I
 I       B-AC         0.169       0.004      0.018     0.007           0.010
I
 I       C-B          0.103       0.001                0.010
I
 ---------------------------------------------------------------------------
-----------------

.---------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I        (VEH MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)     (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I  B-AC      1.66     12.39   0.134                  0.2   0.2        2.4
I
 I  C-A       1.09
I
 I  C-B       1.54      5.86   0.173                  0.3   0.2        3.3
I
 I  A-B       0.94
I
 I  A-C       0.09
I
 I
I
 I               EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                             MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH       WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)            (M)
I
 I
I
 I       B-AC         0.173       0.004      0.018     0.007           0.010
I
 I       C-B          0.104       0.001                0.010
I
 ---------------------------------------------------------------------------
-----------------

.---------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
```

```
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN    I
 I                                 (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.30-09.45
I
 I  B-AC       1.39     12.49    0.111                 0.2    0.1        1.9
I
 I  C-A        0.91
I
 I  C-B        1.29      5.90    0.145                 0.2    0.2        2.6
I
 I  A-B        0.79
I
 I  A-C        0.08
I
 I
I
 I                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                    I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:     (.1M)        (.1M)       (.1M)          (M)              (M)
I
 I
I
 I       B-AC          0.176        0.003      0.018       0.007            0.010
I
 I       C-B           0.104        0.001                  0.010
I
 ------------------------------------------------------------------------------
------------------

QUEUE FOR STREAM   B-AC
-------------------------
TIME SEGMENT     NO. OF
  ENDING       VEHICLES
               IN QUEUE
  08.30            0.1
  08.45            0.2
  09.00            0.2
  09.15            0.2
  09.30            0.2
  09.45            0.1

QUEUE FOR STREAM   C-B
-------------------------
TIME SEGMENT     NO. OF
  ENDING       VEHICLES
               IN QUEUE
  08.30            0.2
  08.45            0.2
  09.00            0.3
  09.15            0.3
  09.30            0.2
  09.45            0.2

            QUEUEING DELAY INFORMATION OVER WHOLE PERIOD
            --------------------------------------------

 ------------------------------------------------------------------------------
 I STREAM I   TOTAL DEMAND  I   * QUEUEING *      I * INCLUSIVE QUEUEING * I
 I        I                 I    * DELAY *        I        * DELAY *       I
 I        I------------------------------------------------------------------I
 I        I  (VEH)  (VEH H) I  (MIN)    (MIN/VEH) I     (MIN)      (MIN/VEH) I
 ------------------------------------------------------------------------------
 I  B-AC  I  152.2 I  101.5 I   14.2 I    0.09    I      14.2  I     0.09   I
 I  C-A   I  100.1 I   66.7 I        I            I            I            I
 I  C-B   I  141.2 I   94.2 I   19.3 I    0.14    I      19.3  I     0.14   I
 I  A-B   I   86.4 I   57.6 I        I            I            I            I
 I  A-C   I    8.2 I    5.5 I        I            I            I            I
 ------------------------------------------------------------------------------
 I  ALL   I  488.2 I  325.4 I   33.5 I    0.07    I      33.5  I     0.07   I
 ------------------------------------------------------------------------------

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


 END OF JOB

 ****** PICADY 4 run completed.
```

Appendix H

PICADY Output Data - Site Access Junction;

2025 Post Development PM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"c:\WORK\luna\08 Reports\Picady\Picady\IA Sept07\2025 Future Year Post Dev PM.vpi"
(drive-on-the-left) at 21:45:37 on Friday, 21 September 2007

RUN TITLE
****
Site Access_Riverview Road 2025 Future Design Year Post Development PM

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

INPUT DATA

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

ARM A IS Riverview Road (West)
ARM B IS Site Access
ARM C IS Riverview Road (South)

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	7.79 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.40 M.
- VISIBILITY	(VC-B)	22.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	250.0 M.
- VISIBILITY TO RIGHT	(VB-A)	250.0 M.
- LANE 1 WIDTH	(WB-C)	4.50 M.
- LANE 2 WIDTH	(WB-A)	0.00 M.

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN) BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	3.09	4.63	3.09
ARM B	15.00	45.00	75.00	4.35	6.52	4.35
ARM C	15.00	45.00	75.00	3.34	5.01	3.34

```
-----------------------------------------------------------------
I                     I        TURNING PROPORTIONS              I
I                     I        TURNING COUNTS (VEH/HR)          I
I                     I       (PERCENTAGE OF H.V.S)             I
I                     ------------------------------------------
I        TIME         I FROM TO I  ARM A I  ARM B I  ARM C I
-----------------------------------------------------------------
I   16.45 - 15.15     I         I        I        I        I
I                     I  ARM A  I  0.000 I  0.490 I  0.510 I
I                     I         I    0.0 I  121.0 I  126.0 I
I                     I         I (  0.0)I ( 10.0)I ( 10.0)I
I                     I         I        I        I        I
I                     I  ARM B  I  0.374 I  0.000 I  0.626 I
I                     I         I  130.0 I    0.0 I  218.0 I
I                     I         I ( 10.0)I (  0.0)I ( 10.0)I
I                     I         I        I        I        I
I                     I  ARM C  I  0.240 I  0.760 I  0.000 I
I                     I         I   64.0 I  203.0 I    0.0 I
I                     I         I ( 10.0)I ( 10.0)I (  0.0)I
I                     I         I        I        I        I
-----------------------------------------------------------------

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

.---------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END      DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/    I
 I                                 (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 16.45-17.00
I
 I   B-AC       4.35     11.65     0.373                  0.0    0.6        8.4
I
 I   C-A        0.80
I
 I   C-B        2.54      5.42     0.301                  0.0    0.4        6.0
I
 I   A-B        1.51
I
 I   A-C        1.58
I
 I
I
 I                   EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY                 I
 I      MARGINAL    LANE WIDTH    WIDTH        WIDTH      (AHEAD FOR MAJOR)  TO RIGHT
I
 I       CHANGE:      (.1M)       (.1M)        (.1M)          (M)              (M)
I
 I
I
 I       B-AC          0.157       0.007        0.015        0.006            0.009
I
 I       C-B           0.099       0.003                     0.009
I
 ---------------------------------------------------------------------------
------------------

.---------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND     PEDESTRIAN  START   END      DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/    I
 I                                 (RFC)    (PEDS MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.00-17.15
I
 I   B-AC       5.19     11.36     0.457                  0.6    0.8       11.9
I
 I   C-A        0.96
I
 I   C-B        3.03      8.29     0.365                  0.4    0.6        8.2
I
 I   A-B        1.81
I
 I   A-C        1.58
I
 I
I
 I                   EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY                 I
 I      MARGINAL    LANE WIDTH    WIDTH        WIDTH      (AHEAD FOR MAJOR)  TO RIGHT
I
 I       CHANGE:      (.1M)       (.1M)        (.1M)          (M)              (M)
I
 I
I
 I       B-AC          0.151       0.005        0.018        0.006            0.005
I
 I       C-B           0.097       0.004                     0.009
I
 ---------------------------------------------------------------------------
------------------

.---------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END      DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/    I
 I                                 (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
```

```
 I 17.15-17.30
I
 I   B-AC        6.36      10.96     0.551                      0.8    1.3         19.0
I
 I   C-A         1.17
I
 I   C-B         3.71       8.12     0.457                      0.6    0.8         11.7
I
 I   A-B         2.21
I
 I   A-C         2.30
I
 I
I
 I                  EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                               MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                I
 I      MARGINAL   LANE WIDTH    WIDTH        WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:     (.1M)       (.1M)        (.1M)          (M)              (M)
I
 I
I
 I        B-AC         0.141       0.010        0.015      0.006            0.008
I
 I        C-B          0.095       0.005                   0.009
I
 ---------------------------------------------------------------------------------
------------------

.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)     (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I   B-AC        6.36      10.95     0.581                      1.3    1.4         20.3
I
 I   C-A         1.17
I
 I   C-B         3.71       8.12     0.457                      0.8    0.5         12.4
I
 I   A-B         2.21
I
 I   A-C         2.30
I
 I
I
 I                  EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                               MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                I
 I      MARGINAL   LANE WIDTH    WIDTH        WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:     (.1M)       (.1M)        (.1M)          (M)              (M)
I
 I
I
 I        B-AC         0.141       0.010        0.018      0.006            0.005
I
 I        C-B          0.095       0.005                   0.009
I
 ---------------------------------------------------------------------------------
------------------

.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)     (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I   B-AC        5.19      11.35     0.458                      1.4    0.9         13.5
I
 I   C-A         0.96
I
 I   C-B         3.03       5.29     0.365                      0.8    0.6          9.2
I
 I   A-B         1.51
I
 I   A-C         1.88
I
 I
I
 I                  EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                               MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                I
 I      MARGINAL   LANE WIDTH    WIDTH        WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:     (.1M)       (.1M)        (.1M)          (M)              (M)
I
 I
I
 I        B-AC         0.150       0.005        0.018      0.006            0.008
I
 I        C-B          0.097       0.004                   0.009
I
 ---------------------------------------------------------------------------------
------------------

.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
```

I	(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/
(VEH.MIN I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME
SEGMENT) TIME SEGMENT) I							
I 18.00-18.15							
I B-AC	4.35	11.64	0.374		0.9	0.6	9.4
I C-A	0.80						
I C-B	2.54	8.42	0.301		0.6	0.4	6.8
I A-B	1.51						
I A-C	1.59						

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN·

I VISIBILITY		MAJOR RD.	CENT RES	VIS TO LEFT	
I MARGINAL	LANE WIDTH	WIDTH	WIDTH	(AHEAD FOR MAJOR)	TO RIGHT
I CHANGE:	(.1M)	(.1M)	(.1M)	(M)	(M)
I B-AC	0.157	0.007	0.018	0.006	0.009
I C-B	0.099	0.003		0.009	

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.6	*
17.15	0.8	*
17.30	1.3	*
17.45	1.4	*
18.00	0.9	*
18.15	0.6	*

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.4	
17.15	0.6	*
17.30	0.8	*
17.45	0.8	*
18.00	0.6	*
18.15	0.4	

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-AC	477.2	318.1	82.5	0.17	82.6	0.17
C-A	87.8	58.5				
C-B	278.4	185.6	54.4	0.20	54.4	0.20
A-B	165.9	110.6				
A-C	172.8	115.2				
ALL	1182.0	788.0	136.9	0.12	136.9	0.12

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

END OF JOB

****** PICADY 4 run completed.

Appendix I

PICADY Output Data – Riverview Road / Main Street Junction;

2010 Base plus Committed Development Traffic AM Peak Scenarios

```
                    TRL LIMITED

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

               PICADY 4.1  ANALYSIS PROGRAM
                RELEASE 3.0 (MAY 2001)

          ADAPTED FROM PICADY/3 WHICH IS CROWN COPYRIGHT
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                     TRL SOFTWARE BUREAU
          TEL: CROWTHORNE (01344) 770758, FAX: 770864
                 EMAIL: SoftwareBureau@trl.co.uk
      ------------------------------------------------------------

THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION

Run with file:-
"s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\PICADY\Riverview
junction\
 Final Version Riverview 3005\2010\AM\Riverview final version 2010 AM Base
Deve.vpi"
(drive-on-the-left ) at 13:45:48 on Wednesday, 30 May 2007

 RUN TITLE
 *********
 Ballinasloe Riverview Final Vasion 2010 AM Base Development

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

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

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

ARM A IS Main Street
ARM B IS Riverview Road
ARM C IS Bridge Street
```

```
STREAM LABELLING CONVENTION
---------------------------

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

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

      ETC.


.GEOMETRIC DATA
 --------------

-------------------------------------------------------------------
I                DATA ITEM                  I  MINOR ROAD B    I
-------------------------------------------------------------------
I  TOTAL MAJOR ROAD CARRIAGEWAY WIDTH       I ( W  )  8.70 M.  I
I  CENTRAL RESERVE WIDTH                    I (WCR )  0.00 M.  I
I                                           I                  I
I  MAJOR ROAD RIGHT TURN - WIDTH            I (WC-B)  2.20 M.  I
I                        - VISIBILITY       I (VC-B) 100.0 M.  I
I                        - BLOCKS TRAFFIC   I          NO      I
I                                           I                  I
I  MINOR ROAD - VISIBILITY TO LEFT          I (VB-C)  70.0 M.  I
I             - VISIBILITY TO RIGHT         I (VB-A)  19.0 M.  I
I             - LANE 1 WIDTH                I (WB-C)    -      I
I             - LANE 2 WIDTH                I (WB-A)    -      I
I             - WIDTH AT  0 M FROM JUNC.    I          4.50 M. I
I             - WIDTH AT  5 M FROM JUNC.    I          3.60 M. I
I             - WIDTH AT 10 M FROM JUNC.    I          3.50 M. I
I             - WIDTH AT 15 M FROM JUNC.    I          3.50 M. I
I             - WIDTH AT 20 M FROM JUNC.    I          3.50 M. I
I             - LENGTH OF FLARED SECTION    I DERIVED:  0 PCU  I
-------------------------------------------------------------------


.TRAFFIC DEMAND DATA
 -------------------


TIME PERIOD BEGINS 09.15 AND ENDS 09.45

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

--------------------------------------------------------------------------------
I      I   NUMBER OF MINUTES FROM START WHEN    I    RATE OF FLOW (VEH/MIN) I
I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
```

	TO RISE	IS REACHED	FALLING	PEAK	OF PEAK	PEAK
ARM A	15.00	45.00	75.00	3.38	5.06	3.38
ARM B	15.00	45.00	75.00	0.28	0.41	0.28
ARM C	15.00	45.00	75.00	2.67	4.01	2.67

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

TIME	FROM/TO	ARM A	ARM B	ARM C
08.15 - 09.45				
	ARM A	0.000	0.196	0.804
		0.0	58.0	217.0
		(0.0)	(0.0)	(0.0)
	ARM B	0.727	0.000	0.273
		16.0	0.0	6.0
		(0.0)	(0.0)	(0.0)
	ARM C	0.846	0.154	0.000
		181.0	33.0	0.0
		(0.0)	(0.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
B-C	0.08	8.13	0.009		0.0	0.0	0.1	
B-A	0.20	7.66	0.026		0.0	0.0	0.4	
C-A	2.26							
C-B	0.41	9.80	0.042		0.0	0.0	0.6	
A-B	0.66							
A-C	2.71							

```
                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
                                   MAJOR RD.   CENT RES  VIS TO LEFT     VISIBILITY
    MARGINAL    LANE WIDTH         WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
    CHANGE:     (.1M)              (.1M)       (.1M)     (M)               (M)

    B-C         0.099              0.003                                   0.008
    B-A         0.075              0.005       0.019     0.005             0.008
    C-B         0.107              0.004                 0.009
```

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
B-C	0.09	8.02	0.011		0.0	0.0	0.2	
B-A	0.24	7.46	0.032		0.0	0.0	0.5	
C-A	2.70							
C-B	0.49	9.66	0.051		0.0	0.1	0.8	
A-B	0.79							
A-C	3.24							

```
                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
                                   MAJOR RD.   CENT RES  VIS TO LEFT     VISIBILITY
    MARGINAL    LANE WIDTH         WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
    CHANGE:     (.1M)              (.1M)       (.1M)     (M)               (M)

    B-C         0.098              0.003                                   0.008
```

```
 I      B-A          0.073      0.006      0.019      0.005         0.007
I
 I      C-B          0.105      0.004                 0.009
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I TIME        DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 08.45-09.00
I
 I  B-C       0.11      7.86    0.014                 0.0    0.0        0.2
I
 I  B-A       0.29      7.17    0.041                 0.0    0.0        0.6
I
 I  C-A       3.31
I
 I  C-B       0.60      9.46    0.064                 0.1    0.1        1.0
I
 I  A-B       0.97
I
 I  A-C       3.97
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                 MAJOR RD.   CENT RES  VIS TO LEFT
VISIBILITY                   I
 I    MARGINAL   LANE WIDTH     WIDTH       WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)            (M)
I
 I
I
 I      B-C          0.096      0.004                                  0.008
I
 I      B-A          0.070      0.008      0.019      0.005            0.007
I
 I      C-B          0.103      0.005                 0.009
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I TIME        DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
```

```
 I                                (RFC)    (PEDS MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I  B-C       0.11      7.56    0.014                 0.0    0.0        0.2
I
 I  B-A       0.29      7.17    0.041                 0.0    0.0        0.6
I
 I  C-A       3.31
I
 I  C-B       0.60      9.46    0.064                 0.1    0.1        1.0
I
 I  A-B       0.97
I
 I  A-C       3.97
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                 MAJOR RD.   CENT RES  VIS TO LEFT
VISIBILITY                   I
 I    MARGINAL   LANE WIDTH     WIDTH       WIDTH    (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)       (.1M)        (M)            (M)
I
 I
I
 I      B-C          0.096      0.004                                  0.008
I
 I      B-A          0.070      0.008      0.019      0.005            0.007
I
 I      C-B          0.103      0.005                 0.009
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I TIME        DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I  B-C       0.09      9.02    0.011                 0.0    0.0        0.2
I
 I  B-A       0.24      7.46    0.032                 0.0    0.0        0.5
I
 I  C-A       2.70
I
 I  C-B       0.49      9.66    0.051                 0.1    0.1        0.8
I
 I  A-B       0.79
I
```

A-C	3.24

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.098	0.003			0.008
B-A	0.073	0.006	0.019	0.005	0.007
C-B	0.105	0.004		0.009	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
09.30-09.45								
B-C	0.08	5.13	0.009		0.0	0.0	0.1	
B-A	0.20	7.66	0.026		0.0	0.0	0.4	
C-A	2.26							
C-B	0.41	9.50	0.042		0.1	0.0	0.7	
A-B	0.66							
A-C	2.71							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.099	0.003			0.008
B-A	0.075	0.005	0.019	0.005	0.008
C-B	0.107	0.004		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.0
09.00	0.0
09.15	0.0
09.30	0.0
09.45	0.0

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.0
09.00	0.0
09.15	0.0
09.30	0.0
09.45	0.0

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.1
09.00	0.1
09.15	0.1
09.30	0.1
09.45	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-C	8.2	5.5	1.0	0.13	1.0	0.13
B-A	21.9	14.6	3.0	0.14	3.0	0.14
C-A	248.2	165.5				

C-B	45.2	30.2	4.9	0.11	4.9	0.11
A-B	72.7	48.4				
A-C	297.6	198.4				
ALL	693.8	462.6	9.0	0.01	9.0	0.01

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

END OF JOB

****** PICADY 4 run completed.

Appendix J

PICADY Output Data – Riverview Road / Main Street Junction;

2010 Post Development Traffic AM Peak Scenarios

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                         TRL LIMITED

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

                    PICADY 4.1  ANALYSIS PROGRAM
                      RELEASE 3.0 (MAY 2001)

              ADAPTED FROM PICADY/3 WHICH IS CROWN COPYRIGHT
                BY PERMISSION OF THE CONTROLLER OF HMSO

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                PROGRAM ADVICE AND MAINTENANCE CONTACT:
                         TRL SOFTWARE BUREAU
             TEL: CROWTHORNE (01344) 770758, FAX: 770864
                   EMAIL: SoftwareBureau@trl.co.uk
            ------------------------------------------------------------

 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION


 Run with file:-
 "v:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\PICADY\Riverview
junction\Development After 06 10\
  TA Sep 07\2010\Riverview TA Sep07 2010 AM Post Deve.vpi"
(drive-on-the-left ) at 11:51:27 on Thursday, 20 September 2007

  RUN TITLE
  *********
  Ballinasloe Riverview TA Sep 07 2010 AM Post Development

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

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

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

 ARM A IS Main Street
 ARM B IS Riverview Road
 ARM C IS Bridge Street

 STREAM LABELLING CONVENTION
 ---------------------------

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

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

       ETC.


.GEOMETRIC DATA
 -------------

 ------------------------------------------------------------------
 I                  DATA ITEM                 I  MINOR ROAD B    I
 ------------------------------------------------------------------
 I  TOTAL MAJOR ROAD CARRIAGEWAY WIDTH        I ( W )   8.70 M.  I
 I  CENTRAL RESERVE WIDTH                     I (WCR )  0.00 M.  I
 I                                            I                  I
 I  MAJOR ROAD RIGHT TURN - WIDTH             I (WC-B)  2.20 M.  I
 I                        - VISIBILITY        I (VC-B) 100.0 M.  I
 I                        - BLOCKS TRAFFIC    I          NO      I
 I                                            I                  I
 I  MINOR ROAD - VISIBILITY TO LEFT           I (VB-C)  70.0 M.  I
 I             - VISIBILITY TO RIGHT          I (VB-A)  19.0 M.  I
 I             - LANE 1 WIDTH                 I (WB-C)    -      I
 I             - LANE 2 WIDTH                 I (WB-A)    -      I
 I             - WIDTH AT  0 M FROM JUNC.     I          4.50 M. I
 I             - WIDTH AT  5 M FROM JUNC.     I          3.60 M. I
 I             - WIDTH AT 10 M FROM JUNC.     I          3.50 M. I
 I             - WIDTH AT 15 M FROM JUNC.     I          3.50 M. I
 I             - WIDTH AT 20 M FROM JUNC.     I          3.50 M. I
 I             - LENGTH OF FLARED SECTION     I DERIVED:  0 PCU  I
 ------------------------------------------------------------------


.TRAFFIC DEMAND DATA
 ------------------


 TIME PERIOD BEGINS 08.15 AND ENDS 09.45

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

 DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 ---------------------------------------------------------------------------------
 I      I   NUMBER OF MINUTES FROM START WHEN     I   RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
 I      I   TO RISE    I  IS REACHED I  FALLING   I  PEAK  I OF PEAK I PEAK  I
```

ARM A	15.00	45.00	75.00	4.26	6.39	4.26
ARM B	15.00	45.00	75.00	1.67	2.51	1.67
ARM C	15.00	45.00	75.00	3.75	5.63	3.75

TIME	TURNING PROPORTIONS TURNING COUNTS (VEH/HR) (PERCENTAGE OF H.V.S) FROM TO	ARM A	ARM B	ARM C
08.15 - 09.45	ARM A	0.000	0.372	0.628
		0.0	127.0	214.0
		(0.0)	(0.0)	(0.0)
	ARM B	0.537	0.000	0.463
		72.0	0.0	62.0
		(0.0)	(0.0)	(0.0)
	ARM C	0.587	0.413	0.000
		176.0	124.0	0.0
		(0.0)	(0.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
B-C	0.77	8.67	0.089		0.0	0.1	1.4	
B-A	0.90	6.65	0.135		0.0	0.2	1.2	
C-A	2.20							
C-B	1.55	9.61	0.161		0.0	0.2	2.8	
A-B	1.59							
A-C	2.67							

EFFECT ON CAPACITY (PCU MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.096	0.003			0.009
B-A	0.071	0.007	0.018	0.004	0.007
C-B	0.105	0.005		0.009	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
B-C	0.93	8.47	0.109		0.1	0.1	1.5	
B-A	1.07	6.39	0.168		0.2	0.2	1.9	
C-A	2.63							
C-B	1.85	9.43	0.196		0.2	0.2	3.5	
A-B	1.90							
A-C	3.19							

EFFECT ON CAPACITY (PCU MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.093	0.004			0.009
B-A	0.068	0.008	0.018	0.004	0.006

I	C-B	0.103	0.005		0.009

TIME		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.45-09.00									
	B-C	1.13	8.19	0.138		0.1	0.2	2.3	
	B-A	1.32	6.02	0.215		0.2	0.3	4.0	
	C-A	3.22							
	C-B	2.27	9.18	0.247		0.2	0.3	4.7	
	A-B	2.32							
	A-C	3.91							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.090	0.004			0.005
B-A	0.064	0.010	0.018	0.004	0.006
C-B	0.100	0.007		0.008	

TIME		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
09.00-09.15									
	B-C	1.13	8.19	0.138		0.2	0.2	3.4	
	B-A	1.32	6.02	0.219		0.3	0.3	4.1	
	C-A	3.22							
	C-B	2.27	9.18	0.247		0.3	0.3	4.9	
	A-B	2.32							
	A-C	3.91							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.090	0.004			0.009
B-A	0.064	0.010	0.015	0.004	0.006
C-B	0.100	0.007		0.008	

TIME		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
09.15-09.30									
	B-C	0.93	5.47	0.109		0.2	0.1	1.9	
	B-A	1.07	6.38	0.168		0.3	0.2	3.2	
	C-A	2.63							
	C-B	1.85	9.43	0.196		0.3	0.2	3.8	
	A-B	1.90							
	A-C	3.19							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.093	0.004			0.008
B-A	0.065	0.009	0.018	0.004	0.006
C-B	0.103	0.005		0.009	

I 09.30-09.45

TIME SEGMENT)	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN TIME SEGMENT)
B-C	0.77	8.66	0.089		0.1	0.1	1.5	
B-A	0.90	6.65	0.135		0.2	0.2	2.4	
C-A	2.20							
C-B	1.55	9.61	0.161		0.2	0.2	3.0	
A-B	1.59							
A-C	2.67							

EFFECT ON CAPACITY (PCU MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.095	0.003			0.009
B-A	0.071	0.007	0.018	0.004	0.007
C-B	0.105	0.005		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.1
08.45	0.1
09.00	0.2
09.15	0.2
09.30	0.1
09.45	0.1

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.2
08.45	0.2
09.00	0.3
09.15	0.3
09.30	0.2
09.45	0.2

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.2
08.45	0.2
09.00	0.3
09.15	0.3
09.30	0.2
09.45	0.2

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-C	85.0	56.7	11.3	0.13	11.3	0.13
B-A	98.7	65.9	18.9	0.19	18.9	0.19
C-A	241.3	160.9				
C-B	170.0	113.4	22.7	0.13	22.7	0.13
A-B	174.1	116.1				

A-C	293.4	195.6				
ALL	1062.7	705.5	52.9	0.05	52.9	0.05

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

END OF JOB

****** PICADY 4 run completed.

Appendix K

PICADY Output Data – Riverview Road / Main Street Junction;

2010 Base plus Committed Development Traffic PM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
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Run with file:-
"s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\PICADY\Riverview junction\
Final Version Riverview 3005\2010\PM\Riverview final version 2010 PM Base Deve.vpi"
(drive-on-the-left) at 13:49:05 on Wednesday, 30 May 2007

RUN TITLE
****

Ballinasloe Riverview Final Vesion 2010 PM Base Development

.MAJOR MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

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

ARM A IS Main Street
ARM B IS Riverview Road
ARM C IS Bridge Street

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	8.70 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	100.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	70.0 M.
- VISIBILITY TO RIGHT	(VB-A)	19.0 M.
- LANE 1 WIDTH	(WB-C)	-
- LANE 2 WIDTH	(WB-A)	-
- WIDTH AT 0 M FROM JUNC.		4.50 M.
- WIDTH AT 5 M FROM JUNC.		3.60 M.
- WIDTH AT 10 M FROM JUNC.		3.50 M.
- WIDTH AT 15 M FROM JUNC.		3.50 M.
- WIDTH AT 20 M FROM JUNC.		3.50 M.
- LENGTH OF FLARED SECTION	DERIVED:	0 PCU

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS	TOP OF PEAK	FLOW STOPS	RATE OF FLOW (VEH/MIN) BEFORE	AT TOP	AFTER

	TO RISE	IS REACHED	FALLING	PEAK	OF PEAK	PEAK
ARM A	15.00	45.00	75.00	3.56	5.34	3.56
ARM B	15.00	45.00	75.00	1.55	2.32	1.55
ARM C	15.00	45.00	75.00	3.42	5.14	3.42

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

TIME	FROM/TO	ARM A	ARM B	ARM C
16.45 - 18.15	ARM A	0.000	0.165	0.835
		0.0	47.0	238.0
		(0.0)	(3.0)	(3.0)
	ARM B	0.355	0.000	0.645
		44.0	0.0	80.0
		(3.0)	(0.0)	(3.0)
	ARM C	0.905	0.095	0.000
		245.0	26.0	0.0
		(3.0)	(3.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
16.45-17.00								
B-C	1.00	9.28	0.108		0.0	0.1	1.7	
B-A	0.55	6.09	0.090		0.0	0.1	1.4	
C-A	3.10							
C-B	0.32	9.45	0.034		0.0	0.0	0.5	
A-B	0.59							
A-C	2.97							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.097	0.003			0.009
B-A	0.073	0.005	0.016	0.004	0.006
C-B	0.106	0.004		0.009	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.00-17.15								
B-C	1.19	9.10	0.131		0.1	0.1	2.2	
B-A	0.66	5.89	0.111		0.1	0.1	1.8	
C-A	3.70							
C-B	0.39	9.31	0.042		0.0	0.0	0.6	
A-B	0.70							
A-C	3.55							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.095	0.004			0.009

```
 I       B-A          0.071      0.006      0.016      0.004          0.006
I
 I       C-B          0.104      0.005                 0.009
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I  TIME        DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                               (RFC)     (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.15-17.30
I
 I  B-C        1.46      5.85    0.165                 0.1    0.2          2.9
I
 I  B-A        0.80      5.62    0.143                 0.1    0.2          2.4
I
 I  C-A        4.53
I
 I  C-B        0.48      9.10    0.052                 0.0    0.1          0.8
I
 I  A-B        0.56
I
 I  A-C        4.35
I
 I
I
 I                   EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                  MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                     I
 I      MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:      (.1M)       (.1M)       (.1M)          (M)             (M)
I
 I
I
 I       B-C          0.092      0.005                                    0.009
I
 I       B-A          0.067      0.007      0.016      0.004              0.006
I
 I       C-B          0.102      0.006                 0.009
I
 ------------------------------------------------------------------------------
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.------------------------------------------------------------------------------
-----------------
 I  TIME        DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/    I
 I                               (RFC)     (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I  B-C        1.46      8.55    0.165                 0.2    0.2          2.9
I
 I  B-A        0.80      5.62    0.143                 0.2    0.2          2.5
I
 I  C-A        4.53
I
 I  C-B        0.48      9.10    0.052                 0.1    0.1          0.8
I
 I  A-B        0.56
I
 I  A-C        4.35
I
 I
I
 I                   EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                  MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                     I
 I      MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:      (.1M)       (.1M)       (.1M)          (M)             (M)
I
 I
I
 I       B-C          0.092      0.005                                    0.009
I
 I       B-A          0.067      0.007      0.016      0.004              0.006
I
 I       C-B          0.102      0.006                 0.009
I
 ------------------------------------------------------------------------------
-----------------

.------------------------------------------------------------------------------
-----------------
 I  TIME        DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                               (RFC)     (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I  B-C        1.19      9.10    0.131                 0.2    0.2          2.3
I
 I  B-A        0.66      5.89    0.111                 0.2    0.1          2.0
I
 I  C-A        3.70
I
 I  C-B        0.39      9.31    0.042                 0.1    0.0          0.7
I
 I  A-B        0.70
I
```

A-C	3.55

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VIS TO RIGHT (M)
B-C	0.095	0.004			0.009
B-A	0.071	0.006	0.016	0.004	0.006
C-B	0.104	0.005		0.009	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/TIME SEGMENT)
18.00-18.15								
B-C	1.00	9.28	0.108		0.2	0.1	1.9	
B-A	0.55	6.08	0.090		0.1	0.1	1.6	
C-A	3.10							
C-B	0.32	9.45	0.034		0.0	0.0	0.5	
A-B	0.59							
A-C	2.97							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VIS TO RIGHT (M)
B-C	0.097	0.003			0.009
B-A	0.073	0.005	0.016	0.004	0.006
C-B	0.106	0.004		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.1
17.15	0.1
17.30	0.2
17.45	0.2
18.00	0.2
18.15	0.1

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.1
17.15	0.1
17.30	0.2
17.45	0.2
18.00	0.1
18.15	0.1

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.0
17.15	0.0
17.30	0.1
17.45	0.1
18.00	0.0
18.15	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-C	109.7	73.1	14.0	0.13	14.0	0.13
B-A	60.3	40.2	11.6	0.19	11.6	0.19
C-A	340.1	226.7				

C-B	35.7	23.8	4.0	0.11	4.0	0.11
A-B	64.4	43.0				
A-C	326.3	217.6				
ALL	936.5	624.4	29.6	0.03	29.6	0.03

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

END OF JOB

****** PICADY 4 run completed.

Appendix L

PICADY Output Data – – Riverview Road / Main Street Junction;

2010 Post Development Traffic PM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"e:\luna\PICADY\TA Sep 07\2010\Riverview TA Sep07 2010 PM Post Deve.vpi"
(drive-on-the-left) at 21:33:52 on Monday, 17 September 2007

RUN TITLE
****
Ballinasloe Riverview TA Sep 07 2010 PM Post Development

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

INPUT DATA

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

ARM A IS Main Street
ARM B IS Riverview Road
ARM C IS Bridge Street

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	8.70 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	100.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	70.0 M.
- VISIBILITY TO RIGHT	(VB-A)	19.0 M.
- LANE 1 WIDTH	(WB-C)	-
- LANE 2 WIDTH	(WB-A)	-
- WIDTH AT 0 M FROM JUNC.		4.50 M.
- WIDTH AT 5 M FROM JUNC.		3.60 M.
- WIDTH AT 10 M FROM JUNC.		3.50 M.
- WIDTH AT 15 M FROM JUNC.		3.50 M.
- WIDTH AT 20 M FROM JUNC.		3.50 M.
- LENGTH OF FLARED SECTION	DERIVED:	0 PCU

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	5.19	7.78	5.19

ARM B	15.00	45.00	75.00	5.74	4.61	5.74
ARM C	15.00	45.00	75.00	5.54	5.31	5.54

TIME	FROM/TO	ARM A	ARM B	ARM C
		TURNING PROPORTIONS TURNING COUNTS (VEH/HR) (PERCENTAGE OF H.V.S)		
16.45 - 18.15	ARM A	0.000 0.0 (0.0)	0.441 183.0 (0.0)	0.559 232.0 (0.0)
	ARM B	0.458 210.0 (0.0)	0.000 0.0 (0.0)	0.542 249.0 (0.0)
	ARM C	0.542 240.0 (0.0)	0.458 203.0 (0.0)	0.000 0.0 (0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
16.45-17.00								
B-C	3.11	8.21	0.379		0.0	0.6	8.5	
B-A	2.63	5.94	0.442		0.0	0.8	10.5	
C-A	3.00							
C-B	2.54	9.41	0.270		0.0	0.4	5.2	
A-B	2.29							
A-C	2.90							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.057	0.003			0.008
B-A	0.066	0.009	0.017	0.004	0.006
C-B	0.102	0.006		0.009	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.00-17.15								
B-C	3.72	7.79	0.478		0.6	0.9	12.7	
B-A	3.13	5.60	0.560		0.8	1.2	16.5	
C-A	3.58							
C-B	3.03	9.19	0.330		0.4	0.5	7.0	
A-B	2.73							
A-C	3.46							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.082	0.004			0.008
B-A	0.062	0.010	0.017	0.004	0.006
C-B	0.100	0.007		0.008	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.15-17.30								
B-C	4.55	7.17	0.635		0.9	1.6	22.4	
B-A	3.84	5.13	0.749		1.2	2.5	32.9	
C-A	4.39							
C-B	3.71	8.59	0.417		0.5	0.7	10.1	
A-B	3.35							
A-C	4.24							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.076	0.005			0.007
B-A	0.057	0.013	0.017	0.003	0.005
C-B	0.097	0.005		0.004	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.30-17.45								
B-C	4.55	7.13	0.638		1.6	1.7	25.1	
B-A	3.84	5.12	0.749		2.5	2.7	39.8	
C-A	4.39							
C-B	3.71	8.89	0.417		0.7	0.7	10.6	
A-B	3.35							
A-C	4.24							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.076	0.005			0.007
B-A	0.057	0.013	0.017	0.003	0.005
C-B	0.097	0.008		0.008	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.45-18.00								
B-C	3.72	7.73	0.481		1.7	1.0	15.3	
B-A	3.13	5.59	0.560		2.7	1.3	22.4	
C-A	3.59							
C-B	3.03	9.19	0.330		0.7	0.5	7.5	
A-B	2.73							
A-C	3.46							

EFFECT ON CAPACITY (FCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.052	0.004			0.008
B-A	0.062	0.010	0.017	0.004	0.006
C-B	0.103	0.007		0.008	

TIME SEGMENT 18.00-18.15	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
B-C	3.11	8.17	0.381		1.0	0.6	9.9	
B-A	2.63	5.94	0.442		1.3	0.8	13.1	
C-A	3.00							
C-B	2.54	9.41	0.270		0.5	0.4	5.8	
A-B	2.29							
A-C	2.90							

EFFECT ON CAPACITY (FCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.097	0.003			0.008
B-A	0.066	0.009	0.017	0.004	0.006
C-B	0.102	0.006		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.6	*
17.15	0.9	*
17.30	1.6	**
17.45	1.7	**
18.00	1.0	*
18.15	0.6	*

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.8	*
17.15	1.2	*
17.30	2.5	***
17.45	2.7	***
18.00	1.3	*
18.15	0.8	*

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.4	
17.15	0.5	
17.30	0.7	*
17.45	0.7	*
18.00	0.5	
18.15	0.4	

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN VEH)
B-C	341.4	227.6	93.5	0.27	93.8	0.27
B-A	288.0	192.0	135.5	0.47	135.6	0.47
C-A	329.1	219.4				
C-B	278.4	185.6	46.5	0.17	46.5	0.17
A-B	250.9	167.3				
A-C	318.1	212.1				

```
I  ALL   I 1805.9 I 1203.9 I   275.9 I    0.15   I      275.9  I    0.15   I
-------------------------------------------------------------------------------
```

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

END OF JOB

****** PICADY 4 run completed.

Appendix M

PICADY Output Data - – Riverview Road / Main Street Junction;

2025 Base plus Committed Development AM Peak Scenarios

```
                         TRL LIMITED

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

                   PICADY 4.1  ANALYSIS PROGRAM
                     RELEASE 3.0 (MAY 2001)

            ADAPTED FROM PICADY/3 WHICH IS CROWN COPYRIGHT
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        ------------------------------------------------------
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                        TRL SOFTWARE BUREAU
           TEL: CROWTHORNE (01344) 770758, FAX: 770864
                 EMAIL: SoftwareBureau@trl.co.uk
        ------------------------------------------------------

 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION


 Run with file:-
 "s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\PICADY\Riverview
junction\
  Final Version Riverview 3005\2025\AM\Riverview final version 2025 AM Base
Deve.vpi"
(drive-on-the-left ) at 13:43:53 on Wednesday, 30 May 2007

  RUN TITLE
  *********
  Ballinasloe Riverview Final Vesion 2025 AM Base Development


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

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

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

 ARM A IS Main Street
 ARM B IS Riverview Road
 ARM C IS Bridge Street
```

```
STREAM LABELLING CONVENTION
---------------------------

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

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

    ETC.


.GEOMETRIC DATA
 -------------


 ------------------------------------------------------------------
 I                 DATA ITEM                 I   MINOR ROAD B    I
 ------------------------------------------------------------------
 I  TOTAL MAJOR ROAD CARRIAGEWAY WIDTH       I ( W  )   6.70 M.  I
 I  CENTRAL RESERVE WIDTH                    I (WCR )   0.00 M.  I
 I                                           I                   I
 I  MAJOR ROAD RIGHT TURN - WIDTH            I (WC-B)   2.20 M.  I
 I                        - VISIBILITY       I (VC-B) 100.0 M.   I
 I                        - BLOCKS TRAFFIC   I           NO      I
 I                                           I                   I
 I  MINOR ROAD - VISIBILITY TO LEFT          I (VB-C)  70.0 M.   I
 I             - VISIBILITY TO RIGHT         I (VB-A)  19.0 M.   I
 I             - LANE 1 WIDTH                I (WB-C)    -       I
 I             - LANE 2 WIDTH                I (WB-A)    -       I
 I             - WIDTH AT  0 M FROM JUNC.    I          4.50 M.  I
 I             - WIDTH AT  5 M FROM JUNC.    I          3.60 M.  I
 I             - WIDTH AT 10 M FROM JUNC.    I          3.50 M.  I
 I             - WIDTH AT 15 M FROM JUNC.    I          3.50 M.  I
 I             - WIDTH AT 20 M FROM JUNC.    I          3.50 M.  I
 I             - LENGTH OF FLARED SECTION    I DERIVED:  0 PCU   I
 ------------------------------------------------------------------


.TRAFFIC DEMAND DATA
 -------------------


 TIME PERIOD BEGINS 08.15 AND ENDS 09.45

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

 DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 -------------------------------------------------------------------------------
 I       I   NUMBER OF MINUTES FROM START WHEN    I    RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
```

	TO RISE	IS REACHED	FALLING	PEAK	OF PEAK	PEAK
ARM A	15.00	45.00	75.00	3.66	5.49	3.66
ARM B	15.00	45.00	75.00	0.08	0.11	0.08
ARM C	15.00	45.00	75.00	2.99	4.45	2.99

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

TIME	FROM/TO	ARM A	ARM B	ARM C
08.15 - 09.45	ARM A	0.000	0.147	0.853
		0.0	43.0	250.0
		(0.0)	(0.0)	(0.0)
	ARM B	0.000	0.000	1.000
		0.0	0.0	6.0
		(0.0)	(0.0)	(0.0)
	ARM C	0.874	0.126	0.000
		209.0	30.0	0.0
		(0.0)	(0.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
B-C	0.08	10.58	0.007		0.0	0.0	0.1	
B-A	0.00	4.67	0.000		0.0	0.0	0.0	
C-A	2.61							
C-B	0.38	9.74	0.039		0.0	0.0	0.6	
A-B	0.54							
A-C	3.13							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.099	0.004			0.010
B-A	0.074	0.004	0.013	0.003	0.005
C-B	0.106	0.004		0.009	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
B-C	0.09	10.43	0.009		0.0	0.0	0.1	
B-A	0.00	4.53	0.000		0.0	0.0	0.0	
C-A	3.12							
C-B	0.45	9.59	0.047		0.0	0.0	0.7	
A-B	0.64							
A-C	3.73							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VISIBILITY VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.097	0.005			0.010

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 I      B-A          0.071      0.005      0.013      0.003         0.005
I
 I      C-B          0.104      0.005                 0.009
I
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------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I         (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                             (RFC)     (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.45-09.00
I
 I   B-C        0.11      10.22    0.011                 0.0     0.0         0.2
I
 I   B-A        0.00       4.34    0.000                 0.0     0.0         0.0
I
 I   C-A        3.82
I
 I   C-B        0.55       9.37    0.059                 0.0     0.1         0.9
I
 I   A-B        0.79
I
 I   A-C        4.57
I
 I
I
 I                  EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:      (.1M)       (.1M)       (.1M)         (M)              (M)
I
 I
I
 I      B-C          0.095      0.006                                     0.010
I
 I      B-A          0.068      0.006      0.013      0.003              0.005
I
 I      C-B          0.102      0.006                 0.009
I
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------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I         (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/   I
 I                                 (RFC)    (PEDS MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I   B-C        0.11      10.22    0.011                 0.0     0.0         0.2
I
 I   B-A        0.00       4.34    0.000                 0.0     0.0         0.0
I
 I   C-A        3.82
I
 I   C-B        0.55       9.37    0.059                 0.1     0.1         0.9
I
 I   A-B        0.79
I
 I   A-C        4.57
I
 I
I
 I                  EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                              MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:      (.1M)       (.1M)       (.1M)         (M)              (M)
I
 I
I
 I      B-C          0.095      0.006                                     0.010
I
 I      B-A          0.068      0.006      0.013      0.003              0.005
I
 I      C-B          0.102      0.006                 0.009
I
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------------------
 I  TIME       DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I         (VEH MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                                 (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I   B-C        0.09      10.43    0.009                 0.0     0.0         0.1
I
 I   B-A        0.00       4.53    0.000                 0.0     0.0         0.0
I
 I   C-A        3.12
I
 I   C-B        0.45       9.59    0.047                 0.1     0.0         0.8
I
 I   A-B        0.64
I
```

A-C	3.73					

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.097	0.005			0.010
B-A	0.071	0.005	0.013	0.003	0.005
C-B	0.104	0.005		0.009	

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH MIN)	DEMAND CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
09.30-09.45								
B-C	0.08	10.58	0.007		0.0	0.0	0.1	
B-A	0.00	4.67	0.000		0.0	0.0	0.0	
C-A	2.61							
C-B	0.38	9.74	0.039		0.0	0.[illegible]	0.6	
A-B	0.54							
A-C	3.13							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.099	0.004			0.010
B-A	0.074	0.004	0.013	0.003	0.005
C-B	0.106	0.004		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.0
09.00	0.0
09.15	0.0
09.30	0.0
09.45	0.0

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.0
09.00	0.0
09.15	0.0
09.30	0.0
09.45	0.0

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.0
09.00	0.1
09.15	0.1
09.30	0.0
09.45	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-C	8.2	5.5	0.8	0.10	0.8	0.10
B-A	0.0	0.0	0.0	0.00	0.0	0.00
C-A	286.6	191.1				

```
I  C-B   I   41.1 I   27.4 I     4.5 I    0.11   I       4.5  I    0.11   I
I  A-B   I   59.0 I   39.3 I         I           I            I           I
I  A-C   I  342.9 I  228.5 I         I           I            I           I
-----------------------------------------------------------------------------
I  ALL   I  737.7 I  491.8 I     5.3 I    0.01   I       5.3  I    0.01   I
-----------------------------------------------------------------------------
```

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

END OF JOB

****** PICADY 4 run completed.

Appendix N

PICADY Output Data - Riverview Road / Main Street Junction;

2025 Post Development AM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS IN NO WAY RELIEVED OF HIS RESPONSIBILITY FOR THE CORRECTNESS OF THE SOLUTION

Run with file:-
"v:\02 Projects\2007\515738 Ballinasloe\001\06 Assessements\PICADY\Riverview junction\Development After 06 18\
TA Sep 07\2025\Riverview TA Sep07 2025 AM Post Deve.vpi"
(drive-on-the-left) at 11:53:56 on Thursday, 20 September 2007

RUN TITLE
****
Ballinasloe Riverview TA Sep 07 2025 AM Post Development

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

INPUT DATA

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

ARM A IS Main Street
ARM B IS Riverview Road
ARM C IS Bridge Street

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM	MINOR ROAD B	
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	6.70 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	100.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	70.0 M.
- VISIBILITY TO RIGHT	(VB-A)	19.0 M.
- LANE 1 WIDTH	(WB-C)	-
- LANE 2 WIDTH	(WB-A)	-
- WIDTH AT 0 M FROM JUNC.		4.50 M.
- WIDTH AT 5 M FROM JUNC.		3.60 M.
- WIDTH AT 10 M FROM JUNC.		3.50 M.
- WIDTH AT 15 M FROM JUNC.		3.50 M.
- WIDTH AT 20 M FROM JUNC.		3.50 M.
- LENGTH OF FLARED SECTION	DERIVED:	0 PCU

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 08.15 AND ENDS 09.45

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN) BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK

```
-------------------------------------------------------------------------------
I ARM A I    15.00   I    45.00   I    75.00   I  3.85  I   5.81  I  3.85 I
I ARM B I    15.00   I    45.00   I    75.00   I  0.93  I   1.39  I  0.93 I
I ARM C I    15.00   I    45.00   I    75.00   I  3.99  I   5.95  I  3.99 I
-------------------------------------------------------------------------------
```

```
-------------------------------------------------------------
I                     I         TURNING PROPORTIONS          I
I                     I         TURNING COUNTS (VEH/HR)      I
I                     I        (PERCENTAGE OF H.V.S)         I
I                     ----------------------------------------
I       TIME          I FROM TO I  ARM A I  ARM B I  ARM C I
-------------------------------------------------------------
I  08.15 - 09.45      I         I        I        I        I
I                     I  ARM A  I  0.000 I  0.203 I  0.797 I
I                     I         I    0.0 I   63.0 I  247.0 I
I                     I         I (  0.0)I (  0.0)I (  0.0)I
I                     I         I        I        I        I
I                     I  ARM B  I  0.230 I  0.000 I  0.770 I
I                     I         I   17.0 I    0.0 I   57.0 I
I                     I         I (  0.0)I (  0.0)I (  0.0)I
I                     I         I        I        I        I
I                     I  ARM C  I  0.646 I  0.354 I  0.000 I
I                     I         I  206.0 I  118.0 I    0.0 I
I                     I         I (  0.0)I (  0.0)I (  0.0)I
I                     I         I        I        I        I
-------------------------------------------------------------
```

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

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------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN     I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 08.15-08.30
I
 I   B-C       0.71     10.22     0.070                 0.0    0.1        1.1
I
 I   B-A       0.21      5.65     0.038                 0.0    0.0        0.6
I
 I   C-A       2.58
I
 I   C-B       1.41      9.69     0.146                 0.0    0.2        2.4
I
 I   A-B       0.79
I
 I   A-C       3.09
I
 I
I
```

```
 I                 EFFECT ON CAPACITY (PCU MIN) OF MARGINAL CHANGES IN:
I
 I                                  MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I    MARGINAL     LANE WIDTH      WIDTH        WIDTH    (AHEAD FOR MAJOR)  TO RIGHT
I
 I     CHANGE:       (.1M)         (.1M)        (.1M)          (M)              (M)
I
 I
I
 I      B-C          0.098         0.004                                      0.010
I
 I      B-A          0.070         0.006        0.015        0.004            0.006
I
 I      C-B          0.105         0.004                     0.009
I
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.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN,    I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 08.30-08.45
I
 I   B-C       0.85     10.05     0.085                 0.1    0.1        1.4
I
 I   B-A       0.25      5.42     0.047                 0.0    0.0        0.7
I
 I   C-A       3.07
I
 I   C-B       1.69      9.53     0.177                 0.2    0.2        3.1
I
 I   A-B       0.94
I
 I   A-C       3.69
I
 I
I
 I                 EFFECT ON CAPACITY (PCU MIN) OF MARGINAL CHANGES IN:
I
 I                                  MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I    MARGINAL     LANE WIDTH      WIDTH        WIDTH    (AHEAD FOR MAJOR)  TO RIGHT
I
 I     CHANGE:       (.1M)         (.1M)        (.1M)          (M)              (M)
I
 I
I
 I      B-C          0.096         0.004                                      0.010
I
 I      B-A          0.069         0.007        0.015        0.003            0.005
I
```

```
 I       C-B          0.104      0.005                   0.009
I
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------------------

.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.45-09.00
I
 I   B-C       1.04       9.81   0.106                 0.1    0.1         1.7
I
 I   B-A       0.31       5.11   0.061                 0.0    0.1         0.9
I
 I   C-A       3.77
I
 I   C-B       2.07       9.31   0.222                 0.2    0.3         4.1
I
 I   A-B       1.15
I
 I   A-C       4.52
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                   MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY                    I
 I      MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:      (.1M)       (.1M)       (.1M)         (M)             (M)
I
 I
I
 I        B-C           0.094      0.005                                  0.010
I
 I        B-A           0.064      0.005      0.015       0.003           0.005
I
 I        C-B           0.101      0.006                  0.009
I
 ------------------------------------------------------------------------------
------------------

.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN    I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I   B-C       1.04       9.81   0.106                 0.1    0.1         1.8
I
 I   B-A       0.31       5.10   0.061                 0.1    0.1         1.0
I
 I   C-A       3.77
I
 I   C-B       2.07       9.31   0.222                 0.3    0.3         4.2
I
 I   A-B       1.15
I
 I   A-C       4.52
I
 I
I
 I                 EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                   MAJOR RD.    CENT RES   VIS TO LEFT
VISIBILITY                    I
 I      MARGINAL   LANE WIDTH    WIDTH       WIDTH     (AHEAD FOR MAJOR)  TO RIGHT
I
 I      CHANGE:      (.1M)       (.1M)       (.1M)         (M)             (M)
I
 I
I
 I        B-C           0.094      0.005                                  0.010
I
 I        B-A           0.064      0.008      0.015       0.003           0.005
I
 I        C-B           0.101      0.006                  0.009
I
 ------------------------------------------------------------------------------
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.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I   B-C       0.85      10.05   0.085                 0.1    0.1         1.4
I
 I   B-A       0.25       5.42   0.047                 0.1    0.0         0.8
I
 I   C-A       3.07
I
 I   C-B       1.69       9.53   0.177                 0.3    0.2         3.3
I
 I   A-B       0.94
I
 I   A-C       3.69
I
```

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.096	0.004			0.010
B-A	0.068	0.007	0.015	0.003	0.005
C-B	0.104	0.005		0.009	

TIME SEGMENT		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN TIME SEGMENT)
09.30-09.45									
	B-C	0.71	10.22	0.070		0.1	0.1	1.2	
	B-A	0.21	5.65	0.038		0.0	0.0	0.6	
	C-A	2.58							
	C-B	1.41	9.69	0.146		0.2	0.2	2.6	
	A-B	0.79							
	A-C	3.09							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.098	0.004			0.010
B-A	0.070	0.006	0.015	0.004	0.006
C-B	0.105	0.004		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.1
08.45	0.1
09.00	0.1
09.15	0.1
09.30	0.1
09.45	0.1

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.0
08.45	0.0
09.00	0.1
09.15	0.1
09.30	0.0
09.45	0.0

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.2
08.45	0.2
09.00	0.3
09.15	0.3
09.30	0.2
09.45	0.2

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * DELAY * (MIN)	* QUEUEING * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * DELAY * (MIN)	* INCLUSIVE QUEUEING * DELAY * (MIN/VEH)
B-C	78.2	52.1	8.5	0.11	5.5	0.11
B-A	23.3	15.5	4.5	0.19	4.5	0.19
C-A	282.5	188.3				
C-B	154.9	103.3	19.9	0.13	19.9	0.13
A-B	86.4	57.6				

```
I  A-C   I  338.7 I  225.8 I          I           I            I           I
-------------------------------------------------------------------------------
I  ALL   I  964.0 I  642.6 I    33.0 I    0.03   I       33.0 I     0.03   I
-------------------------------------------------------------------------------
```

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

END OF JOB

****** PICADY 4 run completed.

Appendix O

PICADY Output Data - – Riverview Road / Main Street Junction;

2025 Base plus Committed Development PM Peak Scenarios

TRL LIMITED

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

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 3.0 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

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Run with file:-
"s:\02 Projects\2007\515739 Ballinasloe\001\06 Assessments\PICADY\Riverview junction\
Final Version Riverview 3005\2025\PM\Riverview final version 2025 PM Base Deve.vpi"
(drive-on-the-left) at 13:51:21 on Wednesday, 30 May 2007

RUN TITLE
****

Ballinasloe Riverview Final Vesion 2025 PM Base Development

.MAJOR MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

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

ARM A IS Main Street
ARM B IS Riverview Road
ARM C IS Bridge Street

STREAM LABELLING CONVENTION

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

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

ETC.

.GEOMETRIC DATA

DATA ITEM		MINOR ROAD B
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	8.70 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	2.20 M.
- VISIBILITY	(VC-B)	100.0 M.
- BLOCKS TRAFFIC		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	70.0 M.
- VISIBILITY TO RIGHT	(VB-A)	19.0 M.
- LANE 1 WIDTH	(WB-C)	-
- LANE 2 WIDTH	(WB-A)	-
- WIDTH AT 0 M FROM JUNC.		4.50 M.
- WIDTH AT 5 M FROM JUNC.		3.60 M.
- WIDTH AT 10 M FROM JUNC.		3.50 M.
- WIDTH AT 15 M FROM JUNC.		3.50 M.
- WIDTH AT 20 M FROM JUNC.		3.50 M.
- LENGTH OF FLARED SECTION	DERIVED:	0 PCU

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

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

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

	NUMBER OF MINUTES FROM START WHEN			RATE OF FLOW (VEH/MIN)		
ARM	FLOW STARTS	TOP OF PEAK	FLOW STOPS	BEFORE	AT TOP	AFTER

```
I       I   TO RISE   I  IS REACHED I  FALLING    I  PEAK  I OF PEAK I PEAK  I
-------------------------------------------------------------------------------
I ARM A I     15.00   I      45.00   I     75.00   I  3.92  I   5.59  I  3.92 I
I ARM B I     15.00   I      45.00   I     75.00   I  1.58  I   2.36  I  1.58 I
I ARM C I     15.00   I      45.00   I     75.00   I  3.90  I   5.85  I  3.90 I
-------------------------------------------------------------------------------
```

```
-------------------------------------------------------------
I                    I        TURNING PROPORTIONS          I
I                    I        TURNING COUNTS (VEH/HR)      I
I                    I       (PERCENTAGE OF H.V.S)         I
I                    ----------------------------------------
I         TIME       I FROM/TO I  ARM A I  ARM B I  ARM C I
-------------------------------------------------------------
I   16.45 - 18.15    I         I        I        I        I
I                    I  ARM A  I  0.000 I  0.124 I  0.876 I
I                    I         I    0.0 I   39.0 I  275.0 I
I                    I         I (  0.0)I (  3.0)I (  3.0)I
I                    I         I        I        I        I
I                    I  ARM B  I  0.278 I  0.000 I  0.722 I
I                    I         I   35.0 I    0.0 I   91.0 I
I                    I         I (  3.0)I (  0.0)I (  3.0)I
I                    I         I        I        I        I
I                    I  ARM C  I  0.917 I  0.083 I  0.000 I
I                    I         I  246.0 I   26.0 I    0.0 I
I                    I         I (  3.0)I (  3.0)I (  0.0)I
I                    I         I        I        I        I
-------------------------------------------------------------
```

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

```
.-----------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/    PEDESTRIAN  START    END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE   QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                               (RFC)     (PEDS/MIN) (VEHS)  (VEHS)    TIME
SEGMENT)  TIME SEGMENT) I
 I 16.45-17.00
I
 I   B-C        1.14      9.55     0.119                 0.0     0.1        1.9
I
 I   B-A        0.44      5.72     0.077                 0.0     0.1        1.2
I
 I   C-A        3.58
I
 I   C-B        0.32      9.39     0.035                 0.0     0.0        0.5
I
 I   A-B        0.49
I
 I   A-C        3.44
I
```

```
 I
I
 I                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                  MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I      MARGINAL   LANE WIDTH     WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:     (.1M)        (.1M)       (.1M)          (M)             (M)
I
 I
I
 I        B-C         0.096       0.004                                     0.010
I
 I        B-A         0.071       0.005       0.016         0.094           0.006
I
 I        C-B         0.105       0.004                     0.009
I
 ----------------------------------------------------------------------------
------------------
```

```
.-----------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/    PEDESTRIAN  START    END       DELAY
GEOMETRIC DELAYI
 I          (VEH MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE   QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                               (RFC)     (PEDS MIN) (VEHS)  (VEHS)    TIME
SEGMENT)  TIME SEGMENT) I
 I 17.00-17.15
I
 I   B-C        1.36      9.35     0.145                 0.1     0.2        2.5
I
 I   B-A        0.52      5.51     0.095                 0.1     0.1        1.5
I
 I   C-A        4.27
I
 I   C-B        0.39      9.21     0.042                 0.0     0.0        0.6
I
 I   A-B        0.58
I
 I   A-C        4.10
I
 I
I
 I                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                  MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I      MARGINAL   LANE WIDTH     WIDTH       WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I       CHANGE:     (.1M)        (.1M)       (.1M)          (M)             (M)
I
 I
I
 I        B-C         0.094       0.005                                     0.010
I
```

```
 I       B-A           0.069      0.007      0.016      0.004           0.006
I
 I       C-B           0.103      0.005                 0.009
I
 ------------------------------------------------------------------------------
------------------

.------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)     (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.15-17.30
I
 I   B-C        1.66       9.07    0.183                0.2    0.2         3.3
I
 I   B-A        0.64       5.22    0.123                0.1    0.1         2.0
I
 I   C-A        5.23
I
 I   C-B        0.48       8.98    0.053                0.0    0.1         0.9
I
 I   A-B        0.71
I
 I   A-C        5.03
I
 I
I
 I                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)        (.1M)         (M)            (M)
I
 I
I
 I       B-C           0.091      0.006                                   0.009
I
 I       B-A           0.065      0.008      0.016      0.003           0.005
I
 I       C-B           0.101      0.006                 0.005
I
 ------------------------------------------------------------------------------
------------------

.------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
 I                              (RFC)     (PEDS MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I   B-C        1.66       9.07    0.183                0.2    0.2         3.3
I
 I   B-A        0.64       5.21    0.123                0.1    0.1         2.1
I
 I   C-A        5.23
I
 I   C-B        0.48       8.98    0.053                0.1    0.1         0.8
I
 I   A-B        0.71
I
 I   A-C        5.03
I
 I
I
 I                EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:
I
 I                                MAJOR RD.    CENT RES  VIS TO LEFT
VISIBILITY                 I
 I     MARGINAL   LANE WIDTH    WIDTH        WIDTH     (AHEAD FOR MAJOR) TO RIGHT
I
 I      CHANGE:     (.1M)       (.1M)        (.1M)         (M)            (M)
I
 I
I
 I       B-C           0.091      0.006                                   0.009
I
 I       B-A           0.065      0.008      0.016      0.003           0.005
I
 I       C-B           0.101      0.006                 0.008
I
 ------------------------------------------------------------------------------
------------------

.------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH MIN)  (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                              (RFC)     (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I   B-C        1.36       9.35    0.145                0.2    0.2         2.6
I
 I   B-A        0.52       5.51    0.095                0.1    0.1         1.6
I
 I   C-A        4.27
I
 I   C-B        0.39       9.21    0.042                0.1    0.0         0.7
I
 I   A-B        0.58
I
```

I	A-C	4.10

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.094	0.005			0.010
B-A	0.069	0.007	0.016	0.004	0.006
C-B	0.103	0.005		0.029	

I TIME SEGMENT I 18.00-18.15	DEMAND (VEH/MIN)	CAPACITY (VEH MIN)	DEMAND CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN TIME SEGMENT)	GEOMETRIC DELAY I (VEH.MIN/ TIME SEGMENT) I
B-C	1.14	9.55	0.119		0.2	0.1	2.1	
B-A	0.44	5.72	0.077		0.1	0.1	1.3	
C-A	3.55							
C-B	0.32	9.32	0.035		0.0	0.0	0.6	
A-B	0.49							
A-C	3.44							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.096	0.004			0.010
B-A	0.071	0.006	0.016	0.004	0.006
C-B	0.105	0.004		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.1
17.15	0.2
17.30	0.2
17.45	0.2
18.00	0.2
18.15	0.1

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.1
17.15	0.1
17.30	0.1
17.45	0.1
18.00	0.1
18.15	0.1

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.0
17.15	0.0
17.30	0.1
17.45	0.1
18.00	0.0
18.15	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-C	124.8	83.2	15.7	0.13	15.7	0.13
B-A	48.0	32.0	9.7	0.20	9.7	0.20
C-A	392.2	261.4				

C-B	35.7	23.8	4.0	0.11	4.0	0.11
A-B	53.5	35.7				
A-C	377.1	251.4				
ALL	1031.2	687.4	29.5	0.03	29.5	0.03

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

END OF JOB

****** FICADY 4 run completed.

Appendix P

PICADY Output Data - Riverview Road / Main Street Junction;

2025 Post Development PM Peak Scenarios

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                        TRL LIMITED

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

                 PICADY 4.1  ANALYSIS PROGRAM
                   RELEASE 3.0 (MAY 2001)

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Run with file:-
"e:\luna\PICADY\TA Sep 07\2025\Riverview TA Sep 07 2025 PM Post Deve.vpi"
(drive-on-the-left ) at 21:38:52 on Monday, 17 September 2007

 RUN TITLE
 *********
 Ballinasloe Riverview TA Sep 07 2025 PM Post Development


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

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

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

ARM A IS Main Street
ARM B IS Riverview Road
ARM C IS Bridge Street


STREAM LABELLING CONVENTION
---------------------------

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

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

       ETC.


.GEOMETRIC DATA
 -------------


 ------------------------------------------------------------------
 I                  DATA ITEM                I   MINOR ROAD B    I
 ------------------------------------------------------------------
 I  TOTAL MAJOR ROAD CARRIAGEWAY WIDTH       I ( W  )   8.70 M.  I
 I  CENTRAL RESERVE WIDTH                    I (WCR )   0.00 M.  I
 I                                           I                   I
 I  MAJOR ROAD RIGHT TURN - WIDTH            I (WC-B)   2.20 M.  I
 I                        - VISIBILITY       I (VC-B) 100.0 M.   I
 I                        - BLOCKS TRAFFIC   I          NO       I
 I                                           I                   I
 I  MINOR ROAD - VISIBILITY TO LEFT          I (VB-C)  70.0 M.   I
 I             - VISIBILITY TO RIGHT         I (VB-A)  19.0 M.   I
 I             - LANE 1 WIDTH                I (WB-C)    -       I
 I             - LANE 2 WIDTH                I (WB-A)    -       I
 I             - WIDTH AT  0 M FROM JUNC.    I          4.50 M.  I
 I             - WIDTH AT  5 M FROM JUNC.    I          3.60 M.  I
 I             - WIDTH AT 10 M FROM JUNC.    I          3.50 M.  I
 I             - WIDTH AT 15 M FROM JUNC.    I          3.50 M.  I
 I             - WIDTH AT 20 M FROM JUNC.    I          3.50 M.  I
 I             - LENGTH OF FLARED SECTION    I DERIVED:  0 PCU   I
 ------------------------------------------------------------------


.TRAFFIC DEMAND DATA
 -------------------


 TIME PERIOD BEGINS 16.45 AND ENDS 18.15

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

 DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 ---------------------------------------------------------------------------------
 I       I   NUMBER OF MINUTES FROM START WHEN     I   RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
 I       I   TO RISE   I IS REACHED I   FALLING   I  PEAK  I OF PEAK I PEAK  I
 ---------------------------------------------------------------------------------
 I ARM A I    15.00    I    45.00    I    75.00    I  4.28  I   6.41  I  4.28 I
```

ARM B	15.00	45.00	75.00	4.26	0.39	4.26
ARM C	15.00	45.00	75.00	5.79	5.68	5.79

TIME	FROM/TO	ARM A	ARM B	ARM C
		TURNING PROPORTIONS TURNING COUNTS (VEH/HR) (PERCENTAGE OF H.V.S)		
16.45 - 18.15	ARM A	0.000 0.0 (0.0)	0.222 76.0 (0.0)	0.778 266.0 (0.0)
	ARM B	0.261 89.0 (0.0)	0.000 0.0 (0.0)	0.739 252.0 (0.0)
	ARM C	0.592 274.0 (0.0)	0.408 189.0 (0.0)	0.000 0.0 (0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
16.45-17.00								
B-C	3.15	9.59	0.328		0.0	0.5	6.9	
B-A	1.11	5.38	0.207		0.0	0.3	3.6	
C-A	3.42							
C-B	2.36	9.61	0.246		0.0	0.3	4.6	
A-B	0.95							
A-C	3.35							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.093	0.004			0.009
B-A	0.066	0.008	0.015	0.003	0.005
C-B	0.105	0.005		0.009	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.00-17.15								
B-C	3.76	9.29	0.405		0.5	0.7	9.6	
B-A	1.33	5.07	0.262		0.3	0.3	5.0	
C-A	4.09							
C-B	2.82	9.43	0.299		0.3	0.4	6.1	
A-B	1.13							
A-C	3.97							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.090	0.005			0.009
B-A	0.062	0.009	0.015	0.003	0.005
C-B	0.103	0.005		0.009	

TIME SEGMENT		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.15-17.30									
	B-C	4.61	9.57	0.520		0.7	1.0	14.9	
	B-A	1.63	4.65	0.350		0.3	0.5	7.4	
	C-A	5.01							
	C-B	3.46	9.18	0.376		0.4	0.6	8.6	
	A-B	1.39							
	A-C	4.86							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.086	0.005			0.009
B-A	0.057	0.011	0.015	0.003	0.005
C-B	0.100	0.007		0.008	

TIME SEGMENT		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.30-17.45									
	B-C	4.61	8.86	0.520		1.0	1.1	15.9	
	B-A	1.63	4.65	0.350		0.5	0.5	7.9	
	C-A	5.01							
	C-B	3.46	9.18	0.376		0.6	0.6	8.9	
	A-B	1.39							
	A-C	4.86							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	VISIBILITY TO RIGHT (M)
B-C	0.086	0.005			0.009
B-A	0.057	0.011	0.015	0.003	0.005
C-B	0.100	0.007		0.008	

TIME SEGMENT		DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.45-18.00									
	B-C	3.76	9.28	0.405		1.1	0.7	10.9	
	B-A	1.33	5.07	0.262		0.5	0.4	5.7	
	C-A	4.09							
	C-B	2.82	9.43	0.299		0.6	0.4	6.7	
	A-B	1.13							
	A-C	3.97							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.090	0.005			0.009
B-A	0.062	0.009	0.015	0.003	0.005
C-B	0.103	0.005		0.009	

TIME SEGMENT)	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
18.00-18.15								
B-C	3.15	9.58	0.329		0.7	0.5	7.7	
B-A	1.11	5.37	0.207		0.4	0.3	4.2	
C-A	3.42							
C-B	2.36	9.61	0.246		0.4	0.3	5.1	
A-B	0.95							
A-C	3.33							

EFFECT ON CAPACITY (PCU/MIN) OF MARGINAL CHANGES IN:

VISIBILITY MARGINAL CHANGE:	LANE WIDTH (.1M)	MAJOR RD. WIDTH (.1M)	CENT RES WIDTH (.1M)	VIS TO LEFT (AHEAD FOR MAJOR) (M)	TO RIGHT (M)
B-C	0.093	0.004			0.009
B-A	0.066	0.008	0.015	0.003	0.005
C-B	0.105	0.005		0.009	

QUEUE FOR STREAM B-C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.5	
17.15	0.7	*
17.30	1.0	*
17.45	1.1	*
18.00	0.7	*
18.15	0.5	

QUEUE FOR STREAM B-A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.3	
17.15	0.3	
17.30	0.5	*
17.45	0.5	*
18.00	0.4	
18.15	0.3	

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.3	
17.15	0.4	
17.30	0.6	*
17.45	0.6	*
18.00	0.4	
18.15	0.3	

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-C	345.5	230.4	65.9	0.19	66.0	0.19
B-A	122.0	81.4	33.8	0.28	33.8	0.28
C-A	375.7	250.5				
C-B	259.2	172.8	40.1	0.15	40.1	0.15
A-B	104.2	69.5				
A-C	364.7	243.2				

```
I  ALL   I 1571.4 I 1047.6 I   139.8 I    0.09   I      139.9  I    0.09   I
--------------------------------------------------------------------------

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


 END OF JOB

 ****** PICADY 4 run completed.
```

Appendix Q

ARCADY Output Data – N6 / Bridge Street Junction;

2010 Base plus Committed Development Traffic AM Peak Scenarios

```
                         TRL LIMITED

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         CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

                  ARCADY 5.0  ANALYSIS PROGRAM
                    RELEASE 1.1 (MAY 2001)

           ADAPTED FROM ARCADY/3 WHICH IS CROWN COPYRIGHT
             BY PERMISSION OF THE CONTROLLER OF HMSO

        ------------------------------------------------------
              FOR SALES AND DISTRIBUTION INFORMATION,
              PROGRAM ADVICE AND MAINTENANCE CONTACT:
                       TRL SOFTWARE BUREAU
           TEL: CROWTHORNE (01344) 770758, FAX: 770864
                 EMAIL: SoftwareBureau@trl.co.uk
        ------------------------------------------------------

 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION


 Run with file:-
 "s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\ARCADY\N6 Bridge St
Opt2\
  Final Version N6 Bridge Street 3005\2010\AM\N6_Bridge Street 2010 AM Base
Deve.vai"
(drive-on-the-left ) at 14:14:12 on Wednesday, 30 May 2007

.ROUNDABOUT CAPACITY AND DELAY
 *****************************


.RUN TITLE
 *********
  Ballinasloe N6/Bridge Street Final Version 2010 AM Base Development


.INPUT DATA
 **********
 ARM A - Bridge St
 ARM B - N6 East
 ARM C - N6 South

.GEOMETRIC DATA
 --------------


 -------------------------------------------------------------------------------
---------------------------------------
 I ARM    I   V (M)    I    E (M)    I     L (M)    I     R (M)    I    D (M)    I    PHI
(DEG)  I  SLOPE  I INTERCEPT (PCU/MIN) I
 -------------------------------------------------------------------------------
---------------------------------------
 I ARM A I    2.92    I     3.01    I     0.10    I    21.00    I   19.00    I
25.0     I  0.507  I        15.156         I
 I ARM B I    3.40    I     6.02    I    41.00    I    20.00    I   19.00    I
22.0     I  0.681  I        28.936         I
 I ARM C I    5.00    I     6.60    I    60.00    I    10.00    I   19.00    I
32.0     I  0.679  I        30.869         I
 -------------------------------------------------------------------------------
---------------------------------------

 V = approach half-width        L = effective flare length           D =
inscribed circle diameter
 E = entry width                R = entry radius                     PHI = entry
angle

 **WARNING** ARM B: Effective flare length is outside normal range.
  Treat capacities with increasing caution.
 **WARNING** ARM C: Effective flare length is outside normal range.
  Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA
 -------------------


.TIME PERIOD BEGINS 08.15 AND ENDS 09.45
.LENGTH OF TIME PERIOD  -  90   MINUTES.
 LENGTH OF TIME SEGMENT -  15   MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 -------------------------------------------------------------------------------
 I       I   NUMBER OF MINUTES FROM START WHEN    I   RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
 I       I   TO RISE   I IS REACHED IFALLING     I  PEAK  I OF PEAK I PEAK  I
 -------------------------------------------------------------------------------
 I ARM A I    15.00    I    45.00    I    75.00   I  2.50  I   3.75  I  2.50 I
 I ARM B I    15.00    I    45.00    I    75.00   I  7.66  I  11.51  I  7.68 I
 I ARM C I    15.00    I    45.00    I    75.00   I  5.96  I   8.94  I  5.96 I
 -------------------------------------------------------------------------------


.-------------------------------------------------------------------
 I                      I          TURNING PROPORTIONS             I
 I                      I          TURNING COUNTS (VEH/HR)         I
 I                      I         (PERCENTAGE OF H.V.S)            I
 I                      --------------------------------------------
 I         TIME         I FROM/TO I  ARM A I  ARM B I  ARM C I
 -------------------------------------------------------------------
 I   08.15 - 09.45      I         I        I        I        I
 I                      I  ARM A  I  0.000 I  0.960 I  0.040 I
 I                      I         I    0.0 I  192.0 I    8.0 I
 I                      I         I (  0.0)I (  3.0)I (  3.0)I
 I                      I         I        I        I        I
 I                      I  ARM B  I  0.287 I  0.000 I  0.713 I
 I                      I         I  176.0 I    0.0 I  438.0 I
 I                      I         I (  3.0)I (  0.0)I (  3.0)I
 I                      I         I        I        I        I
```

```
I                   I  ARM C  I  0.092 I  0.908 I  0.000 I
I                   I         I   44.0 I  433.0 I    0.0 I
I                   I         I (  3.0)I (  3.0)I (  0.0)I
I                   I         I        I        I        I
-------------------------------------------------------------
TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

.        QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
         --------------------------------------------------------

.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT)  I
 I 08.15-08.30
I
 I ARM A       2.50     11.98    0.209                  0.0     0.3       3.8
I
 I ARM B       7.68     28.03    0.274                  0.0     0.4       5.5
I
 I ARM C       5.96     28.49    0.209                  0.0     0.3       3.9
I
 I
I
 --------------------------------------------------------------------------------
------------------
.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT)  I
 I 08.30-08.45
I
 I ARM A       2.99     11.44    0.261                  0.3     0.4       5.1
I
 I ARM B       9.16     28.01    0.327                  0.4     0.5       7.1
I
 I ARM C       7.12     28.19    0.253                  0.3     0.3       5.0
I
 I
I
 --------------------------------------------------------------------------------
------------------
.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN    I
```

```
 I                                (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT)  I
 I 08.45-09.00
I
 I ARM A       3.66     10.70    0.342                  0.3     0.5       7.4
I
 I ARM B      11.22     27.99    0.401                  0.5     0.7       9.8
I
 I ARM C       8.72     27.79    0.314                  0.3     0.5       6.7
I
 I
I
 --------------------------------------------------------------------------------
------------------
.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN
(VEH.MIN,   I
 I                                (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT)  I
 I 09.00-09.15
I
 I ARM A       3.66     10.70    0.342                  0.5     0.5       7.7
I
 I ARM B      11.22     27.99    0.401                  0.7     0.7      10.0
I
 I ARM C       8.72     27.79    0.314                  0.5     0.5       6.8
I
 I
I
 --------------------------------------------------------------------------------
------------------
.--------------------------------------------------------------------------------
------------------
 I  TIME       DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN)  (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN,
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT)  I
 I 09.15-09.30
I
 I ARM A       2.99     11.43    0.261                  0.5     0.4       5.5
I
 I ARM B       9.16     28.01    0.327                  0.7     0.5       7.5
I
 I ARM C       7.12     28.18    0.253                  0.5     0.3       5.2
I
 I
I
 --------------------------------------------------------------------------------
------------------
.--------------------------------------------------------------------------------
------------------
```

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
09.30-09.45								
ARM A	2.50	11.97	0.209		0.4	0.3	4.1	
ARM B	7.68	28.03	0.274		0.5	0.4	5.8	
ARM C	5.96	25.48	0.209		0.3	0.3	4.0	

.QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.3
08.45	0.3
09.00	0.5 *
09.15	0.5 *
09.30	0.4
09.45	0.3

.QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.4
08.45	0.5
09.00	0.7 *
09.15	0.7 *
09.30	0.5
09.45	0.4

.QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.3
08.45	0.3
09.00	0.5
09.15	0.5
09.30	0.3
09.45	0.3

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
A	274.2	182.8	33.7	0.12	33.7	0.12
B	841.9	561.3	45.7	0.05	45.7	0.05
C	654.1	436.0	31.6	0.05	31.6	0.05
ALL	1770.2	1180.2	111.0	0.06	111.0	0.06

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

END OF JOB

****** ARCADY 5 run completed.

Appendix R

ARCADY Output Data – N6 / Bridge Street Junction;

2010 Post Development Traffic AM Peak Scenarios

TRL LIMITED

CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM
RELEASE 1.1 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770755, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"v:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\ARCADY\N6 Bridge St Opt2\Development After 06 18\
TA Sep 07\2010\N6_Bridge Street TA Sep07 2010 AM Post Deve.vai"
(drive-on-the-left) at 11:56:46 on Thursday, 20 September 2007

.ROUNDABOUT CAPACITY AND DELAY

.RUN TITLE

Ballinasloe N6/Bridge Street TA Sep07 2010 AM Post Development

.INPUT DATA

ARM A - Bridge St
ARM B - N6 East
ARM C - N6 South

.GEOMETRIC DATA

ARM	V (M)	E (M)	L (M)	R (M)	D (M)	PHI (DEG)	SLOPE	INTERCEPT (PCU/MIN)
ARM A	2.92	3.01	0.10	21.00	19.00	25.0	0.507	15.156
ARM B	3.40	6.02	41.00	20.00	19.00	22.0	0.681	28.936
ARM C	5.00	6.60	60.00	10.00	19.00	32.0	0.679	30.869

V = approach half-width L = effective flare length D = inscribed circle diameter
E = entry width R = entry radius PHI = entry angle

WARNING ARM B: Effective flare length is outside normal range.
Treat capacities with increasing caution.
WARNING ARM C: Effective flare length is outside normal range.
Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA

.TIME PERIOD BEGINS 08.15 AND ENDS 09.45
.LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	3.78	5.66	3.78
ARM B	15.00	45.00	75.00	8.31	12.47	8.31
ARM C	15.00	45.00	75.00	6.30	9.45	6.30

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

TIME	FROM/TO	ARM A	ARM B	ARM C
08.15 - 09.45				
	ARM A	0.000	0.917	0.083
		0.0	277.0	25.0
		(0.0)	(3.0)	(3.0)
	ARM B	0.350	0.000	0.650
		233.0	0.0	432.0
		(3.0)	(0.0)	(3.0)

```
I                    I  ARM C  I  0.151 I  0.849 I  0.000 I
I                    I         I   76.0 I  428.0 I    0.0 I
I                    I         I (  3.0)I (  3.0)I (  0.0)I
I                    I         I        I        I        I
------------------------------------------------------------
TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

.         QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
          ------------------------------------------------------

.-------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I           (VEH/MIN) (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/    I
 I                                (RFC)    (PEDS MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.15-08.30
I
 I ARM A       3.78     12.01    0.314                  0.0    0.5         6.5
I
 I ARM B       8.31     27.88    0.298                  0.0    0.4         6.2
I
 I ARM C       6.30     28.00    0.225                  0.0    0.3         4.3
I
 I
I
 -------------------------------------------------------------------------------
-----------------
.-------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I           (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.30-08.45
I
 I ARM A       4.51     11.47    0.393                  0.5    0.6         9.2
I
 I ARM B       9.93     27.84    0.357                  0.4    0.6         8.1
I
 I ARM C       7.52     27.61    0.272                  0.3    0.4         5.5
I
 I
I
 -------------------------------------------------------------------------------
-----------------
.-------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I           (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN     I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.45-09.00
I
 I ARM A       5.52     10.75    0.514                  0.6    1.0        14.7
I
 I ARM B      12.16     27.78    0.438                  0.6    0.8        11.3
I
 I ARM C       9.21     27.08    0.340                  0.4    0.5         7.6
I
 I
I
 -------------------------------------------------------------------------------
-----------------
.-------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I           (VEH/MIN) (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN
(VEH.MIN,    I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I ARM A       5.52     10.74    0.514                  1.0    1.0        15.6
I
 I ARM B      12.16     27.78    0.438                  0.8    0.5        11.6
I
 I ARM C       9.21     27.05    0.340                  0.5    0.5         7.7
I
 I
I
 -------------------------------------------------------------------------------
-----------------
.-------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I           (VEH MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                                (RFC)    (PEDS MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I ARM A       4.51     11.47    0.393                  1.0    0.7        10.3
I
 I ARM B       9.93     27.84    0.357                  0.8    0.6         8.5
I
 I ARM C       7.52     27.61    0.273                  0.5    0.4         5.7
I
 I
I
 -------------------------------------------------------------------------------
-----------------
.-------------------------------------------------------------------------------
-----------------
```

TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
09.30-09.45								
ARM A	3.78	12.00	0.315		0.7	0.5	7.2	
ARM B	8.31	27.88	0.298		0.6	0.4	6.5	
ARM C	6.30	27.99	0.225		0.4	0.3	4.4	

.QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.5
08.45	0.6 *
09.00	1.0 *
09.15	1.0 *
09.30	0.7 *
09.45	0.5

.QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.4
08.45	0.6 *
09.00	0.9 *
09.15	0.8 *
09.30	0.6 *
09.45	0.4

.QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.30	0.3
08.45	0.4
09.00	0.5 *
09.15	0.5 *
09.30	0.4
09.45	0.3

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
A	414.1	276.1	63.5	0.15	63.5	0.15
B	911.9	607.9	52.3	0.06	52.3	0.06
C	691.1	460.7	35.2	0.05	35.2	0.05
ALL	2017.1	1344.7	151.0	0.07	151.0	0.07

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

END OF JOB

****** ARCADY 5 run completed.

Appendix S

ARCADY Output Data – N6 / Bridge Street Junction;

2010 Base plus Committed Development Traffic PM Peak Scenarios

TRL LIMITED

CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM
RELEASE 1.1 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\ARCADY\N6 Bridge St Opt2\
Final Version N6 Bridge Street 3005\2010\PM\N6_Bridge Street 2010 PM Base Deve.vai"
(drive-on-the-left) at 14:21:36 on Wednesday, 30 May 2007

.ROUNDABOUT CAPACITY AND DELAY

.RUN TITLE

Ballinasloe N6/Bridge Street Final Version 2010 PM Base Development

.INPUT DATA

ARM A - Bridge St
ARM B - N6 East
ARM C - N6 South

.GEOMETRIC DATA

ARM	V (M)	E (M)	L (M)	R (M)	D (M)	PHI (DEG)	SLOPE	INTERCEPT (PCU/MIN)
ARM A	2.92	3.01	0.10	21.00	19.00	25.0	0.507	15.156
ARM B	3.40	6.02	41.00	20.00	19.00	22.0	0.681	28.936
ARM C	5.00	6.60	60.00	10.00	19.00	32.0	0.679	30.869

V = approach half-width L = effective flare length D = inscribed circle diameter
E = entry width R = entry radius PHI = entry angle

WARNING ARM B: Effective flare length is outside normal range.
Treat capacities with increasing caution.
WARNING ARM C: Effective flare length is outside normal range.
Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA

.TIME PERIOD BEGINS 16.45 AND ENDS 18.15
.LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	3.60	5.40	3.60
ARM B	15.00	45.00	75.00	8.74	13.11	8.74
ARM C	15.00	45.00	75.00	6.15	9.23	6.15

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

TIME	FROM/TO	ARM A	ARM B	ARM C
16.45 - 18.15				
	ARM A	0.000	0.983	0.017
		0.0	283.0	5.0
		(0.0)	(3.0)	(3.0)
	ARM B	0.339	0.000	0.661
		237.0	0.0	462.0
		(3.0)	(0.0)	(3.0)

```
I                    I  ARM C  I  0.091 I  0.909 I  0.000 I
I                    I         I   45.0 I  447.0 I    0.0 I
I                    I         I (  3.0)I (  3.0)I (  0.0)I
I                    I         I        I        I        I
-------------------------------------------------------------
TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

.        QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
         ----------------------------------------------------

.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
 I                               (RFC)    (PEDS MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 16.45-17.00
I
 I ARM A       3.60     11.59   0.303                  0.0    0.4        6.2
I
 I ARM B       5.74     28.05   0.311                  0.0    0.5        6.6
I
 I ARM C       6.15     27.97   0.220                  0.0    0.3        4.1
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH,MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS,MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.00-17.15
I
 I ARM A       4.30     11.33   0.379                  0.4    0.6        8.7
I
 I ARM B      10.43     28.04   0.372                  0.5    0.6        8.7
I
 I ARM C       7.34     27.57   0.266                  0.3    0.4        5.3
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN    I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.15-17.30
I
 I ARM A       5.26     10.57   0.498                  0.6    1.0       13.8
I
 I ARM B      12.78     28.03   0.456                  0.6    0.8       12.2
I
 I ARM C       8.99     27.03   0.333                  0.4    0.5        7.3
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN
(VEH.MIN,   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I ARM A       5.26     10.57   0.498                  1.0    1.0       14.6
I
 I ARM B      12.78     28.03   0.456                  0.8    0.8       12.5
I
 I ARM C       8.99     27.03   0.333                  0.5    0.5        7.5
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN,
(VEH.MIN/   I
 I                               (RFC)    (PEDS MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I ARM A       4.30     11.32   0.380                  1.0    0.6        9.7
I
 I ARM B      10.43     28.04   0.372                  0.8    0.6        9.1
I
 I ARM C       7.34     27.57   0.266                  0.5    0.4        5.6
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
```

```
 I  TIME       DEMAND  CAPACITY  DEMAND/    PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                                (RFC)     (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 18.00-18.15
I
 I ARM A       3.60      11.85   0.303                   0.6    0.4          6.8
I
 I ARM B       8.74      28.05   0.311                   0.6    0.5          6.9
I
 I ARM C       6.15      27.96   0.220                   0.4    0.3          4.3
I
 I
I
---------------------------------------------------------------------------------
-----------------

.QUEUE AT ARM A
 -------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00          0.4
   17.15          0.6  *
   17.30          1.0  *
   17.45          1.0  *
   18.00          0.6  *
   18.15          0.4

.QUEUE AT ARM B
 -------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00          0.5
   17.15          0.6  *
   17.30          0.8  *
   17.45          0.8  *
   18.00          0.6  *
   18.15          0.5

.QUEUE AT ARM C
 -------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00          0.3
   17.15          0.4
   17.30          0.5
   17.45          0.5
   18.00          0.4
   18.15          0.3

.               QUEUEING DELAY INFORMATION OVER WHOLE PERIOD
                --------------------------------------------

 -------------------------------------------------------------------------------
 I  ARM  I   TOTAL DEMAND  I     * QUEUEING *     I  * INCLUSIVE QUEUEING *  I
 I       I                 I      * DELAY *       I         * DELAY *        I
 I       I-----------------------------------------------------------------I
 I       I  (VEH)   (VEH/H) I  (MIN)    (MIN/VEH) I    (MIN)      (MIN/VEH)  I
 -------------------------------------------------------------------------------
 I   A   I  394.9 I  263.3 I    59.9 I     0.15   I     59.9  I     0.15    I
 I   B   I  958.5 I  639.0 I    56.0 I     0.06   I     56.0  I     0.06    I
 I   C   I  674.6 I  449.8 I    34.1 I     0.05   I     34.1  I     0.05    I
 -------------------------------------------------------------------------------
 I  ALL  I 2028.0 I 1352.0 I   150.1 I     0.07   I    150.1  I     0.07    I
 -------------------------------------------------------------------------------

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

 END OF JOB

 ****** ARCADY 5 run completed.
```

Appendix T

ARCADY Output Data – N6 / Bridge Street Junction;

2010 Post Development Traffic PM Peak Scenarios

```
                          TRL LIMITED

                 (C) COPYRIGHT 1990,1996,2000

          CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

                  ARCADY 5.0  ANALYSIS PROGRAM
                     RELEASE 1.1 (MAY 2001)

          ADAPTED FROM ARCADY/3 WHICH IS CROWN COPYRIGHT
             BY PERMISSION OF THE CONTROLLER OF HMSO

    --------------------------------------------------------------
            FOR SALES AND DISTRIBUTION INFORMATION,
            PROGRAM ADVICE AND MAINTENANCE CONTACT:
                       TRL SOFTWARE BUREAU
          TEL: CROWTHORNE (01344) 770758, FAX: 770864
               EMAIL: SoftwareBureau@trl.co.uk
    --------------------------------------------------------------


 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION


 Run with file:-
 "e:\luna\ARCADY\TA Sep 07\2010\N6_Bridge Street TA Sep07 2010 PM Post Deve.vai"
(drive-on-the-left ) at 21:04:54 on Monday, 17 September 2007

.ROUNDABOUT CAPACITY AND DELAY
 *****************************


.RUN TITLE
 *********
  Ballinasloe N6 Bridge Street TA Sep07 2010 PM Post Development


.INPUT DATA
 **********
 ARM A - Bridge St
 ARM B - N6 East
 ARM C - N6 South

.GEOMETRIC DATA
 --------------


--------------------------------------------------------------------------------
----------------------------------------
 I ARM   I   V (M)   I    E (M)   I    L (M)   I    R (M)   I   D (M)   I   PHI
(DEG)  I  SLOPE  I INTERCEPT (PCU MIN) I
--------------------------------------------------------------------------------
----------------------------------------
 I ARM A I    2.92   I     3.01   I     0.10   I    21.00   I   19.00   I
25.0     I  0.507  I       15.156         I
 I ARM B I    3.40   I     6.02   I    41.00   I    20.00   I   19.00   I
22.0     I  0.681  I       28.936         I
 I ARM C I    5.00   I     6.60   I    60.00   I    10.00   I   19.00   I
32.0     I  0.679  I       30.869         I
--------------------------------------------------------------------------------
----------------------------------------

 V = approach half-width         L = effective flare length             D =
inscribed circle diameter
 E = entry width                 R = entry radius                       PHI = entry
angle

 **WARNING** ARM B: Effective flare length is outside normal range.
  Treat capacities with increasing caution.
 **WARNING** ARM C: Effective flare length is outside normal range.
  Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA
 -------------------


.TIME PERIOD BEGINS 16.45 AND ENDS 18.15
.LENGTH OF TIME PERIOD  -  90    MINUTES.
 LENGTH OF TIME SEGMENT -  15    MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 -------------------------------------------------------------------------------
 I       I   NUMBER OF MINUTES FROM START WHEN     I   RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
 I       I   TO RISE   I  IS REACHED IFALLING     I  PEAK  I OF PEAK I PEAK  I
 -------------------------------------------------------------------------------
 I ARM A I     15.00   I    45.00    I    75.00   I  5.64  I   5.46  I  5.64 I
 I ARM B I     15.00   I    45.00    I    75.00   I  9.88  I  14.81  I  9.88 I
 I ARM C I     15.00   I    45.00    I    75.00   I  6.68  I  10.01  I  6.68 I
 -------------------------------------------------------------------------------


.------------------------------------------------------------
 I                       I        TURNING PROPORTIONS           I
 I                       I        TURNING COUNTS (VEH/HR)       I
 I                       I        (PERCENTAGE OF H.V.S)         I
 I                       ----------------------------------------
 I        TIME           I FROM/TO I  ARM A I  ARM B I  ARM C I
 ------------------------------------------------------------
 I  16.45 - 18.15        I         I        I        I        I
 I                       I  ARM A  I  0.000 I  0.885 I  0.115 I
 I                       I         I    0.0 I  399.0 I   52.0 I
 I                       I         I (  0.0)I (  3.0)I (  3.0)I
 I                       I         I        I        I        I
 I                       I  ARM B  I  0.438 I  0.000 I  0.562 I
 I                       I         I  346.0 I    0.0 I  444.0 I
 I                       I         I (  3.0)I (  0.0)I (  3.0)I
 I                       I         I        I        I        I
 I                       I  ARM C  I  0.197 I  0.803 I  0.000 I
 I                       I         I  105.0 I  429.0 I    0.0 I
```

```
 I                    I         I :  3.0)I ,  3.0)I (  0.0)I
 I                    I         I        I        I        I
 -------------------------------------------------------------
 TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
 THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

 .        QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
          ---------------------------------------------------------

.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 16.45-17.00
I
 I ARM A       5.64     12.00    0.470                 0.0    0.9       12.3
I
 I ARM B       9.88     27.66    0.357                 0.0    0.6        5.1
I
 I ARM C       6.68     27.05    0.247                 0.0    0.3        4.8
I
 I
I
 --------------------------------------------------------------------------------
-----------------
.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.00-17.15
I
 I ARM A       6.73     11.47    0.587                 0.9    1.4       19.5
I
 I ARM B      11.79     27.57    0.428                 0.6    0.7       10.9
I
 I ARM C       7.97     26.47    0.301                 0.3    0.4        6.3
I
 I
I
 --------------------------------------------------------------------------------
-----------------
.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.15-17.30
I
 I ARM A       8.24     10.74    0.768                 1.4    3.0       39.8
I
 I ARM B      14.44     27.45    0.526                 0.7    1.1       16.0
I
 I ARM C       9.76     25.68    0.380                 0.4    0.6        9.0
I
 I
I
 --------------------------------------------------------------------------------
-----------------
.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN    I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I ARM A       8.24     10.73    0.768                 3.0    3.1       46.2
I
 I ARM B      14.44     27.45    0.526                 1.1    1.1       16.5
I
 I ARM C       9.76     25.68    0.380                 0.6    0.6        9.2
I
 I
I
 --------------------------------------------------------------------------------
-----------------
.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS) (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I ARM A       6.73     11.46    0.587                 3.1    1.5       23.9
I
 I ARM B      11.79     27.56    0.428                 1.1    0.5       11.6
I
 I ARM C       7.97     26.46    0.301                 0.6    0.4        6.6
I
 I
I
 --------------------------------------------------------------------------------
-----------------
.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
```

```
 I          (VEH/MIN) (VEH MIN) CAPACITY       FLOW      QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/   I
 I                             (RFC)      (PEDS MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 18.00-18.15
I
 I ARM A      5.64     11.99   0.470                 1.5    0.9       14.2
I
 I ARM B      9.58     27.65   0.357                 0.8    0.6        8.5
I
 I ARM C      6.68     27.03   0.247                 0.4    0.3        5.0
I
 I
I
 ---------------------------------------------------------------------------
-----------------
```

.QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.9	*
17.15	1.4	*
17.30	3.0	***
17.45	3.1	***
18.00	1.5	*
18.15	0.9	*

.QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.6	*
17.15	0.7	*
17.30	1.1	*
17.45	1.1	*
18.00	0.8	*
18.15	0.6	*

.QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.3	
17.15	0.4	
17.30	0.6	*
17.45	0.6	*
18.00	0.4	
18.15	0.3	

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
A	618.4	412.3	156.0	0.25	156.0	0.25
B	1083.3	722.2	71.7	0.07	71.7	0.07
C	732.2	488.2	40.9	0.06	40.9	0.06
ALL	2433.9	1622.6	268.5	0.11	268.6	0.11

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

END OF JOB

****** ARCADY 5 run completed.

Appendix U

ARCADY Output Data - N6 / Bridge Street Junction;

2025 Base plus Committed Development AM Peak Scenarios

TRL LIMITED

CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM
RELEASE 1.1 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS IN NO WAY RELIEVED OF HIS RESPONSIBILITY FOR THE CORRECTNESS OF THE SOLUTION

Run with file:-
"s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\ARCADY\N6 Bridge St Opt2\
Final Version N6 Bridge Street 3005\2025\AM\N6_Bridge Street 2025 AM Base Deve.vai"
(drive-on-the-left) at 14:17:19 on Wednesday, 30 May 2007

.ROUNDABOUT CAPACITY AND DELAY

.RUN TITLE

Ballinasloe N6/Bridge Street Final Version 2025 AM Base Development

.INPUT DATA

ARM A - Bridge St
ARM B - N6 East
ARM C - N6 South

.GEOMETRIC DATA

ARM	V (M)	E (M)	L (M)	R (M)	D (M)	PHI (DEG)	SLOPE	INTERCEPT (PCU/MIN)
ARM A	2.92	3.01	0.10	21.00	19.00	25.0	0.507	15.156
ARM B	3.40	6.02	41.00	20.00	19.00	22.0	0.681	28.936
ARM C	5.00	6.60	60.00	10.00	19.00	32.0	0.679	30.869

V = approach half-width   L = effective flare length   D = inscribed circle diameter
E = entry width   R = entry radius   PHI = entry angle

WARNING ARM B: Effective flare length is outside normal range.
Treat capacities with increasing caution.
WARNING ARM C: Effective flare length is outside normal range.
Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA

.TIME PERIOD BEGINS 08.15 AND ENDS 09.45
.LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

ARM	NUMBER OF MINUTES FROM START WHEN: FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS FALLING	RATE OF FLOW (VEH/MIN): BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	2.58	4.31	2.88
ARM B	15.00	45.00	75.00	8.55	13.25	8.85
ARM C	15.00	45.00	75.00	6.75	10.16	6.75

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

TIME	FROM/TO	ARM A	ARM B	ARM C
08.15 - 09.45				
	ARM A	0.000	0.961	0.039
		0.0	221.0	9.0
		(0.0)	(3.0)	(3.0)
	ARM B	0.287	0.000	0.713
		203.0	0.0	505.0
		(3.0)	(0.0)	(3.0)

```
I                    I  ARM C  I  0.079 I  0.921 I  0.000 I
I                    I         I   43.0 I  499.0 I    0.0 I
I                    I         I (  3.0)I (  3.0)I (  0.0)I
I                    I         I        I        I        I
-------------------------------------------------------------
TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

.         QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
          --------------------------------------------------------

.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE   QUEUE     (VEH.MIN
(VEH.MIN/    I
 I                                 (RFC)    (PEDS MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.15-08.30
I
 I ARM A        2.89      11.56    0.249                  0.0     0.2          4.7
I
 I ARM B        5.85      29.02    0.316                  0.0     0.5          6.7
I
 I ARM C        6.75      28.25    0.240                  0.0     0.3          4.6
I
 I
I
-------------------------------------------------------------------------------
-----------------
.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE   QUEUE     (VEH.MIN/
(VEH.MIN/    I
 I                                 (RFC)    (PEDS.MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.30-08.45
I
 I ARM A        3.43      10.94    0.314                  0.3     0.5          5.6
I
 I ARM B       10.57      28.00    0.377                  0.5     0.6          3.9
I
 I ARM C        8.09      27.92    0.290                  0.3     0.4          5.0
I
 I
I
-------------------------------------------------------------------------------
-----------------
.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE   QUEUE     (VEH.MIN/
(VEH.MIN     I
 I                                 (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.45-09.00
I
 I ARM A        4.20      10.09    0.417                  0.5     0.7         10.1
I
 I ARM B       12.94      27.98    0.463                  0.6     0.9         12.5
I
 I ARM C        9.91      27.45    0.361                  0.4     0.6          8.3
I
 I
I
-------------------------------------------------------------------------------
-----------------
.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I            (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE   QUEUE     (VEH.MIN
(VEH.MIN/    I
 I                                 (RFC)    (PEDS/MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I ARM A        4.20      10.08    0.417                  0.7     0.7         10.6
I
 I ARM B       12.94      27.98    0.463                  0.9     0.9         12.8
I
 I ARM C        9.91      27.45    0.361                  0.6     0.6          8.4
I
 I
I
-------------------------------------------------------------------------------
-----------------
.------------------------------------------------------------------------------
-----------------
 I  TIME       DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I            (VEH MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE   QUEUE     (VEH.MIN,
(VEH.MIN/    I
 I                                 (RFC)    (PEDS MIN)  (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I ARM A        3.43      10.93    0.314                  0.7     0.5          7.2
I
 I ARM B       10.57      28.00    0.377                  0.9     0.6          9.3
I
 I ARM C        8.09      27.91    0.290                  0.6     0.4          6.2
I
 I
I
-------------------------------------------------------------------------------
-----------------
.------------------------------------------------------------------------------
-----------------
```

```
 I  TIME       DEMAND  CAPACITY  DEMAND/    PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN) (VEHS)  (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.30-09.45
I
 I ARM A        2.58      11.55   0.249                   0.5    0.3          5.2
I
 I ARM B        8.85      28.02   0.316                   0.6    0.5          7.1
I
 I ARM C        6.75      28.25   0.240                   0.4    0.3          4.8
I
 I
I
--------------------------------------------------------------------------------
------------------
```

.QUEUE AT ARM A

```
 TIME SEGMENT   NO. OF
  ENDING       VEHICLES
               IN QUEUE

  08.30           0.3
  08.45           0.5
  09.00           0.7  *
  09.15           0.7  *
  09.30           0.5
  09.45           0.3
```

.QUEUE AT ARM B

```
 TIME SEGMENT   NO. OF
  ENDING       VEHICLES
               IN QUEUE

  08.30           0.5
  08.45           0.6  *
  09.00           0.9  *
  09.15           0.9  *
  09.30           0.6  *
  09.45           0.5
```

.QUEUE AT ARM C

```
 TIME SEGMENT   NO. OF
  ENDING       VEHICLES
               IN QUEUE

  08.30           0.3
  08.45           0.4
  09.00           0.6  *
  09.15           0.6  *
  09.30           0.4
  09.45           0.3
```

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
A	315.4	210.3	44.4	0.14	44.4	0.14
B	970.6	647.2	57.4	0.06	57.4	0.06
C	743.2	495.5	38.4	0.05	38.4	0.05
ALL	2029.4	1352.9	140.2	0.07	140.2	0.07

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

END OF JOB

****** ARCADY 5 run completed.

Appendix V

ARCADY Output Data - N6 / Bridge Street Junction;

2025 Post Development AM Peak Scenarios

```
                         TRL LIMITED

               (C) COPYRIGHT 1990,1996,2000

          CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

                 ARCADY 5.0  ANALYSIS PROGRAM
                   RELEASE 1.1 (MAY 2001)

          ADAPTED FROM ARCADY/3 WHICH IS CROWN COPYRIGHT
            BY PERMISSION OF THE CONTROLLER OF HMSO

      ----------------------------------------------------------
            FOR SALES AND DISTRIBUTION INFORMATION,
            PROGRAM ADVICE AND MAINTENANCE CONTACT:
                      TRL SOFTWARE BUREAU
          TEL: CROWTHORNE (01344) 770758, FAX: 770864
               EMAIL: SoftwareBureau@trl.co.uk
      ----------------------------------------------------------

 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION


 Run with file:-
 "v:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\ARCADY\N6 Bridge St
Opt2\Development After 06 IP\
  TA Sep 07\2025\N6_Bridge Street TA Sep07 2025 AM Post Deve.vai"
(drive-on-the-left ) at 11:57:58 on Thursday, 20 September 2007

.ROUNDABOUT CAPACITY AND DELAY
 ****************************


.RUN TITLE
 *********
  Ballinasloe N6/Bridge Street TA Sep07 2025 AM Post Development


.INPUT DATA
 **********
 ARM A - Bridge St
 ARM B - N6 East
 ARM C - N6 South

.GEOMETRIC DATA
 --------------


 --------------------------------------------------------------------------------
----------------------------------------
 I ARM    I   V (M)   I    E (M)   I    L (M)   I    R (M)   I   D (M)   I   PHI
(DEG)  I  SLOPE  I INTERCEPT (PCU/MIN) I
 --------------------------------------------------------------------------------
----------------------------------------
 I ARM A I    2.92   I     3.01   I     0.10   I    21.00   I   19.00   I
25.0     I  0.507  I       15.156          I
 I ARM B I    3.40   I     6.02   I    41.00   I    20.00   I   19.00   I
22.0     I  0.681  I       28.936          I
 I ARM C I    5.00   I     6.60   I    60.00   I    10.00   I   19.00   I
32.0     I  0.679  I       30.869          I
 --------------------------------------------------------------------------------
----------------------------------------

 V = approach half-width        L = effective flare length             D =
inscribed circle diameter
 E = entry width                R = entry radius                       PHI = entry
angle

 **WARNING** ARM B: Effective flare length is outside normal range.
  Treat capacities with increasing caution.
 **WARNING** ARM C: Effective flare length is outside normal range.
  Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA
 -------------------


.TIME PERIOD BEGINS 08.15 AND ENDS 09.45
.LENGTH OF TIME PERIOD  -  90   MINUTES.
 LENGTH OF TIME SEGMENT -  15   MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 -------------------------------------------------------------------------------
 I       I   NUMBER OF MINUTES FROM START WHEN     I   RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
 I       I   TO RISE   I  IS REACHED IFALLING     I  PEAK  I OF PEAK I PEAK  I
 -------------------------------------------------------------------------------
 I ARM A I    15.00    I     45.00   I    75.00   I  3.47  I   5.21  I  3.47 I
 I ARM B I    15.00    I     45.00   I    75.00   I  9.49  I  14.23  I  9.49 I
 I ARM C I    15.00    I     45.00   I    75.00   I  6.99  I  10.48  I  6.99 I
 -------------------------------------------------------------------------------


.------------------------------------------------------------
 I                     I         TURNING PROPORTIONS        I
 I                     I         TURNING COUNTS (VEH/HR)    I
 I                     I        (PERCENTAGE OF H.V.S)       I
 I                     --------------------------------------
 I         TIME        I FROM/TO I  ARM A I  ARM B I  ARM C I
 ------------------------------------------------------------
 I   08.15 - 09.45     I         I        I        I        I
 I                     I  ARM A  I  0.000 I  0.924 I  0.076 I
 I                     I         I    0.0 I  257.0 I   21.0 I
 I                     I         I (  0.0)I (  3.0)I (  3.0)I
 I                     I         I        I        I        I
 I                     I  ARM B  I  0.343 I  0.000 I  0.657 I
 I                     I         I  260.0 I    0.0 I  499.0 I
 I                     I         I (  3.0)I (  0.0)I (  3.0)I
 I                     I         I        I        I        I
```

```
I                    I  ARM C  I  0.116 I  0.854 I  0.000 I
I                    I         I   65.0 I  494.0 I    0.0 I
I                    I         I (  3.0)I (  3.0)I (  0.0)I
I                    I         I        I        I        I
-------------------------------------------------------------
TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

         QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
         --------------------------------------------------------

.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN
(VEH.MIN/   I
 I                               (RFC)    (PEDS MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.15-08.30
I
 I ARM A        3.47     11.59   0.300                 0.0     0.4        6.1
I
 I ARM B        9.49     27.92   0.340                 0.0     0.5        7.5
I
 I ARM C        6.99     27.77   0.252                 0.0     0.3        4.9
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH,MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.30-08.45
I
 I ARM A        4.15     10.98   0.378                 0.4     0.6        8.7
I
 I ARM B       11.33     27.85   0.406                 0.5     0.7       10.0
I
 I ARM C        8.34     27.34   0.305                 0.3     0.4        6.5
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN    I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 08.45-09.00
I
 I ARM A        5.08     10.14   0.501                 0.6     1.0       14.0
I
 I ARM B       13.89     27.53   0.499                 0.7     1.0       14.4
I
 I ARM C       10.22     26.75   0.382                 0.4     0.6        9.0
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN
(VEH.MIN,   I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.00-09.15
I
 I ARM A        5.08     10.13   0.502                 1.0     1.0       14.8
I
 I ARM B       13.88     27.83   0.499                 1.0     1.0       14.8
I
 I ARM C       10.22     26.74   0.382                 0.6     0.6        9.2
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
 I  TIME      DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH MIN) (VEH,MIN) CAPACITY     FLOW      QUEUE  QUEUE    (VEH.MIN,
(VEH.MIN/   I
 I                               (RFC)    (PEDS MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 09.15-09.30
I
 I ARM A        4.15     10.97   0.378                 1.0     0.6        8.7
I
 I ARM B       11.33     27.89   0.406                 1.0     0.7       10.6
I
 I ARM C        8.34     27.33   0.305                 0.6     0.4        6.7
I
 I
I
 -------------------------------------------------------------------------------
------------------
.-------------------------------------------------------------------------------
------------------
```

```
 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END        DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                                (RFC)    (PEDS/MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 09.30-09.45
I
 I ARM A       3.47      11.55   0.300                  0.6    0.4          6.7
I
 I ARM B       9.49      27.91   0.340                  0.7    0.5          7.9
I
 I ARM C       6.99      27.76   0.252                  0.4    0.3          5.1
I
 I
I
-------------------------------------------------------------------------------
------------------
```

.QUEUE AT ARM A

```
  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   08.30          0.4
   08.45          0.6  *
   09.00          1.0  *
   09.15          1.0  *
   09.30          0.6  *
   09.45          0.4
```

.QUEUE AT ARM B

```
  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   08.30          0.5  *
   08.45          0.7  *
   09.00          1.0  *
   09.15          1.0  *
   09.30          0.7  *
   09.45          0.5  *
```

.QUEUE AT ARM C

```
  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   08.30          0.3
   08.45          0.4
   09.00          0.6  *
   09.15          0.6  *
   09.30          0.4
   09.45          0.3
```

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

```
-------------------------------------------------------------------------------
I  ARM  I   TOTAL DEMAND  I     * QUEUEING *     I  * INCLUSIVE QUEUEING *  I
I       I                 I     * DELAY *        I         * DELAY *        I
I       I---------------------------------------------------------------I
I       I  (VEH)   (VEH/H) I  (MIN)    (MIN/VEH) I    (MIN)       (MIN/VEH) I
-------------------------------------------------------------------------------
I   A   I  351.2 I  254.1 I    60.0 I     0.16   I      60.0  I      0.16   I
I   B   I 1040.7 I  693.8 I    65.2 I     0.06   I      65.2  I      0.06   I
I   C   I  766.5 I  511.0 I    41.5 I     0.05   I      41.5  I      0.05   I
-------------------------------------------------------------------------------
I  ALL  I 2185.5 I 1459.0 I   166.7 I     0.08   I     166.7  I      0.08   I
-------------------------------------------------------------------------------
```

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

END OF JOB

****** ARCADY 5 run completed.

Appendix W

ARCADY Output Data - N6 / Bridge Street Junction;

2025 Base plus Committed Development PM Peak Scenarios

TRL LIMITED

CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM
RELEASE 1.1 (MAY 2001)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"s:\02 Projects\2007\515738 Ballinasloe\001\06 Assessments\ARCADY\N6 Bridge St Opt2\
Final Version N6 Bridge Street 3005\2025\PM\N6_Bridge Street 2025 PM Base Deve.vai"
(drive-on-the-left) at 14:23:09 on Wednesday, 30 May 2007

.ROUNDABOUT CAPACITY AND DELAY
****

.RUN TITLE
****
Ballinasloe N6/Bridge Street Final Version 2025 PM Base Development

.INPUT DATA
****
ARM A - Bridge St
ARM B - N6 East
ARM C - N6 South

.GEOMETRIC DATA

```
I ARM   I   V (M)   I   E (M)   I   L (M)   I   R (M)   I   D (M)   I   PHI (DEG)  I  SLOPE  I INTERCEPT (PCU/MIN) I
-------------------------------------------------------------------------------------------------------------------
I ARM A I    2.92   I    3.01   I    0.10   I   21.00   I   19.00   I   25.0   I 0.507  I    15.156    I
I ARM B I    3.40   I    6.02   I   41.00   I   20.00   I   19.00   I   22.0   I 0.681  I    28.936    I
I ARM C I    5.00   I    6.60   I   60.00   I   10.00   I   19.00   I   32.0   I 0.679  I    30.869    I
-------------------------------------------------------------------------------------------------------------------
```

V = approach half-width   L = effective flare length   D = inscribed circle diameter
E = entry width   R = entry radius   PHI = entry angle

WARNING ARM B: Effective flare length is outside normal range.
Treat capacities with increasing caution.
WARNING ARM C: Effective flare length is outside normal range.
Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA

.TIME PERIOD BEGINS 16.45 AND ENDS 18.15
.LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

```
-----------------------------------------------------------------------------
I       I   NUMBER OF MINUTES FROM START WHEN      I    RATE OF FLOW (VEH MIN) I
I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
I       I   TO RISE   I IS REACHED IFALLING      I  PEAK  I OF PEAK I PEAK  I
-----------------------------------------------------------------------------
I ARM A I    15.00    I    45.00    I   75.00    I  4.15  I   6.23  I  4.15 I
I ARM B I    15.00    I    45.00    I   75.00    I 10.06  I  15.09  I 10.06 I
I ARM C I    15.00    I    45.00    I   75.00    I  7.03  I  10.54  I  7.03 I
-----------------------------------------------------------------------------
```

```
.----------------------------------------------------------------
I                     I          TURNING PROPORTIONS           I
I                     I          TURNING COUNTS (VEH/HR)       I
I                     I          (PERCENTAGE OF H.V.S)         I
I                     ------------------------------------------
I        TIME         I FROM/TO I  ARM A I  ARM B I  ARM C I
-----------------------------------------------------------------
I   16.45 - 18.15     I         I        I        I        I
I                     I  ARM A  I  0.000 I  0.985 I  0.015 I
I                     I         I    0.0 I  327.0 I    5.0 I
I                     I         I (  0.0)I (  3.0)I (  3.0)I
I                     I         I        I        I        I
I                     I  ARM B  I  0.339 I  0.000 I  0.661 I
I                     I         I  273.0 I    0.0 I  532.0 I
I                     I         I (  3.0)I (  0.0)I (  3.0)I
I                     I         I        I        I        I
```

```
I                   I  ARM C  I  0.084 I  0.916 I  0.000 I
I                   I         I   47.0 I  515.0 I    0.0 I
I                   I         I (  3.0)I (  5.0)I (  0.0)I
I                   I         I        I        I        I
-------------------------------------------------------------
TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

.        QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT
         -------------------------------------------------------

.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/   I
 I                               (RFC)    (PEDS MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 16.45-17.00
I
 I ARM A       4.15     11.46   0.362                 0.0    0.6        5.0
I
 I ARM B      10.06     28.05   0.359                 0.0    0.6        8.1
I
 I ARM C       7.03     27.66   0.254                 0.0    0.[illegible]        5.0
I
 I
I
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 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.00-17.15
I
 I ARM A       4.96     10.82   0.458                 0.6    0.5       11.9
I
 I ARM B      12.02     28.04   0.428                 0.6    0.7       11.0
I
 I ARM C       8.39     27.21   0.308                 0.3    0.4        6.6
I
 I
I
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-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN    I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.15-17.30
I
 I ARM A       6.07      9.94   0.610                 0.8    1.5       21.0
I
 I ARM B      14.72     28.03   0.525                 0.7    1.1       16.0
I
 I ARM C      10.27     26.59   0.386                 0.4    0.6        9.2
I
 I
I
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.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.30-17.45
I
 I ARM A       6.07      9.94   0.611                 1.5    1.5       22.9
I
 I ARM B      14.72     28.03   0.525                 1.1    1.1       16.5
I
 I ARM C      10.27     26.55   0.386                 0.6    0.6        9.4
I
 I
I
 --------------------------------------------------------------------------------
-----------------
.--------------------------------------------------------------------------------
-----------------
 I  TIME      DEMAND  CAPACITY  DEMAND    PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH MIN) (VEH/MIN) CAPACITY     FLOW     QUEUE  QUEUE     (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS MIN) (VEHS)  (VEHS)   TIME
SEGMENT)  TIME SEGMENT) I
 I 17.45-18.00
I
 I ARM A       4.96     10.81   0.459                 1.5    0.9       13.6
I
 I ARM B      12.02     28.0[illegible]   0.428                 1.1    0.8       11.6
I
 I ARM C       8.39     27.20   0.308                 0.6    0.4        6.8
I
 I
I
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 I  TIME       DEMAND  CAPACITY  DEMAND/   PEDESTRIAN  START   END       DELAY
GEOMETRIC DELAYI
 I          (VEH/MIN) (VEH/MIN) CAPACITY      FLOW     QUEUE  QUEUE    (VEH.MIN/
(VEH.MIN/   I
 I                               (RFC)    (PEDS/MIN) (VEHS)  (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 18.00-18.15
I
 I ARM A       4.15      11.44   0.363                   0.9    0.6        9.0
I
 I ARM B      10.06      28.05   0.359                   0.8    0.6        5.6
I
 I ARM C       7.03      27.65   0.254                   0.4    0.3        5.2
I
 I
I
-------------------------------------------------------------------------------
------------------

.QUEUE AT ARM A
 -------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00           0.6  *
   17.15           0.8  *
   17.30           1.5  **
   17.45           1.5  **
   18.00           0.9  *
   18.15           0.6  *

.QUEUE AT ARM B
 -------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00           0.6  *
   17.15           0.7  *
   17.30           1.1  *
   17.45           1.1  *
   18.00           0.8  *
   18.15           0.6  *

.QUEUE AT ARM C
 -------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00           0.3
   17.15           0.4
   17.30           0.6  *
   17.45           0.6  *
   18.00           0.4
   18.15           0.3


.              QUEUEING DELAY INFORMATION OVER WHOLE PERIOD
               --------------------------------------------

-------------------------------------------------------------------------------
I  ARM  I   TOTAL DEMAND  I      * QUEUEING *      I  * INCLUSIVE QUEUEING *  I
I       I                 I       * DELAY *        I         * DELAY *        I
I       I-----------------------------------------------------------------------I
I       I  (VEH)   (VEH/H)  I  (MIN)     (MIN/VEH) I     (MIN)       (MIN/VEH)  I
-------------------------------------------------------------------------------
I   A   I  455.2 I  303.5 I    56.4 I      0.19    I       86.5  I     0.19    I
I   B   I 1103.8 I  735.9 I    71.7 I      0.06    I       71.7  I     0.06    I
I   C   I  770.6 I  513.7 I    42.2 I      0.05    I       42.2  I     0.05    I
-------------------------------------------------------------------------------
I  ALL  I 2329.7 I 1553.1 I   200.4 I      0.09    I      200.4  I     0.09    I
-------------------------------------------------------------------------------

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

 END OF JOB

 ****** ARCADY 5 run completed.
```

Appendix X

ARCADY Output Data - N6 / Bridge Street Junction;

2025 Post Development PM Peak Scenarios

```
                    TRL LIMITED

          (C) COPYRIGHT 1990,1996,2000

    CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

           ARCADY 5.0  ANALYSIS PROGRAM
             RELEASE 1.1 (MAY 2001)

    ADAPTED FROM ARCADY/3 WHICH IS CROWN COPYRIGHT
      BY PERMISSION OF THE CONTROLLER OF HMSO

 ----------------------------------------------------------
      FOR SALES AND DISTRIBUTION INFORMATION,
      PROGRAM ADVICE AND MAINTENANCE CONTACT:
              TRL SOFTWARE BUREAU
   TEL: CROWTHORNE (01344) 770758, FAX: 770864
        EMAIL: SoftwareBureau@trl.co.uk
 ----------------------------------------------------------

 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY  RELIEVED OF HIS RESPONSIBILITY  FOR THE CORRECTNESS  OF THE SOLUTION

 Run with file:-
 "e:\luna\ARCADY\TA Sep 07\2025\N6_Bridge Street TASep07 2025 PM Post Deve.vai"
(drive-on-the-left ) at 21:06:50 on Monday, 17 September 2007

.ROUNDABOUT CAPACITY AND DELAY
 ****************************


.RUN TITLE
 ********
  Ballinasloe N6 Bridge Street TA Sep 07 2025 PM Post Development


.INPUT DATA
 **********
 ARM A - Bridge St
 ARM B - N6 East
 ARM C - N6 South

.GEOMETRIC DATA
 -------------


 ---------------------------------------------------------------------------------
 -----------------------------------------
 I ARM   I   V (M)    I    E (M)    I     L (M)    I     R (M)    I   D (M)    I    PHI
(DEG)  I  SLOPE  I INTERCEPT (PCU MIN) I
 ---------------------------------------------------------------------------------
 -----------------------------------------
 I ARM A I    3.92    I     3.01    I     0.10    I     21.00    I    19.00    I
25.0     I  0.507  I       15.156          I
 I ARM B I    3.40    I     6.02    I     41.00    I    20.00    I    19.00    I
22.0     I  0.681  I       28.936          I
 I ARM C I    5.00    I     6.60    I     60.00    I    10.00    I    19.00    I
32.0     I  0.679  I       30.869          I
 ---------------------------------------------------------------------------------
 -----------------------------------------

 V = approach half-width       L = effective flare length           D =
inscribed circle diameter
 E = entry width               R = entry radius                     PHI = entry
angle

 **WARNING** ARM B: Effective flare length is outside normal range.
  Treat capacities with increasing caution.
 **WARNING** ARM C: Effective flare length is outside normal range.
  Treat capacities with increasing caution.

.TRAFFIC DEMAND DATA
 ------------------


.TIME PERIOD BEGINS 16.45 AND ENDS 18.15
.LENGTH OF TIME PERIOD  -  90   MINUTES.
 LENGTH OF TIME SEGMENT -  15 . MINUTES.

.DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA


 --------------------------------------------------------------------------------
 I       I   NUMBER OF MINUTES FROM START WHEN     I   RATE OF FLOW (VEH/MIN) I
 I  ARM  I FLOW STARTS I TOP OF PEAK I FLOW STOPS I BEFORE I AT TOP  I AFTER I
 I       I   TO RISE   I  IS REACHED IFALLING     I  PEAK  I OF PEAK I PEAK  I
 --------------------------------------------------------------------------------
 I ARM A I    15.00    I     45.00    I    75.00    I  6.05  I   9.08  I  6.05 I
 I ARM B I    15.00    I     45.00    I    75.00    I 11.19  I  16.78  I 11.19 I
 I ARM C I    15.00    I     45.00    I    75.00    I  7.32  I  10.99  I  7.32 I
 --------------------------------------------------------------------------------


-------------------------------------------------------------
 I                    I         TURNING PROPORTIONS         I
 I                    I         TURNING COUNTS (VEH/HR)     I
 I                    I        (PERCENTAGE OF H.V.S)        I
 I                    ---------------------------------------
 I        TIME        I FROM/TO I  ARM A I  ARM B I  ARM C I
 ------------------------------------------------------------
 I   16.45 - 18.15    I         I        I        I        I
 I                    I  ARM A  I  0.000 I  0.917 I  0.083 I
 I                    I         I    0.0 I  444.0 I   40.0 I
 I                    I         I (  0.0)I (  3.0)I (  3.0)I
 I                    I         I        I        I        I
 I                    I  ARM B  I  0.428 I  0.000 I  0.572 I
 I                    I         I  383.0 I    0.0 I  512.0 I
 I                    I         I (  3.0)I (  0.0)I (  3.0)I
 I                    I         I        I        I        I
 I                    I  ARM C  I  0.154 I  0.846 I  0.000 I
 I                    I         I   90.0 I  496.0 I    0.0 I
```

I I I : 3.0) I (3.0) I (0.0) I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA
THE PERCENTAGE OF HEAVY VEHICLES VARIES OVER TURNING MOVEMENTS

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

I TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY I (VEH.MIN/ TIME SEGMENT) I
I 16.45-17.00								
I ARM A	6.05	11.58	0.523		0.0	1.1	15.0	
I ARM B	11.19	27.76	0.403		0.0	0.7	9.8	
I ARM C	7.32	26.73	0.274		0.0	0.4	5.5	

I TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY I (VEH.MIN/ TIME SEGMENT) I
I 17.00-17.15								
I ARM A	7.22	10.96	0.659		1.1	1.8	25.7	
I ARM B	13.36	27.69	0.482		0.7	0.5	13.5	
I ARM C	8.75	26.09	0.335		0.4	0.5	7.4	

I TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY I (VEH.MIN/ TIME SEGMENT) I
I 17.15-17.30								
I ARM A	9.85	10.12	0.974		1.5	5.3	64.6	
I ARM B	16.36	27.61	0.593		0.9	1.4	20.8	
I ARM C	10.71	25.23	0.425		0.5	0.7	10.7	

I TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY I (VEH.MIN/ TIME SEGMENT) I
I 17.30-17.45								
I ARM A	8.85	10.11	0.875		5.3	5.9	85.0	
I ARM B	16.36	27.60	0.593		1.4	1.4	21.6	
I ARM C	10.71	25.22	0.425		0.7	0.7	11.0	

I TIME SEGMENT	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY I (VEH.MIN/ TIME SEGMENT) I
I 17.45-18.00								
I ARM A	7.22	10.95	0.660		5.9	2.0	36.0	
I ARM B	13.36	27.67	0.483		1.4	0.9	14.5	
I ARM C	8.75	26.09	0.335		0.7	0.5	7.8	

I TIME DEMAND CAPACITY DEMAND PEDESTRIAN START END DELAY GEOMETRIC DELAY I

```
I          (VEH/MIN) (VEH MIN) CAPACITY      FLOW      QUEUE  QUEUE     (VEH.MIN
(VEH.MIN/    I
 I                             (RFC)     (PEDS MIN) (VEHS) (VEHS)  TIME
SEGMENT)  TIME SEGMENT) I
 I 18.00-18.15
I
 I ARM A       6.05      11.56   0.523                 2.0    1.1       17.9
I
 I ARM B      11.19      27.75   0.403                 0.9    0.7       10.4
I
 I ARM C       7.32      26.72   0.274                 0.5    0.4        5.8
I
 I
I
 -------------------------------------------------------------------------------
------------------

.QUEUE AT ARM A
 --------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00           1.1  *
   17.15           1.8  **
   17.30           5.3  *****
   17.45           5.9  ******
   18.00           2.0  **
   18.15           1.1  *

.QUEUE AT ARM B
 --------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00           0.7  *
   17.15           0.9  *
   17.30           1.4  *
   17.45           1.4  *
   18.00           0.9  *
   18.15           0.7  *

.QUEUE AT ARM C
 --------------

  TIME SEGMENT   NO. OF
   ENDING       VEHICLES
                IN QUEUE

   17.00           0.4
   17.15           0.5  *
   17.30           0.7  *
   17.45           0.7  *
   18.00           0.5  *
   18.15           0.4

.                 QUEUEING DELAY INFORMATION OVER WHOLE PERIOD
                  --------------------------------------------

-------------------------------------------------------------------------------
I  ARM  I   TOTAL DEMAND  I     * QUEUEING *     I  * INCLUSIVE QUEUEING *  I
I       I                 I       * DELAY *      I          * DELAY *       I
I       I-----------------------------------------------------------------------I
I       I  (VEH)   (VEH/H) I  (MIN)    (MIN/VEH) I   (MIN)        (MIN/VEH)  I
-------------------------------------------------------------------------------
I   A   I  663.7 I  442.4 I  244.0 I    0.37   I    244.1  I     0.37     I
I   B   I 1227.2 I  815.2 I   90.7 I    0.07   I     90.7  I     0.07     I
I   C   I  803.5 I  535.7 I   48.2 I    0.06   I     48.2  I     0.06     I
-------------------------------------------------------------------------------
I  ALL  I 2694.4 I 1796.3 I  382.9 I    0.14   I    383.0  I     0.14     I
-------------------------------------------------------------------------------

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

 END OF JOB

 ****** ARCADY 5 run completed.
```

MAP

SEE ENCLOSED

Comhairle Bhaile Béal Atha na Slua
Ballinasloe Town Council

PLANNING VALIDATION CHECKLIST (P&D Regulations 2006)

Planning Reference No: 07|9087 **Status:** VALID.

Regulation	DOCUMENTS		
22(1)	Is the application form fully completed?	✓	
22(4)b(i)	Is a statement of existing use and proposed use enclosed, if applicable?	✓	(E.I.S. SUBMITTED)
Part V Section 97 P&D Act 2000	Is the development for 1 -4 houses in a residentially zoned area?		N/A.
	Is the development for housing on land of 0.1 hectares or less in residential zone?		
	If 'YES' has a Certificate of Exemption from Section 96 been applied for?		
Part V Section 96 P&D Act 2000	Is the application for 5 or more housing units in a residentially zoned area?		
	If 'YES' has the applicant consulted with the Housing Section re Part V of the Act?		
	PUBLIC NOTICES		
17(1)a / 17(2)	Has the application been lodged within 2 weeks of date on the newspaper?	✓	
18(2) a	Is the advertisement in one of the required newspapers?	✓	
18(1)b	Has the Townland or address been stated correctly?	✓	
18	Does the public notice contain misleading information?	NO	
22(2)a	Has the original full page of the newspaper been submitted?	✓	
22(2)a	Has the site notice been submitted? *(Colour: white or Yellow)*	✓	
17(1)b	Has the application been lodged within 2 weeks of the date on the site notice?	✓	
19(1)a	Is the signature of the applicant on the site notice? OR Is the signature and address of the agent on the site notice?	✓	
17/19	Does the site notice include development description and address?	✓	
	MAPS		
22(2)b	Are there 6 Location Maps of scale not less than 1:2500? *(must be 6 originals from OS Mapstore or License No. if applicable)*	✓	
23(1)g	Is Ordnance Survey Sheet stated on all location maps?	✓	
23(1)h	Is the North Point shown on all location maps?	✓	
22(2)b(i)	Is the site outlined in red on all location maps?	✓	
23(1)a	Are there 6 copies of Site Layout map to scale not less than 1:500?	✓	
23(1)h	Is the North Point shown on all site layout maps?	✓	
23(1)a	Is the site outlined in red on all site layout maps?	✓	
23(1)f	Have dimensions been shown from front and side boundary to proposal?	✓	
23(1)a	Is the position of the proposal and services shown on the site layout?	✓	
22(2)c	Is Site Suitability Report submitted for on-site wastewater treatment system?	✓	
23(1)c	Are contour lines or levels shown on the site layout?	✓	TOPOGRAPHY MAPS SUBMITTED
23(1)c	Is the Finished Floor Level shown on the site layout or on floor plans?	✓	
23(1)a	Have adjacent buildings or features within 50m radius been shown?	✓	
22(2)c	Is the position of site notice shown on site layout or site location maps?	✓	2 No
23(2)	Is the proposal within an Architectural Conservation Area? *If proposal is in an ACA, the application must be accompanied by such photographs, plans, and other particulars to show how development would affect the character of the area. Streetscape Elevations required for applications in ACA areas.*		No
23(2)	Is the proposal a Protected Structure? *If proposal is a Protected Structure, the application must be accompanied by such photographs, plans, and other particulars to show how development would affect the character of the structure.*		No
	PLANS, ELEVATIONS & SECTIONS		
22(2) (d)	Are there 6 copies of plans, all elevations and a cross section?	✓	
23(1)b	Is the scale stated on all drawings and is it correct when measured? *(Drawings must be no less than 1:200 and text must be legible)*	✓	
23(1)f	Are principal dimensions shown on drawing and are they in metric?	✓	
23(1)f	Is the overall height shown on elevations or the cross section?	✓	
23(1)e	Are plans and elevations coloured or marked to identify existing and proposed?	✓	EXISTING RIGHT-OF-WAY PROPOSED DIVERSION

History File(s): 04/074, LA/01/2002

(Schedule 9) Fee required: €36 270·00 (€3·60 x 10 075 m²) **Class:** 4

Townland: BACK & TOWNPARKS (CLONNACNOWEN BY) **OS No.:** 88 I (3296)

Date Checked: 24th OCT 2007 **Signed:** Geraldine Mulkerrins (TECHNICIAN)

Refer to:

NRDO – Proposed Roads	*Environment Section GCC* ✓	*Town Engineer* ✓
Dept. Env. Heritage & L.G. (RPS & SMR) ✓	*Water Section GCC*	*Chief Medical Officer* ✓
Conservation Officer – (RPS)	*Architect (Declan Molloy)GCC*	*Chief Fire Officer* ✓
Heritage Officer – (NHA, SAC, SPA & SMR) ✓	*An Taisce* ✓	*OTHER -* 1. N.P.W.S
Office of Public Works – (River Suck) ✓	*NRA – Existing National Roads*	2. FAILTE IRELAND

Ballinasloe Town Council *Comhairle Bhaile Béal Atha na Slua*

Planning Applications - Technical Data to be entered into iPlan

File No: 07/9089

Process Tab >>>> Location Details >>>> Add Location Details

Site Area: 2.406 No. of Floors: 2

Water Type	Sewerage Type
Leave Blank	Leave Blank
Bored Well	Existing Septic Tank
Group	New Septic Tank
Main ✓	Public Sewer ✓
Other	Bord na Móna Puraflo
Private	Biocycle

OS Map Ref: 88I / 3296 Once Off House Leave Blank / Yes

****

Process Tab >>>>Development Units >>>> New Development Unit

Local Category	CSO Category
Industrial	One-Off Houses
Offices	Communal Dwellings
Commercial ✓	Blds. for Mining, Energy & Water
Community	Blds. For Industrial & Manufacturing Handicrafts
Miscellaneous	Blds. For Transport
Domestic	Public Admin. & Public Blds. for Special Purposes
Domestic Extension	Blds. for Health & Welfare
Agricultural Building	Blds. for Entertainment & Recreation
	Blds. for Religious and Funerary Purposes
	Crèches
	Other Non-Residential
	Multi-Development Houses
	Apartments
	Exempt from CSO Returns
	Trade & Other Economic Activities ✓
	Blds for Agricultural, Forestry & Fishery Purposes
	Blds. for Education, Culture, Science & Research
	Hotels, Restaurants, Cafés etc. ✓
	Offices, Admin & Finance

Unit Area: Total: 10075m2

Unit Description: MIXED USE RETAIL / COMMERCIAL DEVELOPMENT

Number of Units: __________

****

Process Tab >>>>Significant Cases/Comments

Significant Application Indicator: 7

Comments: *(brief description of the development)*

****

PD 07|9087

Planning Application Form

1. Name of relevant Planning Authority: Ballinasloe Town Council

2. Location of Proposed Development:

Postal Address **or** *Townland* **or** *Location (as may best identify the land or structure in question)*	**Lands north east of river, street, Bridge Street & main street, back, Ballinsloe, Co Galway**
Ordance Survey Map Ref No (and the Grid Reference where available)[1]	**231626 east** **185288 north**

BALLINASLOE TOWN COUNCIL
RECEIVED
17 OCT 2007

3. Type of planning permission (please tick appropriate box) :

[√] Permission
[ ] Permission for retention
[ ] Outline Permission
[ ] Permission consequent on Grant of Outline Permission

4. Where planning permission is consequent on grant of outline permission:
Outline Permission Register Reference Number: **N/A**

Date of Grant of Outline Permission: **N/A**

5. Applicant[2]

Name (s)	**Harte Holdings (Ballinasloe) Ltd**
	Address to be supplied at the end of this form (Question 23)

6. Where Applicant is a Company (registered under the Companies Acts 1963 to 1999):

Name (s) of company director (s)	**Marian Flannery** **Daniel Finbarr (Barry) Harte**
Registered Address (of company)	**O'Mahony Crowley & Associates** **South Main Street** **Bandon** **Co Cork**

7. Person / Agent acting on behalf of the Applicant (if any):

Name	**Wilson Architecture**
	Address to be supplied at the end of this form (Question 24)

8. Person responsible for preparation of Drawings and Plan[3]

Name	**Paud O'Mahony**
Address	**Wilson Architecture**

9. Description of Proposed Development:

Brief description of nature and extent of development[4]	Provision of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Supermarket as defined by Article 5(1)(d) of the Planning Regulations (including alcohol sales and off licence sales as an ancillary part of the retail area) and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit, one betting office, one off licence and one cafe/restaurant) first floor management suites and store areas, ancillary

	retail toilets and services, associated signage, site level changes and re-grading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, vehicular access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure. An Environmental Impact Statement has been prepared and accompanies this application.

10. Legal Interest of Applicant in the Land or Structure

Please tick appropriate box to show applicant's legal interest in the land or structure	**A.** *Owner* √	**B.** *Occupier*
	C. *Other*	
Where legal interest is 'Other', please expand further on your interest in the land or structure	**N/A**	
If you are not the legal owner, please state the name and address of the owner of consent to make the application as listed in the accompanying documentation	**N/A**	

11. Site Area

Area of site to which the application relates in hectares	**2.406**	ha

12. Where the application relates to a building or buildings

Gross floor space²of any existing building (s) in m²	**nil**
Gross floor space of proposed works in m²	**10,075m2**
Gross floor space of work to be retained in m² (if appropriate)	**nil**
Gross floor space of any demolition in m² (if appropriate)	**nil**

13. In the case of mixed development (e.g. residential, commercial, industrial, etc), please provide breakdown of the different classes of development and breakdown of the gross floor area of each class of development:

Class of Development	*Gross floor area in m²*
n/a	

14. In the case of residential development please provide breakdown of residential mix:

NOT APPLICABLE

Number of	Studio	1 Bed	2 Bed	3 Bed	4 Bed	4+Bed	Total
Houses							
Apartments							
Number of car-parking spaces to be provided	Existing		Proposed		Total		

15. Where the application refers to a material change of use of any land or structure or the retention of such a material change of use:

Existing use[6](or previous use where retention permission is sought)	**Rough agricultural grazing with permission for hotel.**
Proposed use (or use it is proposed to retain)	**Proposed use: Retail Development**
Nature and extent of any such proposed use (or use it is proposed to retain)	Provision of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Supermarket as defined by Article 5(1)(d) of the Planning Regulations (including alcohol sales and off licence sales as an ancillary part of the retail area) and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit, one betting office, one off licence and one cafe/restaurant) first floor management suites and store areas, ancillary retail toilets and services, associated signage, site level changes and re-grading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, vehicular access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure. An Environmental Impact Statement has been prepared and accompanies this application.

16. Social and Affordable Housing

Please tick appropriate box	Yes	No
Is the application an application for permission for development to which Part V of the Planning and Development Act 2000 applies?		x
If the answer to the above question is 'yes' and the development is not exempt (see below), you must specify, as part of your application, the manner in which you propose to comply with section 96 of Part V of the Act. *If the answer to the above question is 'yes' but you consider the development to be exempt by virtue of section 97 of the Planning and Development Act 2000[8], a copy of the Certificate of Exemption under section 97 must be submitted (or, where an application for a certificate of exemption has been made but has not yet been decided, a copy of the application should be submitted).* *If the answer to the above question is 'no' by virtue of section 96(13) of the Planning and Development Act 2000[9], details indicating the basis on which section 96(13) is considered to apply to the development should be submitted.*		**retail development**

17. Development Details

Please tick appropriate box	Yes	No
Does the proposed development consist of work to a protected structure and / or its cartilage or proposed protected structure and / or its cartilage?		x
Does the proposed development consist of work to the exterior of a structure which is located within an Architectural Conservation Area (ACA)?		x
Does the application relate to development which affects or is close to a monument or place recorded under section 12 of the National Monuments (Amendment) Act, 1994[10]		x
Does the application relate to work within or close to a European Site (under S.I. No.94 of 1997) or a Natural Heritage Area (NHA)?	√	
Does the proposed development require the preparation of an Environmental Impact Statement[11]?		
Does the application relate to a development which comprises or is for the purposes of an activity requiring an Integrated Pollution Prevention And Control Licence?		x
Does the application relate to a development which comprises or is for the purposes of an activity requiring a Waste Licence?		x
Do the Major Accident Regulations apply to the proposed development?		x
Does the application relate to a development in a Strategic Development Zone?		x
Does the proposed development involve the demolition of any habitable house[12]?		x

18. Site History

Details regarding site history (if known)

Has the site in question ever, to your knowledge, been flooded?

Yes [√] No [ ] If yes, please give details e.g. year, extent
Refer to enclosed Hydrology Report.

Are you aware of previous uses of the site e.g. dumping or quarring?

Yes [√] No [ ] If yes, please give details.
Rough agriculture grazing with permission for Hotel.

Are you aware of any valid planning applications previously made in respect of this land/structure?

Yes [√] No [ ]
If yes, please state planning reference number(s) and the date(s) of receipt of the planning application(s) by the planning authority if known:

Reference No: **04/074** Date **2004**

NOTE: If a valid planning application has been made in respect of this land or structure in the 6 months prior to the submission of this application, then the site notice must be on a yellow background in accordance with Article 19(4) of the Planning and Development Regulations 2001 as amended.

Is the site of the proposal subject to a current appeal to An Bord Pleanala in respect of a similar development[13]?

Yes [ ] No [x] An Bord Pleanala Reference No:__________

19. Pre-application Consultation

Has a pre-application consultation taken place in relation to the proposed development [14]?

Yes [√] No [ ] If yes, please give details:

Reference No: (if any) __________

Date(s) of consultation: **08/05/07**

Persons involved: **Alan Farrell, Town Clerk, BTC, Kevin Kelly, Director of Services Galway CC. POM/BW/DM = WA**
Glen Barry Harte Holdings, John Crean Cunnane Stratton Reynolds.

20. Services

Proposed Source of Water Supply **REFER TO ENGINEERS REPORT AND DRAWINGS**
Existing connection [ ] New connection [ ] Public Mains [ ] Group Water Scheme [ ] Private Well [ ] Other (please specify): ________________ *Name of Group Water Scheme (where applicable)* ________________
Proposed Wastewater Management/Treatment **REFER TO ENGINEERS REPORT AND DRAWINGS**
Existing [ ] New [ ] Public Sewer [ ] Conventional septic tank system [ ] Other on-site treatment system [ ] Please specify ______________
Proposed Surface Water Disposal **REFER TO ENGINEERS REPORT AND DRAWINGS**
Public Sewer/Drain [ ] Soakpit [ ] Watercourse [ ] Other [ ] Please specify

21. Details of Public Notice

Approved newspaper[15] in which notice was published.	**Irish Independant**
Date of publication	**12th October 2007**
Date on which site notice was erected[17]	**17th October 2007**

22. Application Fee

Fee Payable[18]	**€36,270**
Basis of Calculation	**10,075m² x €3.60**

I hereby declare that, to the best of my knowledge and belief, the information given in this form is correct and accurate and fully complaint with the Planning & Development Act 2000, as amended, and the Regulations made thereunder:

Signed: *(Applicant or Agent as appropriate)*	Agent: Wilson Architecture, 5 Lapps Quay, Cork
Date:	**17th October 2007**

An applicant will not be entitled solely by reason of a planning permission to carry out the development. The applicant may need other consents, depending on the type of development. For example, all new buildings, extensions and alterations to, and certain changes of use existing buildings must comply with building regulations, which set out basic design and construction requirements.

CONTACT DETAILS

23. Applicant address/contact details[19]

Applicant	**Harte Holdings (Ballinasloe) Ltd**
Address	**O'Mahony Crowley & Associates** **South Main St** **Bandon** **Co Cork**

24. Agent's (if any) address[19]

Agent (if any)	**Wilson Architecture**
Address	**5 Lapps Quay** **Cork**
Please indicate which address all correspondence be sent to the above address? (please tick appropriate box) (Please note that if the answer is 'No', all correspondence will be sent to the Applicant's address) Yes **[X]** No [ ]	

Additional Contact Information

The provision of additional contact information such as email addresses or phone numbers is voluntary and will only be used by the Planning Authority to contact you should it be deemed necessary for the purposes of administrating the application. These details will not be made available to any third party with the exception of An Bord Pleanala in the event of an appeal, where again it will only be used by An Bord Pleanala for the purposes of administering the appeal.

The name and address elements of the application provided in questions 23-24 will be held, and be available for inspection/purchase by the public in accordance with the Planning and Development Act 2000 and associated regulations for a period of 7 years commencing on the date of the making of the decision. The additional contact information will be destroyed on the completion of the application process and when no appeal is made to An Bord Pleanala.

Phone Number	**021-4272070**
Email Address	**info@wilsonarchitecture.ie**
The above details belong to: The applicant [ ] The agent **X**	

www.etenders.gov.ie or
telephone 01-890 5604.

PLANNING APPLICATIONS

An Bord Pleanala
Notice of Planning
Appeal Wicklow County
Council
Planning Register
Reference Number 06/6294
Appeal Reference
Number PL 27.222211

An appeal has been made to An Bord Pleanala against the decision made on the 8th day of February, 2007 by Wicklow County Council bearing the above planning reference number which decision was to grant permission with conditions to County Wicklow Amenities Limited. The application to the planning authority was described as an application for permission for development of 9 no. townhouses and 2 no. apartments together with associated site works. Glebe House, Rathdrum, Co. Wicklow. The Bord has received revised proposals on the 24th day of September, 2007 which comprise of the following: 9 no. dwellings and their repositioning on the site together with associated site works. Glebe House (a protected structure), Rathdrum, Co. Wicklow. The application and revised proposals may be inspected at the offices of the Wicklow County Council, Council Offices, County Buildings, Wicklow. This notice is being erected at the request of An Bord Pleanala. Any person may make written submissions or observations to the Bord in relation to the application within four weeks beginning on the date of publication of this notice. Any such submissions or observations must be accompanied by the statutory fee of €50, unless the submissions or observations are made by certain prescribed bodies, and should be addressed to the Secretary, An Bord Pleanala, 64 Marlborough Street, Dublin 1. DATE OF PUBLICATION: 12th October 2007

CORK CITY COUNCIL — Further information/revised plans. Application by Kevin Cluskey for development at Eden Hall Tennis Centre, Model Farm Road, Cork to consist of change of use of existing tennis centre to part children's play centre incorporating gym/fitness area and dance studios at both ground and first floor mezzanine levels within the existing Eden Hall Tennis Centre. That significant further information/revised plans in relation to the application have been furnished to the Planning Authority and are available for inspection or purchase at a fee not exceeding the reasonable cost of making a copy at the offices of the Authority during office hours. A submission or observation in relation to the further information/revised plans may be made in writing to the Planning Authority on payment of the prescribed fee within two weeks of the date of receipt of this further information/revised plans.

the Company off the Register.

By Order of the Board
Location Location Location
Limited
Company Secretary

PLANNING APPLICATIONS

DUBLIN CITY COUNCIL — Derek Quinlan, intends to apply for planning permission for development at 43 Ailesbury Road, Dublin 4 - a protected structure. The development will consist of the refurbishment and extension of the existing offices comprising: removal of a free-standing brick pier pergola at the rear of the property and gates at the side of the property; construction of a single storey extension at the rear of the property; alterations to combine existing kitchen and store at garden level to form larger kitchen; installation of damp proofing at garden floor level; minor alterations to the window and door openings on the rear elevation and building return at garden level to facilitate access to the proposed extension and enlarged kitchen area; installation of new window on rear of building return at garden level; replacement of all facing bricks on front and side elevations with salvaged or custom made facing bricks; rerendering of side and rear elevations; reslating of roof using existing slates and matching replacements; repair and refurbishment of windows; and replacement of all gutters and downpipes. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy at the offices of Dublin City Council during its public opening hours. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the prescribed fee of €20 within a period of five weeks beginning on the date of receipt by the Planning Authority of the application.

DUBLIN CITY COUNCIL — Permission is sought by ESB Telecoms, 27 Lower Fitzwilliam Street, Dublin 2, for the erection of a 24 metre high, free standing monopole communications structure, carrying antennae and communication dishes, with associated ground-mounted equipment cabinets, shared with third party operators, within a 2.4m high palisade compound, at ESB's existing 38kV Substation, Schoolhouse Lane, Santry, Dublin 9. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy at the offices of the Dublin City Council during its public opening hours and a submission or observation in relation to the application may be made to the Authority in writing on payment of the prescribed fee within the period of 5 weeks beginning on the date of receipt by the Authority of the application.

NOTICE OF APPLICATION

TAKE NOTICE that Marie Cusack whose place of abode is Echo Gate, Dublin Road, Trim in the County of Meath intends to apply to this Honourable Court sitting at the Courthouse Trim in the County of Meath, at the sessions thereof commencing on the 9th of November 2007 at 10.00 a.m. in the forenoon or so soon thereafter as this application may be taken in its place in the Court list for:

1. 'A' Certificate entitling and enabling the Applicant to receive an Excise License pursuant to the above entitled statutory provisions in respect of a Hotel premises known as the Knightsbrook Hotel and Golf Resort and situate at Iffernock, the civil parish of Trim barony of Lower Moyfenrath, the townland of Iffernock, Trim in the County of Meath which said premises are more particularly delineated in plans to be adduced in the hearing of this application.

2. An order pursuant to the provisions of Section 19(3) of the Intoxicating Liquor Act 1960.

Dated this 5th day
of October 2007

BALLINASLOE TOWN COUNCIL
RECEIVED
17 OCT 2007

Signed: Marie Cusack

Signed: Brady & Co.
Solicitors,
High Street,
Trim,
Co. Meath

TO: District Judge,
C/o District Court Clerk,
Courthouse,
Trim,
Co. Meath.

TO: The County Registrar,
The Courthouse,
Trim,
Co. Meath

TO: The Superintendent of the
Garda Siochana
Trim,
Co. Meath

TO: The Chief Fire Officer
Navan Fire Station,
Abbey Road,
Navan,
Co. Meath

LEGAL

I, Rory Kelly of 23 Beechwalk, Rathfarnham, Dublin 16 wish to apply to the Superintendent in Tallaght Garda Station for a Certificate of Personal Fitness in accordance with the 1931 Betting Act.

PLANNING APPLICATIONS

WATERFORD COUNTY COUNCIL — I, John Ronan, intend to apply for permission for demolition of existing two storey dwelling house, construction of new 857sqm dwelling house consisting of three levels (ground floor and two storeys over) over basement level, extension of existing driveway, site landscaping and associated site development works at lands at Coolnamuck Demesne, 2km approximately west of the centre of Carrick-on-Suir, along the R680 Regional Route. The planning application may be inspected or purchased, at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority, Civic Offices, Dungarvan, Co Waterford, during its public opening hours and a submission or observation in relation to the application may be made to the Planning Authority in writing on payment of the prescribed fee of €20 within the period of 5 weeks beginning on the date of receipt by the Authority of the application.

DROGHEDA BOROUGH COUNCIL — We Goney Developments Ltd, intend to apply for permission for development at Newtown Link Road, Termonfeckin Road, Drogheda, Co. Louth. The development will consist of a two storey 10.1 metre high extension to the south side of existing food processing plant, 1 number dock leveller to east elevation, a single storey 5.5 metre high office extension to the south side of existing offices, single storey 5.5 metre high workshop to east elevation, and associated site works. The Planning Application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority - Drogheda Borough Council, Fair Street, Drogheda during normal opening hours 9.00 a.m. - 5.00 p.m. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the appropriate fee of €20.00 within the period of 5 weeks beginning on the date of receipt by the Planning Authority of the application.

DUN LAOGHAIRE RATHDOWN COUNTY COUNCIL — Planning permission is sought by Mrs Angela Jennings for retention of singlestorey, kitchen, bedroom and bathroom extension, at Dunedin, 20 Monkstown Avenue, Monkstown, Co. Dublin. The application may be inspected or purchased at the Offices of the Planning Authority, County Hall, Marine Road, Dun Laoghaire, during its public opening hours. A submission or observation in relation to the application may be made in writing on payment of a fee of €20, within a period of 5 weeks beginning on the date of receipt of the Planning Application by the Planning Authority.

PLANNING APPLICATIONS

CAVAN COUNTY COUNCIL — Health Services Executive Dublin North East, apply for planning permission for ground floor extension of existing main hospital entrance hall of 87.4m.sq and associated works at Cavan General Hospital, Lisdarn Td, Cavan. The planning application may be inspected, or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority during its public opening hours and that a submission or observation in relation to the application may be made to the Authority in writing, on payment of the prescribed fee within the period of 5 weeks beginning on the date of receipt by the Authority of the application.

FINGAL COUNTY COUNCIL — We, First Glass Ltd., make application for planning permission for alterations to a previously approved application (Reg. Ref. F03A/1448) as follows; Unit A: 1,102m.sq (previously 1,008m.sq), 129m.sq ancillary intergrated office (previously 340m.sq), 9.10m high (previously 13.0m high) totalling 1,231m.sq (previously 1,348m.sq). Unit B: 1,048m.sq (previously 1,002m.sq), 113m.sq ancillary integrated office (previously 237m.sq), 9.10m high (previously 12.25m high) totalling 1,161m.sq (previously 1,239m.sq), provision of an ESB Substation and integrated switchroom, 25m², 3.0m high, plus ancillary works associated with the alterations at Site 43, Rosemount Business Park, Ballycoolin, Dublin 11. The application may be inspected or purchased at the offices of Fingal County Council, Fingal County Hall, Main Street, Swords, Co. Dublin during office hours (9.30 - 15.30 Monday to Friday) and a submission or observation may be made to the Planning Authority in writing and upon payment of the prescribed fee (€20) within 5 weeks of the date of receipt by the Authority of the application.

MEATH COUNTY COUNCIL — I, Mr Daniel Geoghegan, intend to apply for planning permission for development at Unit 1, Ashbourne Industrial Park, Ashbourne, Co. Meath for amendments to previously approved planning permission Reg Ref: DA/60436. The development will consist of a total of 865sq.m additional storage space at mezzanine level and 4no. new access stairs. The planning application may be inspected or purchased at the offices of the Planning Authority at a fee not exceeding the reasonable cost of making a copy during its public opening hours, and a submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the prescribed fee (€20.00) within the period of 5 weeks beginning on the date of receipt by the Planning Authority of the application.

PLANNING APPLICATIONS

BALLINASLOE TOWN COUNCIL — Harte Holdings (Ballinasloe) Ltd intend to apply for full planning permission for the provision of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m on lands north east of River Street, Bridge Street and Main Street, Back, Ballinasloe, Co. Galway. The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Supermarket as defined by Article 5(1)(d) of the Planning Regulations (including alcohol sales and off licence sales as an ancillary part of the retail area) and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit, one betting office, one off licence and one cafe/restaurant) first floor management suites and store areas, ancillary retail toilets and services, associated signage, site level changes and re-grading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, vehicular access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure. An Environmental Impact Statement accompanies this application. The Environmental Impact Statement and Planning Application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy at the offices of the Planning Authority at Ballinasloe Town Council, Council Offices, Ballinasloe, Co. Galway during office hours Monday to Friday excluding bank holidays. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of a fee of €20 within the period of 5 weeks beginning on the date of receipt by the Town Council of the application.

KERRY COUNTY COUNCIL — Permission is being sought for a change of use of the existing builders providers and hardware premises into a pharmacy, at Bridewell Street, Tarbert, Co. Kerry and which includes the demolition of the existing single storey and two storey rear extensions, and including a change of use of a pedestrian access from Bridewell Street to a single storey medical surgery and carparking facility to the rear for Uniprop Limited. The Planning Application may be inspected or purchased at the offices of the Planning Authority at County Buildings, Rathass, Tralee during its opening hours, Monday to Friday 9.00am to 5.00pm. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the prescribed fee of €20 within the period of five weeks beginning on the date of receipt by the Authority of the application.

BALLINASLOE TOWN COUNCIL

BALLINASLOE TOWN COUNCIL
RECEIVED
17 OCT 2007

SITE NOTICE

We **Harte Holdings (Ballinasloe) Ltd** intend to apply for permission/~~retention permission/outline permission/permission consequent on the grant of outline permission (Ref No. of Outline Permission)~~ for development at this site

Lands north east of River Street, Bridge Street and Main Street, Back, Ballinasloe, Co. Galway

The development will consist/~~consists~~ of

Provision of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Supermarket as defined by Article 5(1)(d) of the Planning Regulations (including alcohol sales and off licence sales as an ancillary part of the retail area) and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit, one betting office, one off licence and one cafe/restaurant) first floor management suites and store areas, ancillary retail toilets and services, associated signage, site level changes and re-grading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, vehicular access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure. An Environmental Impact Statement has been prepared and accompanies this application.

The Planning Application and Environmental Impact Statement may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy at the offices of the Planning Authority at : Ballinasloe Town Council, Civic Offices, Ballinasloe, during the office hours of : 9.30 a.m. to 1 p.m., and 2 p.m. - 5.00 p.m. Monday to Friday.

A submission or observation in relation to the application may be made in writing to the planning authority on payment of a fee of €20.00 within a period of 5 weeks beginning on the date of receipt by the authority of the application.

Signed: ____________________
Agent : Wilson Architecture, 5 Lapps Quay, Cork

Date of erection of site notice : **17th October 2007**

Environmental Impact Statement

For

Harte Holdings (Ballinasloe) Ltd intend to apply for full planning permission for the provision of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m. The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Food Sales (including alcohol sales)and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit) first floor management suites and store areas, ancillary retail toilets and services, site level changes and re-grading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure.

An Environmental Impact Statement accompanies this application and will be available for inspection or purchase at a fee not exceeding the reasonable cost of making a copy during office hours at the offices of the planning authority. The planning application may be inspected or purchased at the offices of the Planning Authority at Ballinasloe Town Council, Council Offices, Ballinasloe, Co. Galway during office hours Monday to Friday excluding bank holidays. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of a fee of €20 within the period of 5 weeks beginning on the date of receipt by the Town Council of the application.

CONTENTS

Document Control Sheet

Date	Issue	By	Type
11/04	Ver A	JFC	Draft - Structure
15/05	Ver B	JFC / JP	Reports
01/10	Ver C	JFC	Draft for Issue
15/10	Ver D	JFC	Issue

Issued	Signed
-	[signature]

CONTRIBUTORS

The Contributors to the Environmental Impact Statement are as follows:

Town Planning & EIA Preparation	Cunnane Stratton Reynolds Copley Hall Cotters Street Cork & 3 Molesworth Place Dublin 2
Air Quality	AWN Consulting Clonshaugh Industrial Estate Dublin 17
Architectural & Urban Design	Wilson Architecture 5 Lapps Quay Cork
Human Beings & Material Assets	Cunnane Stratton Reynolds
Landscape & Visual Analysis	Cunnane Stratton Reynolds & O'Callaghan Visualisations Limerick
Flora and Fauna	Scott Cawley Environmental Consultants 27 Lwr Baggott St Dublin 2
Noise and Vibration	AWN Consulting
Archaeology	
Soils	Cunnane Stratton Reynolds & Hayes Higgins Partnership New Street Killkenny
Traffic, Transportation & Parking	Peter Brett Associates City Enterprise Centre Waterford Business Park Cork Road Waterford City

Water & Services	Hayes Higgins Partnership New Street Killkenny
Hydrology	Hydro Environmental Ltd. 2 St Mary's Road Galway, Ireland
Visual Impact Assessment	Cunnane Stratton Reynolds
Material Assets	AP McCarthy 1, Galway Financial Services Centre Moneenageisha Road Galway & Cunnane Stratton Reynolds

Introduction

PREAMBLE

Introduction

This preamble sets out the scoping and screening process involved in the preparation of this Environmental Impact Statement (EIS).

Screening / Scoping of Environmental Impact Statement

This Environmental Impact Statement (EIS) has been prepared by Cunnane Stratton Reynolds on behalf of Harte Holdings Ltd. The scope and range of issues to be considered within this EIS follows initial review of the site, review of previous planning applications and EIS documentation prepared for the site, and an assessment of site issues by the applicant and their consultants.

Environmental Impact Assessment (EIA) is provided for in Part X of the Planning and Development Act 2000 (The Act 2000) and in the Planning and Development Regulations 2001 (the 2001 Regulations) for specified classes of development prescribed by regulations made under section 176 of the Act 2000. The prescribed classes of development are set out in Schedule 5 of the 2001 Regulations. Article 10(b) Part 2, Schedule 5 10(iv) sets out that an EIS is required for urban development which would involve an area greater than two hectares in the case of a business district.

This Environmental Impact Statement has been carried out in accordance with Schedule 6 of the Planning and Development Regulations 2001. The Non-Technical Summary consists of a summary of the specialist technical reports and a commentary upon significant direct and indirect effects upon the environment.

1.0 Introduction

1.1 This Environmental Impact Statement (EIS) was compiled by Cunnane Stratton Reynolds Ltd.

1.2 It has been prepared to address the proposed development of a town centre extension to Ballinasloe at Back, Ballinasloe, Co. Galway. The extension to the Town Centre will take place on lands north east of River Street, Bridge Street and Main Street. The site is currently in rough agricultural grazing but has the benefit of a planning permission for a hotel development and infrastructure works under permission 04/074 (a permission for a 101 bedroom hotel, bar, function room, car parking and ancillary site services).

1.3 The proposed development by Harte Holdings Ltd involves the construction of a mixed use retail/commercial development with a total gross floor area of 10,075sq.m. The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Food Sales (including alcohol sales)and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit) first floor management suites and store areas, one no. ancillary retail area at first floors, toilets and services . The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, access provision off Bank Road (rear of Main Street) and ancillary site development works and infrastructure.

1.4 In summary, the now proposed development will involve the;

- 4,650sq.m. / 2,800 sq. m. GFA Food Sales (including alcohol sales) and 1,850 sq. m. GFA Non Food sales.
- 26 no. retail units
- Medical retail unit
- 326 no. car parking spaces

1.5 This proposal also allows for junction improvements to Main Street at the junction with Bridge Street and Bank Street.

1.6 The scope and range of issues to be considered within this EIS follow an initial scoping exercise by CSR, the applicant and their team of consultants and has been prepared in order to address the following issues:

- Air Quality
- Archaeology
- Architectural Design
- Flora and Fauna
- Human Beings & Material Assets
- Landscape and Visual Analysis
- Noise and Vibration
- Soils
- Town Planning
- Traffic, Transportation & Parking
- Water & Services

This Environmental Impact Statement ('EIS') has been carried out in accordance with the *Planning and Development Regulations 2001*.

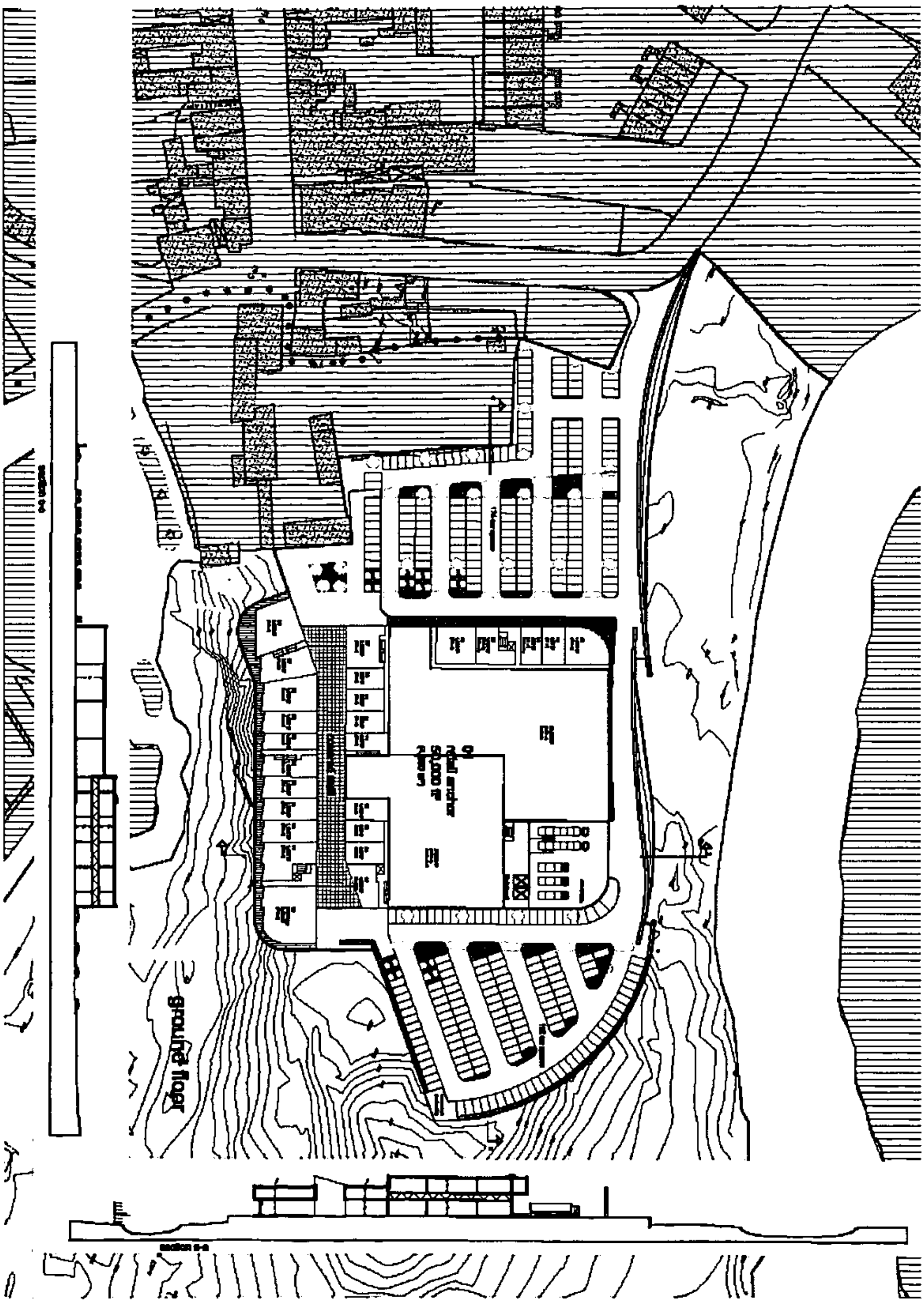
Existing Site & Surrounding Area

1.7 The site is located in the townland of Back in Ballinasloe, Co. Galway. The proposed site will form a natural town centre extension to Ballinasloe on lands to the north east of River Street, Bridge Street and Main Street. The site is located immediately to the

south of the River Suck, between the town core and the river. The site is part of a much larger landholding, a peninsula surrounded by waters of the River Suck. The existing site is currently in rough agricultural grazing but has the benefit of planning permission for a hotel development and infrastructural works under permission 04/074 (a permission for a 101 bedroom hotel, bar, function room, car parking and ancillary site services). The site is of the proposed development and the lands immediately surrounding it are relatively low-lying ranging from 30 m AOD on the flood plains of the River Suck to 40m along the central ridge. The site is located adjacent to the flood plains of the River Suck, which is a slow moving river in a shallow valley flowing from Mountbellow in the Northwest to the River Shannon in the southeast. Directly north of the site are the townlands of Cleaghgarve, Cleaghbeg and Creagh. Creaghgarve abd Cleaghbeg are situated on callow lands of the northern bank of the River Suck. These fertile grasslands are subject to extensive floods each winter. This area and the surrounding landscape has been subject to intensive agricultural management but is not however heavily developed. Lands to the west of the site on the southern banks of the River Suck are lowlying and predominately agricultural. Treelines and hedgerows traverse the landscape while farm buildings and residential housing are concentrated along the road network.The main Galway-Dublin National Primary Route, the N6, winds its way through Ballinasloe turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe, turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe Bridge, approximately .26 kilometres south of the proposed development. Three regional roads, the R348, R357 and the R358, pass within .2 kilometres, .9 kilometres and 1.3 kilometres respectively of the site at their closet point. The cul de sac, Bank Road extends north of Bridge Street to the West of the site.

1.8 The main Galway-Dublin National Primary Route, the N6, winds its way through Ballinasloe turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe, turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe Bridge, approximately .26 kilometres south of the proposed development. Three regional roads, the R348, R357 and the R358, pass within .2 kilometres, .9 kilometres and 1.3 kilometres respectively of the site at their closet point. The cul de sac, Bank Road extends north of Bridge Street to the West of the site.

Figure 1.1 General Site Layout Plan & Application Area



Non – Technical Summary

2.0 Non Technical Summary

2.1 The proposed development site is located in the townland of Back, Ballinasloe, Co. Galway. The proposed site will form a natural town centre extension to Ballinasloe on lands to the north east of River Street, Bridge Street and Main Street. The site is located immediately to the south of the River Suck, between the town core and the river.

Site Description and Surrounding Area

2.2 The site is located in the townland of Back in Ballinasloe, Co. Galway. The proposed site will form a natural town centre extension to Ballinasloe on lands to the north east of River Street, Bridge Street and Main Street. The site is located immediately to the south of the River Suck, between the town core and the river. The site is part of a much larger landholding, a peninsula surrounded by waters of the River Suck. It is currently in rough agricultural grazing but has the benefit of planning permission for a hotel development and infrastructural works under permission 04/074 (a permission for a 101 bedroom hotel, bar, function room, car parking and ancillary site services).

2.3 The main Galway-Dublin National Primary Route, the N6, winds its way through Ballinasloe turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe, turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe Bridge, approximately .26 kilometres south of the proposed development. Three regional roads, the R348, R357 and the R358, pass within .2 kilometres, .9 kilometres and 1.3 kilometres respectively of the site at their closet point. The cul de sac, Bank Road extends north of Bridge Street to the West of the site.

2.4 The site is of high importance in the context of the town, due to its location to the edge of the town centre. The 2003 Ballinasloe Development Plan 2003 has designated part of the site as a S1 Retail Planning Zone – Edge of Centre and C1 -Town Centre, the remainder of the site is zoned Environmental Management Area. Uses permitted on the Town Centre zoning include shop (comparison), shop (convenience), shop (neighbourhood centre), residential, apartments, office, café, restaurant and car park multi-storey.

2.5 It is expected that the development will take approximately 18 months to complete given an envisaged work programme of a 6-day week. It is expected that trading patterns associated with the development will bed down within 12 months of opening (2011).

2.6 The flexibility of hours of construction is required in order to allow significant works to take place outside of normal trading hours in the Town Centre. This will allow for minimal disruption to existing businesses. In addition, special events will have to be catered for in the construction phase where working outside these hours will have to be facilitated in order to prevent unnecessary disturbance on existing town centre traffic flows, parking and business operations. A Traffic Coordinator will be appointed to facilitate any such operations.

2.7 The construction of the development will provide for on-site employment rising to 150/200 persons in total. This figure has regard to the different labour requirements that different stages of construction will have. The number of operatives will vary during the progress of the construction stage project and it is expected to reach a maximum of approximately 150 - 200 persons during the fit out period.

Alternative Uses

2.8 A number of alternative design options were considered. In summary, the proposed development is located in a good location for the development of retail i.e. within the Town Centre. The identification of the site for retail purposes has followed the

elimination of a range of alternative uses given the potential for certain uses to have adverse impacts on the surrounding area.

Specified Information & Forecasting Methods

2.9 In general the compilation of the information necessary for the preparation of the Environmental Impact Statement did not present significant difficulties.

Effects On The Environment

2.10 Pre-planning consultations with Galway County Council and Ballinasloe Town Council officials, Planners and Engineers as to the potential impacts of the proposed development have been taken into account as part of the design process.

2.11 The effects of the development on the environment, has been assessed accordingly. The assessment of environmental impact has been restricted to include;

- Human Beings
- Soils
- Water and Services
- Air Quality
- Noise and Vibration
- Landscape and Visual Impact
- Flora and Fauna
- Traffic and Parking
- Cultural Heritage
- Waste
- Material Assets
- Interaction of the Foregoing

2.12 Each of the above was considered in detail, having regard to both the environment as it currently exists before the development, the likely impacts that a development of this kind would have and the means of reducing the impacts of the development when it is in operation. It should be noted that many of the impacts that the development could have had were excluded at the design stage when a range of different design alternatives were considered. As a result, the impacts identified in this non-technical summary represent a summation of the notable remaining impacts (considered in more detail in the EIS proper) and the means of reducing their impact to a point where they will not be significant.

Human Begins

2.13 The 2006 Census indicate that the population of Ballinasloe Town is 6,049 persons. This represents an increase of 65 persons (1.1%) over the 2002 Census figures.

2.14 There will inevitably be construction impacts on the existing community. Construction impacts are expected to be short-term and are likely to include impacts associated with construction traffic and any possible nuisance associated with such movements. Impacts dealing with issues such as noise and dust are assessed in later chapters.

2.15 Various elements of the development will be controlled in order to minimise disturbance and counteract potential negative impacts on residents in the vicinity. For example, construction hours will be restricted to minimise any short term loss of amenity that may be experienced by local residents.

2.16 The provision of a mixed use retail / commercial development in the area will provide a positive development to the area. The Commercial zoning of the lands by Ballinasloe Town Council signifies the Council's intention that these lands should be developed.

2.17 The remedial measures proposed during the construction period will ensure that the impact on the community will be temporary and will not be significant. Various elements

of the development will be controlled in order to minimise disturbance and counteract potential negative impacts on nearby properties.

Soils

2.18 The proposal is not expected to have any significant impact on soils either on the site or in its vicinity. No mitigation measures are required.

Water

2.19 Surface water drainage comprise of a system of permeable pavements and gravity drains provided within the site. Drainage lines are located in the public road, footpath/verge, car parking or open areas. The minimum diameter of surface water sewers are 225mm. All sewers have been designed to achieve a minimum of self cleaning velocity of 0.75m/sec with an additional 10% capacity provided for climate change.

2.20 Disposal of all surface water from the site shall be in accordance with Galway County Council, Water Services Department, Foul and Surface Water Requirements, Greater Dublin Strategic Drainage Study (GDSDS), Sustainable Urban Drainage Systems Report Series C521 and the Guide for Development of Drainage of Development Sites Report SR574 by HR Wallingford.

2.21 To reduce the impact of the development on the site we aim to mimic the green field runoff response at source through the use of effective source control measures and sustainable drainage practices. As such we have divided the site into a number of sub-catchments, each designed with its own method of Storm Water disposal.

2.22 A number of SUDS components are provided for storm water disposal within our site which will maximise the treatment efficiency of a wide range of pollutants.

a) ***Petrol/Oil Separators:*** will contain serious pollution events and are also used to manage sediment, hydrocarbons and other debris upstream of SUDS devices

b) ***Permeable Pavements:*** will limit concentration of pollutants by immediate localised interception and can further reduce concentration of pollutants by:
- Filtration
- Retention within the pavement
- Biodegrading hydrocarbons and other hydrocarbons trapped in the upper pavement layers
- Settlement and retention of solids

2.23 The 100 year flood level (including increase in flows for climate change) has been determined by the hydrologist to be 38.580m (See separate Hydrologist Report for details).

Protection against river flooding is catered as follows:

- Protection zones of 600mm for all buildings (39.200m) and 450mm for hard-standing areas (39.050m) is provided to the 100 year flood level with climate change
- Attenuation storage designed with limiting discharge rate of 2l/s/ha provided for 100 year storm event, as per the GDSGS policy

2.24 The permeable pavement and subgrade have been designed to attenuate the 100 year storm event and discharge in a controlled manner to the River Suck via the drainage system. The attenuation system has also been designed with no infiltration as the highest expected water table level is within 1000mm of the formation level.

2.25 All foul lines are located in the roads, footpath, verge or open space areas. The minimum diameter of foul sewers is 150mm at a gradient of 1 in 150, where possible 225mm pipes are provided at head of pipelines. All sewers have been designed to achieve a self-cleaning velocity of 0.75m per second. The drainage system will be gravity feed to an on-site pumping station and storage tank and subsequently conveyed to Local Authority sewer.

2.26 The existing local authority sewer comprises of a 225mm pipeline. We propose to connect to the sewer at an existing manhole located at adjacent of our site on Main Street. Foul water will subsequently be conveyed from the sewer to the Local Authority Wastewater treatment plant.

2.27 The proposed pumping station will have a capacity of 12 hour storage and be constructed in accordance with Local Authority specifications to include duty and stand by pumps, back up generator, dosing facility, telemetry system, control house, magma flow meter etc.

2.28 A 150mm diameter watermain will service the development. The watermain will be connected to the public watermain that adjoins the site at Main Street. An existing Local Authority watermain that traverses the site will be diverted to facilitate the development.

Air Quality

2.29 The proposed development will have a negligible impact on air quality.

Noise

2.30 Section 11 of this EIS, prepared by AWN Consulting Limited, assesses the likely noise and vibration impact in the context of current relevant standards and guidance.

2.31 The existing noise climate has been surveyed during both daytime and night-time periods and has been found to be typical of an urban area. Prevailing noise levels are primarily due to road traffic noise.

2.32 When considering a development of this nature, the potential noise & vibration impact on the surroundings must be considered for each of two distinct stages: the short term impact of the construction phase and the longer term impact of the operational phase.

2.33 Subject to good working practice during the construction phase and not exceeding any limits proposed within the EIS, it is anticipated that noise and vibration will not cause any significant problems.

2.34 Based on detailed information on the site layout and the proposed use of the development, noise levels have been predicted at the relevant noise-sensitive locations. In all cases, noise levels fall below the adopted criteria.

2.35 Traffic flows with and without the development have been analysed to predict the expected change in noise level for many of the surrounding roads. The expected noise impact is slight.

2.36 In summary, the noise impact of the proposed development is not significant.

Landscape & Visibility

2.37 The Landscape and Visual Impact Assessment was carried out in accordance with the EPA's *Guidelines on the Information to be contained in Environmental Impact Statements 2002,* as well as the (British) Landscape Institutes *Guidelines for Visual Impact Assessment, 2002.*

2.38 There will be no significant visual impacts associated with the development

Flora & Fauna

2.39 The proposed development area itself does not fall within any areas designated for environmental protection. The National Parks Wildlife Service records of rare and protected flora throughout Ireland showed that there were no species of concern within or near the site. However, it is on the banks of the River Suck which is a Special Protected Area (SPA site code 004097) and a Natural Heritage Area (NHA site code 000222).

2.40 Detailed faunal assessments were not carried out as part of this strategic assessment; however it would be expected to find a number of species making use of the study area and the habitats recorded therein.

2.41 The derelict stone building at the southwest corner of the site (outside the ownership of the applicant) and the boat house at the northwest corner of the site are potential (but unconfirmed) bat roosts. These will remain unaffected by the proposed development.

2.42 There is evidence of badger (Meles meles) activity within the study area. Badger droppings were found at two locations along the bank of the river. No setts were confirmed to be present in the study area. A large mammal burrow was found on the higher ground on the centre of the site. This burrow was of a size that could belong to a badger, otter, or fox. However there was no clear evidence of any of these species having frequented the burrow as all signs had been obscured by human interference. Several hairs that appeared to be of fox origin were found nearby.

2.43 Evidence of fox (Vulpes vulpes), rabbit (Oryctolagus cuniculus) and brown rat (Rattus norvegicus) was also found. There are also records of Irish hare (Lepus timidus hibernicus) in the area. Other species commonly found in this type of agricultural setting include hedgehog (Erinaceus europaeus), pygmy shrew (Sorex minutus), and wood mouse (Apodemus sylvaticus). It is highly likely that some of these species would make use of the grassland, woodland and freshwater habitats present within the study area. The proposed development retains an extensive area of peninsula to the east of the site as undeveloped area; this is proposed to remain as an amenity area for the foreseeable future and will continue to accommodate wild life.

2.44 Many commonly occurring songbirds were seen such as hooded crow (Corvus corone), song thrush (Turdus philomelos), wren (Troglodytes troglodytes), redwing (Turdus iliacus), blackbird (Turdus merula), blue tit (Parus caeruleus), great tit (Parus major), meadow pipit (Anthus pratensis), house sparrow (Passer domesticus), goldcrest (Regulus regulus), chaffinch (Fringilla coelebs), and robin (Erithacus rubecula), were noted during the site visit. Mute swan (Cygnus olar) and moorhen (Gallinuta chloropus) were also sighted. Snipe (Gallinago gallinago), which are listed under the amber list of the Birds of Conservation Concern in Ireland (BoCCI), which means they are of medium conservation concern, were sighted.

2.45 The loss of grassland habitat will result in an impact of low significance. Impacts upon the floodplain have been avoided and only a small length of poor hedgerow will be removed. No disturbance to the River Suck will occur and as such the SPA and pNHA will not be directly impacted upon. Disturbance of birds is considered to be unlikely given the distance from the proposed development and the nature of operations therein.

2.46 The relatively benign nature of the development in terms of site activities will mean that there will be no significant direct impacts within the site.

2.47 Due to the use of petrol and oil interceptors and the proper disposal of foul waters to the town sewer, there will be a low probability of any impact on the River Suck arising from the operation of the development. Disturbance of birds is considered to be unlikely given the distance from the proposed development and the nature of operations therein. Petrol interceptors will be regularly maintained and checked on a monthly basis. A member of staff with responsibility for this duty must be identified once the development is in operation. No other monitoring requirements are deemed necessary with respect to ecological impacts.

Traffic and Parking

2.48 This Transport Assessment has been undertaken to quantify the potential influence of the proposed commercial development upon the operational performance of the off-site local area road network. Our methodology incorporated a number of key inter related stages, including;

- Site Audit,
- Traffic Count Surveys,
- Trip Generation, Distribution and Assignment exercises
- Sensitivity Analysis,
- Network Impact analysis, and
- Network Assessment.

2.49 Whilst the subject site does not currently accommodate any existing structures it does nevertheless benefit from planning permission for a 100 bedroom hotel with ancillary facilities as granted in 2005 by the local planning authority.

2.50 During the initial master planning stage a sensitivity analysis of the existing road networks ability to accommodate a range of different development permutations on the subject site was undertaken. This sensitivity analysis of the networks operational performance demonstrated that, further to the significant benefits achieved following the implementation of the N6 Ballinasloe by-pass, mitigation measures at a number of off-site junctions would be required.

2.51 The sensitivity analysis concluded that enhancement measures to the Main St / Riverview junction and the Bridge St / N6 (existing alignment) corridor would significantly mitigate the impact as potentially generated by the subject development proposals and strike an optimum balance between the various conflicting demands of all road users travailing through and across these two key junctions.

2.52 The principal findings of the assessment, as detailed in the previous chapters of this report can be summarised as follows;

2.53 The proposed development would provides a key facility within convenient walking distance of the existing town centre and adjoining urban environ.

2.54 Sufficient car parking is proposed on site to both comply with local development standards and to ensure that no overspill onto the adjoining road network is generated during peak seasonal demands.

2.55 The identified off-site infrastructure enhancements return the networks 'Post Development' operational parameters to compatible levels for 'Base plus committed' traffic characteristics in the absence of the proposed junction works.

2.56 The network assessment represents a worst case assessment of future traffic characteristics as in addition to the inclusion of the completed committed developments

the recorded on-site traffic surveys include the construction traffic flows associated with the committed developments construction works.

2.57 The junction assessments reveal that the proposed site access junction will operate with a significant amount of reserve capacity in both the 2010 and 2015 Post Development traffic scenarios.

2.58 Similarly the junction enhancements to the Main St / Riverview junctions ensure that the this key junction will also operate within capacity in both the 2010 and 2015 Post Development traffic scenarios.

2.59 The junction analysis at the N6 / Bridge St Junction demonstrates that whilst the junction will operate well within capacity during the AM period, it will be approaching capacity for a short period over the PM peak hour in the 2025 Future Design Year. Nevertheless this level of operation is compatible to what would be expected should no enhancement works be carried out on the subject junction in a 'base plus committed' development traffic scenario.

2.60 In conclusion the Transport Assessment demonstrates that the proposed commercial development, in addition to the parallel implementation of the identified off-site junction enhancement works, can be accommodated on the subject site with no significant adverse impact upon the operational capacity of the local road network.

Cultural Heritage & Archaeology (Add in findings)

2.61 There are no recorded archaeological monuments or protected structures located on the area proposed for the development at Back Townland. No features of archaeological interest were noted during field inspection of the site by Dominic Delaney & Associates as part of previous archaeological assessment carried out for the extant permission on site, nor have there been any features or structures indicated on the site from cartographic or documentary evidence.

2.62 Although there are no known or recorded archaeological monuments on the site of the proposed development, topsoil stripping, ground reductions and general landscaping works (including drainage, cutting and filling) have the potential to reveal hitherto unknown sites, features and artefacts of archaeological potential and interest. Any ground works involving topsoil removal, excavation of trenches and cutting of ground is likely to endanger or destroy buried material of archaeological importance if such remains occur on the site.

2.63 Generally the proposed development site at Back Townland, Ballinasloe, is deemed to be of fair archaeological potential. In view of the possibility that archaeological remains that have no visible surface trace that may be disturbed during construction it is considered prudent to carry out an **archaeological monitoring programme** of all ground removal works associated with the construction of the proposed development.

2.64 In the event of an archaeological find being discovered from the proposed development area, the main contractor and all sub-contractors should be obliged to facilitate the archaeological consultant in every possible way in investigating any archaeological features, finds or deposits. Finds within the excavated layers will be noted and should any substantial archaeology or any discoveries be made, the archaeologist will have the authority to take the necessary time to evaluate the character of the find/feature. The archaeologist will also be afforded a suitable amount of time to undertake the appropriate level of recording, which will ultimately depend on the nature and extent of the feature. (Recording will be by means of Best Archaeological Practice (*Institute of Archaeologists of Ireland: Codes of Conduct 2006*). All archaeological features will be recorded using context sheets and scaled field illustrations. A photographic record will also be maintained which will show the work-in-progress and any archaeological features or finds. Any artefacts found will be fully recorded by context and a sampling strategy for artefacts, soil, wood, charcoal and stone will also be undertaken. These samples will be retained for post-excavation analysis if it is deemed necessary. In the

unlikely event of a significant find, the relevant authorities will have to be contacted to ascertain appropriate procedures

Waste

2.65 Waste will be generated by the construction of the development and also by its operation.

2.66 Segregation of waste types will be carried out on site during the construction phase of the development.

2.67 The waste arising from the development will be dealt with in compliance with the provisions of the Waste Management Act 1996, and associated Regulations. Any waste and demolition contractor chosen will have a number of recycling options available for the waste from the development, in order to achieve optimum levels of recycling, reuse and recovery.

Material Assets

2.68 The proposed development will have impacts on the material assets of the area during the construction period, affecting local business and operational activities and also affecting traffic and circulation measures.

2.69 These impacts will change from short term adverse impact to long term positive impact with the development of high quality Town Centre retail facilities likely to add to the footfall in the Town centre.

2.70 The proposed development will address a deficit in retail provision that has been identified in the town's catchment area.

2.71 The proposed retail development satisfies the requirements of the Retail Planning Guidelines 2005, the Galway County Development Plan 2003-2009 and the Policies and Objectives set out in the Ballinasloe Development Plan.

2.72 The Local Government (Planning and Development) General Policy Directive 1998 indicates that the retail sales area of all supermarkets (outside the Greater Dublin Area) should be less than 3,000 sq. metres. In this retail development the total supermarket component accounts for a total 2,800 sq. m net floor area and thus meets with the conditions set out by the Directive.

2.73 The Directive and Retail Planning Guidelines also apply to all retail developments that would represent a substantial addition to existing retail facilities and indicate that such development should be guided by specified criteria. A number of these are considered below.

A. Adequacy of existing shopping outlets in the area:
As outlined under this report there will be a shortfall of retail space available in Ballinasloe by 2012. Retail provision at present is inadequate for current need. Additional retail provision is required to offset this shortfall.

B. Size and location of existing centres:
Retail units in Ballinasloe tend to be small, with a few exceptions such as Tesco and Lidl. The proposed retail development in this RIA will improve the viability and vitality of the town centre and will help to consolidate the development of a sustainable commercial core. The supermarket is not excessive in size and its location along with other retail units will provide a strong shopping centre adjacent to the local community. This development will not negatively impact on the vitality or viability of Ballinasloe but will reverse the outflow of expenditure to Galway City and create beneficial synergies with the existing stores.

C. Quality and convenience of existing outlets:

The lack of and restrictive nature of retail provision at present in Ballinasloe would ensure that a considerable leakage of retail spend seeps out of the catchment area to other areas and particularly to Athlone Town. This proposal will help to reverse this leakage and bring a greater spend into the Village.

D. Effect on existing communities:

The present poor provision of retail facilities in the Ballinasloe catchment area results in many local people having to travel longer distances than necessary to do their weekly and daily shopping. Considerable seepage of expenditure is presently going to Athlone Town and Galway City.

The proposed development will reverse this trend and facilitate local people do their shopping in a more convenient place. It will have no adverse impact on the Athlone Town market. Other centres around the region are already prospering in their own right and will not be adversely impacted by the development of new retail provision in Ballinasloe.

E. Needs of people dependent on the availability of retail shopping outlets within walking distance:

The proposed retail development is adjacent to the established centre of Ballinasloe and has been designated for town centre development. It is walkable from most parts of the town in a five minute time period. The granting of this retail planning proposal would be of significant advantage to the retail sector and most importantly to the consumer. The proposal will lead to a higher degree of self-sufficiency for Ballinasloe.

F. Countering urban decline by promoting urban renewal and best use of existing resources in the urban area:

A modern multifunctional space will be provided that will include a number of retail units – both small and medium sized, offices and 36 no. residential units. This development will be located within the Town Centre of Ballinasloe and will enhance the urban setting by providing a vibrant, multifunctional mixed use development.

2.74 This Retail Impact Assessment has clearly demonstrated that the proposed retail development can be accommodated within the catchment area with no detrimental impacts on the existing centres.

Flooding

2.75 A review of the potential impact of the proposed development on the area's flood regime has been carried out and the proposal can be built at an appropriate flood level without causing flooding up stream or down stream of the site.

Interaction of the Foregoing

2.76 Interactions are expected between human beings/noise, human beings/dust, human beings/air quality, human beings/landscape and visibility, flora and fauna/landscape and visibility. These interactions are fully assessed in the following chapters.

Environmental Impact Assessment

3.0 The Development

3.1 This chapter outlines the proposed development in terms of its location, current land use and the description of the proposed development. In addition, the various relevant planning issues and planning policies at a national, regional and local scale are addressed.

Site Description and Surrounding Area

3.2 The site is located in the townland of Back in Ballinasloe, Co. Galway. The proposed site will form a natural town centre extension to Ballinasloe on lands to the north east of River Street, Bridge Street and Main Street. The site is located immediately to the south of the River Suck, between the town core and the river. The site is part of a much larger landholding, a peninsula surrounded by waters of the River Suck. It is currently in rough agricultural grazing but has the benefit of planning permission for a hotel development and infrastructural works under permission 04/074 (a permission for a 101 bedroom hotel, bar, function room, car parking and ancillary site services).

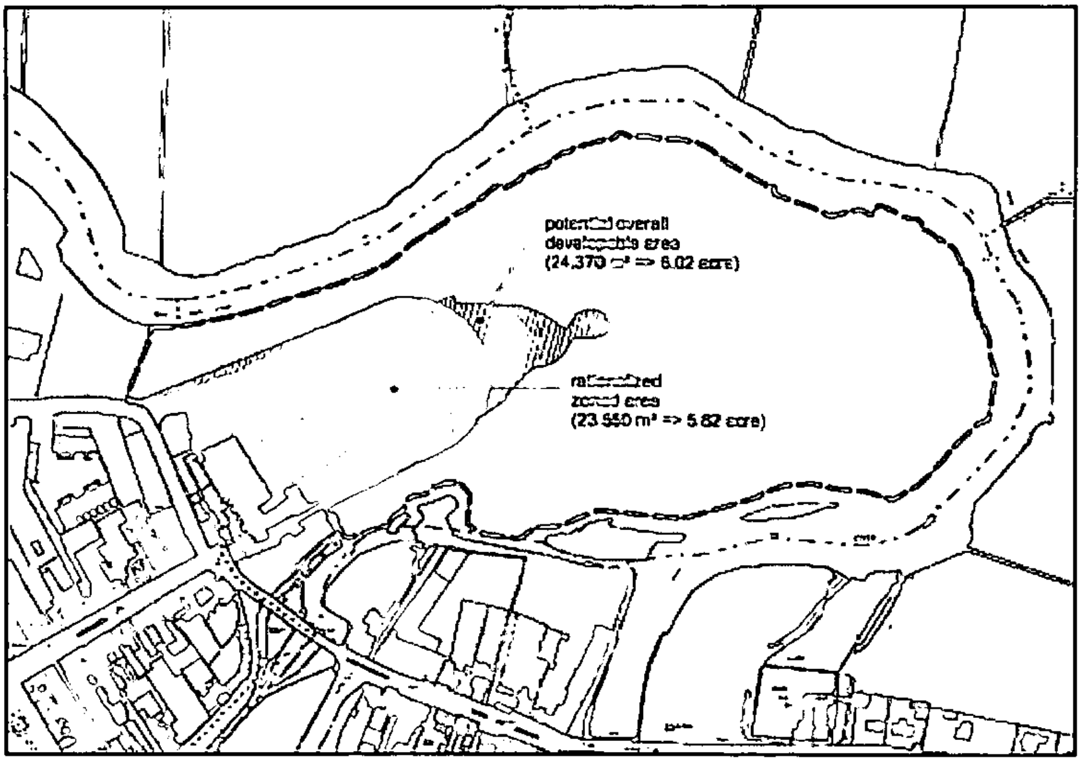


Figure 1 **General Ownership Boundary**

3.3 The site is of the proposed development and the lands immediately surrounding it are relatively low-lying ranging from 30 m AOD on the flood plains of the River Suck to 40m along the central ridge. The site is located within the flood plains of the River Suck, which is a slow moving river in a shallow valley flowing from Mountbellow in the Northwest to the River Shannon in the southeast. Directly north of the site are the townlands of Cleaghgarve, Cleaghbeg and Creagh. Creaghgarve and Cleaghbeg are situated on callow lands of the northern bank of the River Suck. These fertile grasslands are subject to extensive floods each winter. This area and the surrounding landscape has been subject to intensive agricultural management but is not however heavily developed. Lands to the west of the site on the southern banks of the River Suck are low-lying and predominately agricultural. Treelines and hedgerows traverse the landscape while farm buildings and residential housing are concentrated along the road network.

3.4 The main Galway-Dublin National Primary Route, the N6, winds its way through Ballinasloe turning sharply west at the junction with Bridge Street, crossing the River Suck at Ballinasloe Bridge, approximately .26 kilometres south of the proposed development. Three regional roads, the R348, R357 and the R358, pass within .2 kilometres, .9 kilometres and 1.3 kilometres respectively of the site at their closet point. The cul de sac, Bank Road extends north of Bridge Street to the West of the site.

Figure 1.2 Aerial View of the Site

3.5 The proposed development will provide for a mixed use retail/commercial development with a total gross floor area of 10,075sq.m. The proposed development incorporates an anchor unit with a gross floor area of 4,650sq.m. (2,800 sq. m. GFA Food Sales (including alcohol sales)and 1,850 sq. m. GFA Non Food sales), 26 no. retail units (including one pharmacy unit) first floor management suites and store areas, ancillary retail toilets and services, site level changes and regrading. The application also includes car parking for 326 no. spaces, ancillary hard and soft landscaping, access provision off Bank Road (rear of Main Street)

Construction Impacts

3.6 The construction of the development will have a different impact than its operation. By its very characteristics, the construction impact will be temporary in nature and must be considered as a transient environmental impact. It is expected that the development will be completed within 18 months of the commencement of construction.

Construction Employment

3.7 The construction of the development will provide for on-site employment up to 150 - 200 persons during the later stages of the constriction and fit out programme. This figure has regard to the different labour requirements that different stages of construction will have. It is expected that there will be a lower labour requirement at the initial stages of the project.

Construction Hours

3.8 The construction phase of the development is expected to comprise a 6 day week for a portion of the project with normal working hours extending from 06.30 to 21.00 where possible. In cases where specific works such as concrete pouring or deliveries of specific materials are necessary out of hours, local residents and businesses will be informed where possible. This work can be carried out outside of normal working hours in the Town Centre in order to minimise disruption to normal commercial activities. It will be necessary to carry out power floating of concrete in association with pours; this may occur outside of the previously noted construction times in order to ensure minimal disruption on city centre trading activities.

3.9 All construction actions will be carried out to ensure that impact on trading operations in the city centre are minimised.

Construction Waste

3.10 Certain wastes will arise from the construction phase. These will be disposed of at an appropriate licensed landfill facility.

Planning Context

Zoning

3.11 The site of the proposed development straddles two designated zonings. The mixed use retail/commercial and residential development is located on lands which are zoned for **C1: Town Centre Uses** in the Ballinasloe Development Plan 2003. The primary aim of this zoning is to protect and provide for town centre uses. The area of the site closer to the river over which public access to the proposed development and walkways are to be provided is designated as an Environmental Management Area. The primary function of this zone is to protect areas of landscape quality and provide for environmental management.

The uses permitted in principle in the Development Plan zoning matrix under the C1 zoning include the following:

- Apartments, ATMs
- Banks, Bed and Breakfast, Betting Office
- Café, Car Park multi-storey
- Hostel, Hotel
- Library, Leisure
- Office, Public House
- Residential, Restaurant
- Shop (comparison), Shop (convenience), Shop (neighbourhood centre)

The uses open for consideration under the C1 zoning include a shopping centre

Planning History

3.12 There has been one previous planning application on this site:

- Planning Reference: 04/074. This application was lodged by Jack Murray for permission to construct a 101 bedroom hotel, bar function room, car parking and all ancillary site services. A grant of permission was issued by the Town Council on the 27/09/2005.

Planning Policy Context – National and Regional Context

Sustainable Development: A Strategy for Ireland (1997)

3.13 The document '*Sustainable Development: a Strategy for Ireland*' prepared by the Department of Environment and Local Government provides a comprehensive analysis and guidance which will allow sustainable development to be taken forward in Ireland. Sustainable development as espoused in this EIS is defined as an acceptable quality of life for present and future generations recognising that the actions of the present affect the inheritance of future generations. In a sustainable world, human activity must not undermine the long term productivity of supporting eco-systems. The concept of sustainability requires that development must be within the capacity of the environment to support it without creating lasting damage or depletion.

The Government considers sustainable development as:

- A dynamic concept which must be given both practical and concrete expression in the present to generate a new development model for the future involving change in socio-economic and consumer behaviours.
- An inclusive concept bringing environment to the heart of economic growth and quality of life concerns, and requiring the active participation of economic operators and the public
- A quality concept which recognises that a clean environment and a conscientious approach by business to environmental protection are an advantage to rather than a constraint on, successful economic performance.

National Spatial Strategy 2002-2020

3.14 The NSS is a twenty year planning framework designed to achieve a balance of social, economic, physical development and population growth between regions. The strategy promotes principles which helps renew, consolidate and develop existing cities keeping them compact, minimising urban sprawl and using urban land ' *carefully, sensitively and efficiently with the aim of reducing dereliction and under utlisation'*. In the Western Region Galway City is identified as a national 'Gateway' while Tuam, Castlebar and Ballina are identified as 'Hubs'. Ballinasloe is identified as a town with a population over 5,000 in the Western Region. The Strategy recognises that Ballinasloe will benefit from the Galway and Midlands Gateways by virtue of its location on national transport routes and their quality of life and cost advantages in the housing and employment areas. According to the NSS, towns such as Ballinasloe provide good bases for population and services which will attractive investment and employment activities to those that need to be located in or near a Gateway. This development will secure the implementation of the objectives of the NSS and contribute to the objective of balanced regional development.

West Regional Planning Guidelines (May 2004)

3.15 The West Regional Planning Guidelines (RPG) covers the counties of Galway, Mayo and Roscommon and incorporates Galway City. The principle objective of the Guidelines is to put in place a broad planning framework for the region and to provide an overall long-term strategy for the making of development and local plans for each of the local authorities in its administrative area. The Guidelines also aim to formulate and implement a settlement strategy for the region that builds up 'critical mass' in the nominated gateway, Galway, the hub of Tuam and the linked hub of Castlebar/Ballina whilst creating a network of smaller settlements which will develop into vibrant communities finding support to/from the gateway and hub/linked hub. It will support development in the towns and villages in the region that is in sympathy with the existing built environment.

Ballinasloe is identified as a key town in the Guidelines and a town designated for decentralisation. According to the Guidelines, decentralisation is to be welcomed and will have a positive impact on the region for towns chosen. It notes that towns like Ballinasloe have the capacity to cater for these developments. It will give extra impetus to their growth and will help them reach a higher level of critical mass thus making them more attractive as higher order service and retail locations

Planning Policy Context – Local Context

Ballinasloe Development Plan 2003 – 2009

3.16 The Ballinasloe Local Area Plan 2003-2009 sets out a development framework and strategy for the future growth and development of Ballinasloe Town and Environs. Section 2.2.1 of the Development Plan identifies several important features that must be taken into consideration when dealing with the future direction and type of development for the development of the town centre area. These features, in summary, are as follows:

- Under utilised backlands,
- Higher concentration of derelict and buildings in poor condition in backland areas,
- Generally, the main commercial streets are in good condition,
- Many archways are existing on the commercial streets to the rear building line,
- Dominance of the car in the town centre and associated parking problems.

The proposed development as detailed takes cognizance of these features of the town centre. The overall design, nature and layout of the proposed development will bring new vibrancy and life to this backlands to the north east of Bank Road, Main Street and Bridge Street.

The policies applicable for the town centre are detailed under section 2.2.1 of the Ballinasloe Development Plan. This section states that it is the policy of Ballinasloe Town Council to:

- Encourage growth in residential and commercial activity behind Main Street in the backlands areas so as to create a new focus of activity in the vicinity of the river and assist in the development of the town's amenities. For residential development proposals in town centre backlands, promote the development of residential and apartment courtyards, with direct pedestrian access onto the main shopping streets via the existing network of laneways and arches.
- Encourage small office facilities on upper floor levels in the commercial area, so as to revitalize upper floor use and to help strengthen the vitality of the town centre.
- Encourage the continuity of shopping facilities at ground floor level along the main commercial centre of Main Street, Dunlo Street, And Soceity Street, thereby ensuring that there is vibrancy of activity at street level, and an identifiable commercial focus to the town centre.
- Discourage office uses on the ground floor level of buildings on Main Street, Dunlo Street, and Sarsfeild Road so as to keep the ground floor level vibrant and accessible for commercial use and to avoid this level being used for office use.
- Continue to improve the physical character of the town centre through landscaping, environmental improvements, co-ordination of street furniture and improved paving.
- Encourage a growth in amenities and activities associated with the River Suck so as to harness its potential as a generator of economic activity in the town.
- Encourage a diversity of uses throughout the town centre.

Ballinasloe has an important sub-regional role in terms of shopping in Galway and is the main urban centre in the east of the County. According to Section 2.3.1 of Ballinasloe has shown an increase in demand for comparison goods floorspace. This may be attributed to the current buoyant state of the national economy and the growing trend towards urbanization. The demand for services and comparison goods are the first to rise with expanding income and this trend is currently noticeable at national level where demand for comparison goods has grown by 6.9% a year. According to the Plan demand for convenience goods has increased by 3.3% a year. It goes on to state that working studies have shown that there is capacity for an additional 5,957 sq.m. of net commercial/retail floorspace in the town between the year 2000 and 2006. The Plan acknowledges that it is important that the town achieves its commercial/retail capacity in the interest of preventing loss of commercial revenue to the surrounding larger urban centres of Galway and Athlone.

Section 2.3.1 of the Ballinasloe Development Plan, adopted in 2005, presents a number of retail policies, which are designed to develop important roles for retail in Ballinasloe. The key policies are as follows:

- Support and reinforce the commercial core comprising Main Street, Dunlo Street, Society Street and all associated backlands as the premier shopping area in the town and sub region.
- Encourage a range of shopping facilities in the town core and promote sustainable economic vitality.
- To promote land assembly within the town core and achieve sustainable development through the intensification of land use and to facilitate the adoption of a sequential approach to retail planning with a preferential order as follow: first in the town centre, then edge of centre and thirdly out-of-centre locations.
- Prohibit large-scale convenience and comparison goods shops outside the town core so as to protect the vitality and viability of the town core.
- Adopt a parking strategy that provides for multi-purpose shopping and ease of access so as to provide commercial synergy and promote sustainable movement patterns.
- Promote aesthetically pleasing innovative design and originality.

It is an objective of the Local Authority to:

S1: Actively facilitate the development of the town's commercial developments on the backlands north of the town centre between the River Suck and Main Street and Society Street.

S2: Ensure that retail development (except local, small scale shopping facilities) respect the sequential approach by prioritizing retail development to occur in the following order:

1) Town Centre
2) Edge of Centre
3) Out of Centre

Section 3.4.1 of the Development Plan states that where commercial developments are proposed the planning authority may require appropriate mixes of use, in accordance with the uses of the surrounding area. In general, the planning authority will encourage a mix of uses on upper floors in shopping/neighbourhood centres.

Section 3.4.2 specifically deals with shopping centres and permitted locations for shopping. It states that shopping centres will be encouraged to locate within town centre zones. Out-of-town shopping centres will normally only be permitted within neighbourhood centres as identified by the Development Plan. Shopping zones for town centre, edge of centre and out of centre are identified in the Development

Objective Map – Map 8. It illustrates that the subject is identified as an edge of centre location suitable for a shopping centre.

The site of the proposed development is also subject to the Open Space specific objectives of the Ballinasloe Development Plan:

A1: Provision of a Linear Park

Provide a linear park along the rivers banks in the backlands of the town (to the rear of Main Street and Society Street and including lands associated with the Hill O' the back and to connect with the old disused canal network southwards to the Theampelean (old church ruin) in Poolbeg.

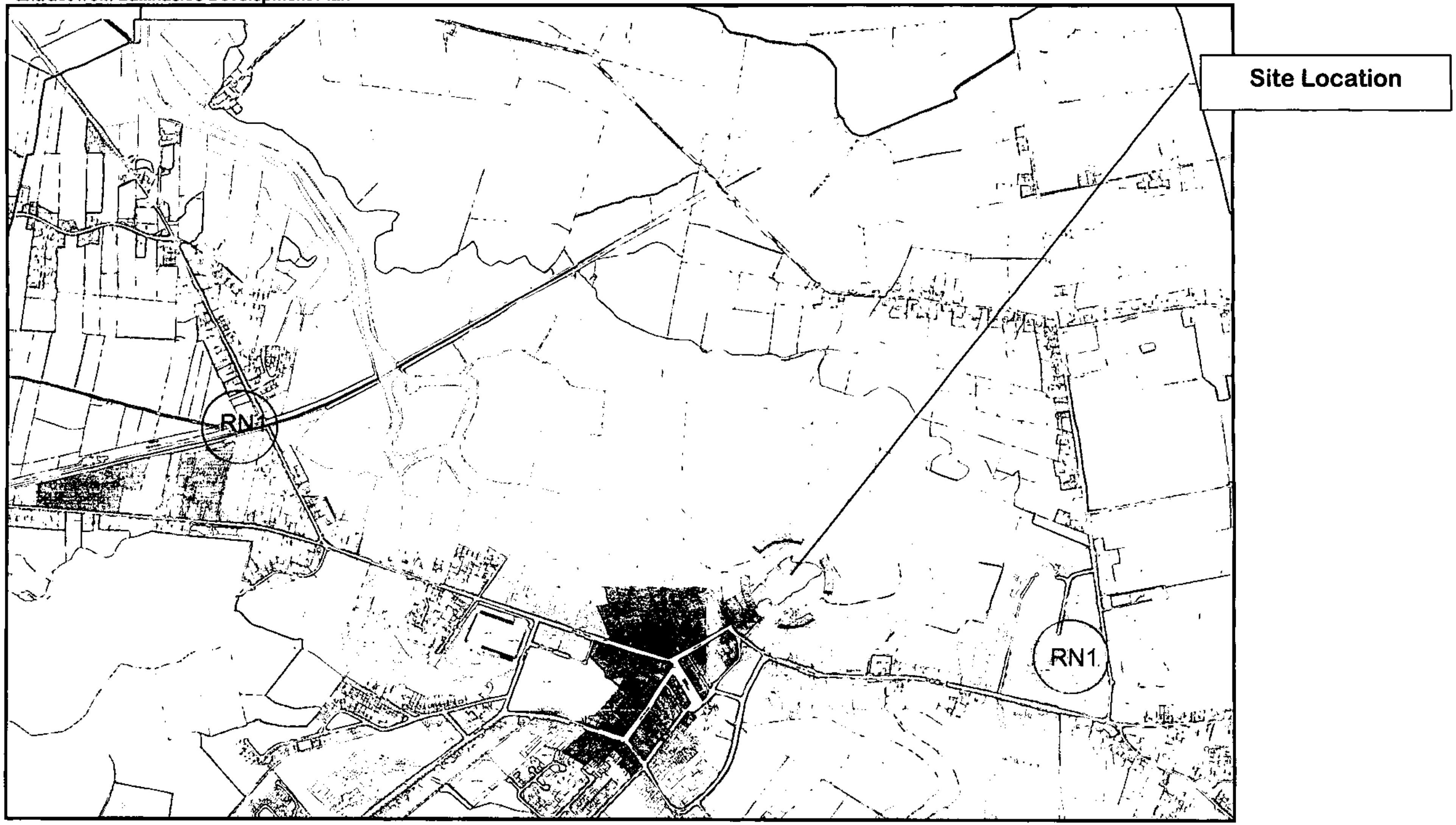
A2: Provision of a Public Walkway Including Cycle Path

Ensure the provision of a public walkway including cycle path in association with any development of objective A1

A7: Reserve Linear Park

Reserve, where practical, a system of linear parks along all river and stream courses, in particular the Deerpark River and the Suck

Figure 3.1: Adopted Zoning Plan (Map 7 of the Ballinasloe Development Plan 2003)
Extract from Ballinasloe Development Plan



4.0 ALTERNATIVES EXAMINED

4.1 The Environmental Protection Agency's *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* outlines that alternatives indicating the main reasons for choosing the proposed development may be described at three levels, namely alternative locations, design and processes.

Alternative Locations

Location within Ballinasloe

4.2 The proposed development is located in a town centre area. The site is zoned for development in the current Development Plan which indicates the Planning Authority's intention that the site will be developed in the future.

4.3 The site is zoned for **town centre uses**, in the Ballinasloe Development Plan 2003. The uses that are permitted in principle and open for consideration in these zones are outlined below.

4.4 The uses permitted in principle in the Development Plan zoning matrix for this zoning include 'supermarket' 'shop (convenience)', 'shop (comparison)', 'apartments', 'residential', 'office' 'café' and 'restaurant' uses.

4.5 The mix of uses proposed within the development is compatible with the zoning objectives applicable to the site.

4.6 The nature of the site and the activities proposed as part of this development paid due regard to the range of uses permitted by the Ballinasloe Development Plan for the area.

Location within the Site

4.7 The arrival at the proposed design considered a number of possible layouts within the site and these are outlined in greater detail in the following section.

Alternative Uses

4.8 The opportunity for alternative uses to the mixed use retail/commercial and residential scheme proposed is limited by the design and zoning guidance available for the site.

4.9 The proposed use of the site is potentially the most sustainable use of the site. It is likely that the alternative uses that the site could be developed for (subject to a viable planning permission), would nether represent an effective use of the land or a use that is compatible with the Development Plan.

4.10 A number of alternative uses for the site include the following:

A "do nothing" approach

This does not represent a viable alternative to the development of the site.

Develop an Office Based Scheme

Commercial uses are permitted in an edge of centre location although ground floor retail uses are demanded by the Town Development Plan. Large scale office development would not be viable and would lead to dereliction and an adverse impact on the town centre.

Develop mixed use Office, Residential and Commercial Scheme

All the above uses are likely to be permitted as part of the development on the site. However, conflicts may occur between the mix of uses where different demands are presented throughout a 24 hour period. This also raises difficult issues in relation to servicing and parking and it potentially limits the viability of an mixed use scheme in the Town Centre.

The combination of the above uses also leads to challenges in relation to accessing and servicing of the site.

Develop Retail/Commercial Scheme

This is the alternative adopted as an option for the proposed development. In determining the most appropriate use for the site, a range of purely retail (comparison and convenience goods) commercial development is promoted. This ensures that "after dark" uses such as cinemas and pubs are not proposed as part of the development. This restrictive approach to formulating the mix of uses ensures that no commercial use injures the amenities of residents living nearby and that the overall challenge of trying to service the scheme with a multiple range of uses within the capacity of the areas junctions to accommodate development is minimised..

Alternative Design

4.11 In reaching the submitted design a number of alternatives were assessed by the design team. Issues such as internal circulation, shape of buildings, location and orientation of buildings, scale of buildings, floorspace, suitable access to the site and for servicing vehicles were all discussed. Having taken the site parameters into account such as road access, environmental issues, a number of options were considered

4.12 The following section describes the urban design concept and architectural approach to the proposed development. The development as proposed by Harte Holding has been designed by Wilson Architects in response to the urban context, site topography and orientation.

4.13 Initial reviews as to the form and nature of the design of the site were cognisant of the need to provide an appropriate access solution to the lands. This included a revise of various potential access options from the north, south east and west. In summary, all options explored other than the permitted hotel access indicated that extensive works in and adjacent to the river NHA / SAC would be necessary, potentially leading to undesirable environmental consequences.

4.14 As a result, access proposals which allowed for access to the site via the road alignment permitted under the established hotel permission were adopted as the most appropriate and environmentally sensible access solution. An alternative access could be developed to the south east of the Bank of Ireland but this may ultimately allow (most appropriately) for pedestrian access given the adverse impact that high volumes of traffic in this area may have on the protected structures (see Figure 4.1 overleaf). Pedestrian Access is provided for through the application site should the area be developed in the future.

4.15 The layout adopted also had regard to the lands identified as suitable for development, this included both lands on which access infrastructure for the previous hotel was permitted on, lands on which the permission for the hotel was allowed and lands on which are zoned. See Figure No. 4.2 overleaf.

Figure 4.1 Access Options

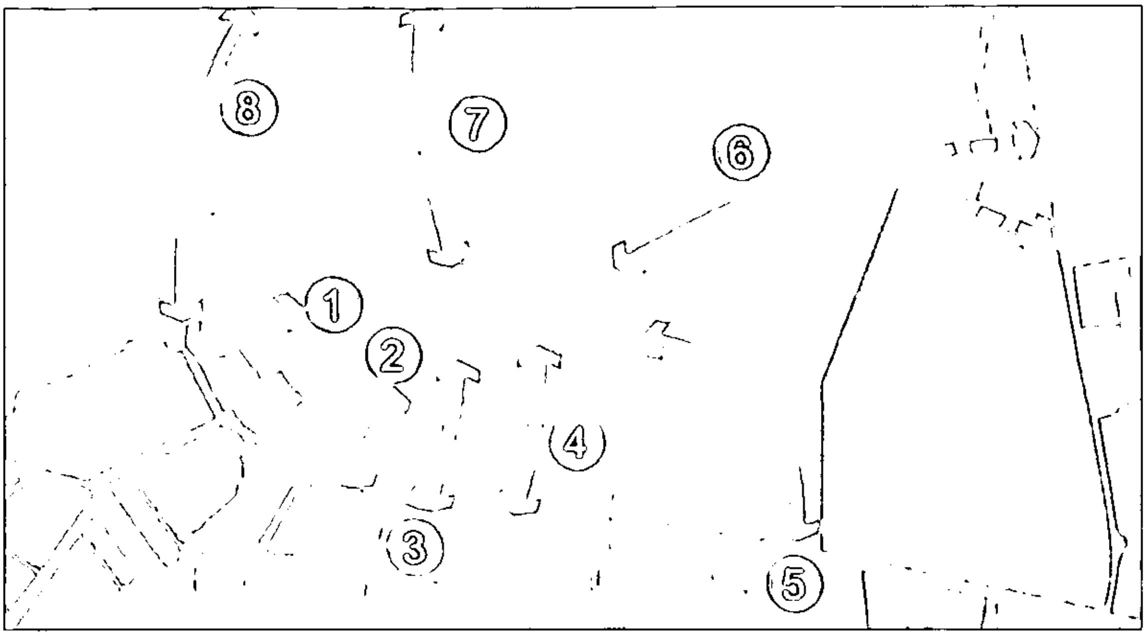
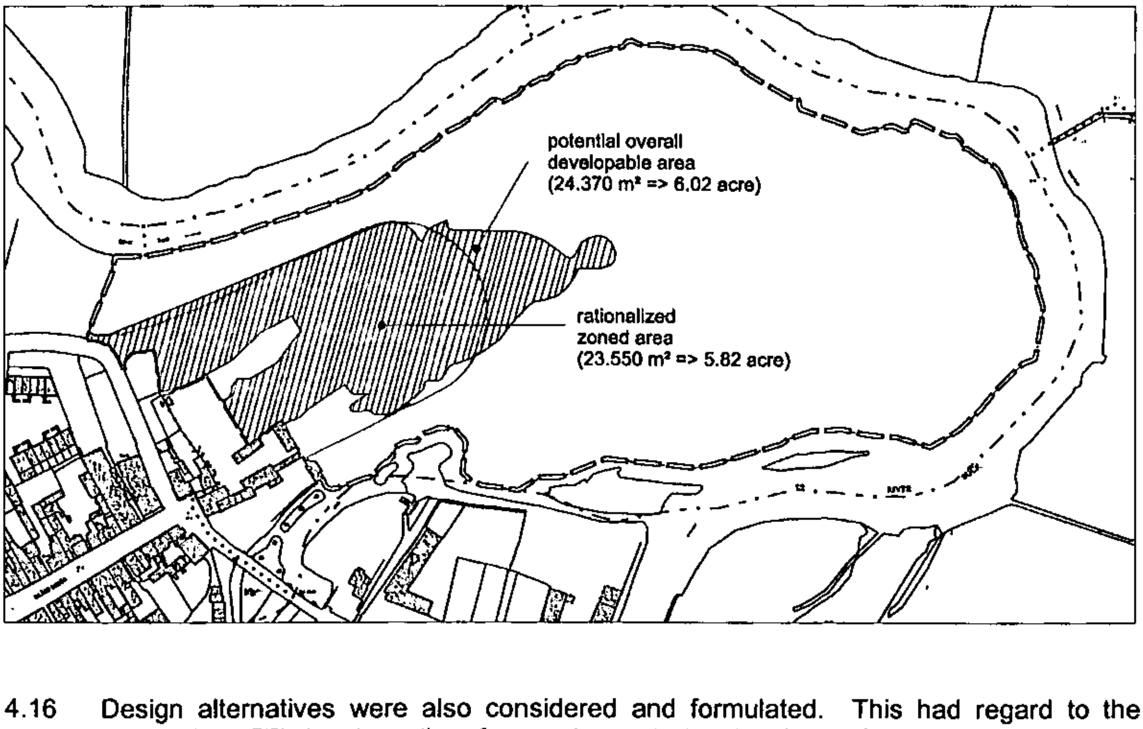


Figure 4.2 Immediate Development Area



4.16 Design alternatives were also considered and formulated. This had regard to the appropriate FFL level to allow for a scheme to be developed free from flood risk, an appropriate area for flood relief so that the proposal does not have any impact outside of the site and a consideration of the issues related to necessary floorspace and type of floorspaces necessary to meet future needs of the community. Commercial requirements were then identified; see Figure 4.3 – 4.7 following. These commercial layouts were refined to present a layout that architecturally and environmentally, allowed for both design that address environmental constraints, environmental issue and commercial requirements. This latter layout is detailed in Figure 4.5.

Figure 4.3 Initial Layout

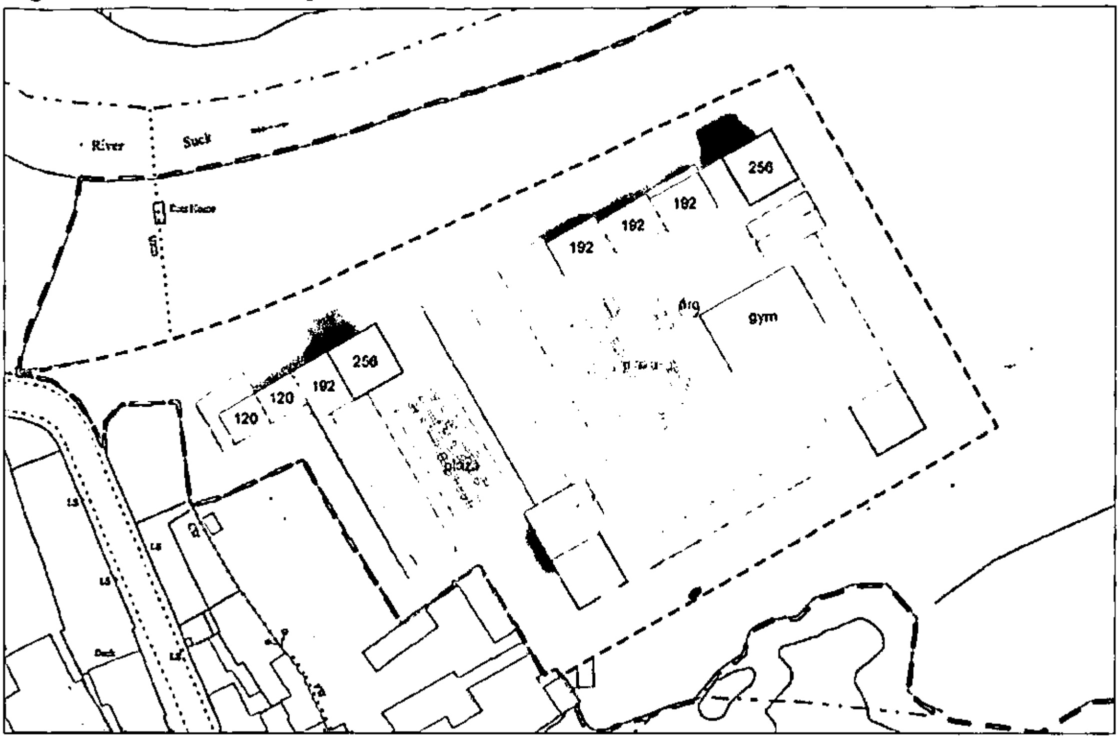


Figure 4.4 Initial Layout – Refined Option

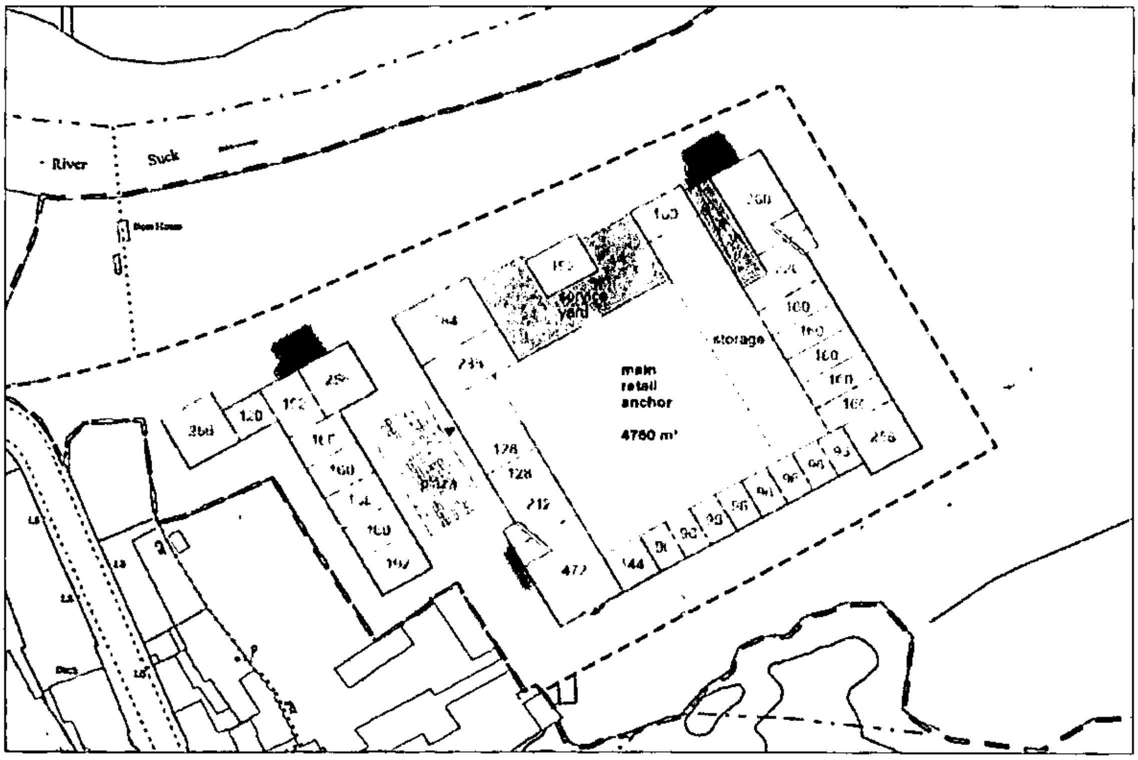
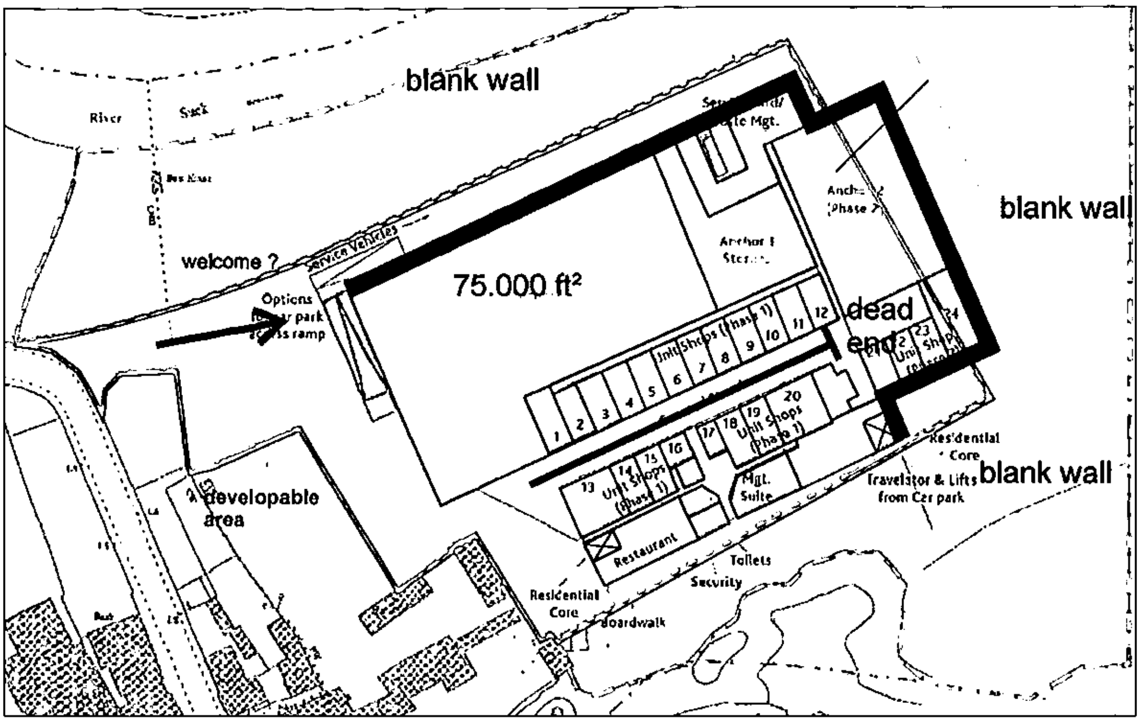


Figure 4.5 Initial Layout – Further Refined Option – Viable Commercial Mix



4.14 The various options for this development considered in the pre-planning stages have resulted in the current layout and design chosen as the basis for the application (see Figure 4.6 & 4.7). The chosen option is the one with a minimal impact on the surroundings yet has an aesthetically quality design and meets the internal circulation and servicing requirements for a development of this nature.

Figure 4.6.1 Initial Layout – Further Refined Option – Viable Commercial Mix Refined to Suit Environmental and Architectural Requirements of the Site

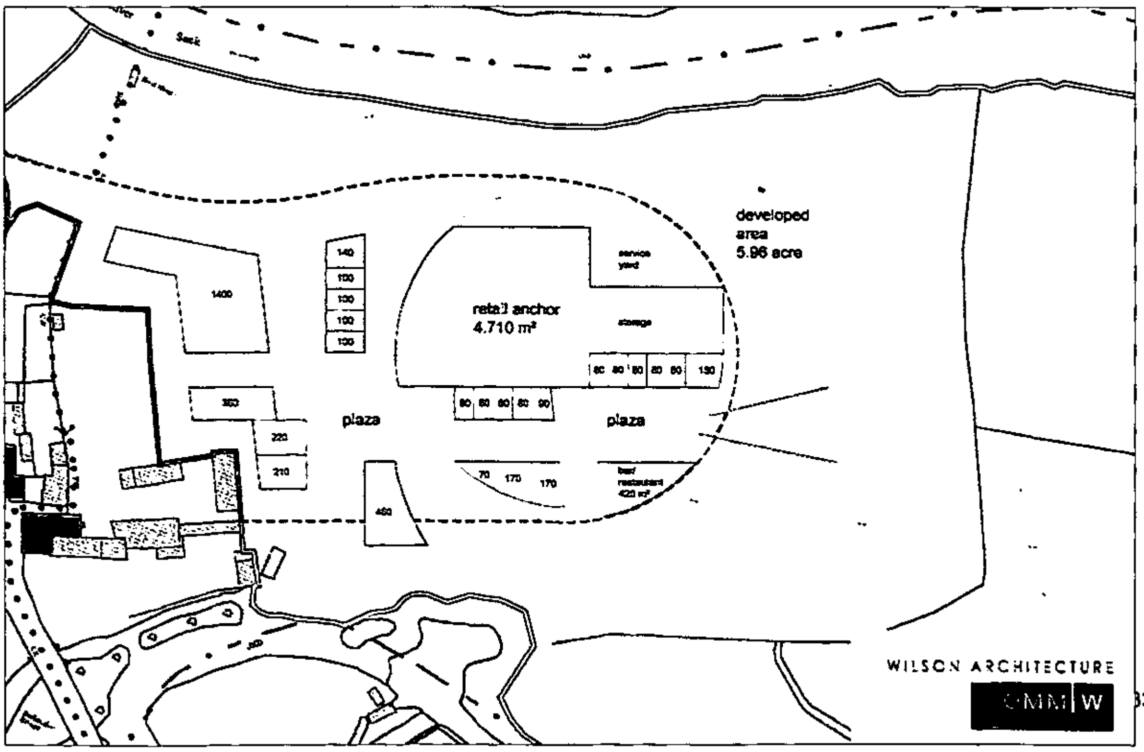


Figure 4.6.2 Further Refined Option

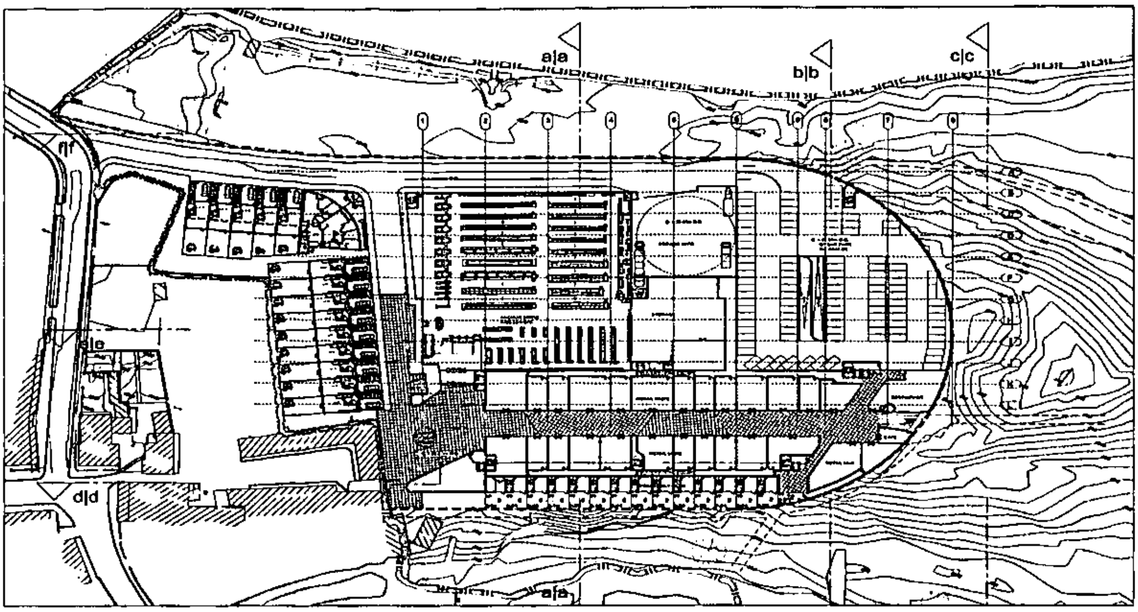
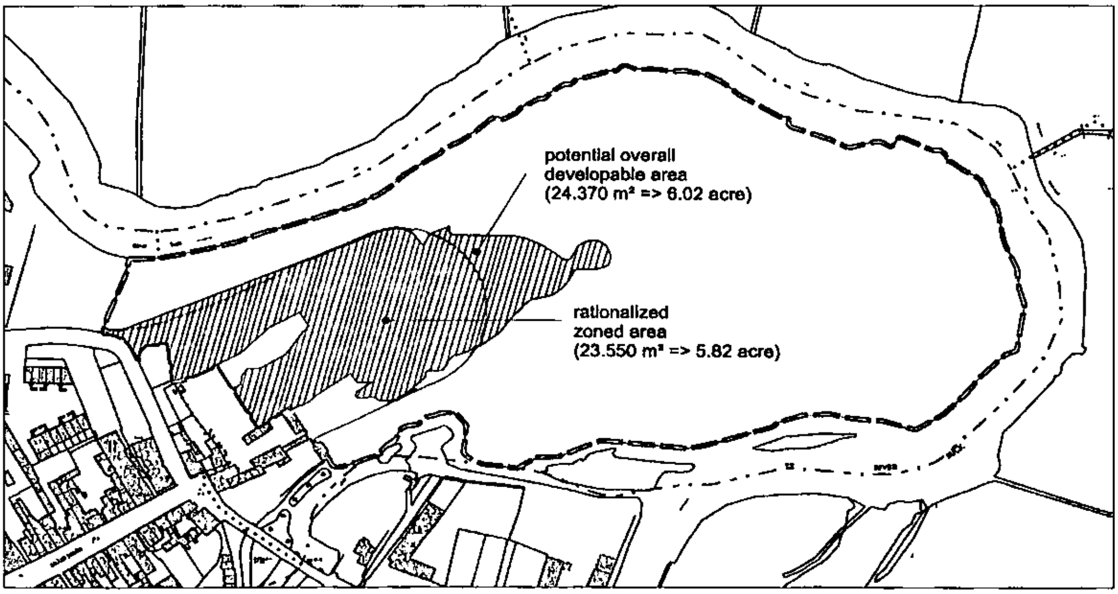
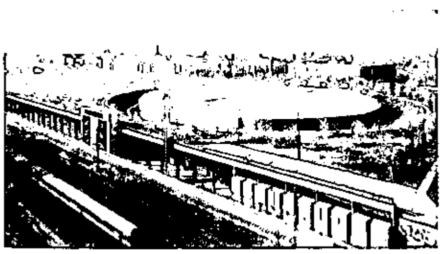
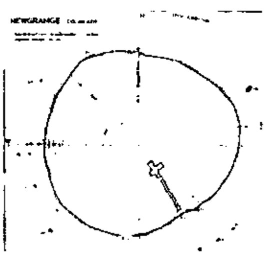


Figure 4.6.3 Respecting the Peninsula





cycling stadium, berlin



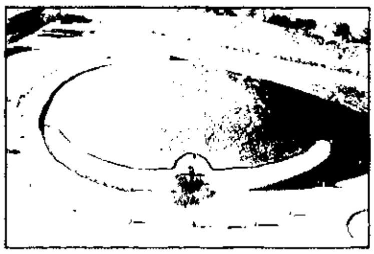
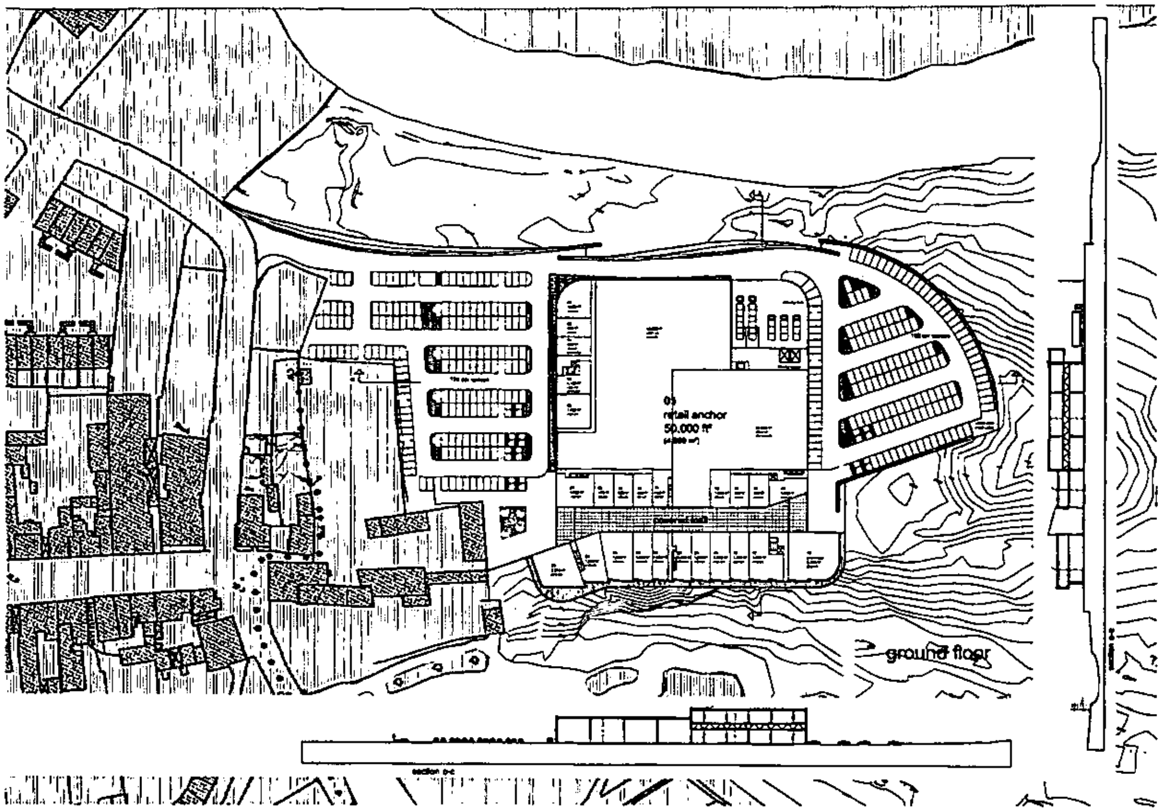
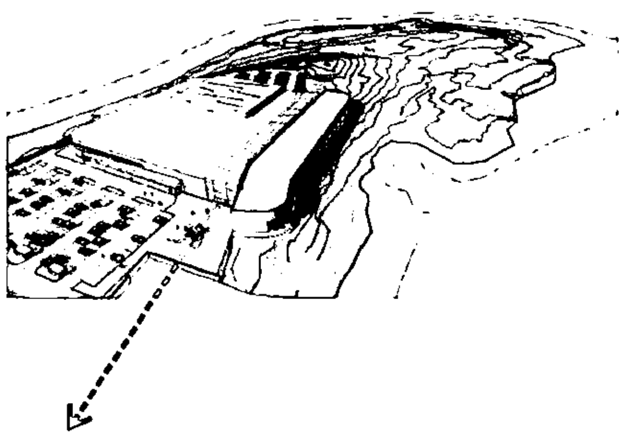


Figure 4.7 Final Layout – Refined Layout – Application Solution

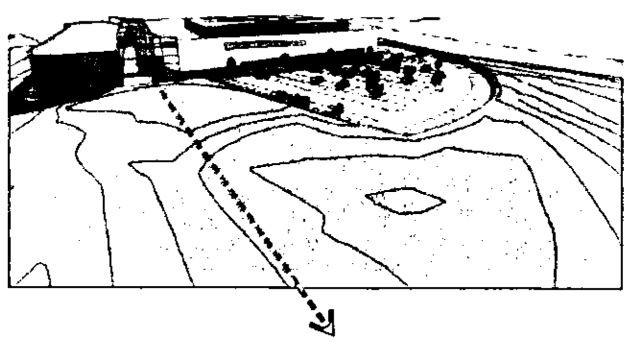


4.15 The selected layout and elevations design respects the location of the site and the contexts of the area, allowing for linkage to the town centre and the wider open spaces adjacent to the site.

Integrate with the Town



Integrate with the Peninsula



5.0 SPECIFIED INFORMATION

Difficulties in Compiling Specified Information

5.1 No significant difficulties arose in the preparation of the EIA and the collection and collation of data.

6.0 FORECASTING METHODS & METHODOLOGY

Forecasting Methods

6.1 The methods used in Chapter 6 of this Statement to forecast the effects of the proposal on the environment are tried and tested methods employed in each of the relevant fields of expertise. The particular methodologies for some of the more specific disciplines are set out below.

Flora & fauna

6.2 A qualitative baseline study of the subject site was carried out in August 2005. No changes have occurred since that time. During this site visit a detailed and comprehensive account of the floral and faunal composition was recorded. This, combined with desktop consultations of the following resources produced the finalised baseline report as presented.

- O.S. maps for Cork City
- Site Strategy Layout Plan
- National Parks and Wildlife Service Database, The Department of the Environment, Heritage and Local Government.

6.3 The proposed development site was surveyed using methodology outlined in the Joint Nature Conservancy Council's *Phase I Habitat Survey Techniques* (JNCC, 1993). The principal habitats present within the site were identified and classified using the Heritage Council's *A Guide to Habitats in Ireland* (Fossitt, 2000). The dominant species were noted and a species list compiled for each habitat represented.

6.4 Floral nomenclature follows *An Irish Flora* (Webb, Parnell & Doogue, 1996) for Latin names and the *Census Catalogue of the Flora of Ireland* (Scannell & Synnott, 1987) for common names. Nomenclature for horticultural species follows the Royal Horticultural Society's *Encyclopaedia of Garden Plants* (Brickell, 1998).

Faunal identifications were confirmed using the following sources:

- *The Macmillan Guide to Birds of Britain & Europe, Macmillan 1998,*
- *Collins Bird Guide, HarperCollins 2001*
- *Exploring Irish Mammals, Dúchas The Heritage Service 2001.*

6.5 As opposed to floral investigations, the surveying of faunal usage of subject lands cannot be based upon direct sightings alone. The presence of fauna is substantiated through the detection of field signs such as tracks, habitats, markings, feeding signs, and droppings, as well as by direct observation. Likewise, bird species present on site are recorded along with any notable avifauna habitats, droppings, or tracks. The likely species were assessed in relation to the habitats present within the site.

Air Quality

6.6 In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set.

6.7 Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2002, incorporating EU Directives 1999/30/EC and 2000/69/EC, which provide limit values for lead, CO, benzene, SO_2, NO_2 and PM_{10}

(see Tables 12.1 – 12.2). Although the EU Air Quality Limit Values are the basis of legislation, additional thresholds outlined by the EU Directives are used which are triggers for particular actions.

6.8 The European Commission sponsored report "Second Position Paper on Particulate Matter" (Dec. 2004), prepared by the CAFE sub-group Working Group on Particulate Matter, recommended that the principal metric for assessing exposure to particulates should be $PM_{2.5}$ rather than PM_{10} after 2008. The report also suggested that the annual average should be in the range 12 – 20 $\mu g/m^3$. These indicative limit values were to be reviewed in the light of further information on health and environmental effects, technical feasibility etc.

6.9 Following on from this report, proposed Directive COM(2005) 447 on Ambient Air Quality and Cleaner Air for Europe (21/09/2005) has recently outlined proposals to revise and combine several existing Ambient Air Quality Standards including Council Directives 96/62/EC, 1999/30/EC and 2000/69/EC. In regard to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. It is however proposed to set new ambient standards for $PM_{2.5}$.

6.10 The proposed approach for $PM_{2.5}$ is to establish a concentration cap of 25 $\mu g/m^3$, as an annual average (to be attained by 2010), coupled with a non-binding target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target is currently proposed at 20% of the average exposure indicator (AEI). The AEI is to be based on measurements taken in urban background locations averaged over a three year period from 2008-2010.

6.11 The impact of the development should also be assessed in terms of the relative additional contribution of the development, expressed as a percentage of the limit value. Although no relative impact, as a percentage of the limit value, is enshrined in EU or Irish Legislation, the National Roads Authority document *"Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes"* details a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the development. The NRA significance criteria have been adopted for the current development. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the limit values. However the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

6.12 Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002[1,2]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2007 to 2012[3,4]. The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties (COP12) to the agreement was convened in Nairobi in December 2006.

Meteorological Data

6.13 A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels)[14]. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to

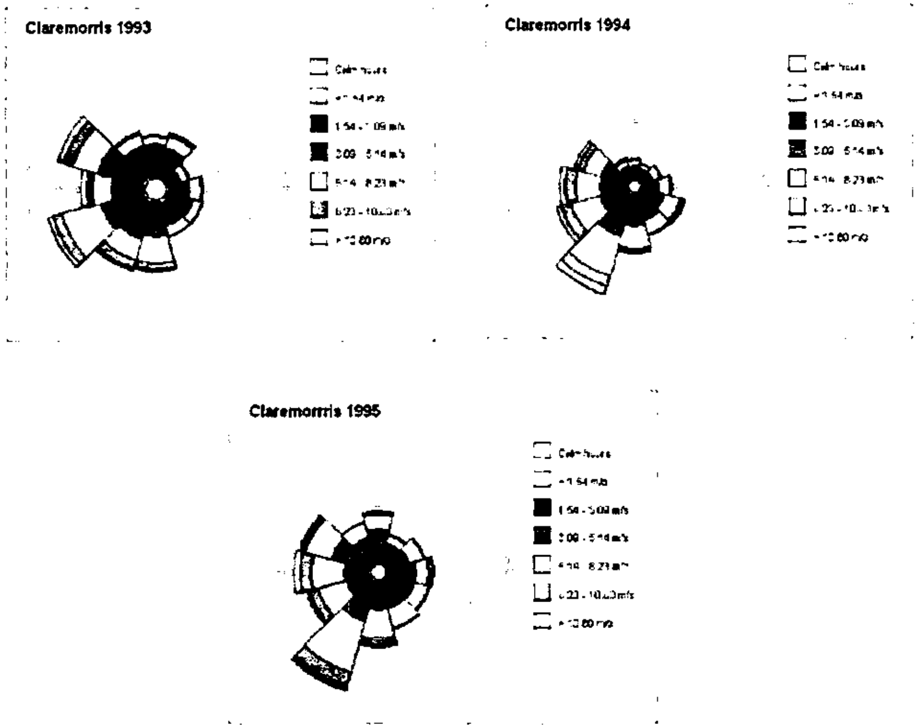
PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

6.14 The nearest representative weather station collating detailed weather records is Claremorris meteorological station, which is located approximately 70 km northwest of the site. Meteorological data from Claremorris has been examined to identify the prevailing wind direction and average wind speeds over a three-year period (see Figure 6.1). For data collated during three representative years (1993-1995), the predominant wind direction is south-westerly with an average wind speed of approximately 4-6 m/s.

6.15 Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, air pollution concentrations from road sources generally decreases significantly with distance from major road sources[10]. Thus, residential exposure in urban and suburban areas will be determined by the location of sensitive receptors relative to major roads sources in the area. Typically, the air quality experienced at residential receptors will be significantly less than worst-case levels reported by the EPA, such as urban city centres. Temporally, air quality can vary significantly by several orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

6.16 In assessing baseline air quality, two tools are generally used: ambient air monitoring and air dispersion modelling. In order to adequately characterise the current baseline environment through monitoring, comprehensive measurements would be required at a number of key receptors for PM_{10}, NO_2 and benzene. In addition, two of the key pollutants identified in the scoping study (PM_{10} and NO_2) have limit values which require assessment over time periods varying from one hour to one year. Thus, continuous monitoring over at least a one-year period at a number of locations would be necessary in order to fully determine compliance for these pollutants. Although this study would provide information on current air quality it would not be able to provide predictive information on baseline conditions[6], which are the conditions which prevail just prior to opening in the absence of the development (Year 2010). Hence the impacts of the development were fully assessed by air dispersion modelling[6] which is the most practical tool for this purpose. The baseline environment has also been assessed using modelling, since the use of the same predictive technique for both the "do nothing" and "do something" scenario will minimise errors and allow an accurate determination of the relative impact of the development.

Figure 6.1 Wind Speed Data



Project
Ballinasloe Air Quality Assessment

Reference
07/3694AR01

Figure 6.1
Claremorris Windrose 1993-1995

awn consulting
The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17.
Tel: +353 (0)1 847 4220 Fax: +353 (0)1 847 4257

Noise

An environmental noise study was conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: Acoustics - Description and measurement of environmental noise 1982. Specific details are outlined below.

Location 1 is located along River View, beyond the western boundary of the proposed development in the vicinity of a number of noise sensitive locations.

Location 2 is located in a car park beyond the western boundary of the proposed site.

Location 3 is located at the northern end of Main Street, in the vicinity of the nearest noise sensitive location.

Survey Periods

Noise measurements were conducted at Locations 1 to 3 over the course of two survey periods as follows:

- Daytime 10:30hrs to 13:05hrs 10 April 2007;
- Night-time 23:00hrs to 01:40hrs 09/10 April 2007.

The daytime measurements cover a typical period that was selected in order to provide a typical snapshot of the existing noise climate, with the primary purpose being to ensure that the proposed noise criteria associated with the development are commensurate with the prevailing environment.

The night-time period provides a measure of the existing background noise levels.

The weather during the day survey period was mild and dry with a very gentle breeze. Weather during the night survey period was cool, dry and still.

Personnel and Instrumentation

Louis Smith (AWN) performed the measurements during all the survey periods.

The noise measurements were performed using a Brüel & Kjær Type 2250 Precision Sound Level Analyser and a Brüel & Kjær Type 2238 Integrated Sound Level Meter. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

Procedure

Measurements were conducted at Locations 1 to 3 on a cyclical basis. Sample periods for the noise measurements were nominally 15 minutes during both the daytime and night-time periods. The results were noted onto a Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

Measurement Parameters

The noise survey results are presented in terms of the following three parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

Traffic and Transportation

6.17 A Transport Assessment Report (TAR) for the proposed development has been prepared by Peter Brett Associates Ireland Ltd (PBA)

6.18 The purpose of this Transport Assessment Report is to set out the methodology by which the potential level of any transport impact generated as a result of the proposed development has been calculated and subsequently assessed. The scope of the analysis covers transport and related sustainability issues including means of vehicular access, pedestrian and cycle movement and local public transport connections. The principal objective of the report is to quantify this level of impact across the local road network and subsequently ascertain the existing and future operational performance of the network.

6.19 The approach to the study accords with policy and guidance both at a national and local level. Furthermore the adopted methodology responds to best practices in addition to current and emerging guidance, exemplified by a series of publications, all of which advocate this method of analysis. Key publications consulted include;

- 'Traffic and Transport Assessment Guidelines' National Roads Authority (2005);
- 'Traffic Management Guidelines' Dublin Transportation Office & Department of the Environment and Local Government (May 2003);
- 'Guidelines for Traffic Impact Assessments' The Institution of Highways and Transportation;
- 'DTO Advice Note: Retail and Leisure Development" Dublin Transportation Office (February 2003); and
- 'Sustainable Development' Department of the Environment

6.20 The methodology incorporated a number of key inter related stages, including;

- Site Audit: A site audit was undertaken to quantify existing road network issues and to establish an appreciation of existing local traffic characteristics, in addition to establishing the level of accessibility to the site in terms of walking, cycling and public transport. An inventory of the local road network was also developed during this stage of the assessment.
- Traffic Counts: Junction turning counts have been undertaken across the local road network with the objective of establishing local traffic characteristics in the immediate area of the proposed development
- Trip Generation: A comprehensive trip generation exercise has been carried out to establish the potential level of vehicle trips generated by the different categories proposed in the mixed use development.

- Trip Distribution: Based upon existing traffic characteristics and the network layout in addition to the spatial / land use configuration and density of the urban structure across the catchment area of the development, a distribution exercise has been undertaken to assign site generated vehicle trips across the local road network.
- Network Impact: Ascertain the specific level of influence generated by the proposed development upon the local road network and subsequently identify which junctions need to be assessed in greater detail in accordance with the Institute of Highways and Transportation; Traffic Impact Assessment guidelines.
- Network Assessment: Drawing upon the findings of the previous stages, an operational assessment of the local road network has been undertaken to evaluate the performance of key junctions both prior to and following the implementation of the proposed development.

6.21 The TAR seeks to clarify the potential level of influence generated by the proposed development across the local road network and subsequently ascertain the existing and future operational performance of the local Transport system. The structure of the report responds to the various stages of this exercise as detailed below.

Archaeology & Cultural Heritage

6.22 An assessment of the archaeological potential of the site was carried out as part of previous application on site. This determined that there would be no adverse impact subject to appropriate mitigation measures.

Landscape and Visual Impact Assessment

6.23 The Landscape and Visual Impact Assessment was carried out in accordance with the EPA's *Guidelines on the Information to be contained in Environmental Impact Statements 2002,* as well as the (British) Landscape Institutes *Guidelines for Visual Impact Assessment, 2002.*

6.24 An initial desk study of topography, landform, location of archaeologically significant areas/features, ecological designations and scenic views and prospects was carried out using OSI maps and Heritage Council data. Other man-made features such as built environment and land-use were also taken into consideration. The Cork City Development Plan was consulted to help to identify landscape character areas and significant landscape features.

6.25 The site was surveyed in detail during site visits in November 2005, when the main landscape features and the landscape character of the area were identified and evaluated in terms of their vulnerability/sensitivity. The potential for visual impact from key locations in the vicinity of the site was assessed and further evaluated using photographic views.

6.26 Landscape impacts were analysed based on:

- The capacity of the existing urban landscape (townscape) to absorb the proposed development;
- Effects on landscape character and features (e.g. removal or alteration) as well as on the urban landscape (townscape) values.

Visual impacts are evaluated taking account of:

- The visual envelope or zone or visual influence;
- The potential level of visual intrusion (i.e. effect impinged upon a view);
- The potential for visual impact dependant on the proximity and extent of the proposed development to a sensitive viewpoint/visual receptor.

Classification of Impacts

6.27 This section describes the classification of impacts relating to urban landscape (townscape) and visual impacts which are addressed in Sections 1.5 and 1.6. Key issues in relation to visual impacts are the nature of the visual receptors within the visual envelope i.e. the nature of the viewers and their sensitivity.

6.28 The potential landscape impact assessment describes the likely nature and scale of changes to individual landscape elements and characteristics, and the consequential effect on landscape character. Existing trends of change in the landscape are taken into account. The potential landscape impact is assessed based on:

(a) the sensitivity of the landscape resource, which is a function of its land use, landscape patterns and scale, visual enclosure and distribution of visual receptors and the value placed on the landscape. The landscape sensitivity is classified as High (exhibits a very strong positive character with valued elements and characteristics that combine to give an experience of unity, richness and harmony, therefore particularly sensitive to change in general), Medium (exhibits positive character but has evidence of alteration to / degradation / erosion of elements and characteristics resulting in an area of mixed character, therefore potentially sensitive to change in general, or Low (exhibits generally negative character with few valued elements or characteristics), and;

(b) the scale or magnitude of landscape effects or the quantity of change to be imposed on the landscape by the development. The magnitude of change to the landscape is classified as High (total loss of or major alteration to the key elements or characteristics of the landscape, and / or introduction of elements considered totally uncharacteristic in the context of the receiving environment's landscape character), Medium (partial loss of or alteration to one or more key elements or features, and / or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic in the context of the receiving environment), Low (minor loss of or alteration to one or more key elements or characteristics, and / or introduction of elements that may not be uncharacteristic in the context), Negligible (very minor loss, alteration or introduction of elements of the landscape) or Neutral which implies that the development is appropriate to the character of the landscape observed in the view, even if a substantial degree of change occurs (i.e. it complements the scale, landform and pattern of the landscape and maintains the existing qualities).

(c) The significance of change is described as imperceptible, low, medium or high, and adverse, beneficial, and/or neutral.

6.29 The classification is informed by a thorough on-site inspection and description of the views and an understanding of the context and sensitivity of the viewpoint locations. As a general rule, the greater the distance of the viewpoint from the site, the smaller degree of impact it will be considered to have.

The Visual Envelope

6.30 A visual envelope is used to describe the extent of the developments visual affect on the surrounding environment, illustrated through the creation of a visual envelope map. The extent of visual intrusion the development has on the surrounding environment is dependent upon a variety of factors such as landform, existing vegetation and surrounding built form. It should be noted these maps are indicative only and it is not normally possible to assign a tolerance to them. (The approximate zone of visual influence in respect of the proposed St. Patrick's Street development is shown in Chapter 12)

6.31 The potential visual impact assessment describes the changes in the character of the available views and the changes in the visual amenity of the visual receptors for a number of places / viewpoints selected to represent the receiving environment within

the visual envelope and its users and inhabitants. For each viewpoint the field of view towards the site is described in terms of its key elements or characteristics.

6.32 The descriptions are illustrated with photographs taken from the viewpoints, (taken with 50mm lens to illustrate as closely as possible an 'as the eye sees' image. Potential visual impact on each viewpoint is assessed based on:

(a) the sensitivity of the visual receptors, which is a function of the location and context of the viewpoint, the expectations and occupation or activity of the receptor, and the importance of the view. Viewpoint sensitivity is classified as High (e.g. users of outdoor recreation facilities or centres of activity focused on the landscape, and occupiers of residential properties with views affected by the development), Medium (e.g. people travelling through or past the affected landscape in cars or on public transport, i.e. viewing but not focused on the landscape), or Low (e.g. people at their place of work or engaged in similar activities such as shopping, etc., whose attention will be focused on these activities).

(b) the scale or magnitude of visual effects or the degree / quantity of change to the field of view (towards the site) resulting from the development. This takes into account the extent of the view that would be occupied by the intrusion, e.g. full, partial, glimpse, etc. including the distance of the viewpoint from the development and its effect on the importance of the development in the field of view, the proportion of the development or particular features that would be visible, and whether the view of the development would be static, or a sequence or transient (as seen from a moving vehicle). The magnitude of change to each view is classified as High (total loss of or major alteration to the key elements or characteristics of the view, and / or introduction of elements considered totally uncharacteristic in the context of the view), Medium (partial loss of or alteration to one or more key elements or features, and / or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic in the context of the view), Low (minor loss of or alteration to one or more key elements or characteristics, and / or introduction of elements that mat not be uncharacteristic in the context), or Negligible (very minor loss, alteration or introduction of elements of the view).

The Capacity of the Receiving Environment to Accommodate Change

6.33 The capacity of the receiving environment to accommodate change is largely determined by existing topography and vegetation and their potential to screen the proposed development from sensitive viewers within the visual envelope. The type of developments occurring in the area also contributes to the capacity of the local urban landscape (townscape) to absorb new developments of the same or similar kind, and must also be considered.

6.34 A statement is made as to the significance of the urban landscape (townscape) impact that would result from the development, based on the measurement of the magnitude of the urban landscape (townscape) effects against the sensitivity of the urban landscape (townscape) resource. The predicted impact is classified as high, medium or low as well as beneficial, neutral or adverse. This is not an absolute exercise; it is a professional judgement informed by the assessment methodology described.

Assessment of Viewpoints

6.35 The assessment of visual impact involves identifying viewpoints within the visual envelope that are representative within the receiving environment. These viewpoints were selected based on physical inspection of the view. The selected viewpoints are surveyed to ascertain the condition of the existing view (characteristics, features, positive and negative qualities, etc.), and the associated sensitivity of the viewpoint (based on the extent and location type – residential, public road, amenity, etc.). With the aid of representative images the degree of change to be experienced at that location is assessed.

6.36 Each viewpoint is categorised in tabular form summarising the significance of the predicted impact on the visual amenity of the view, as well as a classification of the impact as beneficial, neutral or adverse. The assessment of the significance of impact on each view is based on the measurement of the magnitude of change to the view against the sensitivity of the viewpoint.

The criteria for grading impact significance are summarised as follows:

- Where a viewpoint of High sensitivity is subject to a High or Medium magnitude of change, then the impact is classified as of High significance, and
- Where a viewpoint of Medium sensitivity is subject to a High magnitude of change, then the impact is classified as of High significance.
- Where a viewpoint of Medium sensitivity is subject to a Medium or Low magnitude of change, then the impact is classified as of Medium significance, and
- Where a viewpoint of High sensitivity is subject to a Medium or Low magnitude of change, then the impact is classified as of Medium significance.
- Where a viewpoint of Low sensitivity is subject to a High, Medium, Low or Negligible magnitude of change, then the impact is classified as of Low significance.
- Where a viewpoint of Medium or High sensitivity is subject to a negligible magnitude of change, then the impact is classified as of Low significance.

6.37 The assessment of visual change and visual impact associated to the proposed development from the selected viewpoints is carried out taking into consideration the proposed development on its own merit but also bearing in mind existing developments of similar scale.

Effects on the Environment

7.0 Human Beings

Human Beings - Population

7.1 Human beings are an intrinsic element to be considered as part of the process of this EIS. The EIS should mitigate against any possible adverse impacts on human beings be they environmental impacts such as those on air, water, soils, dust, noise and landscape or social/economic impacts such as employment, material assets, cultural heritage and amenity. Each of these issues and their impacts on human beings are assessed in the succeeding sections with appropriate mitigation measures provided. This chapter will assess the impacts the proposed development will have on;

(i) Population,
(ii) Employment,
(iii) Community.

Human Beings – Population: Receiving Environment

7.2 The 2006 Census indicate that the population of Ballinasloe Town is 6,049 persons. This represents an increase of 65 persons (1.1%) over the 2002 Census figures. The table below charts the change in population in Ballinasloe in comparison to State, Provincial and County change in population.

Table 7.1: Population Change at State, Province, County and Local Level, 1991 To 2006

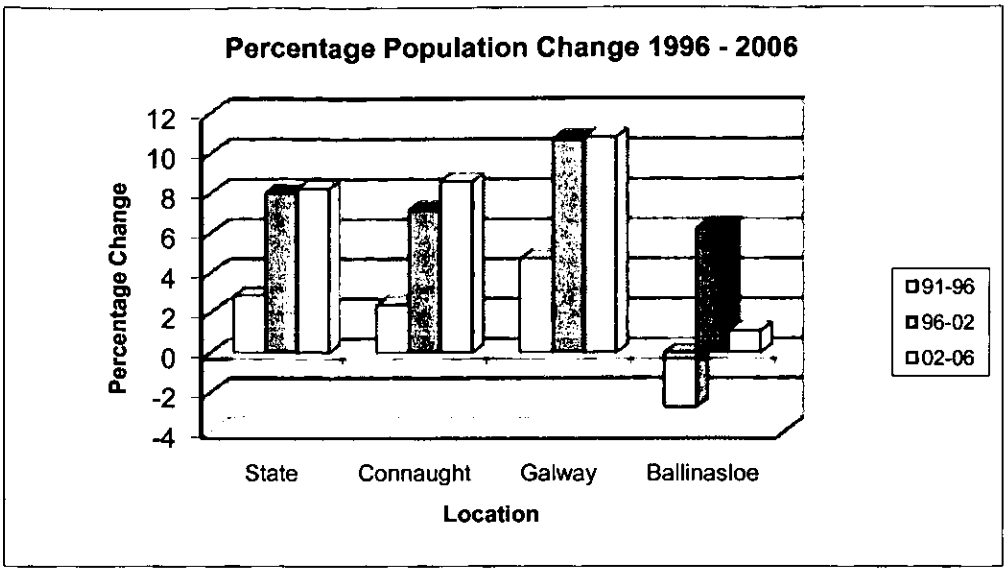
	1991	1996	2002	2006
State	3,525,719	3,626,087	3,917,203	4,239,848
Connaught	423,031	433,231	464,296	54,121
Galway	180,364	188,854	209,077	231,670
Ballinasloe	5,793	5,634	5,984	6,049

[Source: Census of Population 1991 to 2006]

7.3 The Ballinasloe Development Plan 2000-2009 projected that the population of Ballinasloe Town would grow to 7,706 persons by 2006. The Plan proceeded to predict that the population could grow to 11,000 by 2021 (Illustrated in Fig 1 Pg 10).

The chart below further illustrates the percentage change to average State, Province and County levels.

Figure 7.1: Percentage Population Change at a National, Regional and Local Level 1991 - 2006

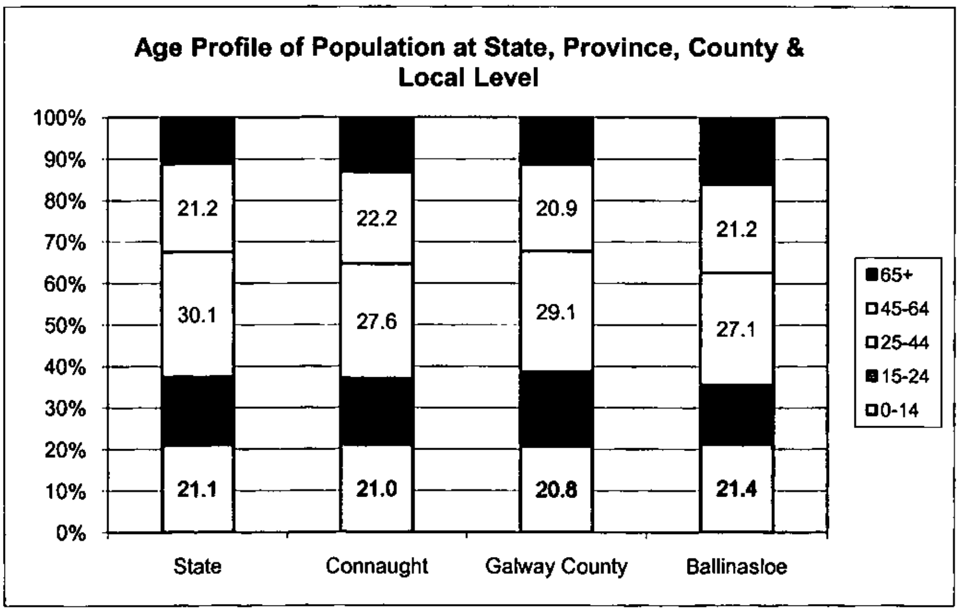


7.4 The chart above illustrates the increase in population experienced and percentage change in the State, Connaught and County Galway since 1991. Ballinasloe Town experienced did not experience the same growth rates over the same periods. In fact, the Ballinasloe experienced a decrease in population between 1991 and 1996, however, this trend was reverse between the inter-census period of 1996-2002 when the population increased by 6%. Population growth for the town slowed down to 1.1% between 2002 and 2006.

Age Profile

7.4 A comparison of various average age profiles relating to the area is given below:

Table 7.2: Age Profile of the State, Province, County and Local Level, 2002



[Source: Census of Population 2002]

7.5 The above table demonstrated the age profile of population at state, provincial, county and local level. It illustrates that Ballinasloe has a slightly higher proportion of 0-14 year olds. The 15-25 age cohort percentages is lower that the other enumeration areas and this may attributed to young people leaving Ballinasloe to attend third level institutions in Galway City and Athlone Town, as there is no third level institution in Ballinasloe. The 25-44 age cohort is lower than the national and county averages which may indicate a lack of employment opportunities within Ballinasloe and its surrounding area. The 45-64 age group are inline with National and County figures; however, there is a higher proportion of 65+ age group in the town. This may suggest that there is an older profile to the general population of the Ballinasloe area, but could also to correlated to nursing home and residential accommodation in the town.

Impact of Proposed Development – Construction Phase

There will be no impact on the population figure of Ballinasloe town during the construction phase.

Impact of Proposed Development – Operational Phase

There will be no impact on the population figure of Ballinasloe town during the operational phase.

Human Beings – Employment

Human Beings – Employment: Receiving Environment

7.6 Unemployment trends in Ballinasloe Town can be demonstrated by considering the Statistical Bulletin records of the Live Register. The figures supplied outline the number of persons on the Live Register for March 2002, 2003, 2004, 2005, 2006 and 2007.

Table 7.2: Live Register Figures 2001-2007

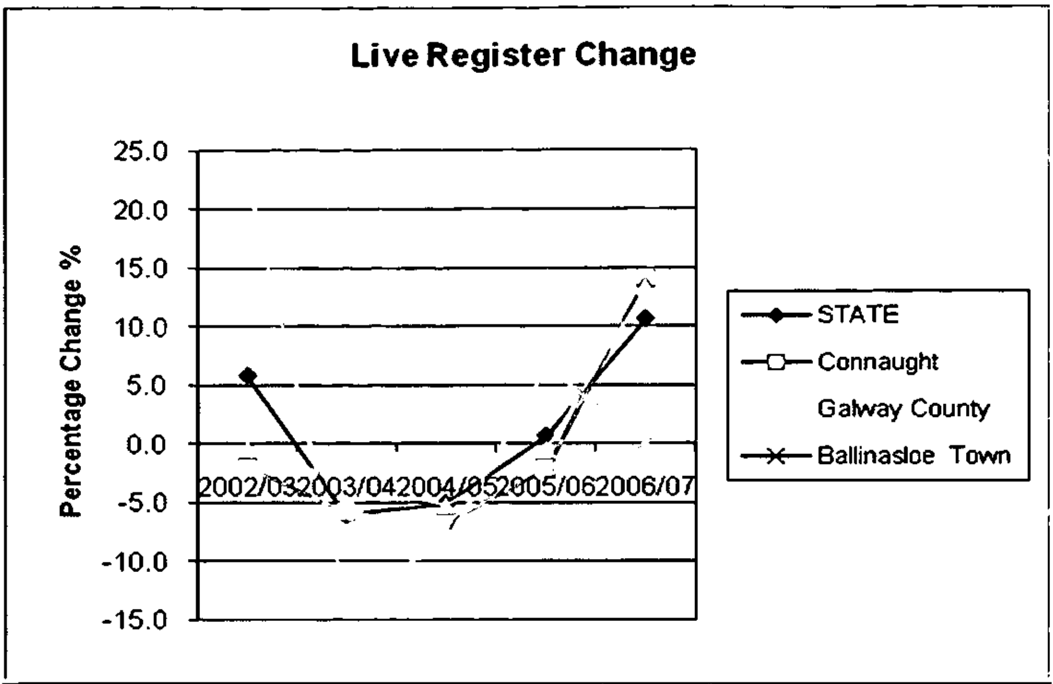
	Sep-02	Sep-03	Sep-04	Sep-05	Sep-06	Aug 07*
STATE	161432	170822	160466	152307	153335	169614
Connaught	20682	20271	19094	17819	17438	19888
Galway County	9472	9426	9134	8650	8606	9753
Ballinasloe Town	910	1120	974	891	949	949

Source: Live Register Monthly Analysis

* August 07 - most up to date data

7.7 The above table shows a slight increase in persons registered on the Live Register in recent years.

Figure 4.3: *Live Register Change 2002-2007*



7.8 This chart illustrates that there has been no increase or decrease in the number on the Live Register in Ballinasloe between September 2006 and August 2007. This is subsequent to a decrease between September 2003 and September 2005. Between September 2006 and August 2007 there was a 0% change in the number on the Live Register in Ballinasloe Town.

Impacts on Employment

7.9 The proposed development will provide for additional construction related employment in the City and surrounding areas during the construction phase. This will have a positive impact on the local economy. The maximum construction employment expected is approx. 150-200 persons. It is expected that during operational phases that there will be at least 100 persons employed on site over shifts and the normal working day.

Mitigation

7.10 The proposed development will have a beneficial impact on employment during construction and operation. No mitigation measures are therefore required or proposed.

Human Beings – Community

Human Beings – Community: Receiving Environment

7.11 The proposed retail scheme will enhance the retail and commercial provision for the area and provide a greater choice in terms of shopping to the local residents, reducing the enticement of shopping outside of the town.

Construction Impacts

7.12 There will inevitably be construction impacts on the existing community. Construction impacts are expected to be short-term and are likely to include impacts associated with construction traffic and any possible nuisance associated with such movements. Impacts dealing with issues such as noise and dust are assessed in later chapters.

7.13 Various elements of the development will be controlled in order to minimise disturbance and counteract potential negative impacts on residents in the vicinity. For example, construction hours will be restricted to minimise any short term loss of amenity that may be experienced by local residents.

Operational Impacts

7.14 The provision of a mixed use retail/commercial development in the area will provide a positive development to the area. The Commercial zoning of the lands by Ballinasloe Town Council signifies the Council's intention that these lands should be developed.

Mitigation

7.15 The remedial measures proposed during the construction period will ensure that the impact on the community will be temporary and will not be significant. Various elements of the development will be controlled in order to minimise disturbance and counteract potential negative impacts on nearby properties.

8.0 Geology and Soils

Introduction

8.1 Cunnane Stratton Reynolds, with review by Hayes Higgins Partnership, undertook a review of the geology, soils, surface water and groundwater at the site of the proposed development. The information is based on a desk study of literature and information relevant to the area along with a review of previous proposals on the subject site

8.2 The impact of the construction and operation of the development on the underlying soils and geology is discussed and evaluated. Mitigation measures are proposed, and the residual effects are described.

8.3 A desk study of the site of the proposed development and the surrounding area was undertaken with regard to soils and geology. Baseline information on soils and geology was gathered through the analysis of previously published literature and material relevant to the area surrounding the site of the proposed development. This included the bedrock, outcrop and quaternary Geology Maps of County Galway, published by the Cartography Unit of the Geological Survey of Ireland as part of the report Groundwater in County Galway, the Soil Map of Ireland (Second Ed., 1980) published by the National Soil Survey of Ireland, An Foras Taluntais, and a Environmental Impact Statement for a proposed hotel on the site prepared by Keville and O' Sullivan Associates Ltd, Environmental Consultants (August 2005).

Receiving Environment - Existing Geology and Soils

Geology

Regional Geology

8.3.1 The site of the proposed development is underlain by undifferentiated carboniferous limestone of the Visean, which is classified as Reef Limestone. In County Galway, the geology of the area west of Lough Corrib contrasts markedly with the area to the east. In Connemara to the west of the lake, the rocks are ancient, severely deformed and metamorphosed, and in clued igneous intrusive rocks, mainly granite. In general, the rocks in mid and east Galway are sedimentary in origin, unreformed, and more recent in age and less complex than in Connernara. The geology of the site and surrounding area is shown in **Figure 8.1.**

Reef Limestone

8.4 Reef limestone is a fossiliferous, bedded rock, pale grey in colour, although occasionally brown stained with fine grained texture. Reef limestone was formed as mounds of shell sands grew up from the sea floor during a period when much of Ireland was covered by a shallow, warm sea, in much the same manner as modern coral reefs are formed.

8.5 This rock type is only found in a small number of areas in County Galway, but is more extensive in Counties Cork and Limerick. The relatively small area of reef limestone that underlies the site of the proposed development extends further east into County Roscommon. Other reefs have been recorded in the Gort area of south County Galway, and further east around Tynagh, Abbey and Duniry. A reef north of Dunmore in north Galway has been recorded as being 150 metres in thickness. In comparison, a large area of reef limestone around Loughrea is only 25-30 metres in thickness.

Burren Limestone

8.6 Burren limestone is the most extensive rock type in County Galway, stretching from Lough Corrib to the River Suck and from Slieve Aughty to Slieve Dart. The extensive

mid-Galway burren limestone formation extends to within 3.5 kilometres of the site of the proposed development, to the north. It is a pale to medium grey, bedded, fossiliferous, course-medium grained limestone. It is generally not clayey.

8.7 The burren limestone extends westwards as far as the area surrounding the western side of Lough Corrib, which delineates the boundary between Burren Limestone and the Galway Granite, and south-westwards into the famous karst landscape of the Burren, Co. Clare. These limestones, which are commonly referred to as the 'Galway-Roscommon Shelf' extend north from the site into Roscommon and Longford.

Calp Limestone

8.8 The main area of Ballinasloe town, and a more extensive local area stretching from Knockroe Hill in the west to Pollboy and Suckfield in the east and into County Roscommon is underlain by an area of calp limestone. This is a dark grey or black clayey limestone with black calcareous shales. It is well bedded with most beds being less than eight centimetres thick. It is rarely fossiliferous and is cherty towards the base. Calp limestone underlies a large area of east Galway, stretching from Athenry to Portumna and north to Banagher in County Offaly.

Local Geology

8.10 The area immediately underlying the site of the proposed development on in Ballinasloe is classified as undifferentiated Visean limestone. This local formation is known to extend over the urban area of Ballinasloe town, and further west and southeast. A larger area extends to the north, north of a fault line described in more detail below.

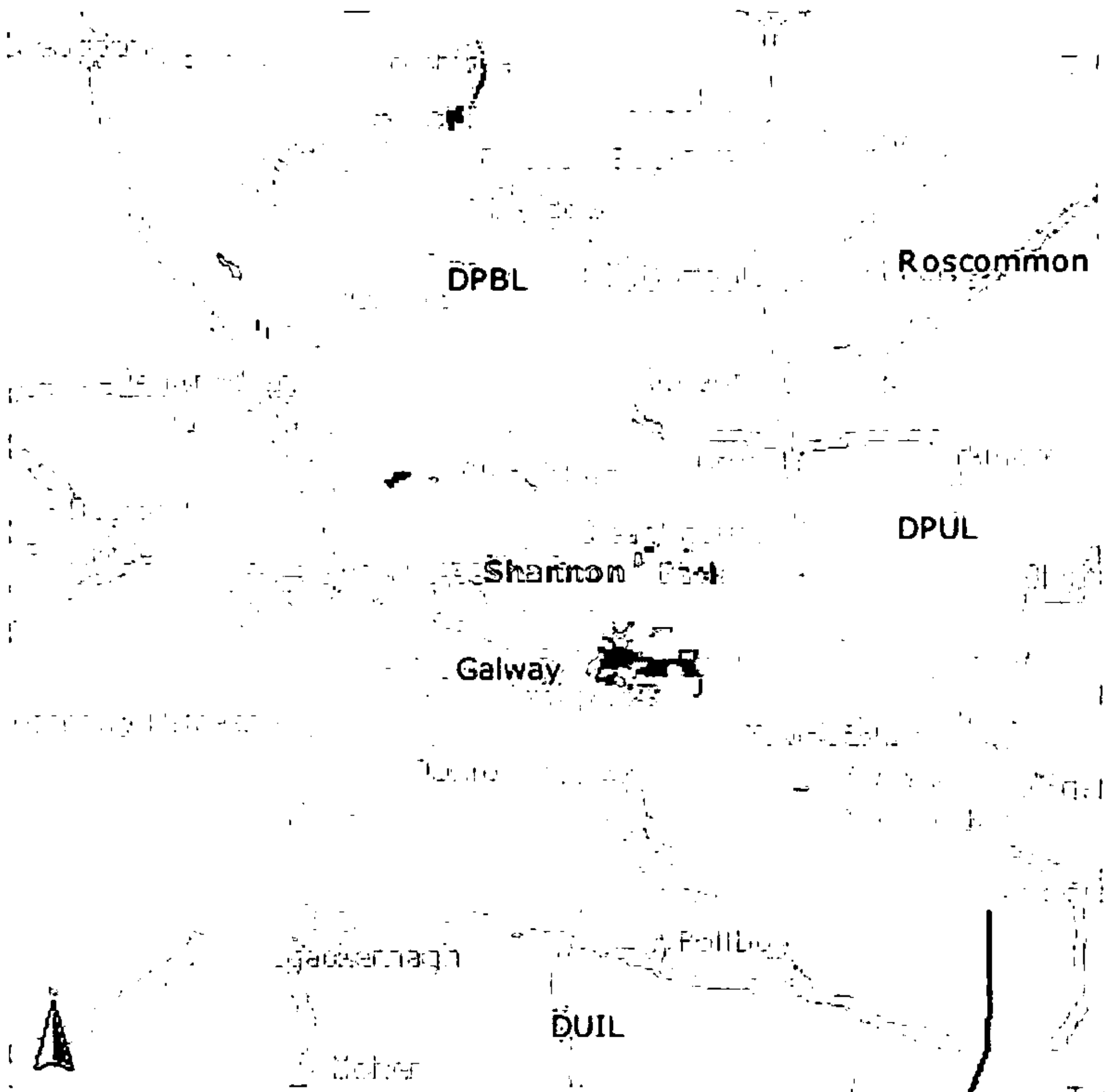
8.11 South and west of the undifferentiated Viscean limestones, an extensive area of dark limestone and shale (calp) extends south towards the Slieve Aughty Mountains. A smaller area of massive unbedded lime-mudstone is found to the northeast of the undifferentiated Viscean limestones that surround the site.

8.12 Karstification of the limestone underlying the site of the proposed development has taken place to some extent. Karstification is a secondary weathering process whereby fractures and fissures present in limestones are increased by solution. The limestone bedrock has been subjected to these processes over time, either by the percolation of rainwater and groundwater rich in carbonic acid through the overlying but shallow glacial till, or by the development of older karst preceding the subsequent deposition of thick Quaternary cover (glacial till).

8.13 Fragmental limestone, which was formed by the comminution of shells and other calcareous hard parts of marine creatures, contains well-preserved fossils, especially corals and brachiopods. There are no exposed sections of rock in the immediate area around the site of the proposed development exhibiting such fossils. Fragmental limestones are also valued by the building trade and are quarried for building purposes in the west of Ireland. There are no quarries located in the immediate vicinity of the site of the proposed development.

Figure 8.1 Bedrock Classifications

- BV - Basalts and other Volcanic rocks
- CM - Cambrian Metasediments
- DDL - Dinantian Dolomitised Limestones
- DESSL - Dinantian early Sandstones, Shales and Limestones
- DKS - Devonian Kiltorcan type Sandstones
- DLIL - Dinantian Lower Impure Limestones
- DMSC - Dinantian Mudstones and Sandstones Cork Group
- MSSL - Dinantian Mixed Sandstones, Shales and Limestones
- DORS - Devonian Old Red Sandstones
- DPBL - Dinantian Pure Bedded Limestones
- DPUL - Dinantian Pure Unbedded Limestones
- DS - Dinantian Sandstones
- DSL - Dinantian Shales and Limestones
- DUIL - Dinantian Upper Impure Limestones
- GII - Granites and other Igneous Intrusive rocks
- NSA - Namurian Sandstones
- NSH - Namurian Shales
- NU - Namurian Undifferentiated
- OM - Ordovician Metasediments
- OV - Ordovician Volcanics
- PM - Precambrian Marbles
- PQGS - Precambrian Quartzites, Gneisses and Schists
- PTMG - Permo Triassic Mudstones and Gypsum
- PTS - Permo Triassic Sandstones
- SMV - Silurian Metasediments and Volcanics
- WSA - Westphalian Sandstones
- WSH - Westphalian Shales



Bedrock Outcrops

8.14 There are no areas of bedrock outcrop in the vicinity of the site of the proposed development. The closest area is located approximately five kilometres west of the site, in the area around the townland of Knockroe.

Quaternary Geology

8.15 The Quaternary geology of the area surrounding the site of the proposed development is quite varied in nature, with four deposits underlying Ballinasloe town and outlying areas.

8.16 The Geological Survey of Ireland's quaternary geology map gives a general description of subsoil deposits in the region. However it is important to note that proper quaternary mapping has never been carried out in County Galway. The GSI's Quaternary Geology Map for County Galway is a general representation due to the lack of data and the variability of Quaternary deposits over short distances, which cannot be depicted on a map of the scale produced.

8.17 The site of the proposed development is shown underlain with sandy till. This is the major overburden type in east Galway and is of limestone composition, which produces well drained soil. Together with the esker gravels, the sandy till results in the minor relief and irregular topography.

8.18 An extensive area of basin peat is found to the northwest of Ballinasloe town, and occurs extensively in east Galway. The depth of organic material varies between three and eight metres and it comprises a layer of acid peat over a peat formed under base rich conditions (Hammond, 1979). An area of sand and gravel with some clay is found south of Ballinasloe town, and isolated 'strips' of esker sand and gravel further east of the town.

Soils

Soil Formation

8.19 The formation of soil types is in part determined by the underlying parent material, which affects the chemical composition of the soil. In the region of the site of the proposed development, the limestone bedrock has encouraged calcification processes and the formation of basic soils to some extent. However, the presence of superficial glacial drift deposits has also greatly influenced soil formation in the area. Glacial drift, the most common parent material of Irish soils, varies considerably in constitution and in geological composition, giving rise to many different soils. Other important soil forming processes at work in the region include leaching and gleisation. Leaching is important in areas where the soil is free - draining and involves the carrying of soluble constituents down through the soil profile. The soil becomes progressively more acid and an iron pan may be formed at a lower level (also known as podzolisation). Gleisation is the soil forming process resulting from water-logging, which leads to anaerobic conditions and the formation of gleys and peats. Climate and topography are also important factors contributing to soil formation. The interaction of all these processes, in combination with varying and uneven deposits of drift, have created a mixture of soil types in East Galway, with great local variation.

Soil Associations

8.20 The soils in the region of the site of the proposed development belong to Association 30 of the General Soil Map of Ireland. A soil association is defined as a cartographic unit, consisting of two or more soils, usually formed from the same type of parent material and associated on the landscape in a particular pattern. Soil Association 30 is grouped with other associations in the broad physiographic division of Flat to

Undulating Lowland. The principal soils of Association 30 are grey brown podzolics (70%), brown earths (20%), gleys (5%) and peats (5%).

8.21 These soils are formed from fluvioglacial coarse-textured gravels and sands of predominantly Carboniferous limestone composition, deposited widely during the last glaciations in form of kames, eskers and outwash materials. Elevations for this soil association type is mainly around 120 metres O.D. but may be less in the vicinity of river valleys and depressions, as is the case around the site of the proposed development.

8.22 The topography of this association varies from flattish to gently undulating, but some are hummocky with sharp changes ranging from OO to **12'** and occasionally up to **20'** on the steep sides of eskers.

Soil Classification

8.23 Soils samples taken in relation to a previous proposal on site for a proposed hotel development. Ground conditions have not changed since then.

8.24 Soil samples were previously taken from the surface layer of four separate trial holes. These were classified according to BS 5930:1981. A mechanical excavator excavated the trial holes to various depths. The soil types encountered in all four trial holes were consistent, classified according to BS 5930 as a sandy loam. Analysis of the soil sample rendered a slightly sandy feel with a faint rasping sound when moistened. Other classifications such as sand, loamy sand were ruled out for the samples as the rasping sound was not excessive, nor could the texture be described as smooth or soapy which would classify the soil as a silt loam, clay loam or clay.

Subsoil Classification

8.25 According to previous studies on site topsoil identified was found to be underlain by a number of strata of subsoils in each of the four trial holes. The classification of each subsoil layer was carried out and is described in accordance with the Geological Survey of Ireland's Flow Chart for Describing Subsoils, which is based on BS5930:1999. Their findings are as follows:

- Trial hole one was excavated to a depth of 4.2 metres. The thin layer of topsoil was underlain by almost pure sand. Bedrock was not encountered at the furthest extent of the depth of excavation.

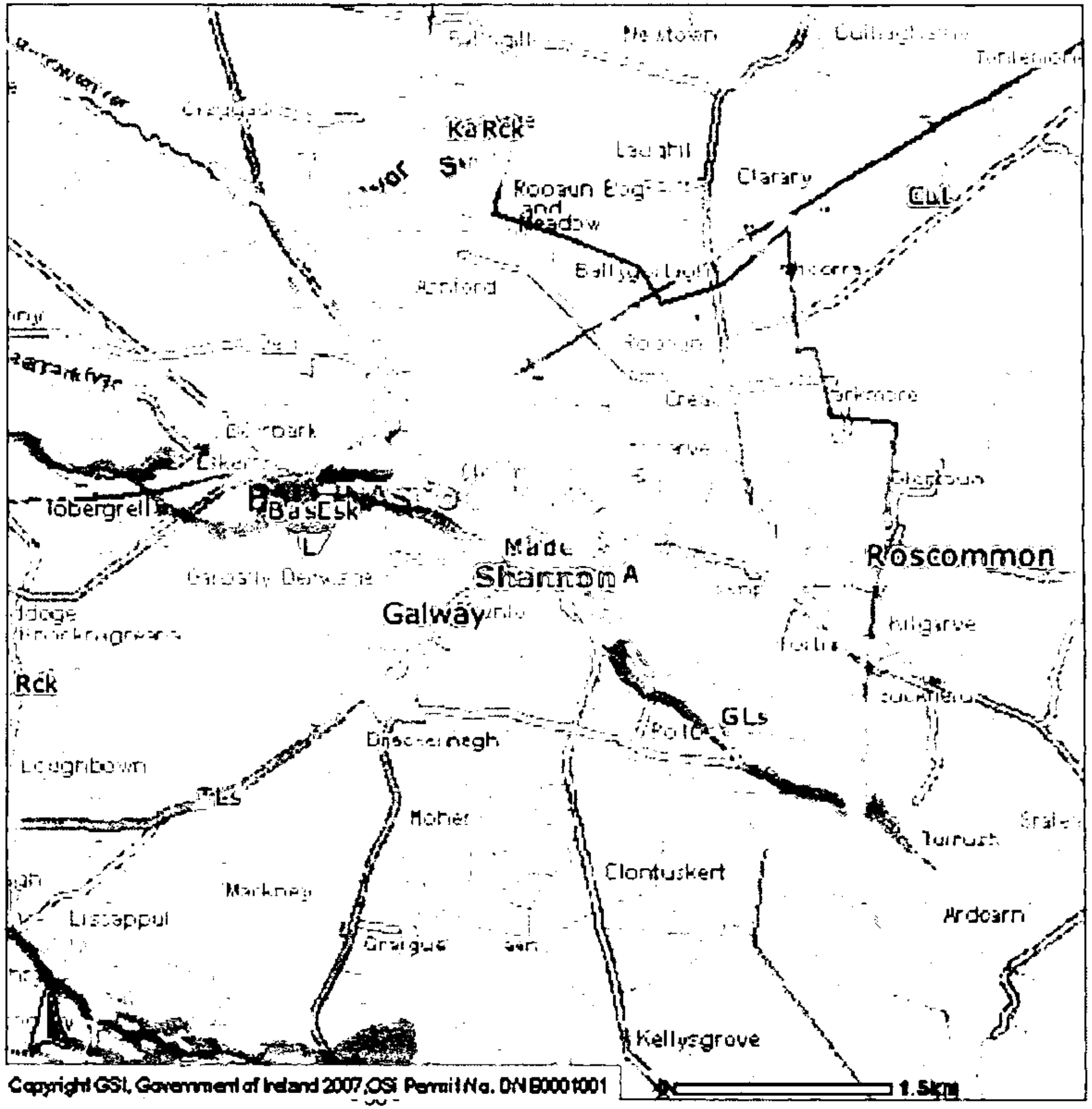
- Trial hole two was excavated to a depth of 3.7 metres. At this depth, the sidewalls of the hole were already collapsing under their own weight. The thin layer of topsoil was underlain by a layer of sand to a depth of 1.5 metres below ground level, below which was a very smooth clay.

- Trial hole three was excavated to a depth of 3.2 metres. At this depth, the sidewalls of, the hole were already collapsing under their own weight. The topsoil was underlain by a layer a sand to a depth of 1.5 metres below ground level, below which was a silt.

- Trial hole four was excavated to a depth of 3.4 metres. At this depth, sand layer exposed at depth gave way to flowing water, which was infiltrating from the nearby River Suck. The topsoil was underlain by a shallow layer of peaty substrate. Underneath the peat were two layers of silt, and although distinctly different in colour, both demonstrated the same silt properties. The silt was underlain by a layer of sand towards the bottom of the trial hole.

Figure 8.2 Sub Soil Classifications

- Alluvium
- Beach sands and gravels
- Bedrock outcrop and subcrop
- Esker sands and gravels
- Glaciofluvial sands and gravels
- Lake sediments
- Made ground
- Marine/estuarine silts and clays
- Marsh
- Peat
- Scree
- TD derived chiefly from Devonian sandstones
- TD derived chiefly from Lower Palaeozoic rocks
- TD derived chiefly from Namurian rocks
- TD derived chiefly from basic igneous rocks
- TD derived chiefly from cherts
- TD derived chiefly from granite
- TD derived chiefly from limestone
- TD derived from metamorphic rocks
- TD derived from mixed Devonian and Carboniferous rocks
- Water
- Windblown sands



- No bedrock was encountered in any of the excavated trial holes which would suggest, due to the proximity of the site to the adjoining River Suck and the types of subsoils encountered, that much of the sites sub-strata is alluvial in origin. There was no obvious evidence of preferential flowpaths, mottling of the soil, or example of iron pans in the profiles of soils and subsoils exposed during the trial hole excavations.

Impacts

Soils and Geology Impacts

Construction Phase

8.26 Regrading and redistribution of soils along with an increase in the formation level necessary for the proposed development will have to be carried out in order to address the need to protect the proposal from future flooding (this is considered in more detail in the section of the EIS dealing with Hydrology). The proposed development will have a minimum Finished Floor Level of 39.5 mOD. Cut and Fill will occur as part of the proposal. There will be a requirement to take material off site for disposal of at a licensed landfill and as part of a general revision to the level of the site to accommodate the construction of the formation level described above. It is envisaged that the proposed development will have no significant impacts on the local or regional geology of the area. Construction work such as foundation works and excavation and pipe laying will not impact on the limestone bedrock. There are no particular geological features, such as exposed outcrops of limestone pavement, in the immediate area that would be of intrinsic scientific value. It is expected that any necessary off site disposal of soil / spoil will be accommodated and an appropriate licensed landfill facility.

Any potential impacts on the soils of the immediate area that may arise as a result of the proposed development will be confined to the construction phase. Activities during this phase that may have an effect on the soils of the site include excavation of foundations and the general coming and going of heavy vehicles and machinery.

Regrading and leveling of the existing soils on site will take place and this will be compacted where necessary in line with conventional construction methods.

It is possible that there may be some impact, particularly in the form of compaction in the areas where the proposed formation level for the development is to be provided.

Any material excavated during the construction of the proposed development will be stored immediately transported off-site. All excavated material that is not reused on the site will be disposed of at an appropriate licensed waste disposal site, if a suitable re-use cannot be found.

Cut and Fill drawings are included as part of the Engineering Drawing package submitted as part of this planning application. The environmental impact of the possible effect of this cut and fill, site regarding and redistribution has been assessed in this EIS in the consideration of all relevant sections to which it applies, i.e. design, flooding etc.

Operational Phase

8.26 When operational, the development will not have any impact on the soils and geology of the site.

Surface and Groundwater Impacts

8.27 The Groundwater classifications of the area are illustrated on Figure 8.3 overleaf. The site is located in an area classified as a Regionally Important Aquifer. This is the same for the entire town and hinterland of Ballinasloe.

Construction Phase

8.28 The sources of pollution that could have an effect on the surface or groundwater will be fuels, lubricants, suspended solids, and bulk concrete. However, good construction practices should ensure minimal pollution. Such practices will include adequate bunding for oil containers, wheel washes and dust suppression on site roads, and regular plant maintenance.

8.29 The Construction Industry Research and Information Association (CIRIA) provide guidance on the control and management of water pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRIA, 2001), which provides information on these issues.

Operational Phase

8.30 The sources of pollution that could potentially have an effect on surface or groundwater during the operational phase of the development will be oil and fuel leaks from parked cars or service vehicles.

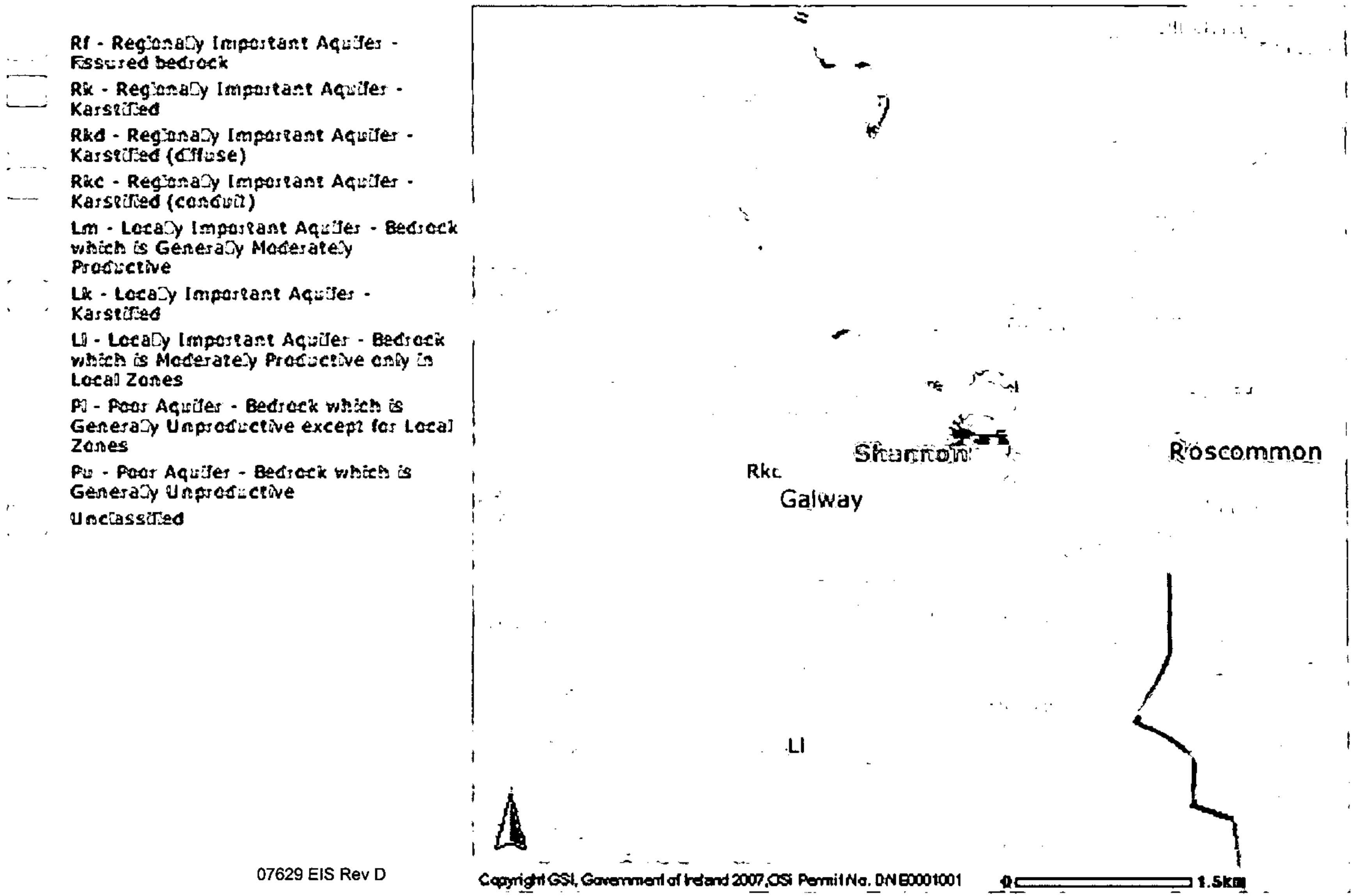
8.31 The construction management of the building project will incorporate protection measures to minimise as far as possible the risk of spillage that could lead surface and groundwater contamination. All appropriate methods will be utilised to ensure that surface water arising during the course of construction activities will contain minimum sediment, prior to discharge to the river.

8.32 Best practice in design and construction will be employed for the installation of stormwater and sanitary drainage. All surface water from the site will be drained via hydrocarbon interceptors.

Mitigation

8.33 It is anticipated that there will be no significant residual impacts on the soils and geology, surface and ground water.

Figure 8.3 Groundwater Classifications



9.0 Water And Services Infrastructure

9.1 An assessment of the potential impact of the development on the area's services infrastructure has been carried out by Hayes Higgins Partnership. This has reviewed the matters of water provision, foul sand surface water drainage presented by the proposed development of the commercial scheme.

Receiving Environment

9.2 There is no significant infrastructure on site given its current land use and zoning designation. An existing drain that traverses the site will be diverted as part of the proposed development.

Foul & Storm Water Drainage

9.3 The design of the storm systems has been carried out in accordance with the Modified Rational Method and the Colebrook-White Equations. The foul sewer system has been designed taking account of the Modified Rational Method, the Colebrook-White Equations, the current Building Regulations and BS 8301: 1985, Building Drainage.

9.4 The storm water system proposed for the development is gravity feed storage system. The storm water run-off from the site will be attenuated on site prior to being discharged to the River Suck via a hydrobrake devise. Storm water runoff will be limited to a runoff rate of 2 litres / sec / hectare.

9.5 The proposed foul system is gravity feed system that discharges to an on site pumping station. From the storage location it will be pumped to the local authority sewer on Main Street, via a 100mm diameter rising main. The sewerage will subsequently be conveyed to the Local Authority municipal wastewater treatment plant.

9.6 The foul sewer has been designed in accordance with the Colebrook-White formulas, B.S. 8301: 1985, BS5572: 1994, Building Regulations 2000 (Technical Guidance Document H) and the Department of the Environment and Local Enterprise Recommendations for site development works for housing areas. Calculations of design flows were carried out using the Probability Method of Discharge in accordance with BS 8301.

9.7 The system will be gravity fed to a sump with 24 hour storage capacity located to the south west of the site as shown on the Foul drainage Layout drawing.

9.8 Storage capacity has been calculated as follows:

Retail Area	=	8500m2
Occupancy	=	1 person/20m2
Loading	=	15 l/s/person
Total	=	6375 l/day
Total storage provided for 24 hrs	=	6.5m3

9.9 The proposed pumping station includes for:

- Overflow facility from pumping station to holding tank capable of storing 24 hours effluent discharge from the development
- Suitable washing, lighting and lifting facilities
- A suitable flow recorder
- Suitable vehicle access to pumping station
- Robust vandal proof electrical panels and access covers
- Back up power supply (provided from standby generator for main building)

- Dosing facility to prevent smell/odour
- Comply with Galway County Council specification for pumping station

9.10 From the storage location effluent will be pumped via a 100mm diameter rising main to the Local Authority Sewer on Main Street. The rising main is designed such that self-cleansing velocities are achieved and that septicity will not arise. The maximum allowable retention time in the rising main is 3 hours with a velocity of 0.75m/s at minimum flow rate and 3m/s at maximum flow. The rising main terminates at a stand off manhole located adjacent to Main Street. Effluent is then discharged by gravity to the existing Local Authority manhole/sewer via a monitoring manhole/chamber. The monitoring facilities include:

- Manhole with permanent access
- Discharge pipeline into the manhole/chamber of at least 10 pipeline diameters straight upstream of the discharge point to ensure hydraulic conditions suitable for flow measurement
- Manhole/chamber suitable for installation of in-sewer flow measurement equipment
- Manhole/chamber suitable for taking samples of the discharge effluent

9.11 The drawings included with the submission show the proposed foul sewer layouts. The pipe sizes for the foul sewerage system consist of 150mm pipelines laid at a gradient of 1 in 150, where possible 225mm pipes are provided at head of pipelines. All sewers have been designed to achieve a self-cleaning velocity of 0.75m per second. All foul pipelines are located in the road/footpath/verge/on-street parking or open space.

9.12 As can be seen in Appendix A of the Engineering Report submitted as part of this planning application, on site both the full bore & partial velocities for pipes all lie above the accepted limit. (i.e. > 0.75m/s).

9.13 The full bore & partial velocities were designed in accordance with the Colebrook-White formulas (ref.: Wavin sewer Systems, Design information, page 21). It can also be seen in Appendix A, of the Engineering Report submitted as part of this planning application, that the capacities of the pipes provided throughout the scheme are sufficient to cope with the estimated peak flows from the proposed development.

9.14 The onsite drainage system discharges to the existing 225mm diameter local authority sewer on Main Street. We propose to connect to the sewer at an existing manhole located at Main Street. Foul water will subsequently be conveyed from the sewer to the Local Authority Wastewater treatment plant.

Storm Water

9.15 The storm sewer system has been designed in accordance with the Colebrook-White formulas, BS 8301:1985 and the Greater Dublin Strategic Drainage Study (GDSDS). (See Appendix B of the Engineering Report submitted as part of this planning application for Design Calculations)

9.16 The areas taken into account in the design include the total area of the roofs and the total area of paving contributing to the pipe system and shall use a constant rate of rainfall intensity of 50mm/hr for all sections of the sewer.

9.17 The proposed development has a sustainable drainage gravity feed storage system within the development to discharge via attenuation storage devices and hydro-brake's to the River Suck that bounds our site.

9.18 All storm pipelines are located in the road/footpath/verge/on-street parking or open space. The storm water system proposed for the development is gravity feed storage system. The minimum diameter surface water sewers are 225mm.

9.19 A number of SUDS components are provided for storm water disposal within our site which will maximise the treatment efficiency of a wide range of pollutants.

- Petrol/Oil Separators: will contain serious pollution events and are also used to manage sediment, hydrocarbons and other debris upstream of SUDS devices.

- Permeable Pavements: will limit concentration of pollutants by immediate localised interception and can further reduce concentration of pollutants by:
    a. Filtration
    b. Retention within the pavement
    c. Biodegrading hydrocarbons and other hydrocarbons trapped in the upper pavement layers
    d. Settlement and retention of solids

9.20 Permeable pavement is provided in all car parking and public open spaces. There is a concrete finish to the service area, runoff from this area is collected by road gullies and is treated by a Petrol/Oil separator prior to connecting to the main drainage system.

Storm Sewer System

9.21 The pipe network has been designed for a rainfall rate of 50mm/hr for all sections of sewer as recommended in the Greater Dublin Strategic Drainage Study.

9.22 The time of entry has been taken as 4 minutes (in accordance with Recommendations for Site Development Works) and appropriate pipe roughness coefficients have been taken from the pipe manufacturer's literature.

9.23 A number of drawings including storm sewer layout, rational design sheets and numbering systems have been submitted with this application as seen in the appendices. (See Appendix B of the Engineering Report submitted as part of this planning application for Design Calculations)

Storm Water Attenuation Design

9.24 As part of our design process and to protect against flooding we have designed an impermeable attenuation system comprising of permeable pavements (type system C) with outflow limited to a discharge rate of 2l/s/ha. These systems have been designed to cater for the 100 year storm event with an additional 10% capacity provided for climate change.

9.25 Permeable Pavement with a total storage volume of 1588m3 will be located in all car parking and public open spaces. These pavements have been designed for a voids ratio of 30% using crushed angular stone.

9.26 Typically for the 1 in 100 year event it is sufficient to allow the surface water drainage system to surcharge to the roads and hard standing areas with shallow ponding for a limited time. In this case however given the sites location to the River Suck and to protect against flooding it is not considered appropriate. As such the attenuation facilities have been designed to cater for the 100 year event thus preventing surcharging of the system.

9.27 Runoff of storm water is limited to a discharge rate of 2 litres/sec/hectare by use of hydro-brakes. An emergency overflow to cater for flows in excess of the 100 year storm event is provided from the attenuation chambers.

Water Supply

9.28 A 150mm diameter watermain will service the development. The watermain will be connected to the public watermain that adjoins the site at Main Street. Supply to the development will be measured by a magma flow meter complete with power supply and kiosk to Local Authority specifications.

9.29 An existing Local Authority watermain that traverses the site will also be diverted to facilitate the development.

9.30 Air valves and scour valves will be provided around the site.

9.31 Screw down type fire hydrants complying with B.S. 750: 1984 will be provided in accordance with the Fire Certificate Drawings. All hydrants locations will be in accordance with the Technical Guidance Document B of the Building Regulations.

Impact

Storm Water Drainage

9.32 No adverse impacts are anticipated.

Foul Water Drainage

9.33 No adverse impacts are anticipated.

Water Supply

9.34 No adverse impacts are anticipated.

Mitigation

9.35 No mitigation is necessary other then the measures detailed above.

10.0 AIR QUALITY AND CLIMATE

10.1 INTRODUCTION

AWN Consulting Limited were commissioned to conduct an assessment into the likely impact on air quality and climate associated with the proposed development.

10.2 THE RECEIVING ENVIRONMENT - AIR

Baseline Air Quality

A short-term monitoring study was carried out for NO_2, benzene, PM_{10} and $PM_{2.5}$. The survey was indicative only and cannot be used to gauge compliance with either the short-term or annual limit values for the reasons outlined above. The survey does however allow an indicative assessment of the influence of local road sources relative to the prevailing background level of these pollutants in the area.

<u>NO_2</u>

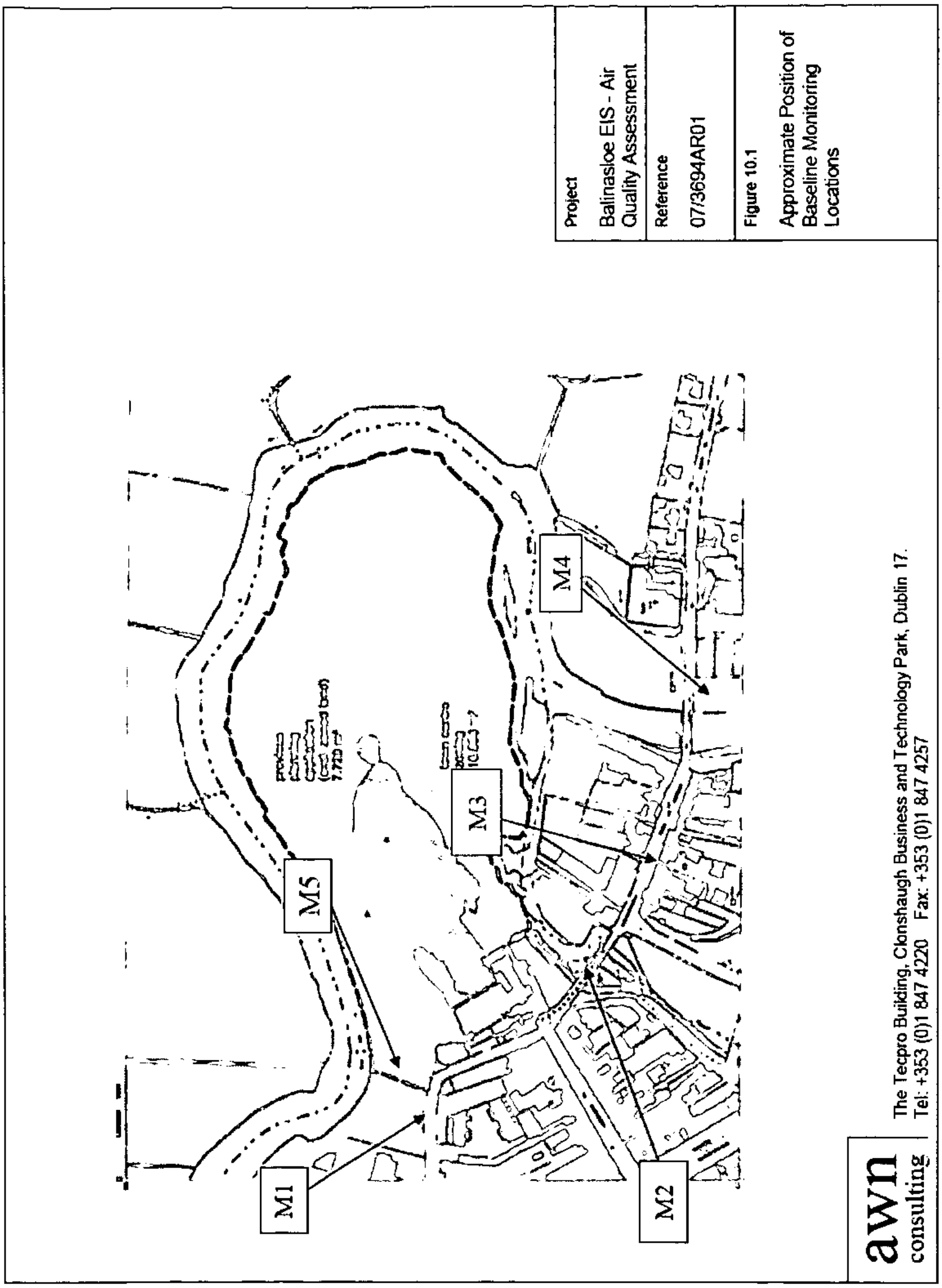
NO_2 was monitored, using nitrogen dioxide passive diffusion tubes, over a two-week period at four locations near the proposed development (see Figure 10.1, M1-M4). The locations were chosen in order to assess roadside exposure to NO_2. The results also allow an assessment of the spatial variation of NO_2 away from the main road sources in the area. The spatial variation away from roadside is particularly important for NO_2, as a complex relationship exists between NO, NO_2 and O_3 leading to a non-linear variation of NO_2 concentrations with distance from the road. Passive sampling of NO_2 involves the molecular diffusion of NO_2 molecules through a polycarbonate tube and their subsequent adsorption onto a stainless steel disc coated with triethanolamine. Following sampling, the tubes were analysed using UV spectrophotometry, at a UKAS accredited laboratory (Bureau Veritas, Runcorn, Cheshire).

Studies in the UK have shown that diffusion tube monitoring results generally have a positive or negative bias when compared to continuous analysers. This bias is laboratory specific and is dependent on the specific analysis procedures at each laboratory. The diffusion tube bias for the Bureau Veritas laboratory of 0.79 was obtained from the UK Air Quality Review and Assessment website (www.uwe.ac.uk/aqm/review) and applied to the diffusion tube monitoring results.

<u>Benzene</u>

Benzene was monitored, using passive diffusion tubes over a two-week period at two locations near the proposed development (see Figure 12.2, M1 and M3). Passive sampling of benzene involves the molecular diffusion of benzene molecules through a stainless steel tube and their subsequent adsorption onto a stainless steel gauze coated with Chromasorb 106. Following sampling, the tubes were analysed using Gas Chromatography, at a UKAS accredited laboratory. The locations were positioned to allow an assessment of roadside exposure to benzene.

Figure 10.1: Monitoring Locations



PM_{10} / $PM_{2.5}$

PM_{10} was monitored, using an Osiris Environmental Dust Monitor, over two 24-hour periods at one location near the proposed development (see Figure 10.1, M5). The location was positioned to allow an assessment of urban background concentration levels of PM_{10}.

10.2.7 Assessment of Compliance

Nitrogen dioxide (NO_2) results are presented in Table 10.8. Average concentrations of nitrogen dioxide are currently below the national and EU annual limit value, at all four locations near the proposed development. Concentrations peak at 82% of the limit value.

Benzene results are presented in Table 10.9. Average concentrations of benzene are currently significantly below the national and EU annual limit value of 5 $\mu g/m^3$.

Daily concentrations of PM_{10} and $PM_{2.5}$ measured at one monitoring station (M5) are shown in Table 12.10. The results show that the levels of PM_{10} were above the 24-hour EU limit value of 50 $\mu g/m^3$ during one of the three 24 hour sampling periods. The average level of PM_{10} measured over the three-day period is approximately 107% of the limit value which is set at 40 $\mu g/m^3$. The average level of $PM_{2.5}$ measured over the three-day period was approximately 101% of the proposed cap which is set at 25 $\mu g/m^3$. The results of the 3-day PM_{10} / $PM_{2.5}$ survey can only provide indicative comparisons to their respective limit values. Hence the results of long-term PM_{10} monitoring carried out by the EPA at other similar locations have been used to provide further information on background PM_{10} levels at the site of the proposed development (see below).

In summary, ambient air quality in the vicinity of the proposed development, based on an analysis of the baseline monitoring survey and existing EPA data, is presently below the ambient air quality standards for PM_{10}, NO_2 and benzene.

10.2.8 Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2005" (EPA, 2006)[(9)], details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes[(9)]. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 16 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, Ballinasloe is categorised as Zone D[(9)].

EPA monitoring is carried out at the rural Zone D locations, Askeaton, Glashaboy and Kilkitt using continuous monitors[(9)]. In addition, the EPA carried out long-term monitoring at Mountrath, at a site outside Drogheda and Castlebar in 2004/05, which is also an urban Zone D location[(8-9)].

Long-term NO_2 monitoring is carried out at the two rural Zone D locations, Glashaboy and Kilkitt[(9)]. The NO_2 annual average in 2005 for both sites was 9 and 2 $\mu g/m^3$, respectively. The results of NO_2 monitoring carried out at the urban Zone D location in Mountrath in 2004/05 indicated an average NO_2 concentration of 13 $\mu g/m^3$[(8)], with no exceedences of the 1-hour limit value. Furthermore, average NO_2 concentrations measured at Carlow, Wexford and Kilkenny in 2005 (Zone C locations) ranged from 9

to 18 μg/m^3 respectively[9]. Hence long-term average concentrations measured at these locations were significantly lower than the annual average limit value of 40 μg/m^3. Based on the above information, a conservative estimate of the background NO_2 concentration for Ballinasloe in 2007 is 14.2 μg/m^3.

The results of CO monitoring carried out in Mountrath in 2004/05 (urban Zone D) showed no exceedences of the 8-hour limit value[8], with an average level of 0.3 mg/m^3. Data for the Zone C station in Wexford in 2005 indicated a long-term average of 0.3 mg/m^3 respectively[9]. Based on the above information, a conservative estimate of the background CO concentration for Ballinasloe in 2007 is 0.26 mg/m^3.

With regard to benzene, continuous monitoring was carried out at a Mountrath in 2004/05[8], with a long-term average of 0.3 μg/m^3 respectively. The results of monitoring carried out in Wexford in 2005 indicated a long-term average of 0.3 μg/m^3[9]. Based on the above information, a conservative estimate of the background benzene concentration for Ballinasloe in 2007 is 0.6 μg/m^3.

Long-term PM_{10} measurements carried out at Mountrath in 2004/05, gave an average level of 26 μg/m^3[8]. In addition, the results of Zone D measurements in Castlebar and a site outside Drogheda in 2005 gave averages of 16 and 17 μg/m^3 respectively[9]. Data from the Phoenix Park provides a good indication of urban background levels, with an annual average in 2005 of 12 μg/m^3[9]. Based on the above information, a conservative estimate of the background PM_{10} concentration for Ballinasloe in 2007 of 14.4 μg/m^3 has been used.

The results of $PM_{2.5}$ monitoring in Mountrath, Carlow, Clonmel and Tralee in 2004/05[8,9] indicated average $PM_{2.5}/PM_{10}$ ratios ranging from 0.34 to 0.50. Based on this information, a conservative ratio of 0.5 was used to generate a background $PM_{2.5}$ concentration in 2007 of 7.2 μg/m^3.

Estimates of the background concentrations in 2010 and 2025 were made using the Netcen background calculator, which uses year on year reduction factors provided by DEFRA[5]. A summary of the background concentrations used in the model is detailed in Table 10.11.

10.3 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

As stated above, road traffic would be expected to be the dominant source of emissions in the region of the development (with the possible exception of PM_{10}) and thus is the focus of the current assessment. Detailed traffic flow information was obtained from the traffic consultant for the project and has been used to model pollutant levels under various traffic scenarios and under sufficient spatial resolution to assess whether any significant air quality impact on sensitive receptors may occur.

Cumulative effects have been assessed, as recommended in the EU Directive on EIA (Council Directive 97/11/EC) and using the methodology of the UK DEFRA[5,6]. Firstly, background concentrations[10] have been included in the modelling study, for both "do nothing" and "do something" scenarios. These background concentrations are year-specific and account for non-localised sources of the pollutants of concern[10]. Appropriate background levels were selected based on the available monitoring data provided by the EPA and Local Authorities[7-9] (see above).

Once appropriate background concentrations were established (see Table 10.11), the existing situation, including background levels, was assessed in the absence of the development for the opening year (Year 2010) and the development year (Year 2025). The cumulative effect of the baseline situation and the additional impact of the development has also been assessed for the opening year (Year 2010) and the development year (Year 2025). This assessment allows the significance of the

development, with respect to both relative and absolute impact, to be determined both temporally and spatially.

10.3.1 Air Dispersion Modelling

The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model (Version 1.02)[10] and following guidance issued by the UK DEFRA[11-13]. Ambient concentrations for CO, benzene, NO_2, PM_{10} and $PM_{2.5}$ for the opening year (2010) and design year (2025), at the nearest sensitive receptors to the development, have been modelled. "Do nothing" and "do something" modelling was carried out at the building façade of the worst-case receptors for both 2010 and 2025. An assessment was also carried out for at two different average traffic speeds, typical of worst-case peak-hour (10 km/hr) and average (40 km/hr) driving conditions.

10.3.2 Climate

Road traffic would be expected to be the dominant source of greenhouse gas emissions as a result of the development. Vehicles will give rise to CO_2 and N_2O emissions near the proposed development.

10.4 PREDICTED IMPACT OF THE PROPOSAL

10.4.1 Locations Used For Modelling Assessment

Two receptors were modelled near the development; (1) a sensitive receptor located to the west of the development on Riverview Street and (2) a residential receptor located along Bridge Street to the south of the proposed development. Results are reported assuming both average daily speeds of 40 km/hr and a worst-case rush hour speed of 10 km/hr. The discussion below is based on an average speed of 40 km/hr for PM_{10}, CO, benzene, NO_2 and $PM_{2.5}$. The effect of reducing speeds from 40 km/hr to 10 km/hr is discussed separately.

10.4.2 "Do Nothing" Modelling Assessment

PM_{10}, CO and Benzene

The results of the "do nothing" modelling assessment for PM_{10}, CO and benzene in the opening year are shown in Tables 10.12 – 10.13. Concentrations are well within the limit values under all scenarios at all worst-case receptors. Levels of all three pollutants range from 11 - 36% of the respective limit values in 2010.

The temporal trend in these pollutants can be established by an examination of levels in 2010 and 2025 (see Tables 10.12 – 10.13). Future trends for the "do nothing" scenario indicate similar levels of PM_{10}, CO and benzene. "Do nothing" levels of all three pollutants range from 11% of the limit value for benzene to 36% of the annual limit value for PM_{10} in 2025.

NO_2

The results of the "do nothing" assessment for NO_2 in the opening year are shown in Tables 10.12 – 10.13. Concentrations are below the annual limit value under all scenarios at all locations. Future trends for the "do nothing" scenario indicate decreasing annual levels of NO_2. "Do nothing" annual average levels of NO_2 range from 34 - 39% of the annual limit value in 2010 and 2025.

The EU limit value for the maximum one-hour standard for NO_2 is based on a one-hour mean not to be exceeded more than 18 times a year (99.8th%ile). "Do nothing" levels in 2010 are below this limit value, with levels at the worst-case receptor 39% of the EU limit value.

Temporally, "do nothing" levels of maximum one-hour NO_2 concentrations over the period 2010 to 2025 will decrease appreciably, with levels peaking at 35% of the limit value at the worst-case receptor in the design year (2025) (see Tables 10.12 – 10.13).

$PM_{2.5}$

The results of the "do nothing" modelling assessment for $PM_{2.5}$ in the opening and design years are shown in Table 10.14. The annual average $PM_{2.5}$ concentration peaks at 9.1 $\mu g/m^3$ in 2010 and 8.9 □g/m^3 in 2025. Hence levels are predicted to reach at most 36% of the $PM_{2.5}$ concentration cap of 25 $\mu g/m^3$ which is likely be set after 2010.

10.4.3 Modelled Impact of the Development Once Operational

PM_{10}, CO and Benzene

The results of the modelled impact of the development for PM_{10}, CO and benzene in the opening year are shown in Tables 10.12 – 10.13. The cumulative impact of both "do nothing" traffic levels and additional traffic due to the development are presented. Concentrations are below the ambient standards under all scenarios. Levels of all three pollutants range from 12 - 38% of the respective limit values in 2010.

Future trends with the development in place indicate lower levels of CO, benzene and PM_{10}. Levels of all three pollutants are below the relevant limit values under all scenarios. Levels of all three pollutants range from 11 - 37% of the respective limit values in 2025.

The impact of the development can be assessed for existing receptors relative to "do nothing" levels in both the opening and design years (see Tables 10.12 – 10.13). For PM_{10}, CO and benzene, relative to "do nothing" levels, the impact of the development will generally increase slightly as a result of the development. As a worst-case, levels will increase by 2% of the respective limit values.

Thus, using the assessment criteria outlined in Tables 10.6 and 10.7, the impact of the development in terms of PM_{10}, CO and benzene is negligible.

NO_2

The result of the assessment of the impact of the development for NO_2 in the opening year (2010) is shown in Tables 10.12 – 10.13. The annual average concentration is within the annual limit value for all scenarios. Future trends, with the development in place, indicate reduced annual levels of NO_2. Levels of NO_2 range from 31 - 44% of the annual limit value in 2010 and 2025. The impact of the development will account for at most 5% of the annual limit value in either 2010 or 2025.

Maximum one-hour NO_2 levels in 2010 (as a 99.8^{th}%ile), with the development in place, will be significantly below the limit value, with levels at the worst-case receptor 44% of the limit value. Temporally, levels of maximum one-hour NO_2 concentrations, with the development in place, will decrease by up to 7% of the limit value between 2010 and 2025.

The impact of the development on maximum one-hour NO_2 levels can be assessed relative to "do nothing" levels in both the opening and design year (see Tables 10.12 – 10.13). Levels are only slightly increased with the development in place, with an increase of at most 5% of the limit value. However, predicted levels will still be well below the NO_2 maximum one-hour limit value, with worst-case levels peaking at 44% of the limit value in 2010.

Thus, using the assessment criteria outlined in Tables 10.6 and 10.7, the impact of the development in terms of NO_2 is slight adverse.

$PM_{2.5}$

The result of the assessment of the impact of the development for $PM_{2.5}$ in the opening and design years is shown in Table 10.14. The annual average $PM_{2.5}$ concentration peaks at 9.9 $\mu g/m^3$ in 2010 and 9.3 $\mu g/m^3$ in 2025. Hence, levels are predicted to reach at most 40% of the $PM_{2.5}$ concentration cap of 25 $\mu g/m^3$ which is likely be set after 2010.

The impact of the development on annual average $PM_{2.5}$ levels can be assessed relative to "do nothing" levels in the opening and design years (see Table 10.14). Levels are slightly increased with the development in place, with an increase of at most 3% of the $PM_{2.5}$ concentration cap which is likely be set after 2010.

Thus, using the assessment criteria outlined in Tables 10.6 and 10.7, the impact of the development in terms of $PM_{2.5}$ is negligible.

Variation in Traffic Speed

An assessment of the effect of changing the traffic speed (for the entire assessment year) from an average speed of 40 km/hr to a worst case peak hour speed of 10 km/hr has also been carried out for all pollutants (see Tables 10.12 – 10.13). The results indicate that pollutant levels are increased at the worst-case traffic speed. Nevertheless, pollutant levels are still significantly lower than the relevant limit values for PM_{10}, NO_2, CO and benzene and the proposed limit value for $PM_{2.5}$.

10.4.4 Summary of Modelling Assessment

"Do nothing" modelling assessments for PM_{10}, CO and benzene indicate that concentrations will be significantly within the ambient air quality standards under all scenarios. In addition, the impact of the development will account for only 2% of the respective limit values. Cumulatively, levels will still be well within the ambient air quality limit values under all scenarios. Levels of all three pollutants with the proposed development in place range from 11 - 38% of the respective limit values in 2010 and 2025. Thus, the impact of the development for these three pollutants is negligible.

The modelling assessment for NO_2 indicates that annual concentrations will be well within the air quality standard under all scenarios. Levels of NO_2 with the development in place will range from 31 - 44% of the annual limit value in 2010 and 2025. The maximum one-hour modelling assessment for NO_2 also indicates that levels will be within the applicable limit value in 2010 and 2025 for all scenarios. The impact of the development on NO_2 levels will be to increase levels by 5% of the respective maximum one-hour limit values in either 2010 or 2025. However, predicted levels will still be below the NO_2 maximum one-hour limit value, with worst-case levels peaking at 44% of the limit value in 2010 and at 37% of the limit value in 2025. Thus, the impact of the development, in terms of NO_2, is deemed slight adverse.

"Do nothing" modelling assessments for $PM_{2.5}$ indicate that concentrations will be significantly within the ambient air quality standards under all scenarios. In addition, the impact of the development will account for 3% of the proposed annual concentration cap. Cumulatively, levels will still be within the proposed $PM_{2.5}$ concentration cap under all scenarios. Levels of $PM_{2.5}$ will peak at 40% of the concentration cap in 2025. Thus, the impact of the development for $PM_{2.5}$ is negligible.

In summary, levels of traffic-derived air pollutants will not exceed the ambient air quality standards both with and without the development in place. Thus, using the assessment criteria outlined in Tables 10.6 and 10.7, the impact of the development in terms of NO_2 is slight adverse and for PM_{10}, $PM_{2.5}$, CO and benzene is negligible.

10.4.5 Climate Impact

Greenhouse gas emissions, as a result of this development, will be imperceptible in terms of Ireland's obligations under the Kyoto Protocol[1,2].

Modification Of Atmospheric Conditions

The size and nature of the development and the nature and volume of emissions will be imperceptible.

Modification Of The Existing Heat Balance In The Area

Mesoscale meteorological modelling results indicate that heat islands in US cities may lead to 1.5-3°C increases relative to the suburbs in the afternoon in summer[15]. Relative to this kind of increase, the size and nature of the proposed development and the nature and volume of emissions will be imperceptible.

10.5 *MITIGATION MEASURES TO REDUCE ADVERSE EFFECTS*

10.5.1 Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (Euro IV (98/69/EC) for passenger cars to be complied with in 2005 and Euro IV and V for diesel HGVs to be introduced in 2006 and 2008). In relation to fuel quality, EU Fuel Directive (98/70/EC) has introduced significant reductions in both sulphur and benzene content of fuels.

In relation to design and operational aspects of road developments, emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems[11]. Improvements in air quality are likely over the next few years as a result of the on-going comprehensive vehicle inspection and maintenance program, fiscal measures to encourage the use of alternatively fuelled vehicles and the introduction of cleaner fuels.

10.5.2 Climate

CO_2 emissions will be reduced to 120 g/km by 2012 through EU legislation. This measure will reduce CO_2 emissions from new cars by an average of 25% in the period 1995 to 2007/2009 whilst 15% of the necessary effort towards the overall climate change target of the EU will be met by this measure alone[16]. Additional fuel efficiency measures include VRT and Motor Tax rebalancing to favour the purchases of more fuel-efficient vehicles, the National Car Test and Fuel Economy Labelling[16,17].

10.6 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

10.6.1 Local Construction Impacts

There is the potential for a number of emissions to the atmosphere during the construction of the development. In particular, the construction activities may generate quantities of dust. Construction vehicles, generators etc., will also give rise to some exhaust emissions.

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions.

10.6.2 Predicted Impacts

If a satisfactory dust minimisation plan is implemented, the effect of construction on air quality will be slight and on climate will be imperceptible.

10.6.3 Mitigation Measures To Reduce Adverse Effects

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions (detailed in Appendix attached).

10.7 FORECASTING METHODS

The air quality assessment has been carried out following procedures described in the publications by the EPA[18,19] and using the methodology outlined in the guidance documents published by the UK DEFRA[5-8, 10-13].

Prediction of traffic derived pollutants was carried out using the UK DMRB Screening Model (Version 1.02 (Nov. 2003))[10] and following guidance issued by the UK DEFRA[11-13] and the EPA[18,19].

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(18) EPA (2002) Guidelines On Information To Be Contain in Environmental Impact Statements
(19) EPA (2003) Advice Notes On Current Practice (In The Preparation Of Environmental Impact Statements)

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	1999/30/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 $\mu g/m^3$ NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 $\mu g/m^3$ NO_2
		Annual limit for protection of vegetation	None	30 $\mu g/m^3$ $NO + NO_2$
Lead	1999/30/EC	Annual limit for protection of human health	60% until 2003 reducing linearly to 0% by 2005	0.5 $\mu g/m^3$
Sulphur dioxide	1999/30/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	90 □g/m^3 until 2003, reducing linearly to 0 □g/m^3 by 2005	350 $\mu g/m^3$
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 $\mu g/m^3$
		Annual & Winter limit for the protection of ecosystems	None	20 $\mu g/m^3$
Particulate Matter (as PM_{10}) Stage 1	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	30% until 2003 reducing linearly to 0% by 2005	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	12% until 2003 reducing linearly to 0% by 2005	40 $\mu g/m^3$ PM_{10}
Particulate Matter (as PM_{10}) Stage 2[Note 1]	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 7 times/year	Not to be exceeded more than 28 times until 2006, 21 times until 2007, 14 times until 2008, 7 times until 2009 and zero times by 2010.	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	50% from 2005 reducing linearly to 0% by 2010	20 $\mu g/m^3$ PM_{10}
$PM_{2.5}$	COM (2005) 447	Annual concentration cap designed to limit unduly high risks to the population	None. Limit value applicable in 2010	25 $\mu g/m^3$ $PM_{2.5}$

Note 1 EU 1999/30/EC states "Indicative limit values to be reviewed in the light of further information on health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States". Proposed EU Directive COM (2005) 447 will *"replace the indicative limit values for PM_{10} for the year 2010 by a legally binding "cap" for the annual average concentrations of $PM_{2.5}$ of 25 □g/m^3 to be attained by 2010".*

Table 10.1 Air Quality Standards Regulations 2002 (based on EU Council Directive 1999/30/EC)

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Benzene	2000/69/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 $\mu g/m^3$
Carbon Monoxide	2000/69/EC	8-hour limit (on a rolling basis) for protection of human health	60% until 2003 reducing linearly to 0% by 2005	10 mg/m^3 (8.6 ppm)

Table 10.2 Air Quality Standards Regulations 2002 (based on EU Council Directive 2000/69/EC)

Pollutant	Regulation	Type	Period	Value
Nitrogen Dioxide	85/203/EEC	Limit Value	98th percentile of yearly mean hourly concentrations	200 $\mu g/m^3$
		Guide Value		135 $\mu g/m^3$
		Guide Value	50th percentile of yearly mean hourly concentrations	50 $\mu g/m^3$
Lead	82/884/EEC	Limit Value	Annual mean	2 $\mu g/m^3$
Sulphur dioxide	80/779/EEC	Limit Value	98th percentile of yearly mean hourly concentrations	250-350[Note 1] $\mu g/m^3$
		Limit Value	Winter (medium of daily values)	130 or 180[Note 1] $\mu g/m^3$
		Limit Value	One year (medium of daily values)	80 or 120[Note 1] $\mu g/m^3$
		Guide Value	98th percentile of yearly mean hourly concentrations	135 $\mu g/m^3$
		Guide Value	50th percentile of 1-hour means	50 $\mu g/m^3$
Smoke	80/779/EEC	Limit Value	One year (medium of daily values)	80 $\mu g/m^3$
		Limit Value	Winter (medium of daily values)	130 $\mu g/m^3$
		Limit Value	98th percentile of daily values	250 $\mu g/m^3$

[Note 1] The lower daily values refer to the situation with corresponding high levels of black smoke.

Table 10.3 Existing European Union Air Standards

Pollutant	Averaging Period	Primary & Secondary Standard Note 1 ($\mu g/m^3$)	PSD Increment Class II Note2 ($\mu g/m^3$)
PM_{10}	Annual – Average over 3 years	50	17
	24-Hour – as a 99th%ile over 3 years	150	30
NO_2	Annual Mean	100	25
CO	8-Hour – 3-year average of annual 4th highest daily maximum 8-hour conc.	10,000	-
	1-Hour – not to be exceeded more than 3 times in 3 consecutive years	40,000	-
Hydrocarbon (Benzene)	3 Hours (6-9 AM) (corrected for methane)	160	-

Note 1 Primary standards to protect public health whilst secondary standards are set to protect public welfare
Note 2 Class I areas are national parks and similar areas. Class II are all areas not originally classified as Class I.

Table 10.4 US National Ambient Air Quality Standards (NAAQS) & PSD Increments

Substances	Time-weighted Average	Averaging Time
Lead	0.5 $\mu g/m^3$	1 year
Nitrogen dioxide	200 $\mu g/m^3$ 40-50 $\mu g/m^3$	1 hour annual
Carbon monoxide	100 $\mu g/m^3$ 60 $\mu g/m^3$ 30 $\mu g/m^3$ 10 $\mu g/m^3$	15 minutes 30 minutes 1 hour 8 hour
Benzene	Note 1	
Particulate matter (PM_{10})	Note 2	

Note 1 No safe level recommended owing to carcinogenicity.
Note 2 No specific guideline recommended because no obvious exposure concentration and duration that could be judged a threshold and decreased by uncertainty factors to avoid risk.

Table 10.5 WHO Guidelines For Air Quality 1999

Magnitude of Change	**Annual Mean NO_2 / PM_{10}**	**Days PM_{10} > 50 µg/m^3**
Very Large	Increase / decrease >25%	Increase / decrease >25 days
Large	Increase / decrease 15-25%	Increase / decrease 15-25 days
Moderate	Increase / decrease 10-15%	Increase / decrease 10-15 days
Small	Increase / decrease 5-10%	Increase / decrease 5-10 days
Very Small	Increase / decrease 1-5%	Increase / decrease 1-5 days
Extremely Small	Increase / decrease <1%	Increase / decrease <1 days

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - National Roads Authority (2006)

Table 10.6 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Standard[Note 1]	**Change in Concentration**					
	Extremely Small	**Very Small**	**Small**	**Moderate**	**Large**	**Very Large**
Decrease with Scheme						
Above Standard with Scheme	slight beneficial	slight beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Above Standard in Do-min, Below with Scheme	slight beneficial	moderate beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Below Standard in Do-min, but not Well Below	negligible	slight beneficial	slight beneficial	moderate beneficial	moderate beneficial	substantial beneficial
Well Below Standard in Do-min	negligible	negligible	slight beneficial	slight beneficial	slight beneficial	moderate beneficial
Increase with Scheme						
Above Standard in Do-min	slight adverse	slight adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Standard in Do-min, Above with Scheme	slight adverse	moderate adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Standard with Scheme, but not Well Below	negligible	slight adverse	slight adverse	moderate adverse	moderate adverse	substantial adverse
Well Below Standard with Scheme	negligible	negligible	slight adverse	slight adverse	slight adverse	moderate adverse

Note 1 Well Below Standard = <75% of limit value.
Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - National Roads Authority (2006)

Table 10.7 Air Quality Impact Significance Criteria

Table 10.8 Results Of NO_2 Diffusion Tube Monitoring Carried Out Near The Site Of The Proposed Ballinasloe Mixed-Use Development, Co. Galway.

Location	Sampling Period	NO_2 Concentration ($\mu g/m^3$)
M1 Riverview Street	29/03/07 – 13/04/07	7
M2 Bridge Street	29/03/07 – 13/04/07	Note 1
M3 N6 North	29/03/07 – 13/04/07	33
M4 – N6 South	29/03/07 – 13/04/07	14
	Limit Value	40 Note 2

Note 1 Sample Lost In The Field.
Note 2 EU Council Directive 1999/30/EC (as an annual average).

Table 10.9 Results Of Benzene Diffusion Tube Monitoring Carried Out Near The Site Of The Proposed Ballinasloe Mixed-Use Development, Co. Galway.

Location	Sampling Period	Benzene Concentration ($\mu g/m^3$)
M2 – Bridge Street	29/03/07 – 13/04/07	Note 2
M4 – N6 North	29/03/07 – 13/04/07	0.2
	Limit Value	5 Note 1

Note 1 EU Council Directive 2000/69/EC (as an annual average).
Note 2 Laboratory unable to analyse Thermal desorption Tube

Table 10.10 Results Of PM_{10} & $PM_{2.5}$ Monitoring Carried Out Near The Site Of The Proposed Ballinasloe Mixed-Use Development, Co. Galway.

Location	Sampling Period	PM_{10} Conc. ($\mu g/m^3$)	$PM_{2.5}$ Conc. ($\mu g/m^3$)
M5	13/04/07 – 14/04/07	42.7	22.7
	14/04/07 – 15/04/07	62.9	42.6
	15/04/07 – 16/04/07	18.6	5.7
	Average	43.3	25.2
Limit Value (Compliance Date 2005)		Maximum 24-Hour = 50(1) Annual = 40(1)	Annual = 25(2)

Note 1 EU Council Directive 1999/30/EC.
Note 2 Proposed Directive COM(2005) 447.

Background Values	Nitrogen Oxides ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)	Particulates ($PM_{2.5}$) ($\mu g/m^3$) Note 1	Carbon Monoxide (mg/m^3)
Year 2007	15.7	14.2	0.6	14.4	8.6	0.26
Year 2010 Note 2	13.6	12.9	0.6	13.5	8.1	0.21
Year 2025 Note 2	11.9	11.7	0.6	13.5	8.1	0.21

Note 1 A conservative ratio of 0.6 has been used for the ratio of $PM_{2.5}$ / PM_{10}.
Note 2 Reduction in future years using the Netcen background calculator (November 2002).

Table 10.11 Summary of background concentrations used in the air dispersion model

Table 10.12 Air Quality Assessment The Proposed Ballinasloe Mixed-Use Development, Co. Galway. Summary Of Predicted Air Quality At Worst-Case Sensitive Receptor West of the Proposed Site on Riverview Road.

Scenarios	Traffic Speed (km/hr)	Carbon Monoxide (mg/m^3)		Hydrocarbons ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)		Particulates (PM_{10}) ($\mu g/m^3$)	
		Annual Average	Maximum 8-hour	Annual mean benzene	99.8th%ile of 1-hr NO_2	Annual average NO_2	Annual average	Number of exceedances of 50 □g/m³
2010 Do Nothing	**10**	0.24	2.4	0.70	70.0	14.0	13.9	0
	40	0.22	2.2	0.67	68.8	13.6	13.7	0
2010 Do Something	**10**	0.27	2.7	0.72	74.1	14.8	14.3	0
	40	0.23	2.3	0.68	70.7	14.1	13.9	0
2025 Do Nothing	**10**	0.24	2.4	0.70	62.0	12.4	13.8	0
	40	0.22	2.2	0.67	60.9	12.2	13.7	0
2025	**10**	0.25	2.5	0.71	63.9	12.8	13.9	0

Do Something	**40**	0.23	2.3	0.68	62.2	12.4	13.7	0
Standards		-	10 Note 1	5 Note 1	200 Notes 2,3	40 Note 2	40 Note 2	35 Notes 2,4

Note 1 EU Council Directive 2000/69/EC (S.I. 271 of 2002)
Note 2 EU Council Directive 1999/30/EC (S.I. 271 of 2002)
Note 3 1-hr limit of 200 µg/m^3 not to be exceeded > 18 times/year (99.8th %ile)
Note 4 24-Hr limit of 50 □g/m^3 not to be exceeded > 35 times/year (90.1th %ile)

Table 10.13 Air Quality Assessment The Proposed Ballinasloe Mixed-Use Development, Co. Galway. Summary Of Predicted Air Quality At Worst-Case Residential Receptor located to the South of the Development at Bridge Street.

Scenarios	Traffic Speed (km/hr)	Carbon Monoxide (mg/m^3)		Hydrocarbons ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)		Particulates (PM_{10}) ($\mu g/m^3$)	
		Annual Average	Maximum 8-hour	Annual mean benzene	$99.8^{th\%ile}$ of 1-hr NO_2	Annual average NO_2	Annual average	Number of exceedances of 50 $\mu g/m^3$
2010 Do Nothing	**10**	0.34	3.4	0.80	85.5	17.1	15.3	0
	40	0.26	2.6	0.70	78.4	15.7	14.5	0
20010 Do Something	**10**	0.45	4.5	0.91	100	20.1	16.8	1
	40	0.30	3.0	0.76	88.6	17.7	15.3	0
2025 Do Nothing	**10**	0.35	3.5	0.80	73.9	14.8	14.8	0
	40	0.26	2.6	0.72	69.3	13.9	14.3	0
2025 Do Something	**10**	0.42	4.2	0.88	81.3	16.3	15.5	0
	40	0.28	2.8	0.75	74.6	14.9	14.7	0
Standards		-	10 Note 1	5 Note 1	200 Notes 2,3	40 Note 2	40 Note 2	35 Notes 2,4

Note 1 EU Council Directive 2000/69/EC (S.I. 271 of 2002)
Note 2 EU Council Directive 1999/30/EC (S.I. 271 of 2002)
Note 3 1-hr limit of 200 □g/m³ not to be exceeded > 18 times/year (99.8th %ile)
Note 4 24-Hr limit of 50 □g/m³ not to be exceeded > 35 times/year (90.1th %ile)

Table 10.14 Air Quality Assessment, The Proposed Ballinasloe Mixed-Use Development, Co. Galway Summary Of Predicted $PM_{2.5}$ At Worst-Case Receptors Near The Proposed Site.

Scenarios	Traffic Speed (km/hr)	Particulates ($PM_{2.5}$) ($\mu g/m^3$) Annual average
2010 Do Nothing	**10**	9.9
	40	9.1
2010 Do Something	**10**	11.4
	40	9.9
2025 Do Nothing	**10**	9.4
	40	8.9
2025 Do Something	**10**	10.1
	40	9.3
Standards		25 Notes 1, 2

Note 1 Proposed EU Directive COM (2005) 447 on Ambient Air Quality and Cleaner Air for Europe

Note 2 Proposed annual concentration cap of 25 $\mu g/m^3$

11.0 NOISE & VIBRATION

INTRODUCTION

11.1 Planning Permission is currently being sought for a retail development at Ballinasloe, Co. Galway. The proposed site is bounded to the south by the Main Street and the River Suck; to the west by River View; to the north and east by the River Suck.

11.2 AWN Consulting Limited has been commissioned to conduct an assessment into the likely noise and vibration impact associated with the proposed development.

RECEIVING ENVIRONMENT

Environmental Noise Survey

11.3 An environmental noise survey was conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 1982: *Acoustics – Description and measurement of environmental noise*. Specific details are set out below.

Choice of Measurement Locations

11.4 Three measurement locations were selected; each is described in turn below and are shown on Figure 11.1 below.

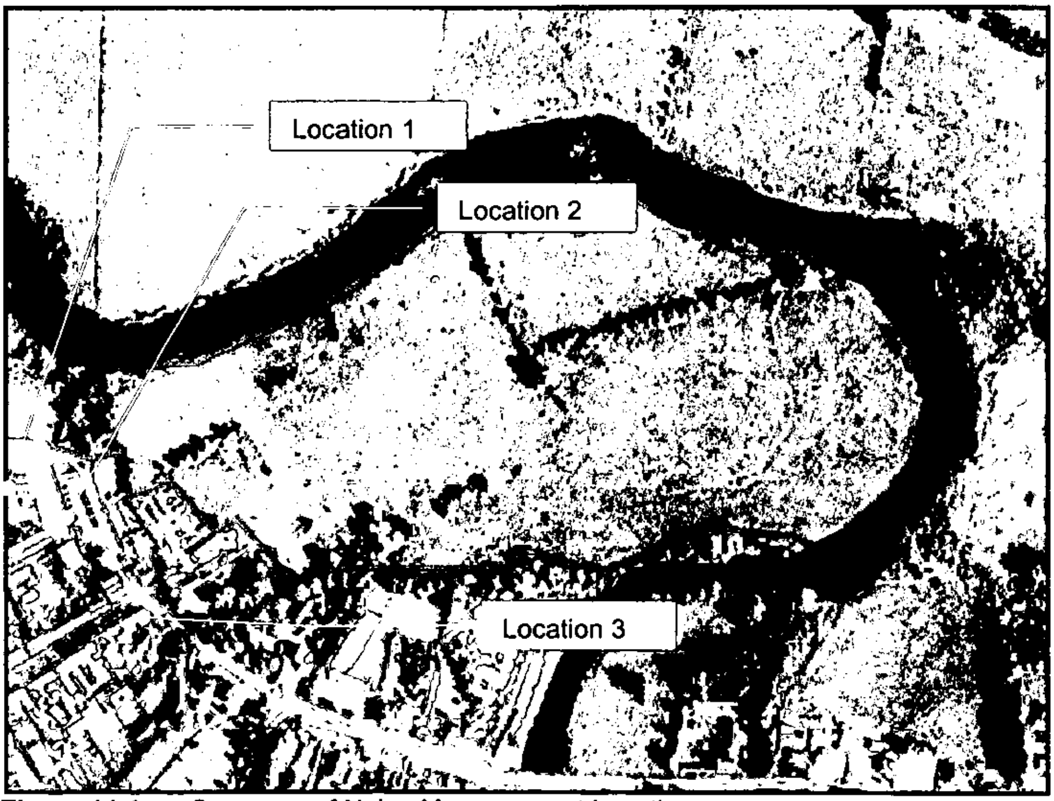

Figure 11.1 Summary of Noise Measurement Locations

Location 1 is located along River View, beyond the western boundary of the proposed development in the vicinity of a number of noise sensitive locations.

Location 2 is located in a car park beyond the western boundary of the proposed site.

Location 3 is located at the northern end of Main Street, in the vicinity of the nearest noise sensitive location.

Survey Periods

11.5 Noise measurements were conducted at Locations 1 to 3 over the course of two survey periods as follows:

- Daytime 10:30hrs to 13:05hrs 10 April 2007;
- Night-time 23:00hrs to 01:40hrs 09/10 April 2007.

11.6 The daytime measurements cover a typical period that was selected in order to provide a typical snapshot of the existing noise climate, with the primary purpose being to ensure that the proposed noise criteria associated with the development are commensurate with the prevailing environment.

11.7 The night-time period provides a measure of the existing background noise levels.

11.8 The weather during the day survey period was mild and dry with a very gentle breeze. Weather during the night survey period was cool, dry and still.

Personnel and Instrumentation

11.9 Louis Smith (AWN) performed the measurements during all the survey periods.

11.10 The noise measurements were performed using a Brüel & Kjær Type 2250 Precision Sound Level Analyser and a Brüel & Kjær Type 2238 Integrated Sound Level Meter. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

Procedure

11.11 Measurements were conducted at Locations 1 to 3 on a cyclical basis. Sample periods for the noise measurements were nominally 15 minutes during both the daytime and night-time periods. The results were noted onto a Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

Measurement Parameters

The noise survey results are presented in terms of the following three parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

11.12 The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

Results and Discussion

Location 1

The survey results for Location 1 are summarised in Table 11.2 below.

Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)

		L_{Aeq}	L_{A10}	L_{A90}
Daytime	10:27 - 10:42	50	52	43
	11:20 - 11:35	50	52	45
	12:14 - 12:29	61	63	47
Night-time	23:07 - 23:22	52	56	35
	23:58 - 00:13	41	41	34
	00:50 - 01:05	35	36	30

Table 11.2 Summary of noise measurements at Location 1

11.13 During the daytime period noise were dominated by distant road traffic noise, local car parking activity and a power hose in operation intermittently. During the third survey period an idling tractor and trailer significantly affected the measured noise levels. Noise levels were in the range 50 to 61dB L_{Aeq} and 43 to 47dB L_{A90}.

11.14 During the night-time period noise sources observed included distant road traffic noise, occasional local vehicle movements and car parking activity. During the first measurement period an idling taxi was also noted. Noise levels were in the range 35 to 52dB L_{Aeq} and 30 to 35dB L_{A90}.

Location 2

The survey results for Location 2 are summarised in Table 11.3 below.

Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{A10}	L_{A90}
Daytime	10:45 - 11:00	54	57	45
	11:37 - 11:52	61	63	49
	12:30 - 12:45	52	56	44
Night-time	23:24 - 23:39	41	42	27
	00:14 - 00:29	48	44	27
	01:07 - 01:22	32	34	24

Table 11.3 Summary of noise measurements at Location 2

11.15 Daytime noise levels were dominated by distant road traffic noise, occasional local vehicle movements along River View and intermittent car parking activity. Noise levels were in the range of 52 to 61dB L_{Aeq} and 44 to 49dB L_{A90}.

11.16 During the night-time the dominant sources of noise were again distant road traffic and occasional local vehicle movements. Noise levels were in the range 32 to 48dB L_{Aeq} and 24 to 27dB L_{A90}.

Location 3

The survey results for Location 3 are summarised in Table 11.4 below.

Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{A10}	L_{A90}
Daytime	11:02 - 11:17	62	64	56
	11:57 - 12:12	61	64	54
	12:47 - 13:02	62	65	54
Night-time	23:41 - 23:56	60	63	39
	00:31 - 00:49	58	59	36
	01:23 - 01:38	54	52	34

Table 11.4 Summary of measurements at Location 3

11.17 During the daytime the dominant source of noise was local road traffic along Main Street. Noise levels were in the range of 61 to 62dB L_{Aeq} and 54 to 56dB L_{A90}.

11.18 During the night time the dominant sources of noise were again local road traffic movements along Main Street and distant road traffic. Noise levels were in the range 54 to 60dB L_{Aeq} and 34 to 39dB L_{A90}.

CHARACTERISTICS OF THE PROPOSAL

11.19 When considering a development of this nature, the potential noise & vibration impact on the surroundings must be considered for each of two distinct stages: the short term impact of the construction phase and the longer term impact of the operational phase.

11.20 The construction phase will involve demolition of existing buildings and earthworks throughout most of the site and the erection of a new building. This impact is short-term in nature and is assessed in the appropriate section of this document.

11.21 The primary sources of noise in the operational context will be deemed long-term and are discussed below,

- Building services noise;
- Car parking on site;
- Deliveries;
- Additional vehicular traffic on public roads;
- Traffic within the development.

POTENTIAL OUTWARD IMPACT OF THE PROPOSAL

Noise Criteria

Construction Phase

11.22 There is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider at their discretion noise limits.

11.23 In the absence of specific noise limits appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the National Roads Authority (NRA) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[1] which indicates the following criteria and hours of operation. The majority of the construction activity is expected to occur during normal working hours.

Table 11.5 indicates the maximum permissible noise levels at the facade of dwellings during the construction period as recommended by the NRA.

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

*Note ** Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

Table 11.5 Maximum permissible noise levels at the facade of dwellings during construction

Operational Phase

1 *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004*, National Roads Authority.

11.24 Due consideration must be given to the nature of the primary noise sources when setting criteria. In this instance, there are five primary sources of noise associated with the development once operational. Criteria for noise from these sources, with the exception of additional vehicular traffic on public roads, will be set in terms of the $L_{Aeq,T}$ parameter (the equivalent continuous sound level).

11.25 Given that vehicle movements on public roads are assessed using a different parameter (the ten percentile noise level; L_{A10}), it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development in terms of the L_{A10} parameter.

11.26 There is no Irish Standard containing guidance that are applicable in this instance. In the absence of such standards, best practice dictates that the potential noise impact of the proposed development is assessed against appropriate British and/or International Standards.

11.27 There are a number of noise sensitive properties, i.e. private residences, located beyond the western and southern boundaries of the proposed development. The locations assessed are shown below on Figure 11.2.

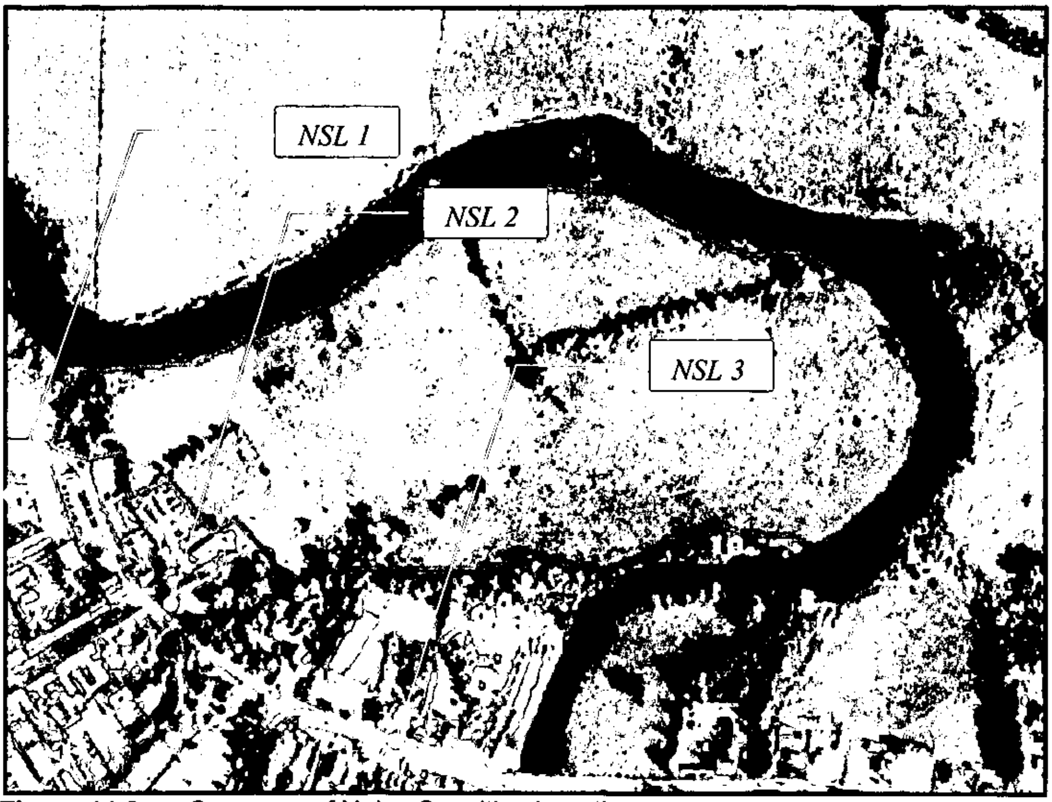

Figure 11.2 Summary of Noise Sensitive Locations

11.28 Appropriate guidance is contained within BS8233: *Sound Insulation and Noise Reduction for Buildings – Code of Practice* (1999). This British Standard sets out recommended noise limits for indoor ambient noise levels as follows:

Criterion for	Typical situation	Design range $L_{Aeq,T}$ (dB)	
		Good	Reasonable
Reasonable resting / sleeping conditions	Living Rooms	30	40
	Bedrooms	30	35

Table 11.6 Recommended indoor ambient noise levels from BS8233 (1999)

11.29 Given the location of the development site, the nearest neighbouring dwellings and the existing noise levels, it is considered appropriate to select the *Reasonable* limit for Living Rooms during the day and the *Good* limit for Bedrooms during the night. The appropriate internal criteria are therefore 40dBL_{Aeq} by day and 30dB L_{Aeq} by night.

11.30 For the purposes of this study, it is appropriate to derive external limits based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by an open window. BS 8233 Paragraph 8.4.7.3 Table 10 suggests this is in the range 10 – 15dB. In order to provide a 'worst case' assessment 10dB will be used.

11.31 As there is the potential for short periods of noise to cause a greater disturbance at night, a shorter assessment time period (T) is adopted. Appropriate periods are 1 hour for daytime (07:00 to 23:00 hours) and 5 minutes for night-time (23:00 to 07:00 hours).

11.32 In summary, the following criteria apply at the façades of those residential properties closest to the proposed development:

- Daytime (07:00 to 23:00 hours) 50dB $L_{Aeq,1hr}$
- Night-time (23:00 to 07:00 hours) 40dB $L_{Aeq,5min}$

11.33 These criteria are also in compliance with the following guidance taken from the World Health Organisation publication "*Community Noise*".

To protect the majority of people from being moderately annoyed during the daytime, the sound pressure level should not exceed 50dB L_{Aeq}.

At night external sound pressure levels should not exceed 45dB L_{Aeq}, so that people may sleep with bedroom windows open.

11.34 In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 11.7 offers guidance as to the likely impact associated with any particular change in traffic noise level.

Change in Sound Level (dB L_{A10})	Subjective Reaction	Impact
< 3	Inaudible	Imperceptible
3 – 5	Perceptible	Slight
6 – 10	Up to a doubling of loudness	Moderate
11 – 15	Over a doubling of loudness	Significant
> 15		Profound

Table 11.7 Likely impact associated with change in traffic noise level

Vibration Guidelines

11.35 Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

11.36 It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For example, piling, one of the primary sources of vibration during construction, is typically tolerated at vibration levels up to 5mm/s. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night.

11.37 Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- British Standard BS 7385 (1993): *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;

- British Standard BS 5228 (1992): *Noise control on construction and open sites* Part 4 *Code of practice for noise and vibration control during piling.*

11.38 BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

11.39 BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 10mm/s for intermittent vibration and 5mm/s for continuous vibration. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. For light and flexible industrial and commercial structures threshold limits of 20mm/s for intermittent and 10mm/s for continuous are recommended, whilst for heavy and stiff buildings higher thresholds of 30mm/s for intermittent and 15mm/s for continuous are recommended.

Forecasting Methods

11.40 Prediction calculations for building services plant have been conducted generally in accordance with ISO 9613: *Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, 1996.*

11.41 Traffic noise levels are predicted in accordance with guidance set out in *Calculation of Road Traffic Noise (CRTN)*[2], giving results in the form of L_{10} values.

Predicted Construction Noise Levels

11.42 A variety of items of plant will be in use for the purposes of demolition, site preparation, construction and road works. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for generation of significant levels of noise.

11.43 Due to the fact that the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels using guidance set out in BS5228: Part 1: 1997: *Noise and vibration control on construction and open sites – Code of practice for basic information and procedures for noise and vibration control.*

11.44 The nearest sensitive locations are located beyond the western boundary of the proposed site (i.e. NSL 2). It is assumed that the closest point that equipment for the site excavation, clearance and road surfacing will be operating is at distance of approximately 85m from this dwelling.

The following assumptions have been made in the preparation of these construction noise predictions:

- a utilisation of equipment of 66% over a working day;
- construction site will be screened by site hoarding of 2.4 metres height.

Table 11.8 below summarises the construction noise prediction calculations,

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2 *Calculation of Road Traffic Noise*, Department of Transport Welsh Office, HMSO, 1988

Phase	Plant Item (BS5228 Ref.)	Plant Noise Level at 10m Distance[3] (dB L_{Aeq})	Predicted Noise Level at Receiver Locations (dB $L_{Aeq,1hr}$)
Site Clearance & Preparation	Pneumatic breaker (C.2.11)	87	62
	Wheeled loader (C.3.51)	74*	49
	Tracked excavator (C.3.43)	75*	50
	Dozer (C.3.30)	76*	51
	Dump truck (C.3.60)	72*	47
	Vibratory roller (C.6.32)	79	54
General Construction (track, conveyors, loading system etc.)	Hand tools, 5 no. in use (C.7.79)	84	57
	Diesel Hoist (C.7.98)	76	51
	Compressor (C.7.27)	70	51
	Generator (C.7.49)	75	55
Roadworks	Spreaders/rollers /lorry (C.8.27)	75	62

*Assume noise control measures as outlined in Table B1 of BS 5228 Part 1 i.e. fit acoustic exhaust.

Table 11.8 Typical noise levels at nearest noise sensitive locations during construction (dB $L_{Aeq,1hr}$)

11.45 There is no item of plant that are expected to give rise to an exceedance of the criterion levels outlined in Table 5.6.4.

11.46 Note that the predicted "worst case" levels are expected to occur for only short periods of time at a limited number of properties. Construction noise levels will be lower than these levels for the majority of the time at the majority of properties in the vicinity of the proposed development.

11.47 It should also be noted that the predicted noise levels referred to in this section are indicative only and are intended for comparison with the construction noise criteria. Depending upon the number and type of sources operating, the noise levels may be higher than those stated and additional noise control measures may be deemed necessary.

11.48 The likely noise impact on the local environment is not significant.

Operational Phase

11.49 There are five primary sources of noise in the operational context.

- Building services noise;
- Car parking on site;
- Deliveries;
- Additional vehicular traffic on public roads;
- Traffic within the development.

Each of these primary noise sources is addressed in turn.

11.50 Note that there are no significant sources of vibration associated with the operational phase of the proposed development.

Building Services Plant

[3] All plant noise levels are derived from BS5228: Part 1

11.51 Once the commercial element becomes fully operational, a variety of electrical and mechanical plant will be required to service the buildings associated with the development. Most of this plant will be capable of generating noise to some degree. Some of this plant may operate 24 hours a day, and hence would be most noticeable during quiet periods (i.e. overnight). Noisy plant with a direct line-of-sight to noise sensitive properties would potentially have the greatest impact.

11.52 Proprietary noise and vibration control measures will be employed in order to ensure that noise emissions from building services plant do not exceed the criteria of 45dB $L_{Aeq,1hr}$ daytime and 35dB $L_{Aeq,5min}$ night-time at 1 metre from the façade of the nearest neighbouring residential dwelling.

11.53 In summary, the likely noise impact of building services noise on the local environment is not significant.

Car Parking On Site

11.54 Noise level measurements have previously been conducted in the vicinity of car parks in support of other planning applications. The typical noise level 10m beyond the boundary of these car parks during busy daytime periods has been found to be of the order 48dB $L_{Aeq,1hr}$.

11.55 Allowing for the additional attenuation to the noise sensitive locations due to distance and screening, the predicted noise levels at the nearest noise sensitive locations have been calculated. The results are presented in Table 11.9.

Source	Noise Levels (dB re. $2x10^{-5}$ Pa)		
	NSL1	NSL2	NSL3
Car Parking on Site	29	35	20

Table 11.9 Summary of Noise Levels Due to Car Parking Activity (dB $L_{Aeq,1hr}$)

11.56 These levels are with the day and night-time criteria of 50dB $L_{Aeq,1hr}$ and 40dB $L_{Aeq,5min}$ respectively.

11.57 In summary, the likely noise impact of car parking on the local environment is not significant.

Deliveries

11.58 The noise level at a distance of 10m from the vehicle dock of a typical service yard is of the order of 64dB $L_{Aeq,1hr}$ during daytime periods and 68dB $L_{Aeq,5min}$ during night time periods. These levels include the effects of reflections from store façades and service yard boundaries and contributions from all sources of noise, i.e. vehicles manoeuvring, air brakes, and trolleys. The main service yard is located along the northern boundary of the site

11.59 The predicted noise levels at the nearest noise sensitive locations due to service yard activity have been calculated. The results are presented below in Table 11.10.

11.60 It is also appropriate to consider the delivery HGV movements associated with the service yard.

11.61 The noise level associated with an event of short duration, such as a passing vehicle movement, may be expressed in terms of its Sound Exposure Level (L_{AX}). The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period.

11.62 The appropriate formula is given below.

$$L_{Aeq,T} = L_{AX} + 10\log10(N) - 10\log10(T) + 10\log10(r_1/r_2) \text{ dB} \qquad \textbf{Eqn 5.61}$$

where:

$L_{Aeq,T}$	is the equivalent continuous sound level over the time period T (in seconds);
L_{AX}	is the "A-weighted" Sound Exposure Level of the event considered(dB);
N	is the number of events over the course of time period T;
r_1	is the distance at which L_{AX} is expressed;
r_2	is the distance to the assessment location.

11.63 The mean value of Sound Exposure Level for a truck at low to moderate speeds (i.e. 15 to 45km/hr) is of the order of 82dB L_{AX} at a distance of 5 metres from the vehicle. This figure is based on a series of measurements conducted under controlled conditions.

11.64 Using the equation detailed above and using a worst case scenario of 12 vehicle movements in a 1-hour period during daytime hours and assuming a 1 vehicle movement in a 5-minute period during night time hours and taking account of attenuation due to distance and screening cumulative noise levels have been predicted at the nearest noise sensitive locations. The results are presented in Table 11.10.

Source	Noise Levels (dB re. $2x10^{-5}$ Pa)					
	NSL1		NSL2		NSL3	
	Day	Night	Day	Night	Day	Night
Delivery Activities	26	30	29	33	27	31
HGV Movements Associated with Service Yard	36	36	32	32	19	19
Cumulative	36	37	33	35	28	31
Criterion	50	40	50	40	50	40
Exceeds?	No	No	No	No	No	No

Table 11.10 Summary of Noise Level Changes Due to Service Yard Activity

11.65 These levels are within both the daytime and night-time criterion of 50dB $L_{Aeq,1hr}$ and 40dB $L_{Aeq,5min}$ respectively.

11.66 In summary, the likely noise impact of service yards access roads on the local environment is not significant.

Additional Vehicular Traffic on Public Roads

11.67 A detailed report on roads and traffic has been prepared by Peter Brett Associates Ireland. Information from this report has been used to determine the predicted change in noise levels in the vicinity of a number of roads and junctions in the area surrounding the proposed development for the design year (2023).

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development using the provided peak hour flow figures. The results are presented in Tables 11.11.

Route	Year 2023 – Peak Hour		Change in Noise Levels (dB re. $2x10^{-5}$ Pa)
	Do Nothing	Do Something	
River View West of Site Entrance	190	190	0
River View East of Site Entrance	190	417	+3.4
Private Car Park Access	49	35	-1.5
Bridge Street	652	957	+1.7
Main Street	659	303	-3.4
N6 South	1099	1139	+0.2

Route	Year 2023 – Peak Hour		Change in Noise Levels (dB re. 2x10^{-5} Pa)
	Do Nothing	Do Something	
N6 East	1647	1836	+0.5

Table 11.11 Summary of Noise Level Changes Due to Peak Hour Flows Associated with the Development design year (2019).

11.69 The predicted increase in peak hour traffic levels associated with the development will result in an increase of less than 3dB in the vicinity of the majority of existing roads and junctions surrounding the proposed development. Reference to Table 11.12 confirms that this increase is imperceptible and the resultant impact is not significant.

11.70 The predicted increase in peak hour traffic levels associated with the development will result in an increase of just over 3dB along River View. Reference to Table 11.12 confirms that the resultant impact is slight.

11.71 In summary, the predicted increase in noise levels associated with vehicles at any of the road junctions in the vicinity of the proposed development is not significant.

Traffic Within the Development

11.72 Vehicular access to the development will be provided for by road entering the site from the River View.

11.73 The mean value of Sound Exposure Level for a variety of passenger vehicles (i.e. estate, saloon, hatchback, executive) at low to moderate speeds (i.e. 10 to 30mph) is in the order of 67dB L_{AX} at a distance of 5 metres from the vehicle. This figure is based on a series of measurements conducted under controlled conditions.

11.74 Using the Equation 5.6.1 detailed above and taking the flows detailed in the PBA Associates Ireland Limited traffic report (672 vehicles movement during the design year PM peak hour) prediction calculations have been performed. The results are presented in Table 11.12.

Source	Noise Levels (dB re. 2x10^{-5} Pa)		
	NSL1	NSL2	NSL3
Traffic along Site Road	38	30	23

Table 11.12 Summary of Noise Levels Due to Traffic along Site Road (dB $L_{Aeq,1hr}$)

11.75 These levels are within the daytime criterion of 50dB $L_{Aeq,\ 1hr}$. It is anticipated that vehicle activity along site roads during night-time periods movements will decrease significantly. In summary, the likely noise impact of traffic noise from within the development on the local environment is not significant.

Predicted Outward Impact Of The Proposal

11.76 This section summarises the likely noise impact associated with the proposed development, taking into account the mitigation measures.

Construction Phase

11.77 During the construction phase of the project there will be some impact on nearby residential properties beyond the site boundary due to noise emissions associated with construction activity. However, given that the construction phase of the development is temporary in nature, it is expected that the various noise sources will not be excessively intrusive. Furthermore, the application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum.

11.78 In order to sufficiently ameliorate the likely noise impacts, a schedule of noise control measures has been formulated for both construction and operational phases.

11.79 We would recommend that vibration from construction activities be limited to the values set out in Table 11.13. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Allowable vibration (in terms of peak particle velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
3 mm/s	3 to 8 mm/s	8 to 10 mm/s

Table 11.13 Allowable Vibration During Construction Phase

Operational Phase

Building services noise

Proprietary noise and vibration control measures will be employed in order to ensure that noise emissions from building services plant do not exceed the criteria of 45dB $L_{Aeq,1hr}$ daytime and 35dB $L_{Aeq,5min}$ night-time at 1 metre from the façade of the nearest neighbouring residential dwelling. The resultant noise impact is not significant.

Car parking on site

The predicted noise level associated with car parking activity is within the daytime and night-time criteria of 50dB $L_{Aeq,1hr}$ and 40dB $L_{Aeq,5min}$ respectively. The resultant noise impact is not significant.

Deliveries

The predicted noise level associated with deliveries is within the day and night-time criteria of 50dB $L_{Aeq,1hr}$ and 40dB $L_{Aeq,5min}$ respectively. The resultant noise impact is not significant.

Additional Vehicular Traffic on Public Roads

The increase in the level of road traffic noise on the majority of existing roads will be less than 3dB. The resultant noise impact is not significant.

An increase of 3.4dB along River View will have a slight impact.

Traffic within the development

The predicted noise level associated with the peak hour vehicle movement along the site road is within the daytime criterion of 50dB $L_{Aeq,1hr}$. The resultant noise impact is not significant.

Mitigation Measures

11.80 In order to sufficiently ameliorate the likely noise impacts, a schedule of noise control measures has been formulated for both construction and operational phases.

Construction Mitigation Measures

11.81 The scheme contractor will be obliged to give due regard to BS5228, which offers detailed guidance on the control of noise from construction activities. In particular, it is proposed that various practices be adopted during construction, including:

- limiting the hours during which site activities likely to create high levels of noise are permitted;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise;
- monitoring typical levels of noise during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed, including:

- erection of a 2.4m high solid site hoarding along the boundary of the site;
- selection of plant with low inherent potential for generation of noise;
- erection of localized barriers as necessary around items such as generators or high duty compressors;
- locating of noisy plant as far away from sensitive properties as permitted by site constraints.

Operational Phase Mitigation Measures

Building services noise

The noise impact assessment outlined above has demonstrated that mitigation measures are not required.

Car parking on site

The noise impact assessment outlined above has demonstrated that mitigation measures are not required.

Deliveries

The noise impact assessment outlined above has demonstrated that mitigation measures are not required.

Additional Vehicular Traffic on Public Roads

The noise impact assessment outlined above has demonstrated that mitigation measures are not required.

Traffic within the development

The noise impact assessment outlined above has demonstrated that mitigation measures are not required.

12.0 Landscape And Visual Impact

12.1 The Landscape and Visual Impact Assessment was carried out in accordance with the EPA's *Guidelines on the Information to be contained in Environmental Impact Statements 2002,* as well as the (British) Landscape Institutes *Guidelines for Visual Impact Assessment, 2002.*

12.2 These documents prescribe that landscape and visual impact assessment address two discrete topics. Landscape impact assessment is concerned with alteration to the physical landscape, which may give rise to changes in its character, how it is experienced and hence, the ascribed value of the landscape. Visual impact assessment is concerned with changes that arise in the composition of available views, the response of people to these changes and the overall effects on the area's visual amenity. Landscape and visual impacts do not necessarily coincide and more importantly, their significance may not be related.

12.3 Also consulted in the undertaking of the study were:

- Landscape and Landscape Assessment Consultation Draft Guidelines for Planning Authorities, 2000 – Department of the Environment and Local Government.
- Ballinasloe Development Plan 2003 – 2009

12.4 In order to meet the requirements of the relevant guidelines, the landscape and visual impact assessment takes the following form

- Description of the proposed development. The components of the proposed development are discussed with reference to landscape and visual issues.
- Description of the receiving environment. This explains the urban landscape (townscape) and associated policy context in which the development would take place. It establishes a basis for, (a) the assessment of impact on the landscape (character, quality), and (b) the assessment of visual impact through the selection and survey of representative viewpoints within the proposed development's visual envelope.
- Landscape impact assessment. Based on the above, the appropriateness of the proposed development in terms of potential landscape impacts is discussed.
- Visual impact assessment. The assessment of the selected viewpoints, representative of the proposed development's zone of visual influence, is discussed and illustrated by means of photomontages.
- Conclusion. Finally, a conclusion is drawn as to the appropriateness of the proposed development in terms of landscape and visual impact and,
- Mitigation measures to address specific impacts are set out, to be incorporated into the design programme for the proposed development.

Form, Scale and Massing

12.5 The proposed development is approximately two storeys in height and comprises what may be described as a low monolithic form on the generally open landscape of the riverside promontory. The perimeter of the development is defined by gabion retaining structures that define the necessary levels above the adjacent river flood plain.

Design and Materials

12.6 A variety of good quality materials and detailing are to be used throughout the development. Elevations include substantial areas of powder coated metal cladding as well as glazing along the front elevation facing the town and at a section of the southern elevation that accommodates a café and terrace that overlooks the adjacent river. There is also a substantial element of coloured render along the southern and eastern elevations. The retaining structures along the perimeter are stone filled gabion baskets.

Potential Impact Of The Proposed Development

12.7 The above description identifies a number of aspects of the proposed development that would impact on landscape character and contribute to its visual impact:

- The design language of the proposed development
- The scale and form of the development
- The contrast with adjacent developments
- The materials and colours used in building facades and roof structures
- The proposed mix of uses
- The height of the proposed development.
- The presence of listed buildings and recorded monuments.

Receiving Environment

12.8 Ballinasloe Development Plan 2003 – 2009

The development Plan sets out a development framework and strategy for the future growth and development of Ballinasloe Town and Environs. The strategy is set out in broad and general terms and supplemented by a series of policy statements. Policies are re-inforced where possible by specific development objectives.

- 1.4.5 Landscape Consideration in relation to Strategy Options

Landscape considerations are considered in the regional context and in the more immediate environs of the town. The Plan states that the pursuance of the various strategies should have regard for landscape character and landscape structure. The River Suck and associated floodplain is listed as one of the elements that requires careful consideration. Given the extensive floodplain and the associated history of flooding, it is important that the most significant parts of the floodplain of the River Suck and its associated tributaries are reserved free from development.

- 2.1.4 Cycling and walking

There are opportunities to provide direct and safe pedestrian and cycle routes, for example in conjunction with linear parks or other areas of open space. An alternative crossing point for pedestrians is needed over the River Suck. The current bridge only provides one narrow footpath and the associated noise and danger from the large amount of traffic crossing the bridge discourages pedestrian travel.

- 2.7.1 Natural Environment Analysis

Ballinasloe is situated adjacent to the River Suck within an attractive undulating landscape created by glacial deposits namely the eskers. These create several attractive views and vistas from various locations within the town Council boundary. Even though Ballinasloe has no national statutory landscape designations it contains a rich diversity of habitats, most notably the river and its floodplain, and associated callows and wetlands, in addition to bogs and wooded areas.

Rivers such as the Suck form an attractive part of the Irish Landscape and its preservation and promotion can help promote tourism and recreation as well a safeguard the habitats and species found within it. It is therefore an objective to protect the natural course of the river and generally restrict development within the floodplain and the callows.

- 2.8 The Urban Edge

To the north of the town, the urban edge is well defined as a result of the River Suck and its associated floodplain which has formed a natural boundary to development. The views from the backlands of the town extend into unspoilt countryside creating an attractive interface between town and country.

12.9 It is the policy of Ballinasloe Town Council to;

- Adopt a clear boundary to development so as to ensure that both a controlled and planned growth is achieved

- To encourage the creation of significant landscaped areas or "soft edges" to development boundaries that comprise the urban edge, so as to maintain an attractive visual appearance of the town when viewed from approach roads.

12.10 Ballinasloe Town Development Plan 2003 – 2009 objectives include:

- A20 Have regard to the Protection of Proposed 'National Heritage Area' and Proposed 'Special Protection Area' that include the River Suck and substantial parts of the land on the opposite side of the river from the development site.
- A1 Provision of linear park
- A2 Provision of public walkway including cycle path
- A7 Reserve linear parks

12.11 The policies outlined in the Ballinasloe Development Plan place emphasis on the natural landscape assets in the environs of the town and the need to take due account of them in development proposals for Ballinasloe. The following landscape items are highlighted

- Preservation of the floodplain of the River Suck
- Promotion of 'soft edges' to development boundaries that comprise the "urban edge"
- Avail of opportunities to provide direct and safe pedestrian and cycle routes in conjunction with linear parks or other open spaces.

12.12 The development proposals for Ballinasloe Mixed Use Development embraces these various policies of the city development plan and proposes design solutions that respond to the existing urban grain of the town centre while also delivering a new centre which addresses the Development Plan aspirations for Ballinasloe in line with the zoning of the site for town centre uses.

12.13 This assessment should inform decision makers who aim to balance conservation and development in the city centre. It is incumbent upon decision makers to manage development pressure in a positive way by identifying and protecting vulnerable or sensitive sites of strong and distinctive character which have limited capacity to absorb development without fundamentally altering their inherent character, whilst also identifying areas which have the capacity to absorb development subject to adhering to high standards of design and siting.

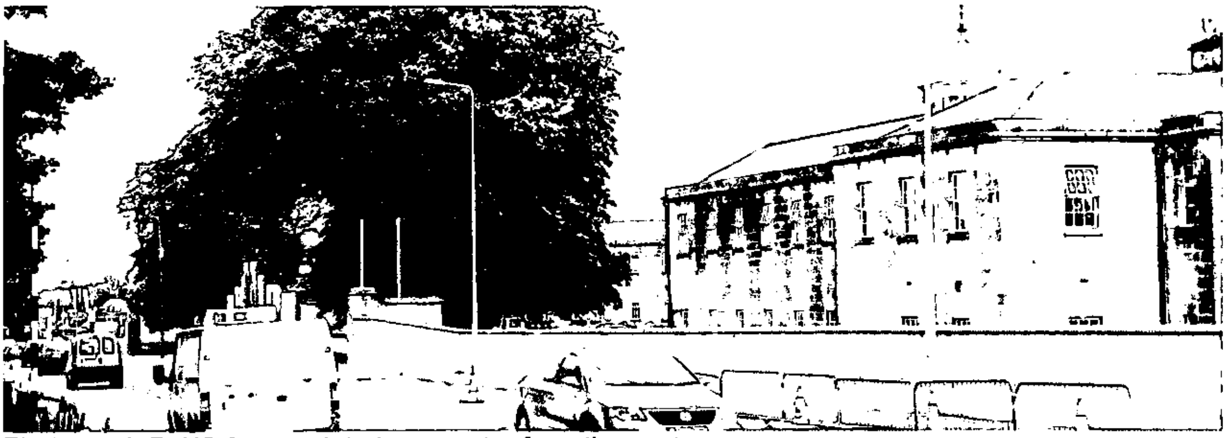
Description Of Receiving Environment

Macro Landscape

12.14 The site is situated to the north east of Ballinasloe between the River Suck and the town centre. The area is generally characterised by the urban fringe location where the edge of the town meets the wider countryside at a bend in the River Suck which defines a promontory of land by virtue of a wide bend in the course of the river.

12.15 The land to the north and east of the is relatively flat in nature and comprises a network of native hedge-bound fields and tree cover. The town is situated on higher ground to the south west and is defined by a typical combination of two and three storey buildings with intermittent church spires and public buildings in distant views. The considerable vegetation cover across the wider landscape generally restricts long distant views where the terrain is flat.

Photograph A View towards site from town centre street



Photograph B N6 Approach to town centre from the east

Photograph C N6 Approach to town centre from the west

Micro Landscape

12.16 The proposed development site itself is located between the town centre and the River suck and is influenced accordingly by both in terms of image and access. The site currently represents a rather untidy urban fringe scene along the town boundary where derelict buildings and fencelines combine with informal carparking and ill-defined pedestrian routeways. The land is currently devoted to grazing to the waters edge and this has resulted in a site that is heavily grazed leaving some existing hedges trees and grass sward only. The site comprises a central raised area that falls away to the waters edge on all sides. The central portion affords some views over the wider landscape particularly to the north where there are breaks in vegetation cover. Views towards the town reveal the backs of town centre properties which present a rather untidy appearance. There is limited vegetation cover on the

site which comprises lengths of hedgerows made up of native species including ash and hawthorn.

12.17 The River Suck and substantial parts of the adjoining lands are designated as Proposed 'National Heritage Areas' and Proposed 'Special Protection Areas' but the proposed development site is excluded from this designation. There is a Development Plan objective for the provision of a Linear Park and the provision of a Public Walkway and Cycle Path across the promontory which the development site forms part of.

Photograph D View north-east from the site

Photograph E View towards town centre from the site

12.18 The description of the receiving environment is divided into three main categories of landscape characteristics, namely, physical, cultural and visual/sensory, which in combination generate the landscape character of an area.

12.19 The above descriptions (and the previous sections) identify a number of characteristics and values of the receiving environment that have the potential to contribute significantly to the enhancement of Ballinasloe town centre.

12.20 These are summarised and categorised according to their socio-cultural or conservation value and their enhancement value. The conservation values indicate those aspects of the receiving environment which are sensitive and should be complemented and preserved by the proposed new development. Enhancement values are those where inevitable change or degraded features provide the scope to restore or the opportunity to alter or create a new characteristic.

Conservation

12.21 The historical built character of Ballinasloe, its urban grain, patterns and layers of architecture (cultural).

- The adjacent River Suck and its riparian flood zone and associated habitats and designations (cultural).
- The existence of listed structures adjacent to the site.

Enhancement

- The recognition of the balance required between conservation and development
- objectives (cultural, visual).
- The encouragement of innovative design and the potential urban tensions which
- may arise (cultural, visual).
- The recognised potential of the site to function for town centre uses (cultural).
- The potential for the development to define the interface between the town and countryside in a positive manner (cultural, visual).
- First impressions of Ballinasloe for visitors (cultural, visual).
- Potential enhancement of the town centre and associated public realm areas (cultural, visual).
- Potential to influence and define the on-going development of the town (cultural, visual).

Impact

12.22 The conservation and enhancement values of the receiving environment character are described in the previous section. The impact of the development proposal on these is as follows:

Conservation Values

12.23 The historical built character of Ballinasloe, its urban grain, patterns and layers of architecture. The proposed development includes a mixture of elements that relate to the traditional development of the town such as the residential and streetscape features and the larger scale elements such as the anchor unit and carpark which reflect the modern demands of developing town. The proposed development, therefore, proposes a balanced approach to the development potential of the site which reflects the existing urban grain of the town while embracing new demands.

- *The adjacent River Suck and its riparian flood zone and associated habitats (cultural)*

  The proposed development will not affect the flood plain of the river. The change of use on the site from intensive grazing will also assist the development of a more bio-diverse habitat along the water's edge.

- *The existence of an architectural conservation area in close proximity to the proposed development site.*

  The conservation area encompasses a significant portion of the town centre but not the existing buildings immediately adjacent to the site some of which are in a derelict condition. The site is, therefore, somewhat removed from the conservation area and the nature of the current development proposals will not significantly impact on it.

Enhancement Values

- The recognition of the balance required between conservation and development objectives.

  The proposed development represents a balanced approached to the development of this high profile site. It respects the historical context and grain of the setting and embraces the principle of conservation.

- *The encouragement of innovative design and the potential to positively influence the urban fringe setting.*

  The proposed development will deliver a development which responds to the proximity of the town centre setting in a manner that will compliment the setting while also bringing its own distinct character and image. Residential elements avail of the southerly aspect and the

development facilitates pedestrian movement around the perimeter of the development with views over the wider landscape and river environment

- Potential enhancement of the town centre and associated public realm areas
- Potential to influence and define the on-going development of the town.

The proposed development will provide a new shopping destination and residential environment within the town that will dovetail with the existing grain of the town while also providing a new and interesting development typology that will assist in raising the profile of the town. The development will allow access to an area of the town where access to the River Suck will be an option for site users. The café has been carefully positioned within the development to avail of the southerly aspect and as a focal point of interface with the riverside landscape. This has longer term potential to act as a gateway to any circular riverside walks that may be developed in the future in keeping with the aspirations of the development plan.

- The recognised potential of the site to function for town centre uses (cultural).

Consideration of the proposed development must bear in mind that the site is designated as suitable for town centre uses. The proposals therefore reflect the demands of a developing town in its scale and massing and mix of proposed uses. However, the proposals have been developed in a balanced manner that respects the character of the town while providing a contemporary design solution that has its own character.

Visual Impact Assessment

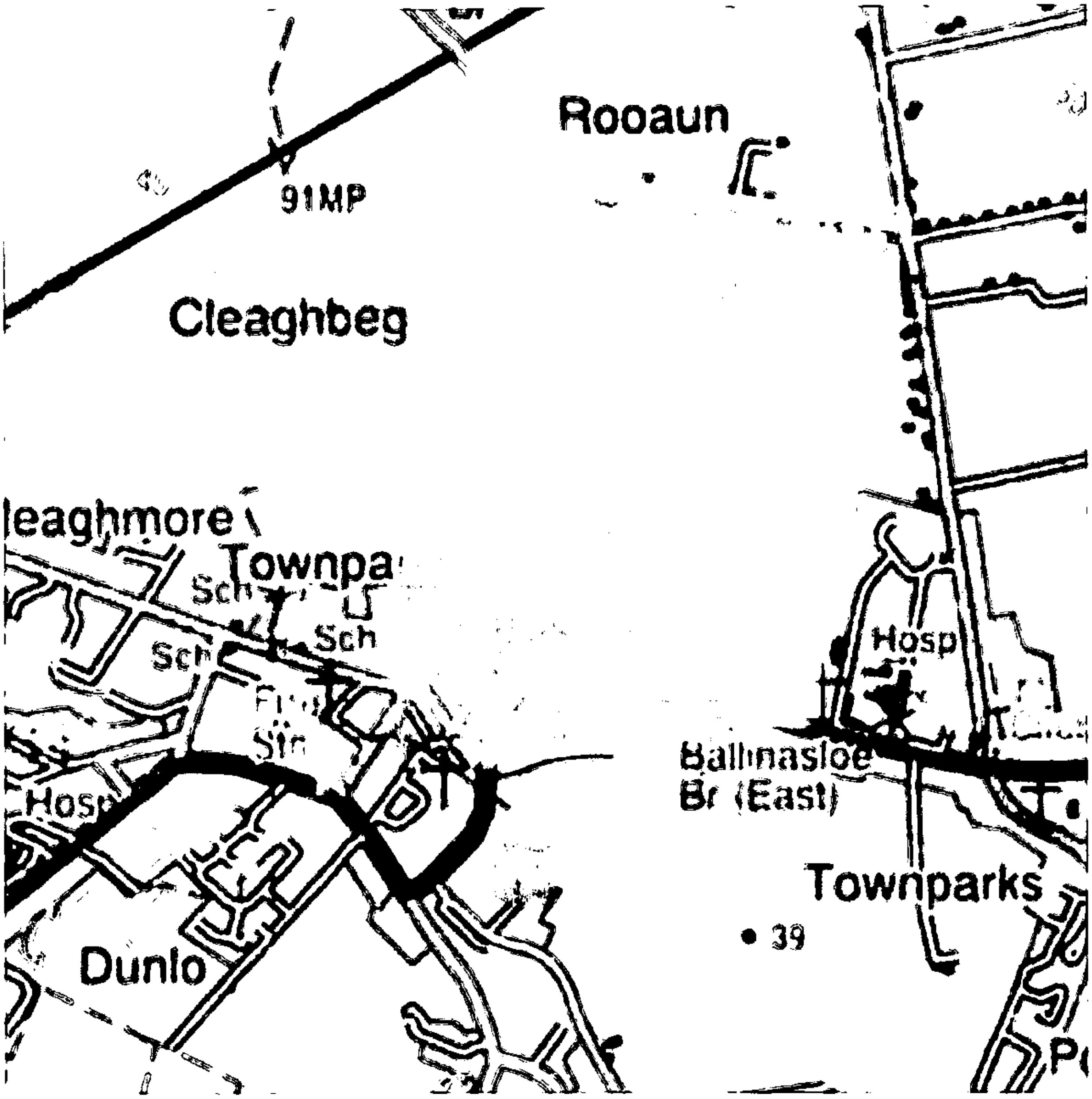


Fig 12.1. ZVI Map

12.24 The above map attempts to approximately represent the area of the anticipated visual envelope. It represents the locality from where the development will have a significant visual impact. It is impossible however to define this area with complete accuracy, due to the complexities of the surrounding built environment and access issues encountered during the survey. Some glimpses, (particularly of the upper levels of the development), may occasionally be experienced beyond this envelope - from upper storey windows of private residences and business premises for example. Any such views will more than likely be of small sections of the development only and tempered by the surrounding built environment.

12.25 Due to the highly urbanised nature of the site location existing buildings running adjacent to the boundaries of the proposed development effectively screen all but occasional glimpses of the proposed development from almost all directions excluding those viewpoint locations directly adjacent to the development.

12.26 The following constitute the main visual receptors in the receiving environment:

Transport routes.

- Road:

  The streets directly adjacent to the development boundary, including Alexander Street, Stephen's Street/Brown's Lane, Michael Street and Castle Street will experience the greatest level of visual impact.

  Manor Street and Parnell Street run in a north south direction adjacent to the site. This street acts as a primary route for traffic in and out of the south of the city, and as such the site is in a prominent location. However the existing urban fabric prevents any long range views of the site occurring.

  Several other roads, particularly in residential areas, will also be impacted upon in varying degrees though the majority of these views are likely to be heavily filtered by existing built form and or vegetation.

- River:

  The proposed development will have very little to no visual impact on The River Suir corridor as existing urban development screens views of the proposed development entirely.

- Commercial/ retail properties.

  The various business properties that are adjacent the site will experience a moderate to high level of visual impact, however it is also these receptors that tend to have the lowest levels of sensitivity.

  Numerous commercial and retail premises including offices, furniture stores, public houses, coffee shops, gift stores, jewellery stores, pharmacies and clothes stores are located on Michael Street. All of the above will be impacted upon to a greater or lesser extent.

- Institutional properties

  A school is located directly opposite the site to the west and will be experiencing a high level of visual impact next to the residential properties; however such receptors tend to have lower sensitivity levels to visual impact.

Residential properties.

The most immediate residential receptors are located on the boundary of the site in almost all directions and will experience the greatest level of visual impact.

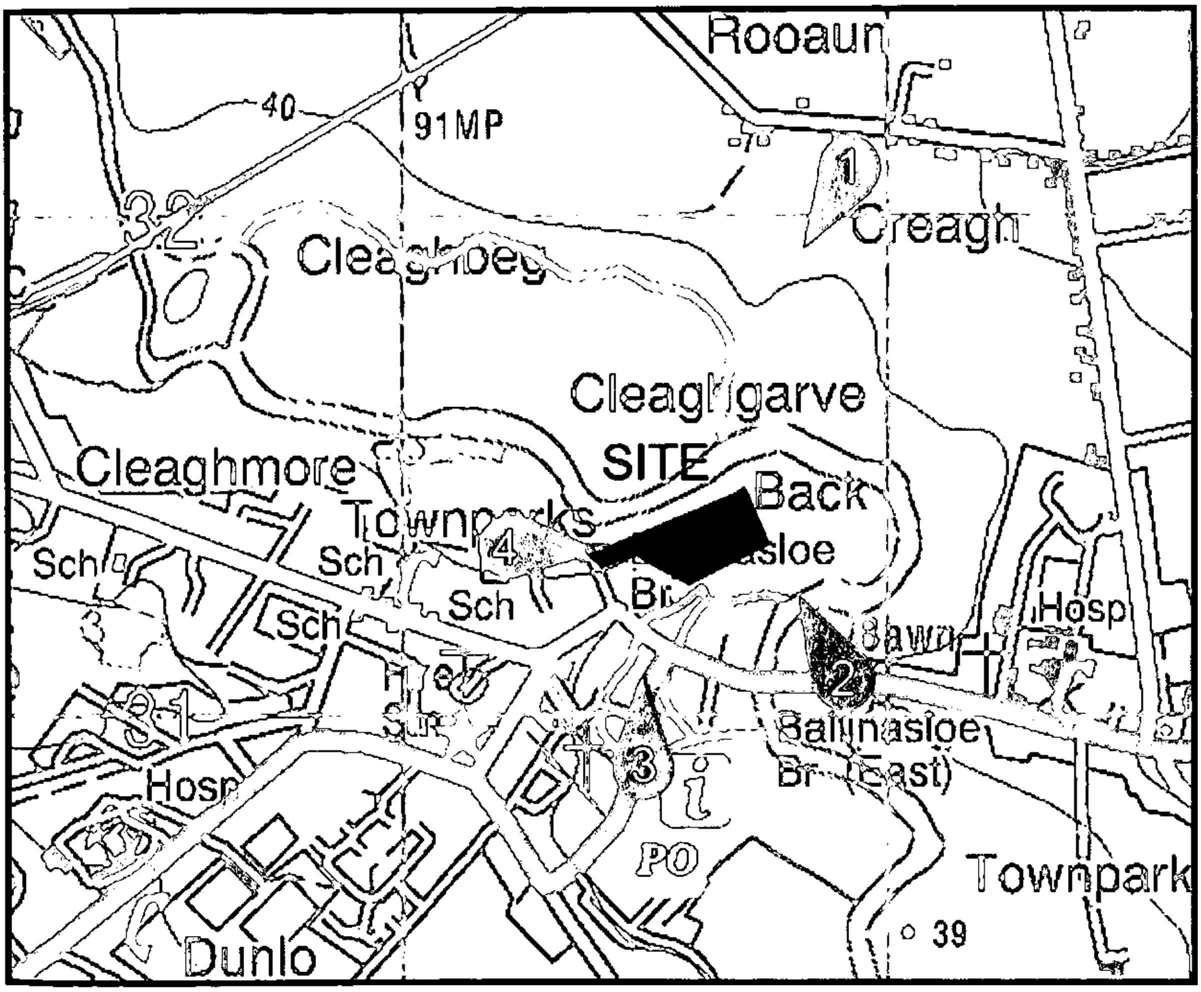
West of the proposed development located higher on the hillside is a mature residential area that will experience close to medium range views of the development however it is likely that these will be filtered by existing development and vegetation.

A number of private residential properties located further a field to the south east will also be affected, but these will be long range views and normally heavily filtered by existing development and vegetation.

The selected viewpoints are as follows: (see Appendix 3)

No	Location	Mapping Coordinates	Direction Of View	Viewpoint Type	Distance to site
1	Rooaun	N 857 322	South	Residential (rural)	1.0 km
2	N6 Galway Dublin Road at Ballinasloe Bridge East	N 858 311	NorthWest	Roadside	0.30 km
3	N6 Galway Dublin Road at Marina	N 854 310	North	Recreational	0.25 km
4	Townparks	N 853 314	East	Business	0.20 km

Fig 12.2. Viewpoint location plan 1



Viewpoint 1 Rooaun

For photomontage view of proposed development refer to Appendix 3.

Description of View

The selected viewpoint is located approximately 1.0km to the north of the proposed development site adjacent to a residence.

Existing View

This view reflects the rural nature of the land to the north of the proposed development site and the gently variation in the local topography. Existing hedgerow vegetation in the middle distance screens views of the town and the proposed development site with the exception of the church spire.

Proposed View and Mitigation

The extent of existing screen vegetation in the middle distance will fully screen views of the proposed development from this location.

VIA Result

The viewpoint sensitivity is considered high, given the residential nature of the location.

The degree of change from this viewpoint would be negligible in the short to medium term and negligible in the long term as the development will not alter the view due to the extent of existing screening.

The significance of the visual impact will be low neutral in the short to medium term and low neutral in the long term as the proposed development will not feature in the view.

During the construction phase the degree of change would be negligible, the significance of this would be neutral.

Viewpoint 2 N6 Galway Dublin Road at Ballinasloe Bridge East

For photomontage view of proposed development refer to Appendix 3.

Description of View

The selected viewpoint is located approximately 0.3km to the south-east of the proposed development site on the main Galway to Dublin Road (N6) near Ballinasloe Bridge East.

Existing View

The view shows existing development at the edge of the town and the extent of existing vegetation cover reflects the transition to the wider countryside. The scene belies the proximity of the town although the scale and nature of the building lend a light industrial character to the setting. The presence of the River Suck is screened by the wall in the foreground.

Proposed View and Mitigation

The proposed development will be screened in the view by the existing building and vegetation cover.

VIA Result

The viewpoint sensitivity is considered medium, given the transient nature of views as people pass along the route in cars or on foot.

The degree of change from this viewpoint would be negligible in the short to medium term and negligible in the long term as the development will not alter the view due to the extent of existing screening.

The significance of the visual impact will be low neutral in the short to medium term and low neutral in the long term as the proposed development will not feature in the view.

During the construction phase the degree of change would be negligible, the significance of this would be neutral.

Viewpoint 3 N6 Galway Dublin Road at Marina

For photomontage view of proposed development refer to Appendix 3.

Description of View

The selected viewpoint is located approximately 0.25km to the south of the proposed development site at a riverside amenity area including car park and marina on the banks of the River Suck.

Existing View

The view shows part of the main N6 through the town which is tree lined and presents a generally pleasant picture. The site is screened in this view by the existing trees and a development currently under construction at the far end of the road.

Proposed View and Mitigation

The proposed development will be screened in the view by the existing building and vegetation cover.

VIA Result

The viewpoint sensitivity is considered medium, given the transient nature of views as people pass along the route or in and out of the riverside amenity area and car park.

The degree of change from this viewpoint would be negligible in the short to medium term and negligible in the long term as the development will not alter the view due to the extent of existing screening.

The significance of the visual impact will be low neutral in the short to medium term and low neutral in the long term as the proposed development will not feature in the view.

During the construction phase the degree of change would be negligible, the significance of this would be neutral.

Viewpoint 4 Townparks

For photomontage view of proposed development refer to Appendix 3.

Description of View

The selected viewpoint is located approximately 0.2 km to the west of the proposed development site at the car park of a builders providers outlet.

Existing View

This view reflects the urban fringe nature of the location where the street network of the town meets the wider countryside close to the River Suck and where the built environment is low key. The view is generally pleasant given the extent of vegetation cover in the view. There are no landscape features that are particularly noteworthy.

Proposed View and Mitigation

The proposed development will have the effect of removing some of the vegetation in the middle distance to accommodate the new access road and carpark and this in turn will open up views of the development itself in the middle distance which will incur a significant degree of impact in the view. However, visual impact will remain relatively low key given the low form of the proposed building and the screening impact of vegetation in the view that will remain unaffected by the proposals. This screening effect will be augmented in the medium to long term as tree planting in the proposed car impact will be partially mitigated by the proposed tree planting in the car park as it matures.

The viewpoint sensitivity is considered low, given the business nature of the viewpoint where people are engaged in work or moving in and out of the car park area.

The degree of change at this viewpoint will be high in the short to medium term given the introduction of a large development in the view and medium in the long term as tree planting in the carpark areas matures and assists in screening the development in the view.

The significance of the visual impact will be low adverse in the short to medium term and low adverse in the long term as while the proposed development will incur considerable visual impact in the view, visual receptors in the town are not deemed to be of high sensitivity.

During the construction phase the degree of change would be low, the significance of this would be low adverse.

Visual Impact Conclusion

View No.	Location	Distance from Site	Degree of Change	Viewpoint Sensitivity	Classification of Impact	Predicted Short/Med term Impact	Predicted Long term Impact
1	Rooaun	0.25km	Low	Low	Low Neutral	Low Neutral	Low Neutral
2	N6 Galway Dublin Road at Ballinasloe Bridge East	0.15km	Low	Low	Low Neutral	Low Neutral	Low Neutral
3	N6 Galway Dublin Road at Marina	0.10km	Low	Medium	Low Neutral	Low Neutral	Low Neutral
4	Townparks	0.15km	Medium	Low	Low Adverse	Low Adverse	Low Adverse

Landscape And Visual Impact Assessment – Conclusions

Landscape Character

12.27 The sensitivity of the local urban landscape is considered to be medium given the urban fringe location which presents a rather untidy interface between town and countryside, the level of grazing that has occurred across the site and the Development Plan designation for 'town centre uses'.

12.28 The degree of change on the site is considered to be medium given the designation for town centre uses. A development of the proposed scale is, therefore, not unusual under these circumstances. The proposed development responds to Development Plan zoning objectives for the area and provides design solutions that respond positively to the urban fringe location. The development remains low rise and includes measures to reduce its visual impact including careful selection of materials and use of existing topography to assist integration into the local landscape. The development will, therefore, assist in defining the urban edge in a positive manner and will contribute towards the development plan aspirations for public access along the river.

12.29 The proposed development will not affect any of the environmental designations associated with adjacent riparian sites nor will it impact on the floodplain of the River Suck. The scale and massing of the proposed development means that it will not compete with the architectural conservation area of the town centre.

12.30 Overall, therefore, it is felt that the proposed development will have a medium and beneficial impact on the receiving urban landscape as while it will constitute a significant intervention in the setting this has been done in a balanced manner that considers existing development in the town while providing a contemporary design solution with its own distinct character and image. The proposed development will therefore provide an attractive destination within the town where visitors, shoppers and residents will have new opportunities to interact with the riparian environment of the River Suck.

Visual Impact

12.31 The visual impact of the proposed development has been closely examined and we have seen that of the four viewpoints assessed it is anticipated that:

- The short to medium term impact will be:

Low Neutral for three viewpoints and low adverse for the remaining viewpoint

- The long term impact will be (i.e. after completion and development of any mitigating landscape treatment that may be required):

Low Neutral for the four viewpoints.

12.32 At the macro level, views of the proposed development are limited through a combination of distance, topography, existing built fabric of the town and existing vegetation cover. The result is that the proposed development remains screened from all the main approaches to the town, from the main streets of the town centre and from residential properties in outlying areas of the town.

12.33 At the micro level, the proposed development inevitably impacts on the local setting given the relatively open nature of the site. However, efforts have been made to reduce these impacts through careful selection of materials and detailing of elevations, the provision of a green 'skin' on some elevations and manipulation of the local topography. The development will, therefore, only be visible from a limited number of properties along the eastern edge of the town.

Mitigation Measures

Avoidance, reductive and remedial measures

12.34 The development proposals include tree planting measures throughout the car parking areas and on the public square at the western side of the development which will help break up the car parking areas themselves and provide a sense of contrast with the built environment particularly along the substantial elevations that make up the retail destination. These trees should be of sufficient size that will ensure impact at an early stage and offer some resistance to possible damage or vandalism. Detailed design should ensure that the trees are sufficiently accommodated in terms of soil provision and maintenance requirements including watering.

13.0 Flora and Fauna

13.1 This flora and fauna impact assessment has been prepared by Scott Cawley. It qualitatively assesses the development of lands in Ballinasloe, Co. Galway within the context of the potential direct, indirect and cumulative impacts upon the flora and fauna presently existing on-site, and in the immediate environs.

13.2 The proposed development site is bounded by the River Suck to the north, east and south and to the southwest by road. Habitats present include wet grassland, hedgerows, drainage ditches, buildings and agricultural grassland. Detailed habitat descriptions are provided later under section 1.4, Receiving Environment.

Methodology

13.3 The assessment comprised a site walkover on the 5th of February 2007. The proposed development site was surveyed using methodology outlined in the Heritage Council Habitat Survey Guidelines (Draft April 2005). The principal habitats present within the site were identified and classified using the Heritage Council's A Guide to Habitats in Ireland (Fossitt, 2000).

13.4 Brief descriptions of the habitats that exist within the proposed development area have been provided in this report. The dominant species were noted and a species list compiled for each habitat represented. Figure 1 illustrates the locations and extent of all habitat types as well as any other noteworthy ecological features.

13.5 Floral nomenclature follows An Irish Flora (Webb, Parnell & Doogue, 1996) for Latin names and the Census Catalogue of the Flora of Ireland (Scannell & Synnott, 1987) for common names. Nomenclature for horticultural species follows the Royal Horticultural Society's Encyclopaedia of Garden Plants (Brickell, 1998).

13.6 Hedgerows have been evaluated according to the Networks for Nature National Hedgerow Survey Guidelines (Draft April 2003).

13.7 Faunal identifications were confirmed using the following sources:

- The Macmillan Guide to Birds of Britain & Europe, Macmillan 1998,
- The Complete Guide to Ireland's Birds (2002), Dempsey E. & O'Cleary. M. Gill & Macmillan.
- Exploring Irish Mammals, Dúchas The Heritage Service 2001.

13.8 Desktop consultations of the following resources were also made:

- O.S. mapping;
- Aerial photography;
- National Parks and Wildlife Service (NPWS) Database, the Department of the Environment, Heritage and Local Government.

13.9 The NPWS records of rare and threatened flora species were reviewed and the NPWS Local Ranger for the area was consulted. Responses and information received have been incorporated into this report.

Environmental Designation

13.10 The proposed development area itself does not fall within any areas designated for environmental protection. The NPWS records of rare and protected flora throughout Ireland showed that there were no species of concern within or near the site. However, it is on the banks of the River Suck which is a Special Protected Area (SPA site code 004097) and a Natural Heritage Area (NHA site code 000222)

The River Suck SPA/ NHA (NPWS SPA site synopsis 2005)

13.11 The River Suck Callows form by far the largest area of lowland wet grassland in Ireland and Britain. The River Suck Callows is bordered by tracts of semi-natural lowland wet grassland, which floods extensively each winter along the River Suck between Castlecoote in the north and Shannonbridge in the south, and passing through Ballinasloe. The River Suck is the largest tributary of the River Shannon. The site follows the river from Castlecoote, near Fuerty to its confluence with the River Shannon, a distance of approximately 70 km. The main habitat is grassland, improved to varying extents, that is seasonally-flooded. The less-improved areas are species-rich. Many of the species present are important food plants for the wintering wildfowl which also forage on the improved grasslands within the designated site. The grassland is used mainly for pasture but some is also used for silage or occasionally hay-making. The designated site adjoins several raised bogs and cutover bogs, and there are turloughs in the vicinity.

13.12 The Suck River Callows is an important site for wintering waterfowl. Of particular interest is the internationally important Greenland White-fronted Goose flock that is based along the Suck. The birds congregate mainly in the middle reaches of the river. A separate sub-flock is centred at Glenamaddy turlough. The populations of Whooper Swan (124), Wigeon (1,203) and Lapwing (3,640) are of national importance. Other species present include Mute Swan, Teal, Pintail, Curlew and Black-headed Gull. Golden Plover, a species that is listed on Annex I of the E.U. Birds Directive, occurs at times. The good quality riverine and grassland habitats are also home to populations of Otter and Irish Hare, and Brown Trout occur in the river.

13.13 Arterial drainage in the past has already reduced the area of naturally flooded grasslands, and drainage and land improvement remain the principal threat to this site. The intensification of agriculture in recent years, with earlier mowing and the replacement of hay with silage, is likely to have caused the decline and eventual absence of breeding Corncrake. Wildfowling causes some disturbance, though there is a Wildfowl Sanctuary at Muckanagh, north of Ballyforan.

13.14 This SPA is of considerable ornithological importance. Of note is that two of the species which occur regularly, Greenland White-fronted Goose and Whooper Swan, are listed on Annex I of the E.U. Birds Directive.

The above information is taken from the NPWS Site synopsis for the SPA/NHA.

RECEIVING ENVIRONMENT

13.15 The study area is bounded by the River Suck to the north, east and south. The area largely made up of wet grassland with a smaller area of slightly elevated land near the western end of the site which is agricultural grassland. The entire study area is under pressure from grazing livestock. The rest of the study area is composed of built land, and hedgerows. There are some field boundaries within the site which comprise of defunct hedgerows and stonewalls.

Habitats and Flora

13.16 This section describes the habitat types that have been identified during the survey. These include the following categories:

- Grassland;
- Woodland;
- Freshwater; and
- Built land.
- Disturbed ground

Grassland

- ***Wet Grassland (GS4)***

13.17 This is the dominant habitat covering approximately 65% of the proposed development site area. This habitat is regularly flooded by the River Suck and is characterised by wetland species such as yellow-flag iris (Iris pseudocorus) water forget-me-not (Myosotis scorpoides), and floating sweet-grass (Glyceria fluitans) and a high proportion of buttercups (Ranunculus repens and R. acris). The dominant grass species present is creeping bent (Agrostis stolonifera). Broadleaf dock (Rumex obtusifolius), meadowsweet (Filipendula ulmaria), lesser cellandine (Ranunculus ficaria), and sheep sorrel are some of the other abundant species present.

Photo 1. Wet Grassland Habitat

- ***Improved Agricultural grassland (GA1)***

13.18 This habitat type covers approximately 30% of the proposed development site area. The habitat was once improved, however it is in poor condition now and is heavily grazed and in some area heavily poached by horses. There are a number of Hawthorn (Crataegus monogyna) and Ash (Fraxinus excelsior) scattered through this habitat. The dominant grass species is creeping bent. Broad-leaved species such as dandelion (Taraxacum spp.), creeping thistle (Cirsium arvense), common nettle (Urtica dioica), major plantain (Plantago major), white clover (Trifolium repens), and wild carrot (Daucus carota) are abundant.

13.19 All of these species are typical of agricultural grassland which experiences human influence in the form of grazing and fertilisation. All flora species are commonly occurring throughout the country.

13.20 Overall, this habitat is of low ecological value and is well represented in the locality and throughout Ireland. Its potential loss due to development would, in isolation, not be regarded to be a significant impact.

Woodland

13.21 This habitat category groups together habitats whose vegetation is predominantly provided by trees, shrubs or brambles. It includes natural, semi-natural or planted and linear features such as hedgerows and treelines.

13.22 The study area is dissected by hedgerows which are classified according to their species composition and their average width at the ground as hedgerows of low ecological value. These hedgerows contain a low numbers of mature trees and they tend to be gappy and eroded at their base. They are dominated by Hawthorn with some larger ash and alder (Alnus glutinosa) trees also present. The ground flora is composed of ivy (Hedera helix), bramble (Rubus fruticosus agg.), nettle (Urtica dioica), and lesser celandine.

13.23 Loss of the hedgerows themselves is not regarded as an ecological constraint as they are of poor conservation value.

Built Land Habitat

- ***Buildings and Artificial Surfaces (BL3)***

13.24 This habitat is represented by an old boat house, located on the river bank to the northwest in the study area, and by an old derelict stone building, located to the southwest of the study area (outside of the site boundary). Neither of these structures support significant flora but may be of ecological significance for bats. The boathouse intact but appears to be unused. The roof of the stone building has fallen in but has stone walls which contain crevices and are covered in ivy and therefore potentially offers shelter to bats. The derelict stone property is immediately outside the site boundary.

- ***Stone Walls and other stonework (BL1)***

13.25 A field boundary to the west of the site is formed by a stone wall. There is a second collapsed stone wall running from the south west of the site north for c. 6 metres. These stone wall habitats have been colonised by ivy, mosses, cleavers (Galium aparine) and lichens. They are of minor ecological significance.

Disturbed Ground

- ***Spoil and bare ground (ED2)***

13.26 There is an area of bare ground to the west of the site. This area has been heavily poached by livestock and is minor ecological significance.

- ***Refuse and other waste (ED5)***

13.27 There is an area of refuse and dumped rock to the northwest of the site. This has been colonised by creeping bent and ruderal species such as plantain, broadleaf dock, ragwort (Senecio jacobaea), buttercups and petty spurge (Euphorbia peplus). This habitat is of little ecological value.

Photo 2: Refuse and other waste with hedgerows on the right of photo and River Suck in the background.

Freshwater

- ***Depositing / Lowland river (FW2)***

13.28 Although the River Suck is not within the proposed site boundary, it is immediately adjacent to it and therefore it is of interest. The River Suck is designated as both a pNHA and an SPA for its nature conservation interests. Sections of the river bank on the north side have been colonised by stands of reed (Phragmites australis) and offer refuge for wildlife that is not available on the south bank. Whilst the river habitat itself did not appear to host any protected flora, its sensitivity to pollution and role in transporting impacts downstream to other sensitive areas makes this habitat of high ecological significance.

Fauna

13.29 Detailed faunal assessments were not carried out as part of this strategic assessment; however it would be expected to find a number of species making use of the study area and the habitats recorded therein.

Mammals

- ***Bats***

13.30 The derelict stone building at the southwest corner of the site and the boat house at the northwest corner of the site are potential (but unconfirmed) bat roosts; this building is not in the planning application area and does not form part of the client's landholding The boat house, which has brick and corrugated sheeting walls and a corrugated metal roof, is a potential bat roost but is currently suitable as a night roost only for species such as Daubenton's bat that frequent wetland habitats. The derelict stone building is also a potential bat roost that could be used by a range of crevice-loving bat species. The roof of the building has fallen in, but has stone walls which contain crevices and are covered in ivy and therefore potentially offers shelter to bats. The extent of this usage of these structures can only be confirmed by

undertaking further surveys in the optimum survey months of May-September. However both structures are immediately outside of the footprint of any proposed works and any interaction with the development is expected to be minimal.

13.31 Currently there are ten species of bat known to breed in Ireland. All ten species and their roost sites are strictly protected under both European and national legislation, which makes it illegal to kill or injure bats in the wild and makes it an offence to wilfully interfere with or to destroy their breeding and resting places.

Photo 3: Showing inside of boat house

Photo 3: Showing derelict building in south west corner.

13.32 In addition to possible roost sites, the hedgerows, wetland and grassland areas on the site are also considered as possible foraging areas and commuting corridors that bats may follow to other foraging areas. Loss of these vegetative corridors can prevent bats reaching feeding grounds and can affect the viability of roosts in some cases. Therefore in the context of bats, the removal of hedgerows that lead from the buildings (include off-site structures) to the river may cause a significant adverse impact and represents a significant constraint.

13.33 Hedgerows are also often important habitats for birds and other mammals, which use these habitats for nesting, food, cover and shelter.

- ***Badgers and Otters***

13.34 There is evidence of badger (Meles meles) activity within the study area. Badger droppings were found at two locations along the bank of the river. No setts were confirmed to be present in the study area.

13.35 A large mammal burrow was found on the higher ground on the centre of the site. This burrow was of a size that could belong to a badger, otter, or fox. However there was no clear evidence of any of these species having frequented the burrow as all signs had been obscured by human interference. Several hairs that appeared to be of fox origin were found nearby. Foxes are not protected in Ireland. Further monitoring is required to determine activity at this location.

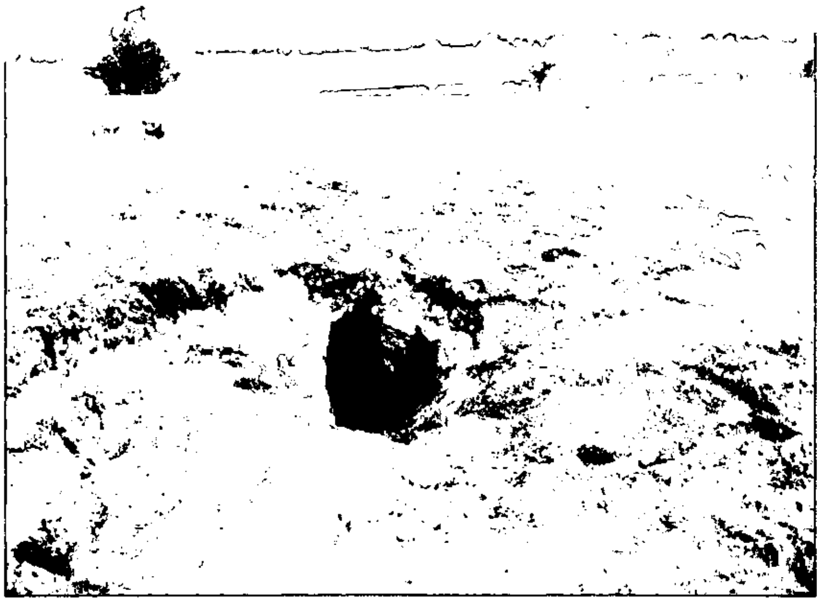


Photo 4: Burrow found on site.

13.36 Should badgers be present then this would represent a moderate ecological constraint. Badgers are protected under national legislation by the Wildlife Acts (1976 and 2000) but only usually represent a significant concern if there is a main breeding sett in a proposed development area. Should otters be using the burrow (which may be possible given the proximity to the river) then this would be considered a more significant feature as otter and their holts are protected under international law. Evidence of otters using the study area was found in the form of otter spraints found in several locations along . The presence of otter spraints confirms that otters are using the study area for feeding or transit purposes.

- ***Other mammal species***

13.37 Evidence of fox (Vulpes vulpes), rabbit (Oryctolagus cuniculus) and brown rat (Rattus norvegicus) was also found. There are also records of Irish hare (Lepus timidus hibernicus) in the area. The Irish hare is listed on Annex V of the E.U. Habitats Directive (92/43/EEC) and protected under the Wildlife Acts (1976 and 2000). Other species commonly found in this type of agricultural setting include hedgehog (Erinaceus europaeus), pygmy shrew (Sorex minutus), and wood mouse (Apodemus sylvaticus). The hedgehog and pygmy shrew are protected by the Wildlife Act. It is highly likely that some of these species would make use of the grassland, woodland and freshwater habitats present within the study area.

- ***Birds***

13.38 Many commonly occurring songbirds were seen such as hooded crow (Corvus corone), song thrush (Turdus philomelos), wren (Troglodytes troglodytes), redwing (Turdus iliacus), blackbird (Turdus merula), blue tit (Parus caeruleus), great tit (Parus major), meadow pipit (Anthus pratensis), house sparrow (Passer domesticus), goldcrest (Regulus regulus), chaffinch (Fringilla coelebs), and robin (Erithacus rubecula), were noted during the site visit. Mute swan (Cygnus olar) and moorhen (Gallinula chloropus) were also sighted. Snipe (Gallinago gallinago), which are listed under the amber list of the Birds of Conservation Concern in Ireland (BoCCI), which means they are of medium conservation concern, were sighted.

13.39 Examination of the grassland areas in the study area did not indicate that these areas are being used by waterfowl for roosting or feeding. Occasional mute swan feathers and droppings were found but there was no evidence of more significant usage of the site.

13.40 Whooper swan (Cygnus cygnus), which are listed under Annex I of the EU Habitats Directive are known to use adjacent lands (Pers. Com. Rebecca Teesdale, NPWS ranger). Flocks of wigeon (Anas penelope), which are also on the BoCCI amber list, are also known to use the land to the north of the River Suck (Pers. Com. Rebecca Teesdale, NPWS ranger). Greenland white fronted geese, which are listed in Annex 1 of the EU Habitats Directive, also feed along the River Suck. Their core feeding areas are in the Middle Suck Callows (Shannonbridge to Athleague) (Fox et al. 1994). Data for the location of feeding grounds is not readily available and it would be likely that data would have to be collected by undertaking overwintering bird surveys to establish the precise level of off-site usage.

- ***Aquatic Fauna***

13.41 No sampling of the river was carried out for the ecological assessment. However, it is likely that the river contains a large range of invertebrate species with organisms from the groups Hirudinea (Leeches), Ephemoroptera (Mayfly), Gastropoda (Snails), Bivalvia (Bi-valves), Diptera (True flies), and Isopoda, Oligochaeta (segmented worms) are present. Shells of the mollusc genus Anodonta were found during the site visit. It is possible that this watercourse supports freshwater crayfish (Austropotamobius pallipes) which is a protected species listed in Annex II of the EU Habitats Directive. There are records of the species in the Cuileen Stream which feeds into the River Suck approximately 3 kilometres upstream of Ballinasloe. The River Suck may also support populations of lamprey. The three lamprey species recorded in Ireland, the brook (Lampetra planeri Bloch), river (Lampetra fluviatilis L.) and sea lamprey (Petromyzon marinus L.), are all listed on Annex II of the European Union (EU) Habitats Directive (92/43/EEC). There are records for lamprey (species unknown) in the River Ahasaragh whose confluence with the River Suck is approximately 2km upstream of Ballinasloe (Kurz & Costello 1999). There are also records of lamprey (species unknown) in the Ballinure Stream which joins the River Suck approximately 8km downstream of Ballinasloe (Kurz & Costello 1999). The River Suck contains Atlantic salmon (Salmo salar) which are protected under Annex II of the Habitats Directive.

Characteristics of the Proposal

13.42 The proposed development will impact upon the elevated areas of the site that are outside of the flood plain as suggested by the vegetative communities. The scoping process has

indicated that the following aspects of the proposal are deemed to be of relevance to the faunal and floral attributes on site:

- Clearance of Vegetation;
- Establishment of Construction Compound;
- Excavation of material;
- Use of large machinery on site;
- Operation of the development including traffic movements.

Potential Impact of the Development

Construction Phase

13.43 The potential negative impacts associated with the construction phase of this proposed development will involve the physical and direct disturbance of the habitats within the proposed development site.

13.44 Following an initial constraints assessment, the design team noted the potential conflict between the proposed development and the sensitive River Suck floodplain. As a result, the footprint of the development has been pulled back to the highest levels above the floodplain.

Direct Impact

13.45 The site clearance phase will involve removal of the grazed grassland. This habitat is elevated above the wetter areas and hence is on lower species richness and of lower ecological importance. The site clearance will directly impact upon the mammal burrow and its removal will be required. Should this be used by fox or badger then the significance of such a removal would be regarded as being of moderate ecological significance. If the burrow is deemed to be used by otter then the loss of the holt would be regarded as being of high ecological significance due to its status as an Annex II and Annex IV species in the Habitats Directive, both of which afford otters, their breeding and resting sites a high level of protection.

Indirect Impact

13.46 Often times it is the indirect and secondary impacts associated with a proposed development that can be of major environmental concern. In this instance potential indirect impacts include the impact upon the River Suck if the construction works for the main development area are not carefully controlled. These could include for example the discharge of water to the River Suck during site excavations, which could increase the river's silt load and the accidental release of oils, fuels and other chemicals to the River Suck as a result of spills or on-site re-fuelling. There will be a minimum buffer zone of 30m from the edge of the development to the river edge. This will reduce the risk of any materials being washed into the Suck.

13.47 Off-site impacts could potentially arise during the construction phase as a result of noise or visual disturbances. Some species of wildfowl, particularly duck and heron are sensitive to disturbance and will avoid areas subject to repeated impacts. However, the distance from the edge of the development to any feeding areas is in excess of 300m and therefore poses a low risk to birds using this area. In addition, the proposed development represents a minor extension to the already developed lands and therefore the additional visual disturbance will not be significant.

13.48 At the constraints stage of the ecological assessment, potential indirect effects caused by changes in the flooding regime were highlighted. Developments that occupy a volume within the floodplain can be assumed to displace a similar volume of floodwater elsewhere in the floodplain. In this scenario, if development took place in the floodplain (i.e. wet grassland habitats) then it is possible that floodwaters could displace birds from roosting sites on the opposite side of the river in the SPA/pNHA. Since the development footprint has been pulled back from the floodplain, this impact has been avoided.

13.49 During construction, illumination of the site compound and access points will be required. In the absence of any mitigation, light spill from these areas to the river and hedgerows could have a significant adverse impact on bats and birds. Whilst some bat species are attracted to the insects that themselves are drawn to lights, other species are less tolerant of lighting and will avoid lit areas.

Operational Phase

13.50 Operation of the development has the potential to give rise to a range of ecological impacts, all of which would be deemed to be of low to moderate level of significance in the absence of mitigation.

Direct Impact

13.51 Due to the complete removal of the semi-natural habitats within the footprint of the development, there will be no further direct impacts following completion of the construction phase. All other impacts will be those outside of the footprint (but within the study area boundary as shown in Figure 1).

Indirect Impact

13.52 Lighting during the night could have similar adverse impacts as described above with respect to temporary construction lighting. Similarly, noise disturbance caused by daytime deliveries could cause a minor impact within the site to the south of the river. Impacts caused by spillages of toxic materials within the development, upon the River Suck and downstream areas are deemed to be of low probability due to the distance to the river.

"Do-Nothing" Scenario

13.53 Should the proposed development not proceed the lands would remain under their current state. Assuming continued grazing along the site, this factor would prevent any significant improvement in habitat and floral diversity across the site. Overall it is unlikely that there would be any change in the ecological importance of the site.

Avoidance, Remedial or Reductive Measures

Mitigation by Avoidance

13.54 Measures to delimit the working area during the construction phase will reduce the impacts from occurring to the River Suck. The construction area will be clearly delimited and machinery will operate only within the allocated area. This will include providing physical barriers to ensure that there is no accidental intrusion into the zone outside of the development footprint. A retaining wall around the perimeter of the development will also help to avoid any risk of materials leaving the site.

13.55 Good ecological practice prevents the cutting or destruction of breeding bird habitat between the beginning of March through to the end of August primarily to avoid negative impacts. However, to avoid indirect disturbance of overwintering wildlfowl in the nearby SPA, any noisy works should be undertaken in the late summer months. This will ensure that no overwintering birds are indirectly affected by the proposed development and will also avoid the peak nesting period around April-June.

13.56 Mitigation of the loss of the mammal burrow will depend upon the nature of the species using it. Prior to the commencement of any works taking place (including fencing or setting out of the site boundary), the burrow will be monitored passively (using spoor or dropping detection) over a period of two weeks. Should the mammal be occupied by fox or badger then exclusion procedures may be required. Exclusion of badgers requires a licence under the Wildlife Act 1976 and 2000 and, if the sett is active, may only be approved between July 1st and November 30th. The sett is not considered to be a breeding sett and therefore does not require an

artificial sett to be constructed. If the burrow is an otter holt then a derogation is required from the requirements of the Habitats Directive to allow its removal. A replacement holt may be required to be constructed if the existing holt is deemed to be used for breeding.

13.57 Avoidance of the adverse effects of light spill on bats and birds can be avoided by directional lighting and by testing various lighting designs and layouts. This will take place at the early stages of the construction phase.

Mitigation by Reduction

13.58 A construction method statement will be provided by the contractor, to be agreed with the Shannon Regional Fisheries Board prior to any works commencing. This method statement will be compliant with the Southern Regional Fisheries Board guidelines Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Pending agreement with the Shannon Regional Fisheries Board the method statement will include the mitigation measures outlined below.

13.59 The control of surface water run-off during construction and the prevention of contamination of the River Suck will follow several basic principles, although the precise methodology and techniques used will be agreed between the contractor and the Shannon Regional Fisheries Board prior to the commencement of any development.

13.60 Surface water collecting on site will be required to undergo settlement by means of an attenuation pond or tank, prior to controlled discharge into the River Suck.

13.61 Control of surface water within the completed development will involve the use of silt and oil interceptors to treat surface water run-off from the hard standing areas of the proposed development, prior to its discharge to the existing system. The interceptors will be regularly checked and cleaned out as necessary. An attenuation tank will be used to avoid any surges in surface water discharge to the existing off-site drainage network and will also help to reduce the amount of sediment in the discharge. The net result of these measures will to reduce the rate of discharge into the river and to update the treatment system in comparison to the existing situation.

Other measures to avoid any contamination of off-site areas include:

- The contractor shall take suitable precautionary measures, as agreed with the Council and the Shannon Regional Fisheries Board, to prevent any material from falling into the waters when concreting, bitumen spraying, blast cleaning or painting operations are being carried out above or close to any receiving water.
- Temporary storage of topsoil and subsoil in heaps and stock piles after stripping will be located min. 30m from the River Suck to prevent collected material either falling into the river or being washed into waters.
- The contractor will ensure that oil is stored min. 30m from the Suir river and located on an impervious base. The contractor shall hold adequate stocks of oil absorbent and contaminant materials and or commercially available booms on site in order to respond to spills. The contractor must ensure a person is nominated to take responsibility
- Cement and grout must not be allowed to enter any water.

13.62 All excavated material that is not used for landscaping on site will be removed for disposal at an appropriate licensed waste disposal facility. Imported fill will be tested for contaminants prior to entering the site to avoid any on-site contamination.

Mitigation by Remedy

13.63 The landscaping plans will have an emphasis on the use of native species as far as possible. Non-native exotic species will not be included within the landscaping and in particular invasive species such as rhododendron (Rhododendron ponticum), Japanese knotweed (Reynoutria japonica) and cherry laurel (Prunus laurocerasus) will not be used.

Predicted Residual Impact

13.64 Taking the above mitigation measures into account, the following predicted impacts will apply.

Construction Phase

Direct Impact

13.65 The loss of grassland habitat will result in an impact of low significance. Impacts upon the floodplain have been avoided and only a small length of poor hedgerow will be removed.

Indirect Impact

13.66 No disturbance to the River Suck will occur and as such the SPA and pNHA will not be directly impacted upon. Disturbance of birds is considered to be unlikely given the distance from the proposed development and the nature of operations therein.

Operational Phase

Direct Impact

13.67 The relatively benign nature of the development in terms of site activities will mean that there will be no significant direct impacts within the site.

Indirect Impact

13.68 Due to the use of petrol and oil interceptors and the proper disposal of foul waters to the town sewer, there will be a low probability of any impact on the River Suck arising from the operation of the development. Disturbance of birds is considered to be unlikely given the distance from the proposed development and the nature of operations therein.

Monitoring

13.69 Petrol interceptors will be regularly maintained and checked on a monthly basis. A member of staff with responsibility for this duty must be identified once the development is in operation. No other monitoring requirements are deemed necessary with respect to ecological impacts.

14.0 Traffic, Transportation & Parking

14.1 The Traffic Impact Assessment of the proposed development was carried out by Peter Brett Associates.

Receiving Environment

14.2 The proposed development site is located less than 200m east of Ballinasloe Town centre. Effectively located on a peninsula, the River Suck forms the sites northern, eastern and south-eastern boundary. The town centre lies immediately to the west forming the sites south-western boundary.

14.3 Access to the site is gained via River View which currently forms a Cul-De-Sac and services the partially developed lands located between the Main St / Society St corridors to the south and the River Suck to the north. River View connects to the town centres road network via a priority junction with Main Street and Bridge Street which are classified as a regional route (R348).

14.4 The subject site does not currently accommodate any existing structures or significant areas of hard standing. The topography of the development site and immediate adjoining roads are generally flat with small trees and hedgerows sparsely distributed along the subject site. The site currently benefits from a 'gated' access directly onto River View.

14.5 A significant stage in the development of a transport assessment is the identification and appreciation of the local networks existing transport conditions and vehicle movement characteristics. It is also important that the appraisal considers the potential effects of all existing and committed developments across the local road network.

14.6 An audit of the local road network was undertaken during both the peak and off traffic peak periods. Carried out on Monday 6th March 2007 the principal objectives of the audit included:

- Establishing the existing vehicle movement patterns across the local network.
- Quantifying the level and quality of transport infrastructure currently provided on the approach to the proposed development site.

Pedestrians

14.7 Facilities for pedestrians across the town centre predominately consist of footpaths which are generally provided on both sides of the local road networks carriageways. The width and quality of the pedestrian footpaths vary from location to location however supplementary facilities such as dropped kerbs, tactile paving and road carriageway crossing facilities are absence at a number of key locations.

14.8 The principal pedestrian routes leading to the subject development site include Main Street, River View and Bridge Street. With the exception of the river crossing on Bridge Street pedestrian footpaths are provided on both sites of these key links. Street lighting is also provided across the town centres and access routes leading to the development site.

Cycling

14.9 The site audit observed that there are currently no dedicated cycle facilities across the immediate area / approach to the subject development site.

Public Transport

14.10 Ballinasloe benefits from the provision of both rail and bus based public transport services. The town's railway station, located to the western extreme of the urban area, is beyond the recognised walking thresholds for the town centre and subsequently the subject site. Located

on the main Dublin to Galway corridor reain services to Galway and Dublin call at Ballinasloe station approximately 8 times for both eastbound and westbound destinations.

14.11 Public transport bus services in Ballinasloe are dominated by Bus Eireann who operate the following services which call at Ballinasloe;

Table 14.1 Bus Services Route

Provider	Route Number	Route Direction	Frequency
Bus Eireann	20	Ballinasloe - Dublin	Mon - Sun
	427	Ballinasloe - Galway	Thurs
	70	Ballinasloe - Galway	Mon - Sat
	20 & 70	Ballinasloe – Athlone	Mon - Sat

14.12 In addition to the above Bus Eireann services, a Galway City to Dublin Airport route operated as Nestor Link, provides 7 additional two-way services calling at Ballinasloe. Nevertheless regional transport will continue to be dominated by the private motor car as evident by rising car ownership rates in the region.

Traffic Characteristics

14.13 PBAI commissioned a specialist survey company to undertake classified vehicle turning count surveys at a number of junctions across the town centre. The surveys, carried out between the hours of 07:00 to 10:00 and 16:00 to 19:00 where undertaken on Thursday 1st March 2007.

14.14 Analysis of the survey data identified the weekday AM and PM peak hour periods as being generated between 08:30 to 09:30 and 17:00 to 18:00 respectively. The observed 2007 peak hour traffic flows are reproduced in Figure 2.

14.15 The site audit established that the subject local area road network is subject to 50kph speed regulations in addition to benefiting from street lighting and pedestrian footpaths as previously detailed.

Emerging Transport Developments

14.16 Based on the Policy Review as detailed previously in *Section 2.5*, a number of key road infrastructure schemes have been identified which once implemented will significantly change existing traffic characteristics across Ballinasloe town centre. The most significant infrastructure proposals across the proposed developments immediate 'area of influence' include:

- N6 Dual Carriageway (Galway to East Ballinasloe bypass)
- New Link Road as detailed in the Ballinasloe Development Plan and identified as Transportation Objective T12. The scheme seeks to 'Provide a new link road from Bank of Ireland (at the junction of Main Street and River Street) to connect with the Scarsfield Road via the access road adjacent to Tesco's or the 'swimming pool site'

14.17 Based upon discussions with the National Roads Authority (NRA), and subsequently traffic data from the N6 Galway to East Ballinasloe schemes EIS (as provided by the NRA), we have calculated that the emerging N6 bypass, when complete and open to traffic in 2010, could potentially generate vehicle reassignments which would result in 37% lower traffic flows along the existing N6 alignment through the Ballinaslow urban area.

14.18 Due to the inherited constraints and potential difficulties in delivering the proposed 'link road' (Objective T12 of the local development plan) from River View to Scarsfield Road, we have assumed for the purpose of this assessment, that this infrastructure proposal would not be implemented until 2024 at the earliest.

Committed Development

14.19 During the site audit it was observed that two number off-site developments, which are currently (March 2007) under construction, have the potential to generate additional traffic flows above and beyond the existing 'base' traffic that the commissioned traffic surveys would record on site. As a result we have incorporated the following two schemes within our appraisal as committed development.

- *Millrace Retirement Village*

14.20 This application (06/029) for a Retirement Village was granted for planning permission on the site located immediately north of the existing N6 / Bridge Street priority junction. The application promotes a scheme consisting of 60 bed nursing home and 46 separate residential suites.

- *Shearwater Plaza Hotel*

14.21 Further to a telephone discussions with a representative of the town council, planning application 04/073 proposes a 60 bedroom hotel with conference and leisure facilities on a site fronting the existing N6 corridor and to the south of the existing N6 / Bridge Street priority junction.

Impact

14.22 The development schedule for the proposed mixed use commercial development is detailed below in Table 14.2.

Table 14.2 Development Schedule

Developments Elements	GFA	Notes
Anchor Retails Unit	6,410m^2 (69,000ft^2)	Comprising food and non-food sales elements
Ancillary Retails Units	3,846m^2 (69,000ft^2)	-
Management Suit	185m^2 (2,000ft^2)	Assumed to be office element
Medical Retail	102m^2 (1,100ft^2)	-

Site Access

14.23 As introduced previously a single access, for both pedestrians and vehicles, is to be provided to the subject site. A 'ghost island' junction arrangement is proposed on River View the layout of which is illustrated in Hayes Higgins Partnership drawing 06KK059 CS005 PL1 as included with the planning application supporting documentation.

14.24 The site access junction will accommodate both patrons and staff of the development in addition to delivery vehicles accessing / exiting the dedicated on-site service area.

Parking

14.25 As illustrated on the architect's site layout a total of 326 car parking spaces is provided for both the patron and staff of the developments. This number includes the provision of conveniently located dedicated disabled bays and 'parent and children' space.

14.26 Table 14.3 below summarises the car parking standards as detailed within the Ballinasloe Development Plan (Chapter 11, Table 11.4).

Table 14.3: Ballinasloe Town Council Car Parking Standards

Land Use / Location	Town Centre	Other area

Shopping: (Retail Floor Space)	30-50m²	10-30m²
Offices (GFA)	100m²	35-50m²

1 – C1 and C2 Zones,
2 – All other Zones reference to Ballinasloe Development Plan – Map 7 : Zoning

14.27 According to Map 7 (Zoning) of the Ballinasloe Development Plan, the subject development site is located within an area zoned as Town Centre (C1). As a result, referencing Table 14.3 above, the proposed development should provide at minimum the following number of car parking spaces in order to comply with the development plan standards of the Ballinasloe Development Plan.

Table 14.4: Proposed Development Car Parking Requirements.

Land Use	Area	Car Parking Number
Anchor Retail Unit (Retail Floor Space)	4645m²	92 – 154
Ancillary Retail Units (Retail Floor Space)	3159 m²	63 – 105
Offices (GFA)	102m²	2
Medical / Retail*	306m²	6 – 10
Total		163 – 271

* - Ancillary Retail car parking requirement is applied for this development element

14.28 From the results summarized within Table 14.4 above, the provision of 326 car parking as part of the development proposals compiles with the local authorities development standards. This level of car parking above the development plan requirements will benefit the neighbouring town centre commercial enterprises in addition to ensuring that during perk periods such as Christmas, the level of any potential parking overflow onto the surrounding road network will be minimised should such a significant demand arise in parallel with a reduction in existing car parking provision across the town centre.

Off-Site Network Enhancements

14.29 During the initial master planning stage a sensitivity analysis of the existing road networks ability to accommodate a range of different development permutations on the subject site was undertaken. This sensitivity analysis of the networks operational performance demonstrated that, further to the significant benefits achieved following the implementation of the N6 Ballinasloe by-pass, mitigation measures at a number of off-site junctions would be required to address both vehicle queuing issues and future capacity constraints in addition to identifying measures to enhance safety levels for vulnerable road users particularly pedestrians.

14.30 The sensitivity analysis concluded that enhancement measures to the following two existing off-site junctions arrangements would significantly mitigate the impact as potentially generated by the subject development proposals and strike an optimum balance between the various conflicting demands of all road users travailing through and across these two key junctions.

- Main St / Bridge St / River View priority junction, and
- Existing N6 corridor / Bridge St priority junction.

14.31 With the objective of maximising free flow traffic characteristics between Main St and Bridge St a 'ghost island' arrangement has been identified which also enables a formal pedestrian crossing facility to be implemented on Main St. The proposed junction arrangement is illustrated in PBA drawing 518738/100/005.

14.32 Whilst the priority junction between the existing N6 corridor and Bridge Street will benefit significantly following the completion of the Ballinasloe by-pass the sensitivity analysis indicated that during the PM peak period there was the potential for vehicle qeueing on Bridge St (West). As a result the junction arrangement illustrated in PBA Drawing *518738/100/003* has been identified to enhance the capacity of the junction's performance and reduce the generation of excessive vehicle queues. The opportunity is also available to introduce a controlled pedestrian crossing as part of the enhancement works subject to the local authorities specific requirements.

Mobility Management Plan

14.33 Mobility Management Plans (MMPs) as defined in the Traffic Management Guidelines are usually required for developments considered to have a potential to generate significant trips. Information on the preparation of Mobility Management Plans is now widely published including the Dublin Transportation Office (DTO) publications such as the *DTO Advice Note: Mobility Management Plans* (http://www.dto.ie/mmp.pdf.) and ***The Route to Sustainable Commuting*** *Employers guide to Mobility Management Plans* (http://www.dto.ie/com.pdf) amongst others.

14.34 MMPs are normally prepared for commercial developments and large centres of employment at which an employer has a "level" of control or influence over the travel habits of employees, patrons, visitors etc. Examples include large office, industrial developments and large shopping centres. In order to encourage people to use sustainable modes of transport, certain physical facilities in addition to information must be available at the subject development.

14.35 The ability to draw up a co-ordinated plan for the proposed development will be dependant on a significant number of variables, including the mix of tenants (1 retail anchor plus additional independent retail units) and the management structure adopted at the proposed development. Clearly customers and shoppers will make up the majority of trips to and from the proposed development. It can be appreciated that in the case of customers and indeed visitors to Ballinasloe, the development operator will have only limited influence on travel behaviour, particularly for short to medium duration trips.

14.36 It is considered premature to prepare a MMP for employees at this planning stage, nonetheless it is envisaged that, if thought necessary, a plan can be formulated and agreed with the Local Authority prior to or shortly after the opening of the proposed development.

14.37 The on-site weekday traffic surveys undertaken in March 2007, identified that the local road networks morning and evening peak hour periods are currently generated between 08:30 to 09:30 and 17:00 to 18:00 respectively. Both of these peak periods are investigated within the scope of our appraisal.

14.38 As noted previously, two identified off-site committed developments have been included in our assessment with associated trips rates calculated employing the TRICS database (Version 2006b) for the most appropriate Land Use categories. The appropriate TRICS output data has been appended in APPENDIX A and APPENDIX B of the Traffic Report enclosed as part of this application.

14.39 In order to achieve a robust prediction for this development, we have employed trip rates from the TRICS sub land-use categories 'Health – Nursing Home' and 'Health – Retirement Flat'. These trip rates are expressed in terms of a calculation factor of 'per unit' of the surveyed sites. Table 14.5 below presents the identified vehicle trip rates for each of these land use categories.

Table 14.5: Retirement Village Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Nursing Home	0.085	0.055	0.14	0.04	0.07	0.11

Retirement Flat	0.04	0.055	0.095	0.06	0.03	0.09

Hotel Development Trips Generation

For the Hotel development of the committed development, we have adopted the category of 'Hotel, Food & Drink – Hotels' to produce the vehicles trip rate, the parameter of this category applied is 'number of bedroom', results trips rate illustrated on Table 14.5b.

Table 14.5b: Hotel Development Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Hotel	0.145	0.185	0.33	0.17	0.12	0.29

Based on the above paragraph, a summery of total trips generated for the Committed Development is presented in Table 14.6.

Table 14.6: Committed Development Traffic Generations

Site Use	AM			PM		
	In	Out	Total	In	Out	Total
Retirement Village	7	5	12	6	5	11
Hotel	9	11	20	10	7	17

Proposed Development

Anchor Retail Unit Trip Generation

14.40 For the anchor retail unit element we have applied a '*Donor Site*' methodology to establish 'local' trip rates for an anchor retail unit. The '*Donor* Site' method is performed by using an existing similar category development in the local area and employing a reverse process of calculating trip rates based upon the recorded vehicle movements travelling to / from the Donor site.

14.41 A traffic survey has been carried out at the existing Tesco retail development (predominately food sales only) in Ballinasloe town on the 4^{th} April 2007. Comparing these vehicle movements to the size (GFA) of the Tesco store it has been possible to calculate the following trips.

Table 14.7: Anchor Retail Unit Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Traffic Survey Result	53	28	81	155	151	306
Donor Site Trip Rate ($2674.5m^2$)	1.982	1.047	3.029	5.795	5.646	11.441

Ancillary Retail Units Trip Generation

14.42 A search of the *"Shopping Centre – Local Shop"* section of the database was completed, including sites located within town centres, so that conditions forecast at the proposed development site could be replicated. All TRICS output data has been appended in APPENDIX C of the Traffic Report enclosed as part of this application.

Table 14.8: Ancillary Retails Unit Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Retails Unit	3.71	2.84	6.55	5.56	6.43	11.99

Management Suite

14.43 Within this appraisal PBAI have applied the trip rates for land use category *'Employment – Offices'* due to the limited database selection provide by TRICS data. However, in reality the management suite will not normally generate vehicles trip as high as 'Offices'. As a result, we believe employing this land use category represents a robust case for this development element. All TRICS output data has been appended in APPENDIX D of the Traffic Report enclosed as part of this application.

Table 14.9: Management Suit (Offices) Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Management Suit (Offices)	2.725	0.7	3.41	0.5	3	3.5

Medical Retails

14.44 Within this appraisal we have applied the retail trip rates to represent the medical / retail element of proposed development. The reason being is that medical / retail element could potentially constitute a chemist / pharmacy.

Table 14.10: Medical Retails Unit Trip Rates AM & PM Peak

Site Use	AM			PM		
	In	Out	2-way	In	Out	2-way
Medical Retails Unit	3.71	2.84	6.55	5.56	6.43	11.99

14.45 The proposed retail anchor unit element is to consist of both food sales and non food sales areas. This proportion will be approximately separated 63% food sales and 37% non food retail sales. The anchor retail units GFA is accordingly separated into the following proportions:

Table 14.11: Retail Anchor Unit Floor Areas.

Total GFA	Food Sales GFA	Non-food Sales GFA
6410m^2	4,090m^2	2,320m^2

14.46 A summery of the potential total trips generated in isolation by the proposed commercial development is presented in Table 14.11.

Table 14.12: Proposed Mixed Use Development Traffic Generations

Site Use	AM			PM		
	In	Out	Total	In	Out	Total
Anchor Retail Unit – Food Sales (4090 m^2)	81	43	124	237	231	468
Anchor Retail Unit – non Food Sales (2320m^2)	86	66	152	129	149	278
Ancillary Retails Unit (3846 m^2)	143	109	252	214	247	641
Management Suit (185 m^2)	5	1	6	1	6	7
Medical Retails (102 m^2)	4	3	7	6	7	13
Total	319	222	541	586	640	1226

14.47 The TIA guidelines compiled by the IHT indicate that some 95 percent of car trips to a new foodstore are trips that are already travelling across the road network. Furthermore a research undertaken as part of the development of the TRICS database reveals that upwards of 85 percent of vehicle trips calling at a Retail Development are already on the network prior to the opening of any new store. Drawing upon the findings of this advice we have assumed the following '*Diverted -Linedk*' trip assumptions for the proposed development:

- 35% of Retail Units Cross-visitation Anchor Retails Unit
- 15% of Retail Unit Cross-visitation Existing Urban Environment
- 30% of Anchor Retails Unit Cross-visitation with Existing Urban Environment / on-site development

- 50% of Medical / Retail Cross-visitation with on-site Retails Units.

14.48 From the above *'Diverted - Link'* trip assumptions, an adjusted 'new' trip profile for the proposed commercial development is established as presented in Table 14.13 below:

Table 14.13: Proposed Commercial Developments 'New' Traffic Generation

Site Use	AM			PM		
	In	Out	Total	In	Out	Total
Anchor Retail Unit – Food Sales (4090 m^2)	57	30	87	166	162	328
Anchor Retail Unit – non Food Sales (2320m^2)	39	30	68	58	67	125
Ancillary Retails Unit (3846 m^2)	64	49	113	96	111	208
Management Suit (185 m^2)	5	1	6	1	6	6
Medical Retails (102 m^2)	2	1	3	3	3	6
Total	167	112	278	324	349	673

14.49 In relation to the Anchor Retail Unit, we have assumed 20 percent of the remaining trips to the proposed development, during the weekday AM and PM peak hour period, will consist of *'Pass-by' Trips*, which involve a diversion from there original route that would otherwise be followed.

Trip Distribution And Assignment

14.50 In this appraisal, we have split the development generated traffic into two network types:

- Local Network Distribution – This distribution assumed 45 percent of the 'new' development traffic is generated within the local area.
- Strategic Network Distribution – 55 percent of the development traffic would be assumed to be generated outside Ballinasloe Town Centre.

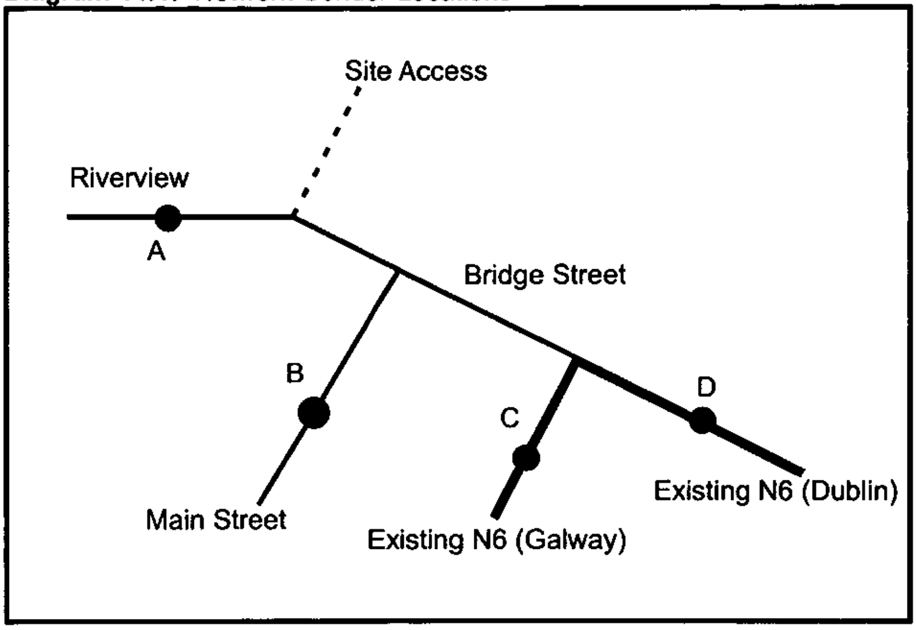
14.51 A cordon was identified encompassing the local road network. A total of four access / egress points have been adopted by which the developments generated vehicle trips can travel across the study areas road network on route to and from the road network outside of the cordon.

14.52 Table 14.14 below illustrates the adopted origin / destination matrix for the proposed development. Diagram 14.1 indicates the locations of each cordon.

Table 14.14: 2010 Opening Year Network Distribution

Network Cordon	Inbound			Outbound		
	Local	Strategic	Total	Local	Strategic	Total
(A) Riverview	0%	0%	0%	0%	0%	0%
(B) Main Street	25.3%	21.2%	46.5%	27.8%	24.2%	52%
(C) N6 South	8.45%	9.4%	17.85%	5.95%	6.4%	12.35%
(D) Bridge Street East	11.25	24.4%	35.65%	11.25%	24.4%	35.65%
Total	45%	55%	100%	45%	55%	100%

Diagram 14.1: Network Condor Locations



14.53 According to Section 3.4, a link road (Policy Objective T12) is identified between Scarsfield Road to Riverview. Our assessment assumes that this link road will be in placed by 2025. As a result a revised network distribution for the 2025 Future Design Year is applied within the appraisal. The revised origin / distribution matrix for 2025 Future Design Year is shown in Table 14.15 below.

Table 14.15: 2010 Opening Year Network Distribution

Network Cordon	Inbound			Outbound		
	Local	Strategic	Total	Local	Strategic	Total
(A) Riverview	22.5%	18.3%	45%	22.5%	18.3%	40.8%
(B) Main Street	5.625%	6.1%	12.95%	7.325%	7.9%	15.225%
(C) N6 South	5.625%	6.2%	9.553%	3.925%	4.4%	8.325%
(D) Bridge Street East	11.25%	24.4%	22.5%	11.25%	24.4%	35.65%
Total	45%	55%	100%	45%	55%	100%

Future Traffic Growth

14.54 With the objective of providing a robust appraisal of the development proposals our assessment investigates the potential traffic impact that may be generated in both the adopted Opening Year and a Future Design Year scenarios. Our assessment adopts a 2010 Opening Year and accordingly, based upon NRA guidelines, a 2025 Future Design Year.

14.55 Utilising 2010 Opening Year and 2025 Future Design Year network scenarios necessitates that the 2007 base network traffic flows are converted to the appropriate base flows in the respective future scenario. The growth of background traffic on the local road network has been estimated employing the growth factors set out in the NRA document "*Future Traffic Forecasts 2002-2040*" (August 2003).

14.56 The NRA derived growth factors for roads classified as 'Non National Road' and 'National Road' have been adopted to convert the 2007 base traffic flows to represent future network base flows within this assessment are presented in Table 14.16 below:

Table 14.16 Growth Rate for Non-national Road

Period	Growth Rate	
	National Road	Non-national Road
2007- 2010	10.57%	5.41%
2007 - 2025	42.28%	21.61%

Network Impact

14.57 The Institution of Highways and Transportation document 'Guidelines for Traffic Impact Assessments' states that the impact of a proposed development upon the local road network is considered material when the level of traffic it generates surpasses 10% and 5% on normal and congested networks respectively. When such levels of impact are generated a more detailed assessment should be undertaken to ascertain the specific impact upon the networks operational performance.

14.58 In accordance with the IHT guidelines we have undertaken an assessment to establish the potential impact upon the junction of the local road network. To enable this calculation to be undertaken we have based the analysis upon the 2010 opening year traffic scenario. The 2007 base flows have been converted to establish the base 2010 vehicle movements across the local road network. The analysis has demonstrated the proposed development will generate the following impacts at the local key junctions during the AM and PM peak hours.

Table 14.17: Network Impact

Junction/ Location	AM	PM
Site Access Junction	214%	339%
Riverview / Main Street Junction	53.56%	100.7%
N6 / Bridge Street Junction	10.1%	20.0%

14.59 In accordance with the IHT 'Guidelines for Traffic Impact Assessments', only the level of impact recorded at the location of the site access is considered material subsequently requiring a more detailed assessment of the operational performance. As a result we have undertaken a detailed investigation of the operational performance of all three of the above junctions as part of this transport assessment.

Construction Traffic

14.60 Due to the central location of the site it is considered important that consideration be given to the transportation implications generated during the construction phase of the development in order to minimise disruption to the networks traffic flows, pedestrian conflicts and the impact on the surrounding environment, particularly the residential and retail areas. It is recommended that a Construction Traffic Plan, developed in partnership with the local roads authority, is identified and agreed in response to the various construction stages of the proposed development.

14.61 A detailed construction traffic management plan can only be developed once the final schedule of construction works has been finalised and directly in response to the various key work stages which may include;

- Site set up and demolished stage;
- Material extraction stage;
- Substructure and retaining structures;
- Superstructure
- Fitting Out.

Predicted Impact

Junctions

14.62 The following paragraphs summarise the results of detailed assessments, which have been undertaken to investigate the operational performance of key junctions across the development sites local network. The three key junctions identified for detailed assessment include;

- Site Access Junction with Riverview (three-arm priority junction),
- Riverview / Main Street / Bridge Street (three-arm priority junction),
- Bridge Street / N6 (three-arm mini – roundabout junction)

Assessment Scenarios

14.63 In accordance with best practice guidance the above three junctions have been assessed for the proposed schemes expected year of opening and a period of fifteen years thereafter. In this particular case it is anticipated, allowing time for the application to process through the planning procedures, construction and commissioning works, the proposed development may be open and fully operational in the second half of 2010. As a result, the years 2010 and 2025 have been adopted as our appraisals 'Year of Opening' and 'Future Design Year' respectively.

14.64 Two different traffic scenarios have been investigated, namely:

- 'Base plus Committed Development', and
- 'Post Development'

14.65 The *Post Development* traffic scenario takes into account the potential level of traffic that could be generated by the 'proposed development' and adds these 'new' flows to the networks *Base plus Committed Development*' traffic characteristics.

Traffic Periods

14.66 As discussed previously both the morning and evening weekday peak hour traffic periods are both investigated within the scope of our appraisal. The on-site traffic surveys established the local networks existing AM and PM peak hours are currently generated between 08:30 to 09:30 and 17:00 to 18:00 respectively.

Proposed Site Access Junction

14.67 In order to assess the operational capacity of the proposed site access junction on Riverview, the TRL developed PICADY (V4.2) software program has been employed. The layout of this junction is illustrated on Hayes Higgins Partnership drawing 06KK059 CS005 PL1.

2010 Opening Year Traffic Flows

14.68 The principal modelling results for the 2010 Opening Year, AM and PM peak hour predicted traffic movements for the *Post Development* traffic scenario are summarised below in Table 14.18. The detailed PICADY output data has been appended in Appendix F and Appendix G of the Traffic Report submitted as part of this planning application.

TABLE 14.18: PICADY Results- 2010 Opening Year Post Development AM & PM

Junction Arm	AM Peak Hour		PM Peak Hour	
	RFC	Queue	RFC	Queue
Site Access	0.152	<1	0.500	1
Riverview Road (East)	0.337	<1	0.683	2

14.69 The output data of the junction simulation model, records a maximum ratio of demand to capacity (RFC) of only 0.683 during PM peak hour. The results demonstrate that the junction will operate well within capacity during the assessed peak periods with a maximum queue on the site access arm of only two vehicles.

2025 Future Year Traffic Flows

14.70 The principal results for the 2025 Future Design Year AM and PM peak hour predicted traffic movements, for the *Post Development* traffic scenario, are summarised below in Table 14.18. The detailed PICADY output data has been appended as Appendix H and Appendix I of the Traffic Report submitted as part of this planning application.

TABLE 14.18: PICADY Results- 2023 Future Year Post Development

Junction Arm	AM Peak Hour		PM Peak Hour	
	RFC	Queue	RFC	Queue
Site Access	0.134	<1	0.581	1
Riverview Road (East)	0.173	<1	0.457	1

14.71 The output data of the junction simulation model, records a maximum ratio of demand to capacity (RFC) of only 0.581 in PM peak hour. The results demonstrate that the junction will operate well within capacity during this peak period with a corresponding maximum queue on the site access arm of only one vehicle.

14.72 The slight decrease in the recorded RFC value, compared to the corresponding 2010 results, is directly due to the implementation of the proposed Riverview 'link road' (Policy T12 of Ballinasloe Development Plan) to Scarsfield Road.

RIVERVIEW / MAIN STREET / BRIDGE STREET JUNCTION

14.73 The enhanced junction arrangement at Riverview / Main Street / Bridge Street has been modelled using the software package PICADY. The proposed junction arrangement is illustrated in PBA drawing 518738/100/005.

2008 Opening Year Traffic Scenario

14.74 The principal modelling results for the 2010 Opening Year are summarised below in Table 14.19 and Table 14.20 for the AM (08:30-09:30) and PM (17:00-18:00) perk periods respectively.

TABLE 14.19 PICADY Results: *2010 Opening Year* AM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	0.014	0	0.138	<1
Riverview (To Main Street)	0.041	0	0.219	<1
Bridge Street	0.064	<1	0.247	<1

TABLE 14.20 PICADY Results: *2010 Opening Year* PM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	0.165	<1	0.638	2
Riverview (To Main Street)	0.143	<1	0.749	3
Bridge Street	0.052	<1	0.417	1

14.75 The output data of the junction simulation model recorded a maximum ratio of demand to capacity (RFC) of 0.247 and 0.749 during the AM and PM *'Post Development'* traffic periods respectively. The results demonstrate that whilst the PM period is the most heavily trafficked, the junction will operate within capacity over the peak hour period. The detailed PICADY output data has been appended as Appendix J through to M of the Traffic Report submitted as part of this planning application.

2025 Future Year Traffic Flows

14.76 The principal results for the 2025 Future Design Year are summarised below in Table 14.21 and Table 14.22 for the AM (08:30-09:30) and PM (17:00-18:00) periods respectively. The detailed PICADY output data is appended in Appendix N to Q of the Traffic Report submitted as part of this planning application.

TABLE 14.21 PICADY Results: *2025 Future Design Year* AM Peak Traffic Scenario

Traffic Scenario / Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	0.011	0	0.106	<1
Riverview (To Main Street)	0.000	0	0.061	<1
Bridge Street	0.059	<1	0.222	<1

TABLE 14.22 PICADY Results: *2025 Future Design Year* PM Peak Traffic Scenario

Traffic Scenario / Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Riverview (To Bridge Street)	0.183	<1	0.520	1
Riverview (To Main Street)	0.123	<1	0.350	1
Bridge Street	0.053	<1	0.376	1

14.77 The junction simulation model recorded a maximum ratio of demand to capacity (RFC) of 0.059 and 0.183 for the AM and PM *'Base plus Committed Development'* traffic scenarios respectively. Comparing these results to the *'Post Development'* scenario, the maximum RFC recorded increases slightly due to the additional traffic generated by the subject development proposals. Whilst the maximum RFC increases to 0.222 and 0.520 (AM and PM respectively) the junction continues to benefit from a significant amount of reserve capacity.

14.78 The junction simulation results demonstrate that the marginal impact generated by the proposed development will give rise to any capacity constraints due in part to the enhancement measures identified at this key junction.

Bridge Street / N6 Mini – Roundabout Junction

14.79 The existing N6 corridor / Bridge Street junction incorporates a three arm priority junction with opportunities to enhance this layout adversely constrainted by both the proximity and 'nature' of the adjoining bridge and private third party lands. Nevertheless, as detailed in Chapter 3, enhancement measures in the form of a mini-roundabout are proposed to mitigate the potential impact of the proposed development at this particular junction. The proposed junction arrangement is illustrated in PBA Drawing *518738/100/003.*

2010 Opening Year Traffic Flows

14.80 The enhanced junction arrangement has been modelled using the software package ARCADY. Table 14.23 and 14.24 presents the principal simulation results for the 2010 AM (08:30-09:30) and PM (17:00-18:00) peak hours respectively.

TABLE 14.23 ARCADY Results: *2010 Opening Year* AM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development'	Post Development

	Traffic			
	RFC	Queue	RFC	Queue
Bridge Street	0.342	1	0.514	1
N6 (East)	0.401	1	0.438	1
N6 (South)	0.314	<1	0.340	1

TABLE 14.24 ARCADY Results: *2010 Opening Year* PM Peak Traffic Scenario

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Bridge Street	0.498	1	0.768	6
N6 (East)	0.456	1	0.526	1
N6 (South)	0.333	<1	0.380	1

14.81 The output data of the junction simulation model, recorded a maximum *Post Development* ratio of demand to capacity (RFC) of 0.514 and 0.768 during the AM and PM Peak hour assessments respectively demonstrating that the junction will be operating within capacity over the peak hours. The detailed ARCADY output data has been appended as Appendix R, S, T and U of the Traffic Report submitted as part of this planning application.

2025 Future Year Traffic Flows

14.82 The principal results for the 2025 Future Design Year AM and PM peak hour predicted traffic movements are summarised below in Table 14.25 and Table 14.26. The detailed ARCADY output data has been appended as Appendix V, W, X and Y of the Traffic Report submitted as part of this planning application.

TABLE 14.25 ARCADY Results: *2025 Future Design Year* AM Peak

Junction Arm	Base Plus 'Committed Development' Traffic		Post Development	
	RFC	Queue	RFC	Queue
Bridge Street	0.417	1	0.502	1
N6 (East)	0.463	1	0.499	1
N6 (South)	0.361	1	0.382	1

TABLE 14.26 ARCADY Results: *2025 Future Design Year* PM Peak

Junction Arm	Base Plus 'Committed Development' Traffic	Post Development

	RFC	Queue	RFC	Queue
Bridge Street	0.611	2	0.875	6
N6 (East)	0.525	1	0.593	1
N6 (South)	0.386	1	0.425	1

14.83 The simulation results indicate that for the *2025* Future Design Year *Post Development* scenario, the maximum RFC recorded would be 0.520 and 0.875 in the Am and PM peak hours respectively. Whilst the modelling exercise demonstrates that the junction will operate well within capacity during the AM period, it will be approaching capacity for a short period over the PM peak hour in 2025. Nevertheless this level of operation is compatible to what would be expected should no enhancement works be carried out on the subject junction in a *'base plus committed'* development traffic scenario.

Mitigation

14.84 During the initial master planning stage a sensitivity analysis of the existing road networks ability to accommodate a range of different development permutations on the subject site was undertaken. This sensitivity analysis of the networks operational performance demonstrated that, further to the significant benefits achieved following the implementation of the N6 Ballinasloe by-pass, mitigation measures at a number of off-site junctions would be required.

14.85 The sensitivity analysis concluded that enhancement measures to the Main St / Riverview junction and the Bridge St / N6 (existing alignment) corridor would significantly mitigate the impact as potentially generated by the subject development proposals and strike an optimum balance between the various conflicting demands of all road users travailing through and across these two key junctions.

14.86 The principal findings of the assessment, as detailed in the previous chapters of this report can be summarised as follows;

- The proposed development would provides a key facility within convenient walking distance of the existing town centre and adjoining urban environ.
- Sufficient car parking is proposed on site to both comply with local development standards and to ensure that no overspill onto the adjoining road network is generated during peak seasonal demands.
- The identified off-site infrastructure enhancements return the networks 'Post Development' operational parameters to compatible levels for 'Base plus committed' traffic characteristics in the absence of the proposed junction works.
- The network assessment represents a worst case assessment of future traffic characteristics as in addition to the inclusion of the completed committed developments the recorded on-site traffic surveys include the construction traffic flows associated with the committed developments construction works.
- The junction assessments reveal that the proposed site access junction will operate with a significant amount of reserve capacity in both the 2010 and 2015 Post Development traffic scenarios.
- Similarly the junction enhancements to the Main St / Riverview junctions ensure that the this key junction will also operate within capacity in both the 2010 and 2015 Post Development traffic scenarios.
- The junction analysis at the N6 / Bridge St Junction demonstrates that whilst the junction will operate well within capacity during the AM period, it will be approaching capacity for a short period over the PM peak hour in the 2025 Future Design Year. Nevertheless this level of operation is compatible to what would be expected should no enhancement works be carried out on the subject junction in a 'base plus committed' development traffic scenario.

14.87 In conclusion this Transport Assessment demonstrates that the proposed commercial development, in addition to the parallel implementation of the identified off-site junction enhancement works, can be accommodated on the subject site with no significant adverse impact upon the operational capacity of the local road network.

15.0 Cultural Heritage

Introduction

15.1 The term cultural heritage in this report encompasses the following topics: Archaeology, Folklore/tradition/history, Architecture/settlements and Monuments/features.

15.2 Cunnane Stratton Reynolds undertook a review of an assessment of the cultural heritage constraints within the environs of and adjacent to a proposed mixed use retail/commercial development site at Back, Ballinasloe, Co. Galway and to assess the likely significant impacts of the proposed development on features of cultural heritage significance on or adjacent to the proposed development area.

Methodology

Desktop Study

15.3 A desktop survey of archaeological, built and cultural heritage sites within the study area and its environs was carried out in order to assess heritage constraints. The *Sites and Monuments Record* (SMR) of County Galway, as published by the Archaeological Survey of Ireland, was the principal source for identifying archaeological constraints. Further information was gained from the *Record of Monuments and Places* (RMP) for the County and a review of local journals and publications including a Cultural Heritage Chapter prepared by Dominic Delaney & Associates for an EIS for the development of a hotel development on the subject site in August 2005. In addition the following sources were consulted:

- Various editions of Ordnance Survey (OS) maps
- Various articles published in local and national journals
- Ballinasloe Town Development Plan 2003
- National Museum of Ireland – Topographical Files

Walkover Survey

15.4 The findings from a field survey assessment carried out by Dominic Delaney & Associates on the 12th of April 2005 for a previous planning application (Planning Reference 04/074), are used in this assessment. The field survey examined the area for unrecorded archaeological features

Legal and Policy Framework for the Protection of Cultural Heritage

Protection of Cultural Heritage

15.5 The management and protection of cultural heritage in Ireland is achieved through a framework of international conventions and national laws and policies (Department of Arts, Heritage, Gaeltacht and the Islands 1999, 35). This is undertaken in accordance with the provisions of the *European Convention on the Protection of the Archaeological Heritage* (Valletta Convention) and *European Convention on the Protection of Architectural Heritage* (Grenada Convention). Cultural heritage can be divided loosely into the archaeological resource covering sites and monuments from the prehistoric period until the post-medieval period and the built heritage resource, encompassing standing structures and sites of cultural importance dating from the post-medieval and modern period.

The Archaeological Resource

15.6 The *National Monuments Acts 1930 to 2004*, the *Heritage Act 1995* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which are deemed to include all man-made structures of whatever form or date except buildings habitually used for ecclesiastical purposes. A national monument is described as 'a monument or the remains of a monument the preservation of

which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (Section 2, National Monument Act, 1930).

15.7 There are a number of mechanisms under the National Monuments Act that are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places (formerly the Sites and Monuments Record), and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

15.8 Until the summer of 2002, the Minister of Arts, Heritage, Gaeltacht and the Islands was responsible for the administration of the national policy in relation to archaeological heritage management. At that point, the ministerial portfolio was abolished and the statutory functions of the Minister were transferred to the Minister for Environment and Local Government (now the Minister for Environment, Heritage and Local Government).

Ownership and Guardianship of National Monuments

15.9 National monuments may be acquired by the Minister for Environment and Local Government whether by agreement or by compulsory order. The State or Local Authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the Local Authority as guardian of that monument if the State or Local Authority agrees. Once the site is in ownership or guardianship of the State it may not be interfered with without the written consent of the Minister. There are no national monuments located within one kilometre of the proposed development site at Cornamaddy.

Register of Historic Monuments

15.10 Section 5 of the 1987 National Monuments (Amendment) Act states that the Minister is required to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas listed on the register are afforded statutory protection under the 1987 Act. Any interference of sites recorded in the Register without the permission of the Minister is illegal, and two months notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register was made largely redundant with the establishment of the Record of Monuments and Places by regulations under the National Monuments (Amendment) Act, 1994.

Preservation Orders and Temporary Preservation Orders

15.11 Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference to the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation surrounding the site must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders by the written consent, and at the discretion, of the Minister.

Record of Monuments and Places

15.12 Section 12 (1) of the 1994 Act provides that the Minister for Environment and Local Government shall establish and maintain a record of monuments and places where the Minister believes that such monuments exist. The record comprises of a list of monuments and relevant places and a map or maps showing each monument and relevant place in respect of each county in the State. Sites recorded on the Record of Monuments and Places all receive

statutory protection under the National Monuments Act 1994. There are five recorded archaeological monuments located within 500m of the proposed development site at Back, all of which are listed in Table 10.1 below.

Table 15.1 List of known archaeological sites located within 500 metres of the study area.

Mon. No.[4]	National Grid	Townland	Classification
GA088:040	18588/23109	Townparks	Castle
GA088:047	18574/23106	Townparks	Bridge
GA088:028	18538/23095	Townparks	Unclassified earthwork
GA088:028	18541/23103	Townparks	Metal working stone
GA088:028	18532/23117	Townparks	Stone sculpture

Section 12 (3) of the 1994 Act provides that *'where the owner or occupier (other than the Minister for Environment and Local Government) of a monument or place included in the Record, or any other person, proposes to carry out, or to cause or permit the carrying out of any work at or in relation to such a monument or place, he or she shall give notice in writing to the Minister for Environment and Local Government to carry out work and shall not, except in the case of urgent necessity and with the consent of the Minister, commence the work until two months after the giving of notice'.*

[4] The term 'Monument Number' or 'Mon. No.' refers to a coding system developed by the Archaeological Survey of Ireland for their *Sites and Monuments Record* (SMR) and *Record of Monuments and Places* (RMP). The system ensures that every known archaeological site in the country is accorded a unique reference number. The SMR/RMP consists of a computer database and a map register based on the Ordnance Survey's Six-Inch Map Series. The first two letters refer to the county and the next number referring to the relevant map sheet (i.e. for 'GA088-002--- the element 'GA088-' stands for OS map number 88 for County Galway. The next component relates to a specific site (i.e. 002--- stands for the second archaeological monument/site recorded on that particular map sheet).

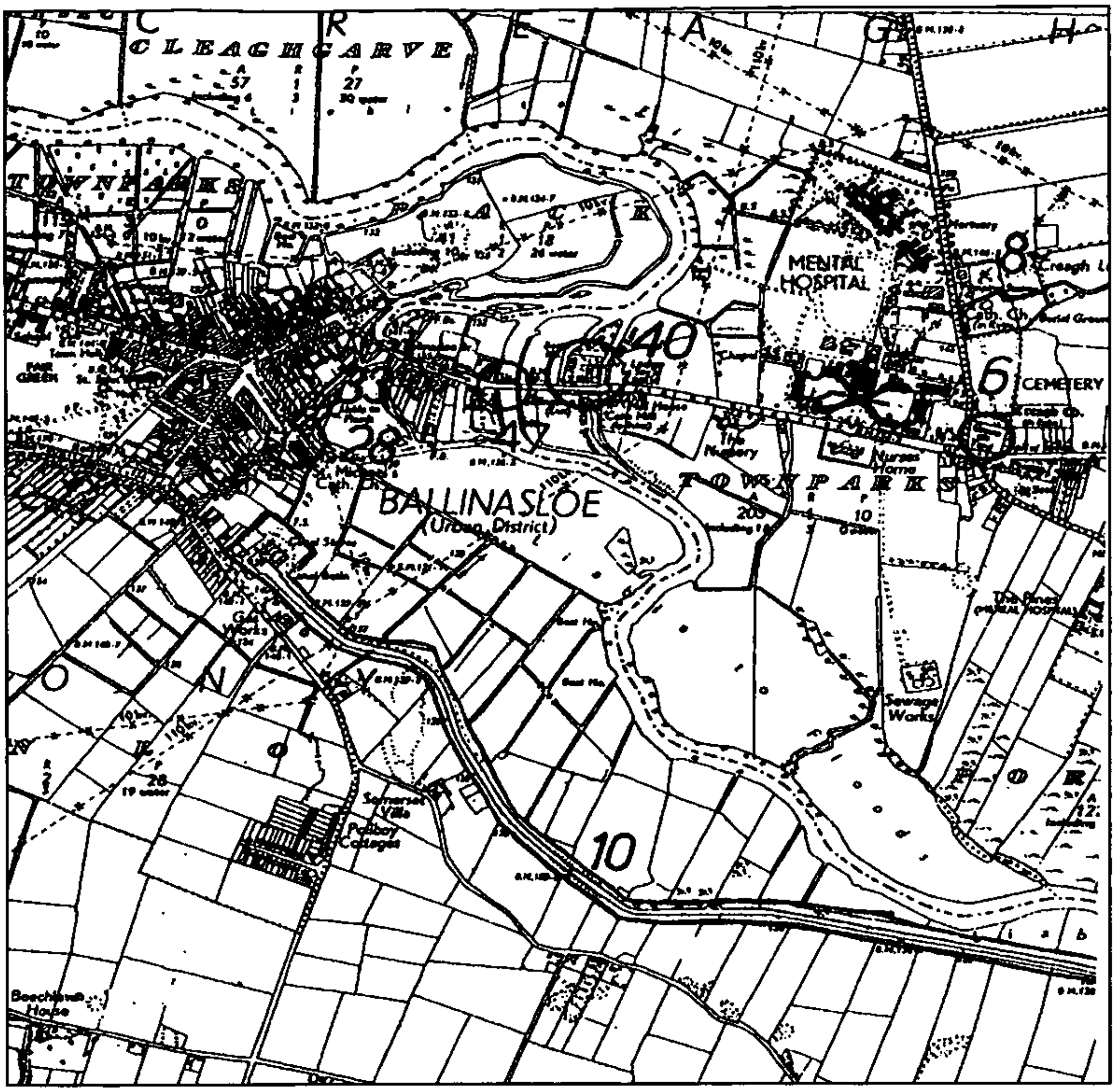


Figure 15.1: Location of known archaeological sites within 500m of the proposed development site at Back, Ballinasloe.

Topographic Files

15.13 The topographic files in the National Museum of Ireland were consulted to see if any stray finds had been recorded in the vicinity of the proposed development. Any finds would be an indication of human activity in the area and may highlight the importance of the area in the archaeological record. The following townland files were consulted; Back, Townparks. Dunlo, Cleaghgarve and Cleagh Beg. No finds were recorded from any of the townlands. Two finds are recorded as coming from the River Suck;

NMI Number	1986:16
Find Location	River Suck near Ballinasloe

Description
A bronze dirk found during drainage operations in the late 1880's. The dirk has a notched butt and bun shaped top. It has an overall length of 0.24m and a maximum width of 0.03m.

NMI Number 1986:19
Find Location River Suck near Ballinasloe

Description A bronze leaf shaped arrowhead was found during drainage operations in the late 1880's. It had been damaged in antiquity as the lower half of the spearhead had broken off where the blade springs from the socket. The length of the surviving fragment is 0.14m and has a maximum width of 0.03m

Architectural and Built Heritage

15.14 Protection of architectural or built heritage is provided for through a range of legal instruments that include the Heritage Act, 1995, the Architectural Heritage (National Inventory) and National Monuments (Misc. Provisions) Act, 1999, and the Local Government (Planning and Development) Act 2000. Section 2.1 of the Heritage Act, 1995, describes architectural heritage as *'all structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents, and, without prejudice to the generality of the foregoing, includes railways and related buildings and structures and any place comprising the remains or traces of any such railway, building or structure'.*

15.15 The Heritage Council was established by the Heritage Act. The Council seeks to promote the interest in, knowledge and protection of Irish heritage, including the architectural resource. The 1995 Heritage Act protects all heritage buildings owned by a local authority from damage and destruction.

15.16 The Architectural Heritage Act, 1999, requires the Minister to establish a survey to identify record and evaluate the architectural heritage of the country. The function of the National Inventory of Architectural Heritage (NIAH) is to record all built heritage structures within the Republic of Ireland. Inclusion in an NIAH inventory does not provide statutory protection; the document is used to advise local authorities on compilation of a Record of Protected Structures (RPS) as required by the Local Government (Planning and Development) Act, 2000.

15.17 Under the Local Government (Planning and Development) Act, 2000, all Planning Authorities are obliged to keep a 'Record of Protected Structures' of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. As of the 1st January 2000, all structures listed for protection in current Development Plans, have become 'protected structures'.

15.18 Since the introduction of this legislation, planning permission is required for any works to a protected structure that would affect its character. If a protected structure is endangered, planning authorities may issue a notice to the owner or occupier requiring works to be carried out. The Act contains comprehensive powers for local authorities to require the owners and occupiers to do works on a protected structure if it is endangered, or a protected structure or a townscape of special character that ought to be restored. There are no protected structures located or adjacent to the proposed development site. There are however, one hundred and three protected structures listed in the *Ballinasloe Town Development Plan 2003.*

Existing Environment

Archaeological and Historical Context

15.19 Ballinasloe is located on a fording point on the River Suck, and is the principal market town of east County Galway. The Irish name for the town is Beal Atha na Sluaighe meaning 'The ford mouth of the gathering'. The nature of the gathering that took place here remains unclear, but it was possibly a precursor for the annual October livestock fair which is reputedly the largest such fair in Europe.

15.20 The town is divided by the River Suck into two unequal portions. The smaller eastern section lies in County Roscommon. The larger Galway section lies mostly within the townland of Dunlo which derives its name from Dunleodha, the fort of Leodha. This fort may have been a ringfort located on the western bank of River Suck. There is a strong local tradition recorded by Egan that the present RC Church occupies the site of Dun Leodha. According to the annals Turlough O'Connor built a castle close to the fording point on the river Suck in 1124. This castle was not built of mortared stone as it was burned in 1131. A small urban settlement developed around the castle and bridge which was built in 1130. The settlement did not develop substantially until the sixteenth century.

15.21 The existing castle ruins, strategically located on the eastern bank of the river Suck are late medieval in date. The castle commands the ancient crossing point on the river. In spite of local tradition it is possible that the castle stands on the site of the O'Conor castle and an Anglo Norman castle built in 1245. The present castle was built by the O'Kellys in the fourteenth century. There are documentary references to a settlement belonging to the O'Kelly clan near the site of this castle, but these sources are unclear regarding the size and exact location. In 1572 the castle was held by the earl of clanricarde but was taken over by the crown in 1579.

15.22 Though there are the remains of medieval buildings in the town, Ballinasloe is not listed as an historic town in the 'Urban Archaeological Survey of Co. Galway'. On the eastern side of the river, at the eastern end of Church Street are the remains of Creagh medieval church.

15.23 Ballinasloe appears to be largely an 18th century foundation of the local landowners the Trench family who became the Earls of Clancarty. The Trench Family succeeded the Spencers, Brabazons and Kellys as the major land holding family in the area. Frederick Trench purchased the lands and castle of Garbally in 1631. Garbally became the family seat of the Trenches. The present Garbally House was designed by Thomas Cundy and was built some time after 1798 when an older house on the site was burned.

15.24 Although the great cattle fairs of Ballinasloe were held from a very early period the earliest record of them dates from the 8th of June 1757. Richard Trench obtained a patent for holding two fairs on the 15th of May and the 13th of July each year. Richard his father and his son were the principal architects in the development and growth of the eighteenth century town.

15.25 According to Lewis, Ballinasloe comprised of 632 houses in 1831. The east and west portions of the town were connected by a line of two bridges and causeways crossing some small islands. The bridge was about 500 yards in length and contained 16 arches. The town contained three tanyards, a flour and three oatmeal mills, a manufactory for felt hats, a coach manufactory, two breweries, and a large establishment for curing bacon. There was also in the vicinity some quarries of excellent lime-stone. Lewis also stated that an extension to the Grand Canal had been formed within the last few years which not only afforded a regular conveyance for passengers to Dublin and other places, but greatly facilitated the trade of the town.

<u>Field Survey Assessment</u>

15.26 A field survey assessment was undertaken on the 12th of April 2005 by the Archaeologist Consultants, Dominic Delaney & Associates, for an EIS for the then proposed hotel development on the subject site. According to the assessment the field survey was undertaken in order to ascertain the actual conditions on the ground and to examine the area for unrecorded archaeological features. Their assessment is still relevant to the site and their findings are reiterated in the following paragraphs.

15.27 The assessment noted that development site is located within a block of land, which corresponds almost fully with Back townland. The land block is located within a large meander of the River Suck just to the north east of Ballinasloe Town. It is presently a green field site used for horse grazing. The area is partially divided by a number of field boundaries formed by low earthen banks, hedgerows and large trees. The majority of the site however is open and boundary free.

15.28 According to the assessment the entire land block was divided into three distinct areas; the western area, the northern area and the south eastern area. The western portion of the entire land block includes the access point from Bank Road. An access point has been broken through a tall well-built stone boundary wall and a rough access road leads eastward across the site. At the western end of this area and along the river bank to the north the ground is low and partially water logged with a well-cropped grass covering. A low grass covered earthen bank runs along the river bank to the north. This bank has been recently breached by a large modern drain outlet and the original bank has been reinstated at either side of the outfall pipe.

15.29 Higher ground falling toward the river to the north and south forms the central portion of the western section of the overall land bank. This central portion is formed by a series of low hillocks situated on a general east west running ridge. To the south of this section another pipe outfall can be seen running into the Suck. This outfall has also recently been constructed or at least upgraded. Excavated material from the construction has been spread across the south-facing slope leading down to the River Suck.

Impacts

15.30 There are no recorded archaeological monuments or protected structures located on the area proposed for the development at Back Townland. No features of archaeological interest were noted during field inspection of the proposed site by Dominic Delaney & Associates, nor have there been any features or structures indicated on the site from cartographic or documentary evidence.

15.31 Although there are no known or recorded archaeological monuments on the site of the proposed development, topsoil stripping, ground reductions and general landscaping works (including drainage, cutting and filling) have the potential to reveal hitherto unknown sites, features and artefacts of archaeological potential and interest. Any ground works involving topsoil removal, excavation of trenches and cutting of ground is likely to endanger or destroy buried material of archaeological importance if such remains occur on the site.

Mitigation

10.32 Generally the proposed development site at Back Townland, Ballinasloe, is deemed to be of fair archaeological potential. In view of the possibility that archaeological remains that have no visible surface trace that may be disturbed during construction it is considered prudent to carry out an **archaeological monitoring programme** of all ground removal works associated with the construction of the proposed development.

15.33 The Archaeological Consultant appointed to undertake the programme of archaeological mitigation/investigation for the proposed residential development will be required to carry out a range of works and utilise investigative methods in accordance with the requirements/recommendations of relevant State authorities (DoEHLG and the National Museum of Ireland). The following outlines a range of mitigation measures deemed appropriate to the study area. (*Please note that these measures do not in any way pre-empt such conditions and recommendations that the Minister for Environment and Local Government may deem necessary to make in relation to the mitigation of archaeological impacts associated with this scheme.*)

15.34 Given the provisions of the National Monuments Acts, no disturbance or interference to any archaeological sites will take place without first consulting the National Monuments Service of the Department of Environment, Heritage and Local Government. A suitably qualified archaeological consultant under license from the Minister for Environment, Heritage and Local Government (MoEHLG) will carry out all archaeological mitigation works associated with the proposed development project.

15.35 In the event of an archaeological find being discovered from the proposed development area, the main contractor and all sub-contractors should be obliged to facilitate the archaeological consultant in every possible way in investigating any archaeological features, finds or deposits. Finds within the excavated layers will be noted and should any substantial archaeology or any

discoveries be made, the archaeologist will have the authority to take the necessary time to evaluate the character of the find/feature. The archaeologist will also be afforded a suitable amount of time to undertake the appropriate level of recording, which will ultimately depend on the nature and extent of the feature. (Recording will be by means of Best Archaeological Practice (*Institute of Archaeologists of Ireland: Codes of Conduct 2006*). All archaeological features will be recorded using context sheets and scaled field illustrations. A photographic record will also be maintained which will show the work-in-progress and any archaeological features or finds. Any artefacts found will be fully recorded by context and a sampling strategy for artefacts, soil, wood, charcoal and stone will also be undertaken. These samples will be retained for post-excavation analysis if it is deemed necessary. In the unlikely event of a significant find, the relevant authorities will have to be contacted to ascertain appropriate procedures.

16.0 Material Assets - General

Introduction

16.1 This section evaluates the impacts, if any, which the proposed development will have on existing services and material assets.

Receiving Environment

Built Environment

16.2 The existing site is currently in use for rough agricultural grazing. It adjoins the town centre and is zoned for commercial expansion. The site has the benefit of a current planning permission for a hotel development.

16.3 The proposed development will not adversely affect any adjacent properties.

Foul Water Services

16.4 There are existing sanitary services in the area.

16.5 The proposal will not adversely affect the established sanitary services in the area.

Surface Water

16.6 There are existing surface water drains in the area. The proposed development will not adversely affect the areas surface water infrastructure.

Telecommunications

16.7 There are existing telecommunications services in the area. These will not be affected by the proposed development.

Water Services

16.8 There are existing water supply services in the area. These will not be affected by the proposed development.

ESB

16.9 There are existing ESB substations within the curtilage of the development area. These will not be affected by the proposed development.

Impact

Built Environment

16.10 No buildings will be demolished as part of this proposal. Access proposals will have to be constructed off Bank Street to allow access to the site and pedestrian access may occur to the south-western corner of the site via the proposed public plaza.

16.11 Construction hoarding and temporary accommodation will have to be erected for construction workers and site offices. This will be a temporary impact.

16.12 The proposal when constructed will facilitate the use of the lands to the north and the south as a linear park, with access to the River. The residual peninsula areas to the north east will be retained in rough agricultural grazing to facilitate the areas evident wildlife. Linkages and informal walks to this area have been facilitated in the design. The proposed layout also allows for the retention of floodplain areas and the proposed development is constructed to a

sufficient height to avoid flooding. This is in accordance with the submitted Engineering Drawings and the Flood Study.

16.13 Traffic Management measures will have to be instituted.

Retail Environment

16.14 The proposal allows sufficient residual expenditure to be retained within the area for both food and non food sales to satisfy other developments.

16.15 There will therefore be no adverse impact in that the proposed development will contribute to meeting a defined need while also meeting development objectives for the town centre.

Waste Management

Construction Phase

16.16 Construction waste will be disposed of at an appropriate licensed landfill.

Construction Impacts

16.17 It is anticipated that the proposed development will have significant impacts during construction phases during which some disturbance will be experienced by local businesses. The site will be screened for the duration of the build programmes in order to minimise the adverse impact of the build programme.

Operational Phase

<u>Waste Streams</u>

16.18 The main waste streams that will be associated with the development, once construction is completed, will be of office/domestic type, such as:

- cardboard and paper
- plastic packaging
- glass and aluminium cans

16.19 These will be stored and disposed of in a suitable and safe manner and where practical, separated prior to disposal.

Waste Handing and Disposal

16.20 The different waste streams will be segregated so as to prevent contamination and to optimise the options for recycling. Within the site as a whole, adequate provision will be made for the installation of refuse collection bins. In addition, a central location has been identified as part of the student housing development for waste collection.

Mitigation Measures

16.21 Grease traps will be installed on drains that will carry kitchen and waste from any commercial facility.

16.22 The site will be screened for the duration of the build programme in order to minimise the adverse impact of the build programme.

16.23 Traffic management coordinators and traffic management measures will be utilised on site in order to minimise disturbance to the traffic network.

Residual Impacts

16.24 It is anticipated that there will be no significant adverse residual impacts on material assets as a result of this development.

17.0 HYDROLOGY

17.1 Introduction

17.1.1 Preamble

This Section of the Environmental Impact Statement focuses on the existing hydrological environment in terms of surface and ground waters and addresses the potential hydrological impacts from the development along with the necessary mitigation measures and identifies any likely residual impacts.

17.1.2 Description of Proposed Development

The proposed Hill of Back development is a mixed use Retail / Commercial development with a total gross floor area of 10,075m2. The development also includes surface car parking for 326 no spaces, ancillary hard and soft landscaping and vehicular access provision off Bank Road.

The proposed site is a Greenfield site, 2.41ha in area located upstream of the Dublin Road at the Hill of Back, Ballinasloe. The Hill of Back is a peninsula bounded by the River Suck and its floodplain to the north, east and south with land connection to the town from the west. The proposed development area is generally located on high ground above the River Suck flood limit and thus will not result in substantial infill of the site to achieve safe formation levels. The proposed minimum finish floor level for the development is 39.5m O.D. Malin. The main area of infill of floodplain land is the proposed access road from the west (from bank road). Such an access road and infill was previously granted planning permission as park of a Hotel Development on the Hill of Back by Mr. Jack Murray in 2005.

Water supply to the development will be from the Local Authority public water supply. Foul disposal from the development will be to the Local Authority public foul sewer which connects to the Ballinasloe Waste Water Treatment Plant located at Pollboy downstream of the site and town. This waste water treatment plant provides secondary treatment and phosphate removal and discharges the treated effluent to the River Suck midway between the Marina and the Pollboy Lock gates. Practically the entire site area will be paved (2.4ha of roads, pavement and roofs) and the surface water drainage will comprise combination of permeable pavements and gravity drains within the site. Disposal of all storm water from the site will be on site in accordance with accepted sustainable urban drainage system (SUDs) policy with a proposed storm overflow discharge to the River Suck via a single outfall and the peak outflow to the river restricted to a Greenfield runoff rate of 2l/s per ha (5l/s). Petrol interceptors will be provided upstream of the outflow (refer to Hayes Higgins Consulting Engineers services report and drawings for details).

Existing Environment; Hydrology and Hydrogeology

17.3.1 Hydrology of the River Suck at Ballinasloe

17.3.1.1 General Hydrology

The Suck River is a major tributary of the River Shannon having a catchment area of some 1520km2 to its confluence with the River Shannon at Shannonbridge. The Suck rises in Lough O'Flynn near Ballinalough, to the northwest of Castlerea and flows in a generally southeast direction to Athleague below which it flows southwards to Ballinasloe and east-southeast to the River Shannon. The Suck catchment overlies a mixture of Burren and Calp Limestone Bedrocks.

The Suck collects a number of important tributaries including Island River whose confluence with the Suck is at Ballymore, the Shiven River whose confluence is 3km north of Ballyforan and the Bunowen (or Ahascragh) River whose confluence is 1km north of Ballinasloe. The River Suck each winter inundates its low-lying expansive flood plain south of Ballinasloe which provides significant flood storage. The reach section downstream of Pollboy is subject to backwatering

from the River Shannon during large winter floods and the bed gradient is very flat suggesting lake like conditions between Shannonbridge and Pollboy Ballinasloe.

Waterways Ireland control the section of river between Ballinasloe Marina and its Confluence with the River Shannon at Shannonbridge. This section of river is navigable and dredging operations were carried out between Pollboy and Ballinasloe resulting in the development of a lock gate and canal at Pollboy, a marina at Ballinasloe (downstream of the N6) and a river channel with a bed invert less than 35m OD Poolbeg (32.3m O.D. Malin) and a 20 to 30m wide navigation width for small pleasure craft. The river channel sections are reasonably regular with top width between river banks generally exceeding 40m. The bed gradient over the study reach is generally flat except for sudden rise and fall at Pollboy (thus the formation of the lock gates). Due to the Flat gradient the River channel meanders significantly between Ballinasloe and Pollboy and some bank erosion on the outer (concave) channel bank is evident.

17.3.1.2 Historical Flood Events at Ballinasloe

Based on gauged flood records at Bellagill since 1952 the most significant flood events that occurred over the past 50 year (1952 to present) are as follows:

Table 17.1 Recorded Maximum Floods at Bellagill Gauging Station

Date	Peak flood Flow at Bellagill gauge	Peak Flood Level at Bellagill gauge	Estimated Return Period (years)
5th November 1968	148 cumec	40.21 m O.D. Malin	94 year flood event
20th Oct 1954	137cumec	40.15m O.D. Malin	44 year flood event
29th December 1999	123 cumec	40.07m O.D. Malin	17 year flood event
8th February 1990	120 cumec	40.05m O.D. Malin	13 year flood event
6th February 2002	115 cumec	40.02m O.D. Malin	10 year flood event

Historical flood levels in the River Shannon at Shannonbridge which backwaters the lower reach of the River Suck as far as Pollboy is as follows:

Table 17.2 Recorded Maximum Floods at Shannonbridge Gauging Station

Date	Peak Flood Level at Shannonbridge gauge	Estimated Return Period (years)
28th December 1999	35.56m O.D. Malin	35 year flood event
30th January 1995	35.50m O.D. Malin	27 year flood event
13th February 2002	35.48m OD Malin	23 year flood event
10th December 1954	35.48m OD Malin	23 year flood event
12th February 1990	35.47m OD Malin	21 year flood event

Flow data are not available for this station as a flow rating relationship has not been derived

17.3.1.3 Anecdotal Flood Information for Ballinasloe

The following anecdotal information concerning flooding in the vicinity of the site and Ballinasloe Town Centre was compiled from a number of different sources:

Photographs of winter flooding taken on the 14th December 1994 give a flood level at canal walk of approximately 37.5m O.D. (flow at Bellagill gauging station on that date was 89cumec). Similar levels were observed in Feb 1997 by Gerry Dolan of Dolan and Associates Consulting Engineers (flow at Bellagill gauging station on those occasions was approximately 98cumec.

Mr. Michael McKiernan of Waterways Ireland observed a flood level of 37.06 mO.D. at the new Marina site based on photograph he took on the 26th December 1999 which was latter surveyed by him (recorded flood peak at Bellagill gauging Station occurred on the 26th Dec, refer to Figure 1). At that time Waterways Ireland were in the process of constructing the Ballinasloe Marina and Mr. McKiernan who was responsible for this project recorded the flood level in the vicinity of the walkway/footbridge. Other flood level measurements recorded by Waterways Ireland over approximately a 5-year period in the 1980's gave a maximum flood level of 36.6m

O.D. (128.97 ft Poolbeg), measured at the East Bridge. Photo evidence taken at Pollboy lock gates on the 28th December 1999 shows the flood levels close to the top of lock wall level upstream of the lock gates giving a flood level of just below 36.51mOD Malin. It was also observed from photos taken that a water level drop between upper and lower locks possibly exceeded 0.8m (rough estimate arrived at from interpretation of photograph). This information confirms that Pollboy was not drowned by downstream floodwaters and suggests given the gradient that critical flow possibly occurred at the Pollboy rapids.

Since the N6 inner bypass road of the town centre has been constructed (at least 15years in existence) no flooding of the road from the River Suck has occurred to date with the lowest road level adjacent to the marina at 38.2m O.D. Malin.

A winter maximum watermark on the rock gabion protection at the new Marina in Ballinasloe gives a level of 36.3m O.D. This is likely to reflect the normal winter levels as opposed to extreme flood levels.

Unsubstantiated anecdotal information suggests that the historical maximum flood (possibly the 1968 flood) reached the steps / boundary wall to St. Michael's Church (no date available for this event and should be treated with caution). This suggests a flood level below 38.0m OD Malin in the canal area.

There is no anecdotal evidence from landowners to suggest that flood levels downstream of the Dublin Road Bridge at Ballinasloe have ever exceeded 37.5m O.D. Malin.

The Caretaker at Ballinasloe Wastewater Treatment Plant (WWTP) located downstream of the East Bridge and upstream of Pollboy Lock, has stated that flood waters have never reached the boundary fence of the WWTP in the 25years he has worked for Ballinasloe Town Council, including the December 1999 flood. The WWTP fence line is at approximately 38m O.D. Malin.

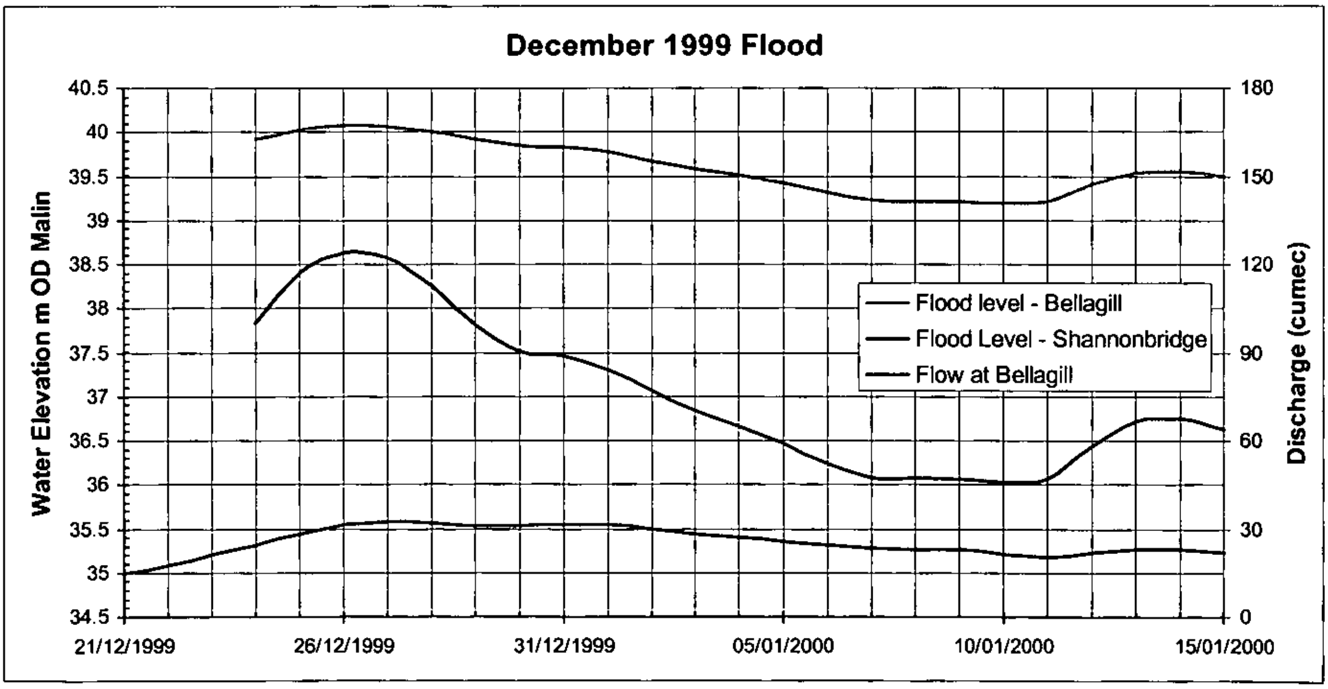


Figure 17.1 December 1999 Flood Hydrograph at Bellagill and Shannonbridge

17.3.1.4 Recent flooding

10th / 11th January 2005 Flood Event

As part of the hydraulic model data gathering exercise Hydro Environmental limited visited Ballinasloe between 12:00 and 14:00 hours on the 10th January 2005, which practically coincided with the peak of the flood event. Photographic evidence of the flooding was taken at

Pollboy, Ballinasloe Marina, canal near St. Michaels, N6 Road Bridge, Hill of Back and Bellagill Bridge. These photographs are presented in Annex D and were subsequently surveyed in to Malin Datum so as to provide flood level data.

The staff gauge reading at Bellagill gave a flood depth of 2.56m which is 39.97m OD Malin and translates based on the rating relationship to a flow rate of 108 cumec which represents a 6 year return period flood peak at Bellagill.

The following flood levels were observed during the site visit:

- the observed flood level downstream of the Pollboy Lock Gate was 35.51mO.D. Malin,
- the flood level immediately upstream of the Pollboy upper lock gate was 36.38mO.D. Malin,
- the flood level at Ballinasloe Marina Walkway was 36.89mOD Malin,
- the flood level at the N6 Road Bridge upstream face was 36.95m O.D. Malin (estimate based on a bridge survey carried out by Brendan Arrigan Ltd.)
- the flood level at the Hill of Back adjacent to the pump inlet chamber was 37.61m OD Malin

Figure 17.2 Photo taken by OPW on the 11th January 2005 showing the extent of flooding at the Hill of Back.

17.3.1.5 Hydrometric Gauging Stations

The following table presents hydrometric gauging stations in the Suck Catchment and a number of these stations are used in a pooled statistical flood frequency analysis presented latter in the section.

Table 17.3 Hydrometric Gauging Sites

Gauge No.	Gauge Site	River	Grid Location	Gauge Type	Authority	Period
26001	Ballinamore	Shiven	M757489	Automatic	OPW	1972 - 2001
26002	Rookwood	Suck	M806571	Automatic	OPW	1973 - 2001
26005	Derrycattle	Suck	M825424	Automatic	OPW	1954 - 2001
26006	Willsbrook	Suck	M692756	Automatic	OPW	1952 – 2002
26007	Bellagill	Suck	M841346	Automatic	OPW	1952 - 2004
26028	Shannonbridge	Shannon	M967254	Automatic	OPW	1954 - 2003

Table17.4 Hydrometric Summary of Gauges

Gauge No.	Gauge Site	Area km2	Mean Flow (cumec)	Annual Max Flow (cumec)	99% low flow (cumec)	DWF (cumec)
26001	Ballinamore	230	N/A	N/A	N/A	N/A
26002	Rookwood	626	14.4	55.11	1.14	N/A
26005	Derrycattle	1050	N/A	92.11	N/A	1.4
26006	Willsbrook	182	3.6	28.84	0.22	.08
26007	Bellagill	1184	25.2	91.95	1.71	1.4
26028	Shannonbridge	4999	N/A	N/A	N/A	N/A

17.3.1.6 Water Level Monitoring at Ballinasloe

As part of data collection for calibration of the hydraulic river model two automatic water level recorders were deployed on the River Suck at Ballinasloe. Gauge A was deployed on the 14th November 2004 1100m upstream of the Dublin Road Bridge at the Waterways Ireland recently constructed canal intake pump chamber located on the right bank adjoining the subject site. Gauge B was deployed on the 6th December 2004 250m downstream of the N6 Road Bridge on the right bank at the entrance to the Marina Channel. These automatic water level gauges were OTT "Aquanaut" pressure transducer electronic recorders which measure temperature and pressure converting it to water level and store up to 3 months data at 10min recording intervals. Spot checks on water levels were carried out over the monitoring period and water level range to allow calibration / tuning of these instruments so as to minimise drift effects.

The water level hydrographs for the monitoring period November '04 to July '05 are presented in Figure 9.3 and the recorded 10th January 2005 flood hydrograph is presented in Figure 9.4. The water level records show a flood peak of 37.61m OD Malin at Gauge A (Hill of Back) and 36.905m O.D. at Gauge B (Marina approach channel) recorded at 6pm on the 10th January 05. The peak flood levels at these sites remained relatively constant for 24hours before slowly receding.

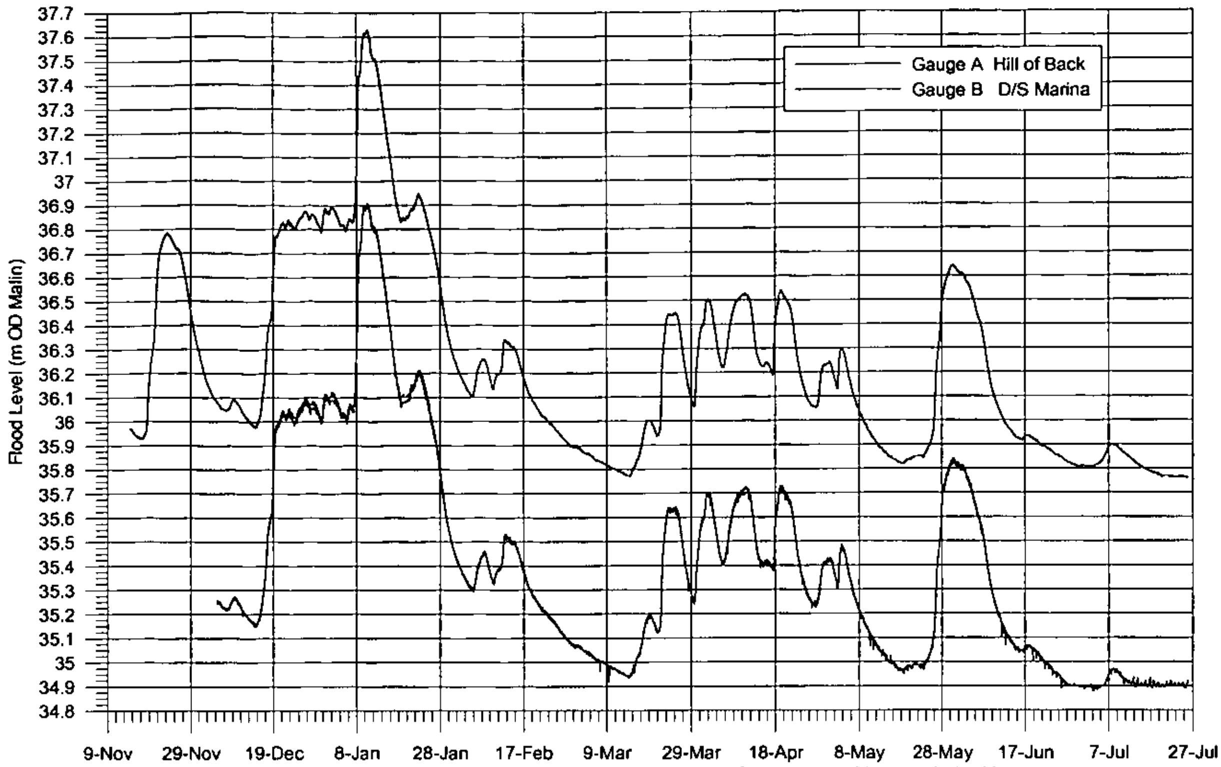


Figure 17.3 Flood level records at Ballinasloe Gauging sites from Nov '04 to July '05

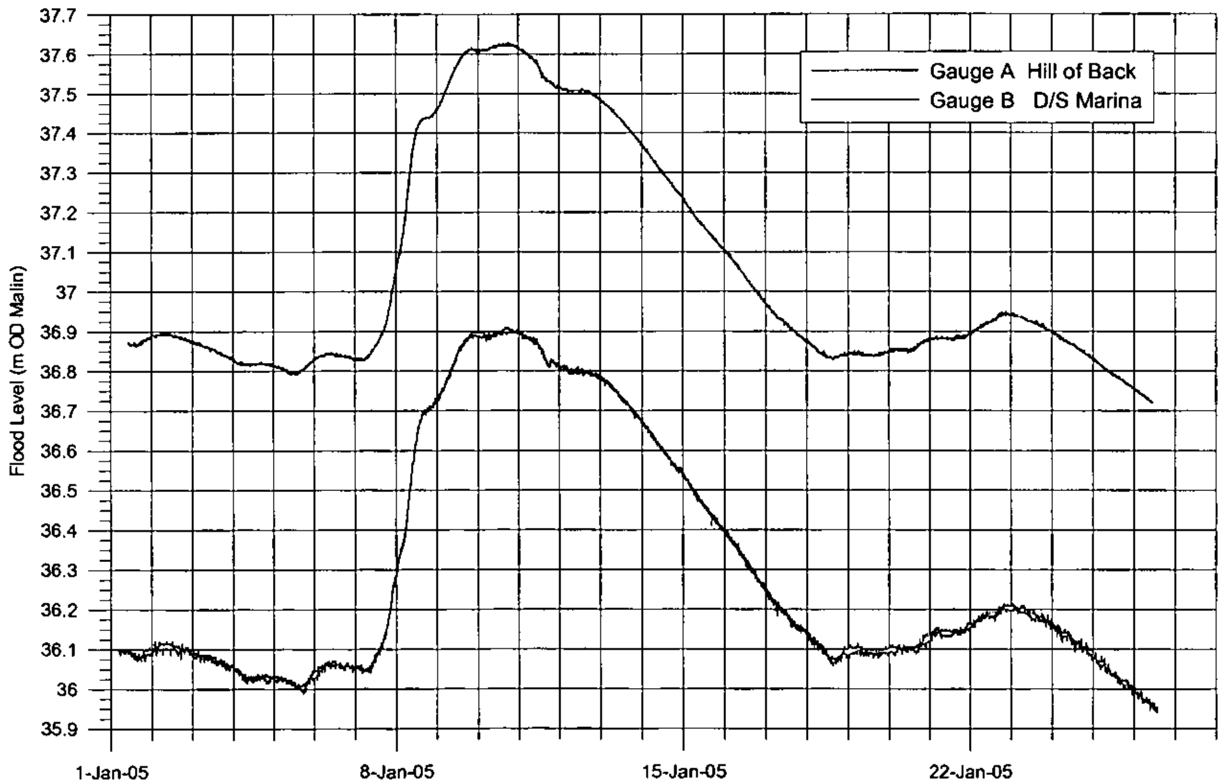


Figure 17.4 January 10th 2005 Flood hydrographs at Ballinasloe Gauging sites

Figure 17.5 Water Level Gauging Locations at Ballinasloe

17.3.2 Flood Flow Analysis

17.3.2.1 Flood Flow Estimation - Introduction

A design flood may be determined by either of two broad categories of methods, these are:

- Methods based on statistical analysis of flood peak data from donor gauges
- Methods based on a design rainstorm and a rainfall-runoff model which converts the design rainstorm into a design flood.

A further distinction arises between gauged and ungauged catchment methods. The later use formulae which relate some key component of the method being used, such as mean annual flood (QBAR) or unit hydrograph time to peak (Tp), to catchment descriptors such as AREA, Slope (S1085), mean annual rainfall (SAAR), runoff coefficient (SOIL) among others.

The nearest OPW hydrometric gauging station to the subject site is located at Bellagill station (26007) located 7km upstream of The Dublin Road Bridge, Ballinasloe. The rating relationship for this station is considered to be very good for high flows, having a reliable rating for flood

flows up to 150cumec. The catchment area to Bellagill is 1184 km2, the catchment area to the N6 road bridge Ballinasloe is 1355km2 and to the Pollboy lock gates is 1360km2. The total catchment area of the River Suck to its confluence with the River Shannon at Shannonbridge is 1520km2.

17.3.2.2 Statistical Analysis of gauged flood flows

Methods based on statistical analysis of flood peak data are usually used for determination of a 100year design flood, especially where a considerable amount of gauged data exists as is the case with Bellagill station. The statistical method may be used on a single site basis or on a pooled basis. In the latter, which is recommended by UK Flood Estimation Handbook (1999), the flood data from several river sites are in effect pooled together to provide an improved estimate of the required flood value. Pooled analysis is regarded as providing a more reliable estimate of the required flood, providing that catchments included in the "pooling" group are sufficiently similar in area, annual rainfall and soil/geology conditions.

The gauging station nearest the project location is Bellagill (26007) from which annual maximum flood data are available since 1952, 53 values in all are available with no missing years. The catchment area to this location is 1184km2 whereas the catchment area to the project location is 1355km2 which is 14.4% greater than the Bellagill value. Since floods are generally proportional to catchment area to a power of approximately 0.8 it is expected that the flood peak values at the project location are approximately 111.4% of the Bellagill values.

For pooled analysis the data of the three stations on the Suck whose catchment areas exceed 500km2 will be used. A disadvantage of this pooling group is that it is too small when judged by the FEH criterion that recommends a minimum of 5T (T is the return Period) station years be included in the pool, in this case 5 x 100 = 500station years. The three stations concerned contain 149 station years.

Single site analysis using the Bellagill Gauge

The annual maximum flow series for Bellagill gauging station was obtained from the Hydrometric Office, Headford (hydrometric years 1952 to 2003). Including in this series the recently observed January 2005 flood peak as the annual maximum value for 2004 hydrometric year, 53 AM values for this station are available. These are plotted sequentially in Figure 9.6.

Single site flood frequency analysis fitting a flat two-parameter extreme value type 1 (EV1 or Gumbel) distribution by the method of least squares to the 53 AM values was performed. A good fit to this data is achieved using the EV1 distribution. These 53 values are shown on probability plot along with the least Squares EV1 Fit in Figure 9.7. The EV1 distribution is recognised as providing a good fit to flood statistics in Irish Rivers particularly the larger rivers.

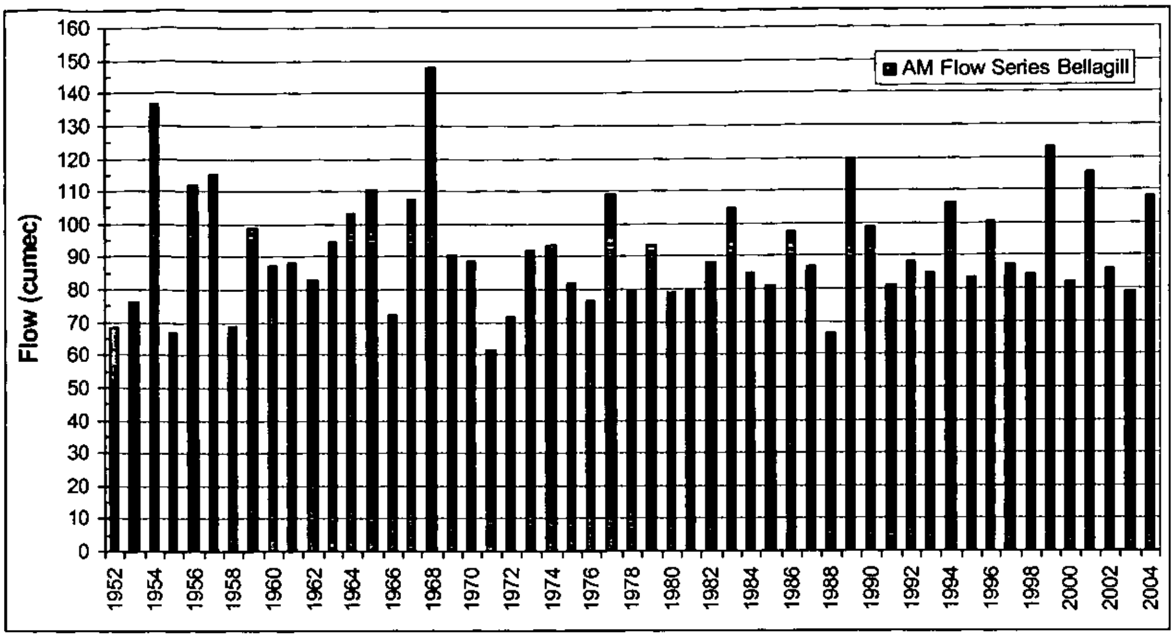


Figure 17.6 Sequential Plot of annual maximum flows for River Suck at Bellagill (26007)

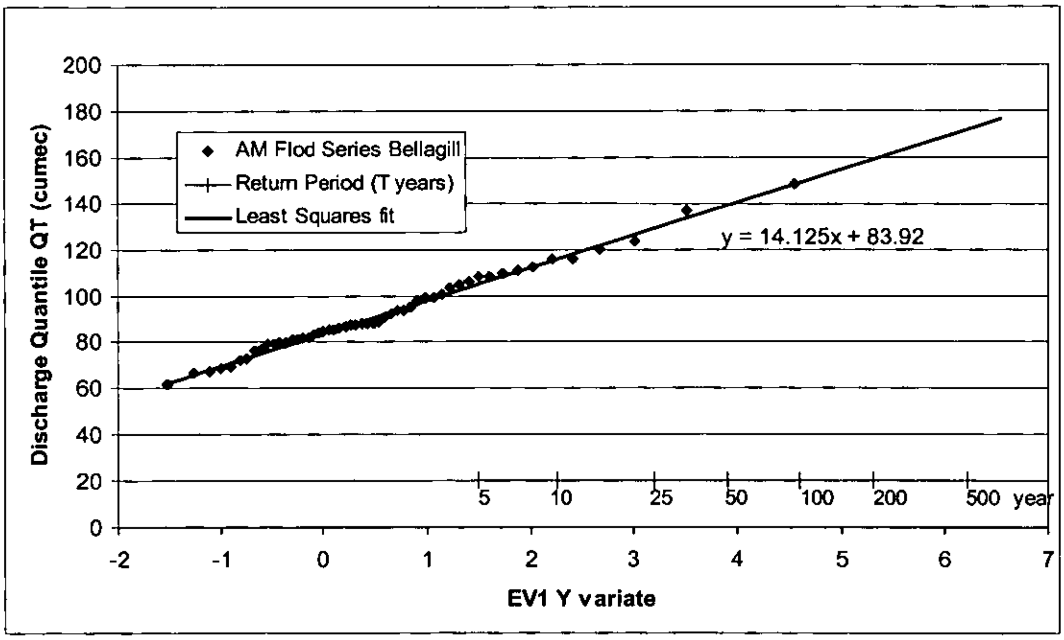


Figure 17.7 Flood frequency Analysis of OPW AM Flow Series at Bellagill (26007), (Showing excellent EV1 Fit to the A.M. data.)

The QBAR value (i.e. mean annual maximum flood flow) for this series is 92cumec having a standard deviation of 17.73cumec and a standard error of 2.33cumec. The return period flow estimates from the EV1 analysis are presented below in Table 17.5.

The computed Bellagill flood statistics presents a considerably flatter growth curve than the National growth curve for Ireland derived in the 1975 Flood Study Report (NERC 1975) and is also flatter than the regional growth curve for the West Region derived by Cawley and Cunnane (2003), refer to Figure 1.9.

Table 17.5 Flood Frequency Estimates for Bellagill

T (years)	EV1 Yvariate	QT (cumec)	s.e. (cumec)	Growth Factor XT
2	0.367	89.1	2.24	0.97
5	1.500	105.1	3.77	1.14
10	2.250	115.7	5.09	1.26
25	3.199	129.1	6.86	1.40
50	3.902	139.0	8.20	1.51
100	4.600	148.9	9.56	1.62
200	5.296	158.7	10.91	1.73

The Q100 from this analysis is 148.9cumec having a standard error of 9.56cumec. The QT estimate plus the addition of twice the standard error represents the 95percent upper confidence limit for the estimate which is 168cumec.

Given the excellent rating available for flood flows at Bellagill and the long series of AM flows available at the gauge (i.e. 1952 to present providing 53years) high confidence can be placed on the flood frequency results from the Bellagill single site analysis.

Pooled Analysis

The index flood method is used, in which

$Q_T = Q_{BAR} * X_T$

Where $X_T = Q_T/Q_{BAR}$ is the standardised regional growth curve ordinate and QBAR is the mean annual flood at the project location. The quantity X_T is the T-year quantile in the standardised flood distribution.

Three stations on the River Suck, Rookwood (26002), Derrycattle(26005) and Bellagill(26007) are included in the pooled analysis. Individual and combined (standardised by dividing AM values by respective QBAR values) statistical frequency analyses were carried out on this data fitting an EV1 probability distribution. All stations showed good fit to an EV1 distribution.

The individual and combined (pooled) growth curves for these stations are presented in Figure 17.8. The pooled growth curve for the three stations is very similar to the Bellagill growth curve and considerably flatter that the National FSR and west Region growth curves, refer to Figure 17.9.

Regional Growth Curve Flood Estimates

In the absence of sufficient pooled or single site data regional growth curves (FSR national Growth Curve, Cawley and Cunnane west region growth curve) can be used with the site estimate QBAR rate to yield return period flow estimates. The return period estimates from this method using West region and FSR National Growth curves along with the previous estimates from the single and pooled gauging methods are presented below in Table 17.6.

Table 17.6 Comparison of Flood estimates using the various Flood Growth Curves

Return Period T years	Bellagill Single Site	Pooled (26002, 26005, 26007)	West Region (Cawley & Cunnane 2003)	FSR National (NERC 1975)
2	89.1	89.0	88.3	88.3
5	105.1	105.5	108.5	110.3
10	115.7	116.4	122.3	126.9
25	129.1	130.2	138.8	147.1
50	139.0	140.4	150.8	162.8
100	148.9	150.6	163.7	180.2
200	158.7	160.7	175.6	196.8

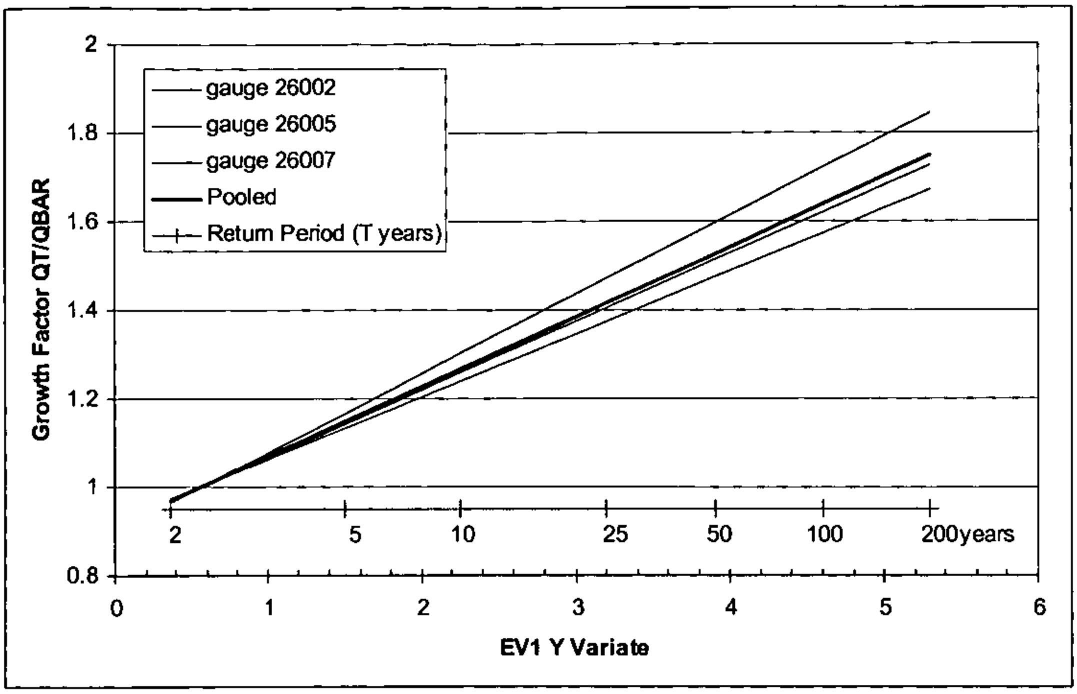


Figure 17.8 Individual and combined station growth curves for the River Suck

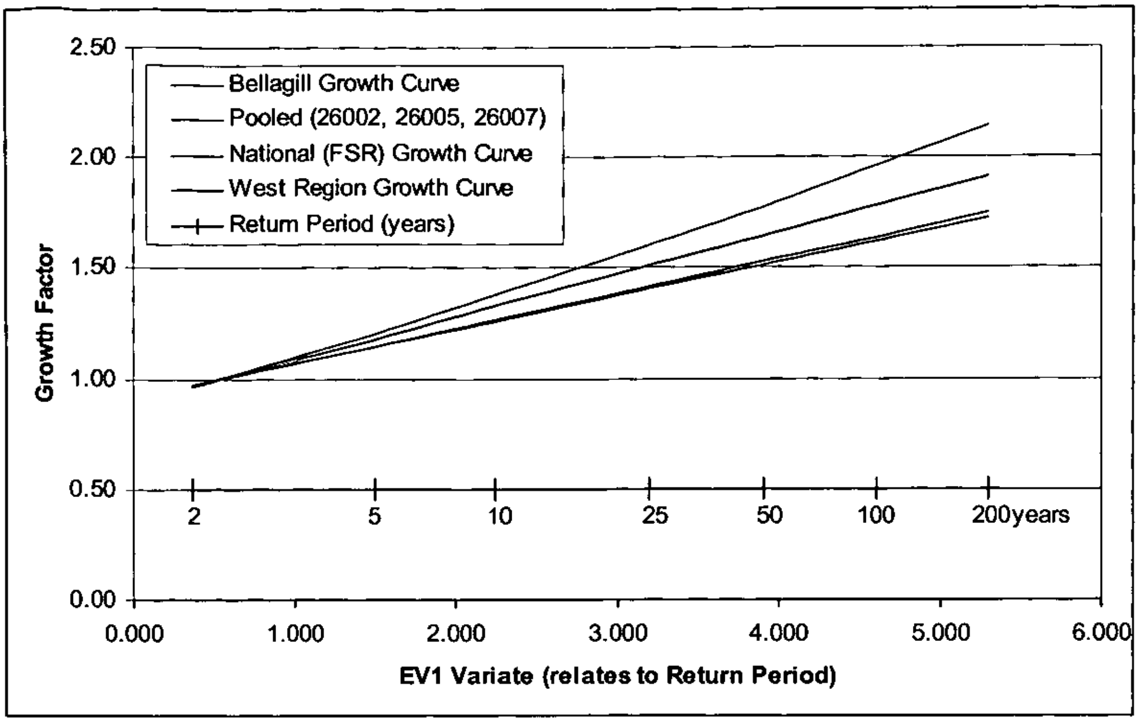


Figure 17.9 Comparison between Bellagill, Pooled (26002, 26005, 26007), National and West Region Flood Growth Curves

17.3.2.3 Climate Change Allowance

The OPW have recently produced draft guidelines in respect to design considerations of possible climate change for flood risk management practice. The recommended design allowances to be used for increases in flood flows during the sensitivity and / or design process are given by region in Table 17.7.

Table 17.7 Regional Flood Peak Allowances

	Allowances (% increase) in Flood Flows	
Region	Summer (and Autumn) Floods	Winter (and Spring) Floods
North	10	20
North West	10	15
West	25	10
South West	10	15
South	15	25
South East	15	20
East	10	20
Midlands	25	20

In the UK research is ongoing to assess regional variations flood allowances and the rate of future change. Current research thus far does not provide any evidence for the rate of future change let alone consider regional variations in such a rate. As a pragmatic approach it is suggested that 10% should be applied up to 2025, rising to 20% beyond 2025, refer to Table 17.8 (DEFRA, 2006).

Table 17.8 The UK Flood and Coastal Defence Appraisal Guidance (DEFRA, 2006) gives the following sensitivity climate change ranges

Parameter	1990 - 2025	2025 - 2055	2055 - 2085	2085 - 2115
Peak rainfall intensity (preferably for small catchments)	+5%	+10%	+20%	+30%
Peak river flow (preferably for larger catchments)	+10%	+20%		

19.3.2.4 Recommended Design Flow Rate at Ballinasloe

The flood frequency analysis of the Bellagill Annual maximum Flow data multiplied by the pooled flood growth curve is the preferred method for estimating the design flows in the Suck at Ballinasloe. High confidence can be placed on the flood frequency results because of a very reliable flood rating relationship (reliable up to 150cumec) at Bellagill, the close proximity of the gauge to Ballinasloe, the excellent EV1 fit to the annual maximum flood flow series, the long continuous series of AM flows (53years currently available), and the close agreement obtained between single site and pooled growth curves.

To convert from Bellagill having a catchment area of 1184km2 to Ballinasloe with a catchment of 1355km2 a scaling factor of 1.114 is used which is obtained using the ratio of catchment areas to the power of 0.8 (NERC, 1975).

Table 17.9 Return Period Flood Flow Estimates for the River Suck at Ballinasloe

T Return Period	Estimated Flow Rate at Ballinasloe without Climate Change Allowance	Estimated Flow Rate at Ballinasloe With 20% Climate Change Allowance
2	99.2	119
5	117.5	141
10	129.7	156
25	145.0	174
50	156.0	188
100	168.0	201
200	179.0	215

The recommended best estimate of the 100year design flood flow with climate change allowance to Ballinasloe is 201cumec based on the pooled analysis. The single site analysis gives a flood flow to Ballinasloe of 199cumec. The FSR index flood method using the national flood growth curve gives a 100year estimate with climate change allowance of 241cumec (20% higher) and using the west region flood growth curve gives a 100year estimate with climate change of 219cumec (10% higher). These larger flood estimates will also be examined in respect to flood levels at the subject site and flood risk for the proposed development.

17.3.2.5 Estimation of Flood Levels Downstream of Pollboy Lock Gates

Statistical Frequency analysis of flood levels at Shannonbridge gauge (26028) and Bellagill gauge (26007) are carried out so as to provide a rational for establishing return period flood levels downstream of Pollboy lock gates which are necessary as boundary conditions to the hydraulic model. The Shannonbridge gauge is located just upstream of the confluence between the River Suck and River Shannon having a catchment area of 4999 km2. It has a slow time to peak resulting in a damped hydrograph and is generally a least 24hours latter than the flood peak in the River Suck at Ballinasloe. Refer to Figure 9.1 for flood hydrographs corresponding to the 1999 flood event.

The estimated flood level at Pollboy lock gates is 35.5m O.D. based on a measure reference point (flood levels reached the 7th step on the 10th January 2005).

Applying an EV1 probability distribution to the flood level data at Shannonbridge and Bellagill stations the following return period flood level estimates are obtained. These estimates are expected to error on the conservative side as the AM series curves downwards away from the EV1 Least Squares best fit line at both stations thus over estimating the higher return period flood levels.

Table 17.10 Flood Frequency results at Bellagill and Shannonbridge

Return Period	AM Flood Level Bellagill (26007) (m O.D. Malin)	AM Flood Level Shannonbridge (26028) (m O.D. Malin)
2	39.80	34.99
5	39.94	35.23
10	40.03	35.39
25	40.15	35.58
50	40.24	35.73
100	40.32	35.88

Both the 1999 and 2005 flood event produced peak flood levels downstream of the lock gates of approximately 35.6 and 35.5m O.D. Malin respectively based on surveying in photographic evidence taken during both events.

The January 2005 flood has an estimated return period at Bellagill of 6 years and thus it is reasonable to assume that the downstream flood level at Pollboy is of the same order of magnitude. At Bellagill the difference in flood level between a 5year and 100year flood is 0.38m and at Shannonbridge it is 0.65m. It is therefore reasonable to assume that the 100year downstream flood level at Pollboy is of the order of 36.1m O.D. (i.e. 0.6m difference between 5 and 100year flood levels).

A 20% increase in flood flow on account of climate change (equivalent to a 100year event becoming a 25year event) is likely to produce a flood level increase at Shannonbridge of 0.2m and at Bellagill of 0.1m. Therefore the recommended 100year design flood level with climate change downstream of Pollboy lock gates is 36.3mO.D.

17.3.3 Predicted Flood Levels

17.3.3.1 Introduction

Hydro Environmental Ltd. have previously developed a HEC-RAS mathematical hydraulic model of the River Suck through Ballinasloe (HEL, 2005,). This model was developed to accurately predict flood levels in the river through the town and downstream to Pollboy Lock Gates.

The selected hydraulic modelling software used is HEC-RAS by the US Army Corp of Engineers. HEC-RAS implements a 1-dimensional model of river flow in the longitudinal direction and takes account of the conveyance and storage within the main river channel and on its adjoining floodplain overbanks. This software is recognised as the industry standard software for such applications.

The model reach is 6.2km long extending from 300m downstream of the Railway bridge river crossing in Ballinasloe to 500m downstream of Pollboy Lock Gates (refer to Figure 9.10). Full details of the model and is set-up and calibration are available in the Flood Risk Assessment report of the Hill of Back, that accompanied planning permission for a hotel Development in 2005.

17.3.3.2 Design Flood Simulations

The design flows considered in this study are as follows:

1. 2 year return period flood event (median (50percentile) flood condition)
2. 100year return period flood event without C.C.
3. 100year return Period Flood Event with C.C.

Table 17.11 Model Boundary Conditions Specified in Hydraulic Simulations

Run	Description	Downstream Flood level m O.D.	Upstream Flow Rate (cumec)
1	2 year return period Flood event	35.3	99
2	100year return period flood event without C.C.	36.1	168
3	100year return Period Flood Event with C.C.	36.3	201

17.3.3.3 Hydraulic Results

The River Suck HEC-RAS hydraulic model was run in steady state mode for the boundary conditions specified above in Table 17.11. The computed longitudinal flood profiles for the three flood conditions are presented in Figure 17.12. The flood levels predicted in the river adjacent to the site are summarised below in Table 17.13 for Sections 10, 16 and 20 with Section 10 (the most upstream section) used to establish the flood risk to development.

Table 17.12 Flood Level Predictions In River Adjacent to site for Flood Simulation Events.

Flood Event	Estimated Flow Rate at Ballinasloe (cumec)	Computed Flood Level Section 20 m. O.D.	Computed Flood Level Section 16 m. O.D.	Computed Flood Level Section 10 m. O.D.
2yr Flood	99	37.05	37.16	37.27
100yr Flood without C.C.	168	38.11	38.22	38.32
100yr flood with C.C.	201	38.59	38.69	38.78

Refer to Figure 17.11 for model section locations in the vicinity of the subject site, Figure 17.12 for computed longitudinal flood profile and Figure 9.13 the computed flood inundation map of site and Hill of Back.

Model Sensitivity

Model simulations were carried out to investigate the effect of 10% and 20% increases in the 100year design flow (i.e. design flow of 201cumec increasing to 221 and 242cumec with a flood level downstream of Pollboy of 36.3m O.D.) as a result of possible error in the flow prediction. These increases in the 100year peak flow were found to increase flood levels in the river at the subject site (River Section 10) by 0.27m and 0.57m respectively.

A sensitivity analysis of the Manning's n was also carried out and this showed that for the 100year flow simulation an increase in roughness of 0.005 increases (15% increase in roughness) the flood level at the project site by 0.21m.

A 500mm increase in the downstream flood level at Pollboy from 36.3 to 36.8m O.D. Malin will only increase the flood level at the site (Section 10) by 0.09m for the 201cumec design flow.

The above analyses show the model predictions at the site to be reasonably robust and that the provision of a freeboard of 600mm on top of the predicted 100year flood level should protect against significant variations in roughness, downstream flood levels and flow rate.

17.3.4 Flood Risk to the Proposed Development

17.3.4.1 Discussion

The proposed minimum finish floor level for the development is to be set at 39.5m O.D. Malin. Such a floor level provides a freeboard of 1180mm over the predicted present day 100year flood level (without climate change) and 720mm freeboard over the design flood which includes a 20% climate change flow allowance.

The flood levels at the site are sensitive to the accuracy of the flow estimate with a 10% increase in flow rate increasing the flood level at the site by the order of 270mm and a 20% increase by 570mm. These relatively dramatic increases in upstream flood level is due to the limited capacity of the existing N6 road bridge and its approach channel.

The proposed minimum finish floor level of 39.5m O.D. provides a generous level of protection against flooding under extreme conditions. At the design flood of 201cumec (which includes climate change) a freeboard allowance of 720mm is available which represents for an additional flow rate of c. 30% to the design flow of 201cumec.

Freeboard is a design consideration quantified as an additional height above the computed / predicted flood level to account for the uncertainties in the hydraulic analysis. Minimum Freeboards of 0.3m are often adopted for low velocity channels in primarily rural areas. Freeboards of 0.5 to 0.75 are often used for other types of channel and flow conditions.

The proposed flood risk to the development has been minimised through the selection of a minimum finish floor level of 39.5m O.D. Malin. This finish level provides protection well in excess of the 100year flood event and includes the recommended provision against future climate change increases.

17.3.5 Low Flows and Water Quality in River Suck

17.3.5.1 Low Flows

The OPW in their hydrometric web site give a flow duration curve for the River Suck at Bellagill station as presented below. This duration curve give the 95 and 99% low flow rates of 2.6cumec and 1.72cumec respectively. Extrapolating to Ballinasloe using catchment areas gives low flow rates of 2.89 and 1.89 cumec respectively. The EPA low flow database gives a 98percentile low flow rate of 1.4cumec which when adjusted for Ballinasloe is 1.56cumec. The historical driest summer occurred in September 1976 and is recognised by the EPA as having a low flow return period of approximately 50years (98-percentile Dry Weather Flow) (McCarthaigh, 2002).

Table 17.13 Flow and water level duration data for River suck at Bellagill

GENERAL STATION DETAILS			
Station Name: Bellagill	Station No: 26007	Watercourse: Suck	NGR: M 841 346
Catchment Area (km^2): 1184	Catchment: Suck	Gauge Type: AR	Datum: Malin

SUMMARY HYDROMETRIC STATISTICS
Annual Average Rainfall (mm)[1]: 1050
Est'd Annual Losses (mm)[1]: 447
Mean Annual Flow (m^3/s): 25.202
(Data derived for the period 1972 to 2005)

STATION HISTORY
1952 to 2005
Period of Digitised Record: 1972 to 2003

DURATION PERCENTILES							
Flows equalled or exceeded for the given percentage of time (m^3/s) (Data derived for the period 1972 to 2005)							
1%	5%	10%	50%	80%	90%	95%	99%
87.1	71.2	58.4	17.9	5.85	3.64	2.6	1.72
Levels equalled or exceeded for the given percentage of time (mAOD Poolbeg) (Data derived for the period 1972 to 2003)							
1%	5%	10%	50%	80%	90%	95%	99%
39.81	39.59	39.4	38.44	38.11	38.03	37.98	37.9

The summer water level adjacent to the site at the OPW Pump intake point is typically 35.6 to 35.8m O.D. Malin.

17.3.5.1 River Quality

The EPA measure the chemical and biological status of the river at a number of monitoring stations along the River Suck and its various tributaries. The relevant stations to the subject site are Bellagill(26S071200), Ballinasloe Bridge (26S071300) and Pollboy (26S071400) The Q value and chemical results are available from the EPA web site for these stations. The Q value system describes the relationship between water quality and the macroinvertebrate community in numerical terms and is considered a reasonably robust method of evaluating water quality in a river system. Q5 waters have high diversity and considered of very good water quality, while Q1 have little or no macroinvertebrate diversity and bad water quality.

- Q4-5, Q5 high status
- Q4 good status
- Q3-4 moderate status
- Q2-3, Q3 poor status
- Q1, Q1-2, Q2 Bad status

Table 17.14 EPA Q Value Data for River Suck at Ballinasloe

Station	2002	2003	2004	2005
Bellagill -26S071200	4	-	-	4
Ballinasloe Br - 26S071300	4	-	-	3
Pollboy - 26S071400	3-4	-	-	3

The above Q value results indicate that Ballinasloe Town and environs is having a significant impact on the water quality in the river, even upstream of the WWTP outfall at Ballinasloe Bridge.

17.3.6 Local Site Drainage

The subject site has no natural drains, being founded on reasonably free draining sand and gravel glaciofluvial deposit. The site is a Hillock falling to the north, south and east with top elevations of 42m O.D. Malin decreasing to floodplain levels of 36.5m O.D. Malin. Lands below 37.0m O.D. Malin will flood regularly each winter.

Crossing from north to south is a pumped water supply pipeline which was installed recently by OPW / Waterways Ireland to supply the canal system at Canal Walk with dry weather flow from the River Suck during summer low flow periods. This supply will have to be maintained as the

canal system can dry out completely in the summer drought periods, thus impacting on the amenity value of the Canal Walk area.

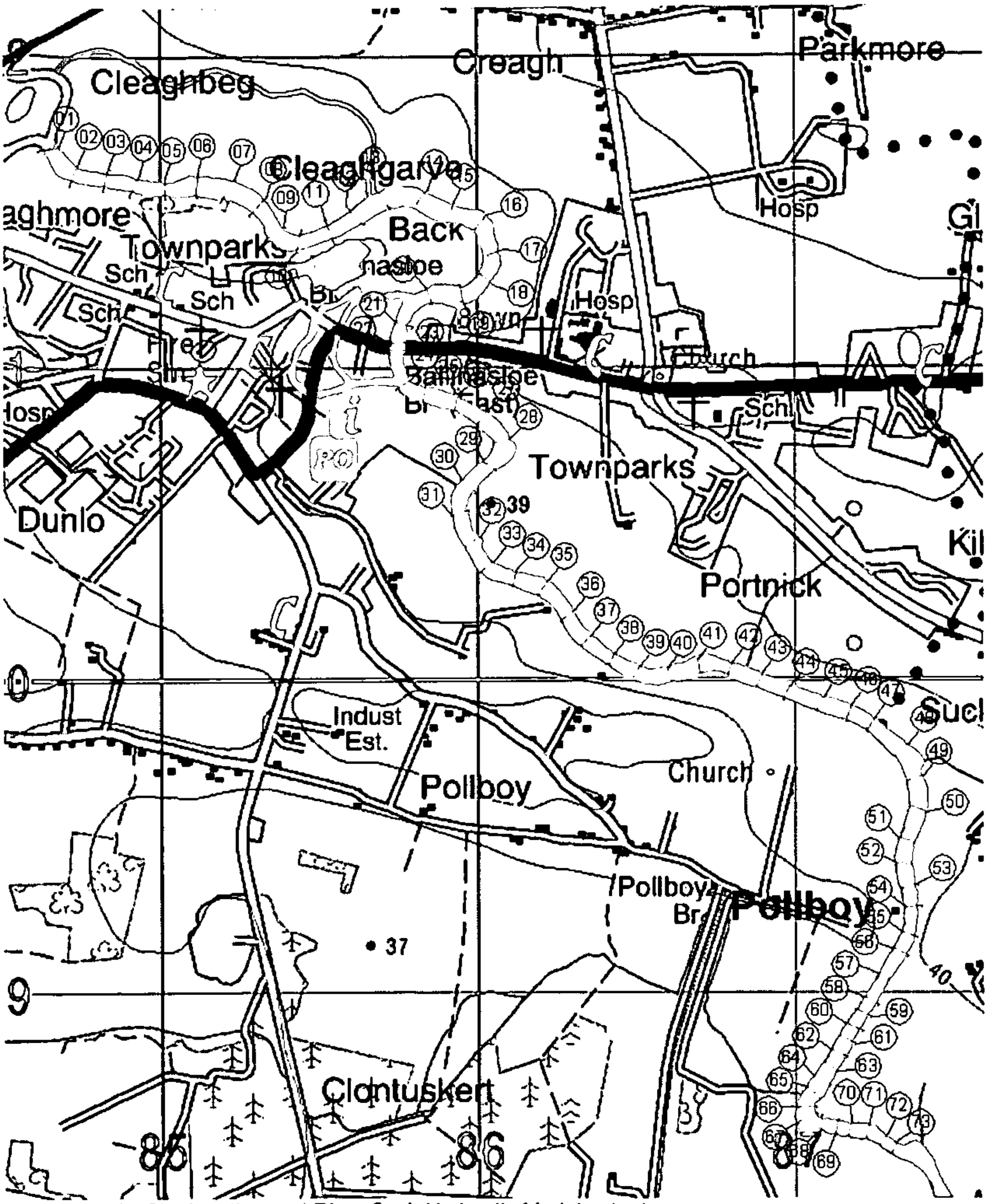


Figure 17.10 Site location and River Suck Hydraulic Model extent

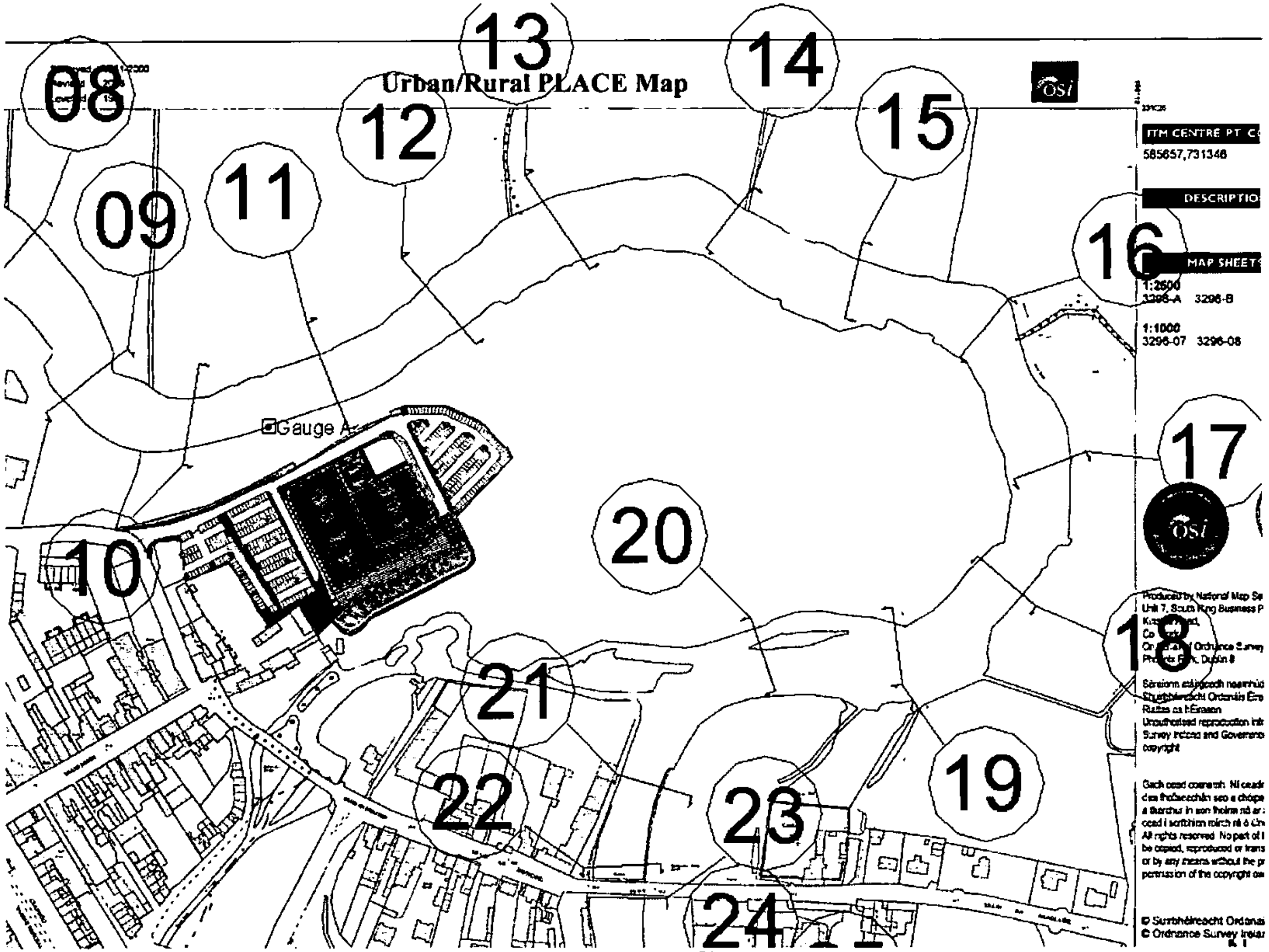


Figure 17.11 Location of Model River Sections adjacent to Proposed Site

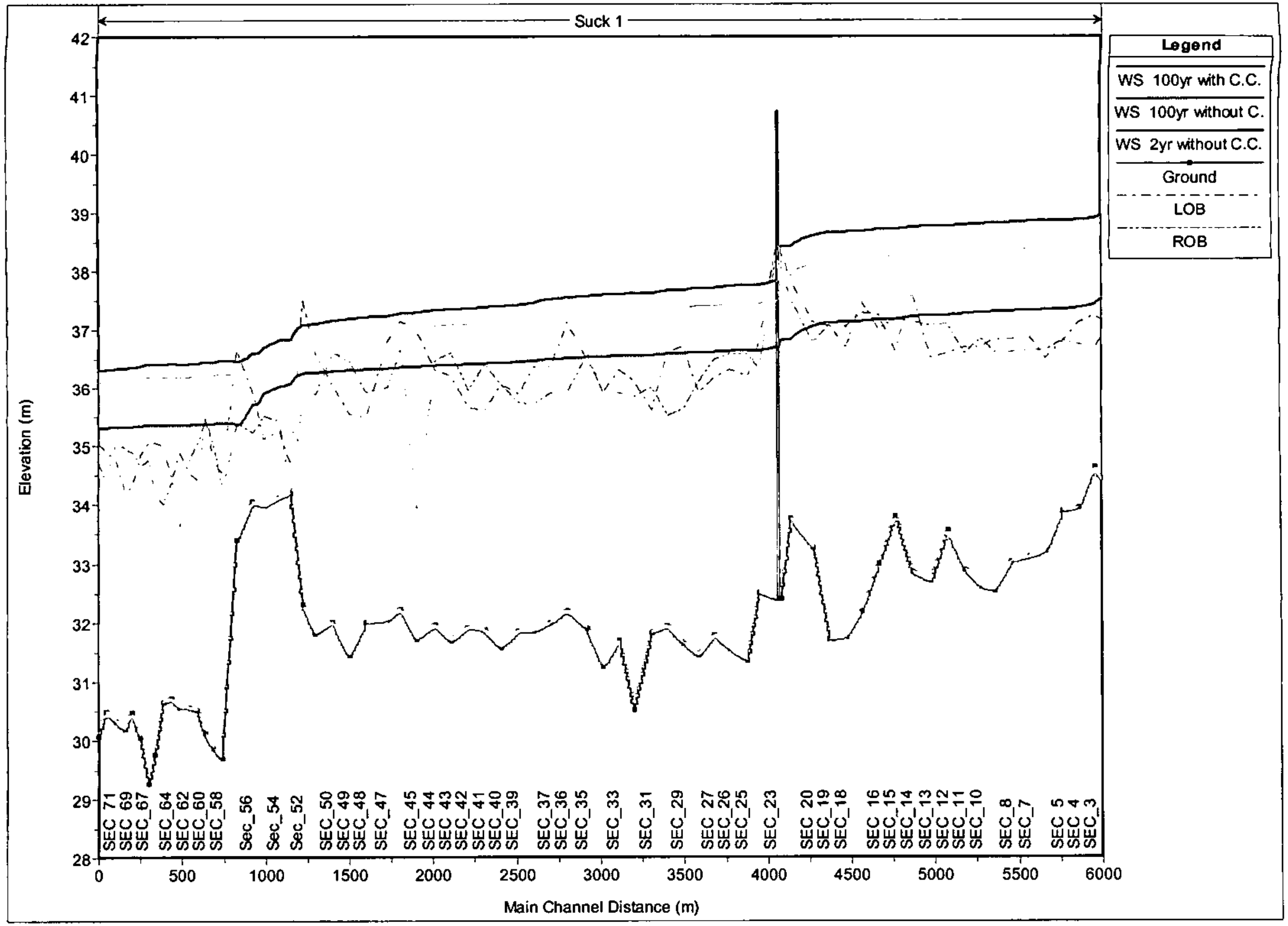


Figure 17.12 Computed Longitudinal Flood Profiles in Study Reach

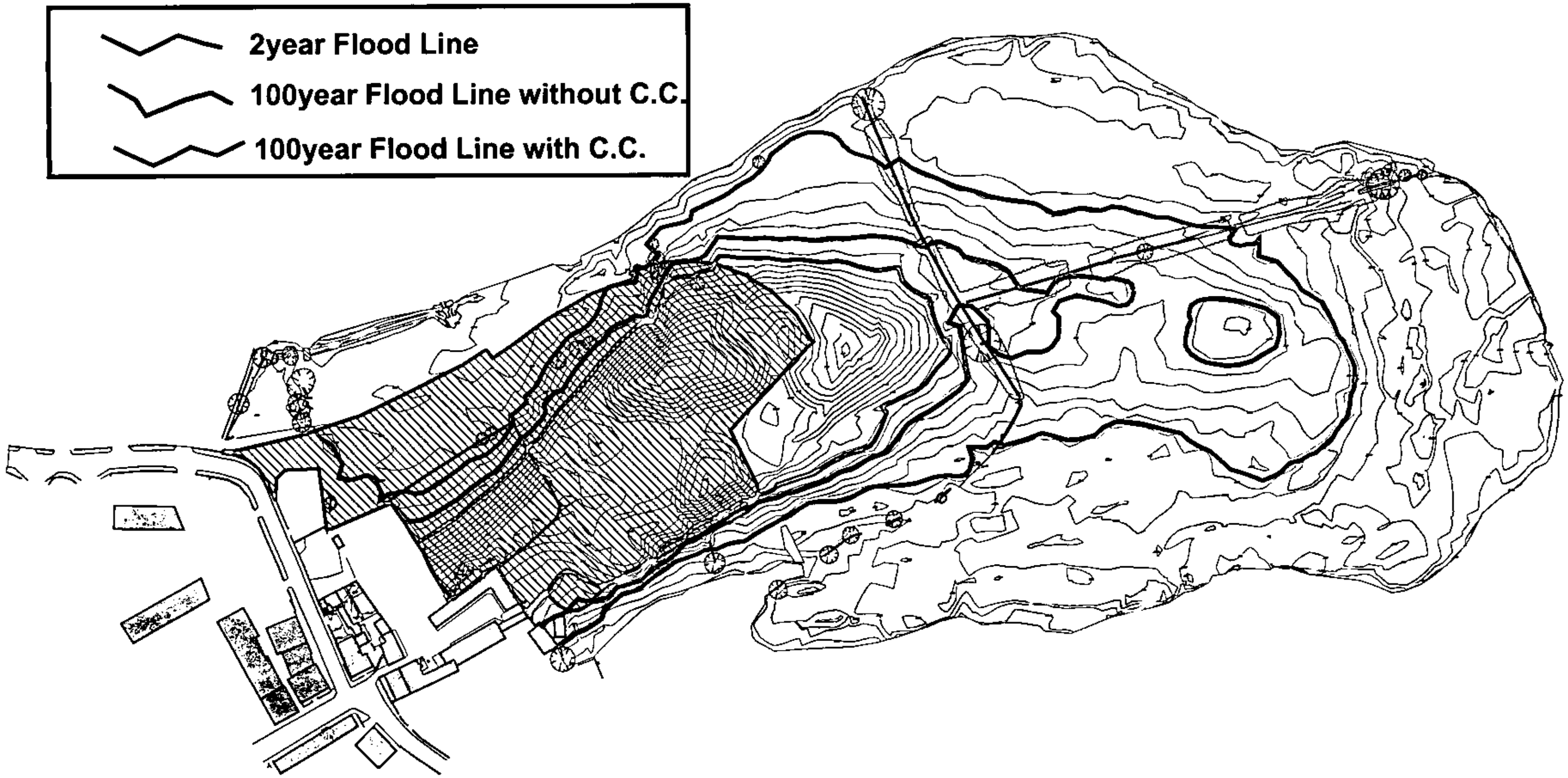


Figure 17.13 Flood Inundation Map of the Hill of Back including Development Site

Figure 17.14 Site Contour Map generated for flood storage loss calculations

17.3.6 Hydrogeology

17.3.6.1 Introduction

The hydrogeology of the development site was assessed by means of desk study of pertinent literature. This included available geological and hydrogeological information and maps from the Geological Survey of Ireland. Soils, subsoils and landuse information was obtained from the EPA environmental mapping web site which includes the Teagasc Soils Database and GIS mapping.

17.3.6.2 Bedrock Aquifer

The site and Ballinasloe town is underlain by Carboniferous Limestone bedrock of Visean Age, classified by the Geological Survey of Ireland as being a "Regionally Important Aquifer" that is karstified with conduit permeability (Rkc). To the east of Ballinasloe the bedrock is a Waulsortion Mudbank limestone and to the south the bedrock formation is an Argillaceous (muddy) "Calp" Limestone of Visean Age. Both formations are classified by the GSI as being Locally Important Aquifers (LI) which are moderately productive only in local Zones. There are no karst bedrock features on the site or within the vicinity of the site with bedrock on the site located at depth (possibly exceeding 8m). Figure 9.16 shows the bedrock geology and Figure 9.17 shows these aquifer locations relevant to the site.

17.3.6.3 Sub-soil Geology

The GSI and EPA have mapped the site subsoil using Teagasc data as being a localised deposit (Hill of Back) Limestone Sands and gravels . The surrounding town centre is on a limestone till consisting of sand and gravels with some clay. Some esker sand and gravels underlies small linear areas to the west and southeast of Ballinasloe town. The Subsoils in the Ballinasloe are presented in Figure 17.15.

17.3.6.4 Groundwater Flow and Levels

There are no borehole and groundwater monitoring data available for the site but given its proximity to the River Suck and free-draining nature of its sub-soils the water table level is likely to be strongly influenced by the river level which has a typical seasonal range from 34.5 to 37.5 m O.D. The flow direction is most probably from north to south with the general direction of the river and the upstream and downstream river levels dictating the gradient for groundwater flow.

17.3.6.5 Groundwater Vulnerability

The Geological Survey of Ireland guidelines given in their Groundwater Protection Schemes publication can be combined with site investigation data (geological and hydrogeological characteristics – primarily permeability and depth of overburden) to obtain appropriate vulnerability ratings for the underlying bedrock aquifer. Given that the bedrock is at depths possibly exceeding 8m, sub-soil is sandy and depth to watertable 3 to 4m, the general vulnerability of the site is considered to be high to moderate.

Interim classification has been carried out by the Geological Survey of Ireland for this region as presented in Figure 17.17. The site and surrounding region is given a classification of high to low Vulnerability based on only an interim study. Combining this rating with the aquifer classification as shown in the vulnerability matrix (Table 9.16) the full classification is Rk/H.

Table 17.15 Groundwater Protection Scheme vulnerability classification

Vulnerability Rating	HYDROGEOLOGICAL CONDITIONS				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat))	(Sand/gravel aquifers only)	(< 30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	n/a
High (H)	> 3.0m	3.0 – 10.0m	3.0 – 5.0m	> 3.0m	n/a
Moderate (M)	n/a	> 10.0m	5.0 – 10.0m	n/a	n/a
Low (L)	n/a	n/a	> 10.0m	n/a	n/a

Notes: n/a = not applicable.
Precise permeability values cannot be given at present.
Release point of contaminants is assumed to be 1-2m below ground surface.

Table 17.16 Vulnerability rating matrix

VULNERABILITY RATING	RESOURCE PROTECTION ZONES					
	Regionally Important Aquifers (R)		Locally Important Aquifers (L)		Poor Aquifers (P)	
	Rk	Rf/Rg	Lm/Lg	Ll	Pl	Pu
Extreme (E)	Rk/E	Rf/E	Lm/E	Ll/E	Pl/E	Pu/E
High (H)	Rk/H	Rf/H	Lm/H	Ll/H	Pl/H	Pu/H
Moderate (M)	Rk/M	Rf/M	Lm/M	Ll/M	Pl/M	Pu/M
Low (L)	Rk/L	Rf/L	Lm/L	Ll/L	Pl/L	Pu/L

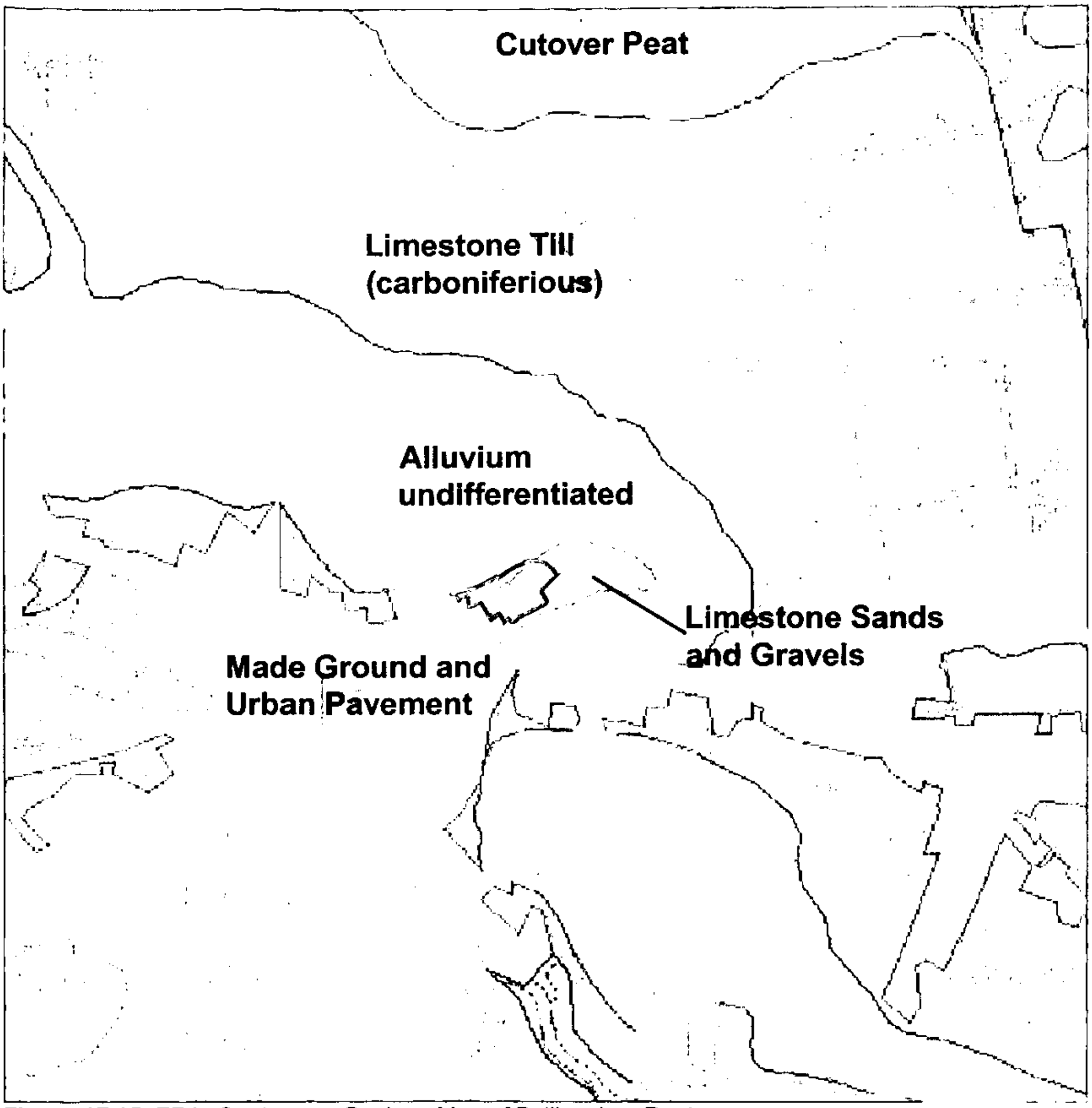


Figure 17.15 EPA Quaternary Geology Map of Ballinasloe Region

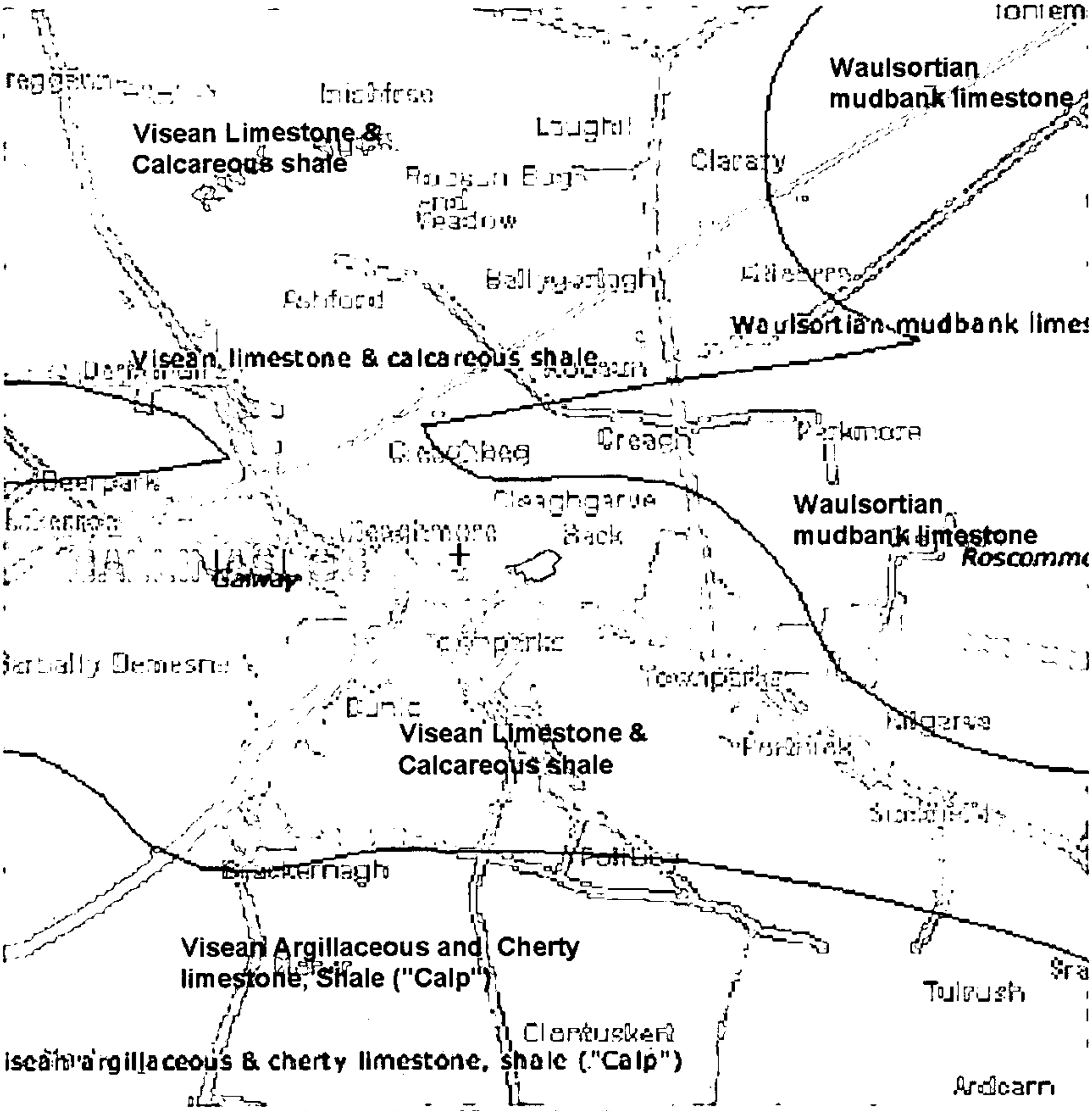


Figure 17.15 GSI Bedrock Geology Map of Ballinasloe Region

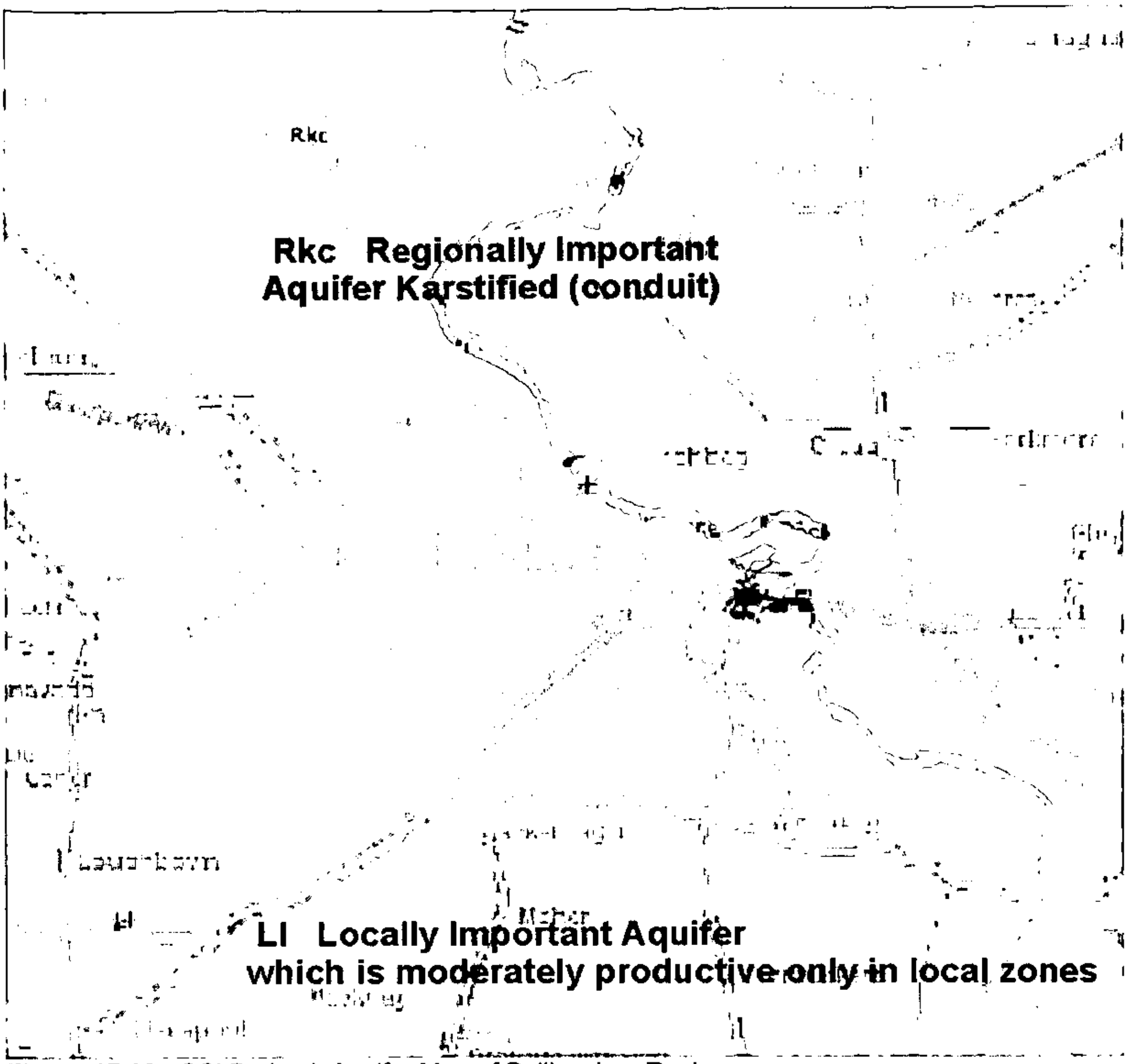


Figure 17.16: GSI Bedrock Aquifer Map of Ballinasloe Region

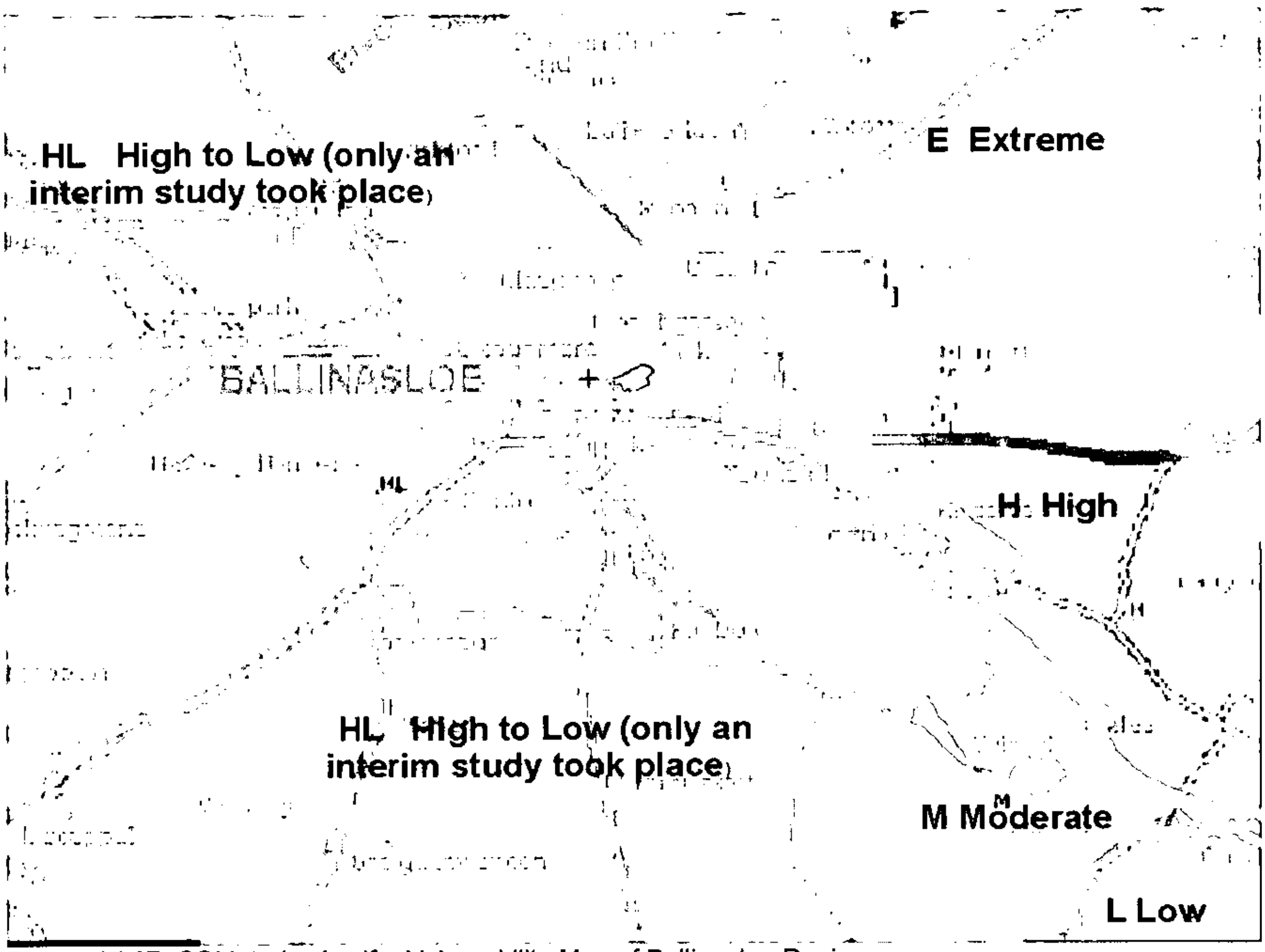


Figure 17.17 GSI Interim Aquifer Vulnerability Map of Ballinasloe Region

17.4 Potential Impacts and Mitigation

17.4.1 Surface Hydrology

17.4.1.1 Introduction

The potential hydrological impacts caused by the developments of this nature on the hydrological regime are outlined as follows:

- Impact on flood levels in rivers, drains and surrounding lands due to interference with channel and overbank conveyance
- Impact on flood levels in rivers and surrounding lands due to removal of flood storage as a result of infill
- Flood risk due to developing in / close to flood prone areas
- Increased flow rate in receiving river/stream/drain as a result of increased surface runoff from the developed site
- Impact of storm water runoff on receiving river water quality
- Constructional phase impacts

The proposed development is shown to encroach into the floodplain of the River Suck along the northern aspect of the site where the access road connecting the site to Bank Road is to be located, refer to Figure 9.18. A floodplain performs two functions: a conveyance function and a flood storage function which control flood levels.

17.4.1.2 Impact to Flood Conveyance

The conveyance section is that width of floodplain in which floodwaters are moving under the available hydraulic gradient. Such lands are important in respect to flood levels and any encroachment by infill development can result in increases in the upstream flood levels due to a reduction in flow width / flow area and the generation of local energy losses at the contraction and expansion of the river flow around such encroachments.

Depending on the topographical characteristics of the floodplain area the conveying width of the floodplain / overbanks is generally confined to the bank section closest to the river channel with the more remote floodplain lands being occupied by standing / pooled flood waters which are not conveying. The conveying section of a floodplain is often referred to as the active floodplain area.

To simulate the impact of the proposed access road and surrounding proposed infill on flood flow conveyance the hydraulic model simulations were carried out with and without overbank flow conveyance available between model sections 10, 11 and 12 (i.e. model sections adjacent to the Access Road and represents a generous allowance for the proposed infill footprint). This was achieved by using the ineffective flow width option in the HEC-RAS model. The simulation results for the 100year design flood show no discernable difference in flood levels adjoining or upstream of the development resulting from the removal of overbank conveyance at these sections. In reality the proposed development will not encroach right up to the channel bank leaving an overbank width at the tightest pinch point of 20m and generally the development footprint will be set back 30m or more.

Site visits by Hydro Environmental Ltd. during the flood events of the 10th January 2005 and the more recent December 2006 event showed no discernable overbank conveyance of flood waters at the proposed infill location.

It can be concluded based on sensitivity modelling of the overbank conveyance function at the site that the proposed encroachment of the low-lying section o will have negligible impact on flood flow conveyance in the river and thus on local flood levels. This represents an imperceptible impact on the flooding regime.

Proposed mitigation

The encroachment of the development into the floodplain area will have negligible effect on flood conveyance and thus no mitigation is proposed.

17.4.1.2 Loss of Flood Storage

Developments within a flood plain will result in the displacement of floodplain storage through infill. Reduction of floodplain storage if in significant amount can lead to reduced flood attenuation capacity and the subsequent increase in the downstream flood peak. The storage function of a floodplain allows a certain amount of water to be stored on the floodplain as the flood wave in the river passes downstream and releases it slowly back to the river with the receding / falling river stage. The significance of floodplain storage on reducing/dampening down the peak of the flood (i.e. flood attenuation) will depend on the flood storage volume available and the characteristics of the flood wave, (i.e. whether it is a rapidly rising flood wave or a dampened slow rising flood wave depending on the catchment characteristics). The River Suck flood hydrograph presented in Figure 9.1 is relatively sluggish given the large size of catchment area and thus requires vast flood storage lands to dampen the flood peak.

The proposed development footprint will remove 7,560m3 of flood storage at the predicted present day (without flood storage) 100year flood level of 38.32m O.D. Malin. This represents a loss in floodplain area of 0.76ha. At the median (2 year) flood level (37.3m O.D.) the flood storage loss will be 1540 m3 and represents a loss of floodplain area of 4180 m2.

The River Suck has a relatively sluggish response to rainfall with the flood hydrograph having a slow rise, a prolonged peak and a slower recession (refer to December 1999 recorded flood hydrograph at Bellagill shown in Figure 9.1). The existing 100year runoff rate for the catchment to Ballinasloe is of the order of 0.125cumec / km2 (or 1.25 l/s) which is quite low indicating a reasonably damped catchment with the river flood peak well attenuated by the time it reaches Ballinasloe.

It is estimated that the total flood plain area available from Pollboy Lock gates upstream to Bellagill is of the order of 4 to 5 km2 at the 100year flood level and is of similar magnitude downstream of Pollboy to Correen. The proposed development will remove 0.76ha of this flood plain which represents 0.08% of the estimated floodplain area between Bellagill and Correen This is a very small fraction of the overall storages particularly when considering the total flood plain area available downstream to Shannonbridge.

The loss of flood storage as a result of the proposed development is negligible in comparison to the flood volume flowing in the river. The characteristics of the River Suck flood hydrograph is a very gradual rise occurring over a number of days 3 to 4 days, a flat peak of approximately 2 days duration and gradual recession. The 100year flood at Ballinasloe will produce a flood peak of the order of 168cumec lasting for at least 24hours before slowly receding. One day at 168cumec produces a flood volume of 14.5mllion m3 this would fill the infill storage loss 2300 times over (0.05% of the 1 day volume). The computed flood storage loss of 7,560m3 would completely fill within 45seconds at a flow rate of 168cumec. During the December 1999 flood the flow rate exceed 120 cumec for close to 48 hours (refer to Figure 1) based on the Bellagill flood record.

In reality the majority of the site's storage will fill with the rising river stage well in advance of the arrival of the flood peak and consequently will no longer serve for flood peak attenuation once filled.

The December 1999 flood hydrograph at Bellagill was converted for Ballinasloe by multiplying it by the areal factor of 1.114 was routed through the hydraulic model, running it in its unsteady mode with and without the floodplain storage included. The model results showed no discernable difference in flood level or the computed flow hydrographs between the existing and proposed scenarios.

It can be concluded that the loss of 7560m3 of flood storage at the present day 100year flood level will have negligible impact on flood peak attenuation and thus on downstream flooding given the characteristics in terms of the scale and duration of the River Suck Flood Hydrograph, the attenuated nature of the flood hydrograph at Ballinasloe and the ample availability of floodplain storage between Bellagill and Shannonbridge.

Proposed mitigation

The loss of flood storage as a result of infill will have negligible effect on flooding and thus no mitigation is proposed.

17.4.1.3 Flood Risk to Development

The proposed development is located on and adjacent to flood prone lands, a portion of which (20%) is liable to flooding, primarily located on the north side of the site. A detailed Flood Risk Assessment study of the site which is supported by monitoring data and hydraulic modelling predicts a design flood level of 38.78m O.D. Malin which includes for a climate change allowance of 20%. Such a flood level would pre-development, inundate 0.98ha of the site area. Therefore a quantifiable flood risk is associated with developing the site which could potentially have a significant socio economic long-term impact and thus requires mitigation.

A proposed minimum finish floor level of 39.5m O.D. Malin will mitigate such a flood risk providing protection against river flooding well in excess of 100year return period.

17.4.1.4 Storm Flow Contribution

The conditions required to generate peak flood flow in the receiving river are winter wet antecedent conditions followed by a 24 hour duration extreme storm event. Such meteorological conditions are associated with winter depressional (cyclonic) precipitation.

The peak storm flows generated from the proposed development having a paved area of 2.4ha are produced by short duration storm events. The runoff rates and volumes for such events are presented in Table 17.17 for a 100year return period storm event. Short duration high intensity storms are associated with convectional precipitation events (i.e. summer thunderstorm events) and not with the depressional precipitation that is required to generate winter flooding in the river.

Table 17.17 Potential 100year Storm Runoff from 2.4ha Paved/Roof Area

Storm Duration (minutes)	Rainfall (mm)	Runoff Rate (cumec)	Runoff Volume (m3)
15	19	0.51	456
30	25	0.33	600
45	28	0.25	672
60	31	0.21	744

These short duration 100year storm flows should only be considered in isolation and not combined with the river flow as they are not produced by the same type of precipitation event. In isolation these storm peaks generated by the proposed development are easily accommodated within the river channel and will not produce overbank flooding at the site or in the downstream reaches.

For the majority of storm events the storm peak runoff from the site will have passed downstream well before the river flood peak arrives (which has a time to peak of approximately 18 to 24hrs to Ballinasloe) availing of the ample spare flow capacity in the river channel. The critical storm event in terms of potential flood impact is when both the river flood peak and the site storm runoff coincide. Typically a 24hour duration or greater storm event is required to facilitate such an event. Within such a storm event the rainfall pattern is generally not uniform and spikes of higher intensity for shorter durations can occur but will not be of the same order of magnitude as the thunderstorm downpours presented in the Table 9.17 above. With frontal depressions higher intensities have a tendency to occur near the start of the storm event with a tapering off of intensities towards the end of the storm.

The impact of the proposed stormwater discharge to the River Suck on flooding will be negligible given the difference in scale of the storm and river discharges and timing of the respective flood peaks. The provision of stormwater attenuation for the development will be of no benefit in respect to flooding in the River Suck and is therefore is not required for this particular site.

Surface water from the impervious surfaces (roof, roads and pathways, car parking, yards/driveways) will have the potential to impact the water quality of the receiving water by potentially introducing silt laden runoff waters and hydrocarbons from petrol and fuel oils spilt on the road and car parking surfaces. This impact during summer low flows is likely to produce a minor to moderate negative impact.

The stormwater system for the development will be designed with SUDs in mind so as to maximise the treatment efficiency of storm water collection system. It is proposed to attenuate the peak stormwater flows to a Greenfield runoff rate of 2l/s per ha notwithstanding the ample capacity available in the receiving water body to receive such flows.

This will be achieved through the use of petrol / oil separators upstream of the proposed storm outfall, a hydrobreak on the outfall to restrict flows to the river and the use of permeable pavements to store and infiltrate the collected surface water through the stone sub-strata and underlying free-draining sand and gravel subsoil. The permeable pavement and sub-strata have been designed to attenuate through storage the 100year storm event and discharge it in a controlled manner to the River Suck via a proposed outfall at a maximum outflow rate of 5l/s.

17.4.1.4 Impact of storm water runoff on receiving river and groundwater quality

The stormwater from the proposed development will for the majority of the runoff areas be infiltrated to ground beneath the permeable pavement areas. These areas will be allowed to overflow to the receiving water via an overflow pipe with a petrol interceptor. All surface waters from identified loading areas will be passed separately through a petrol interceptor and sediment grit removal prior to discharging to the river. Given the proposed treatment of storm water on site through use of natural sub-soil infiltration and petrol interceptor the potential impact on the receiving waters of the River Suck is considered to represent a local minor negative impact not requiring any further mitigation than that proposed above.

17.4.1.5 Constructional Impacts

Large construction sites such as housing developments if not properly managed can lead to significant impact on surface quality. The main source of contamination is suspended sediment in runoff waters from the work site and accidental spillage of liquid cement, fuel oils and lubricants from construction. These runoff waters if not adequately controlled could potentially impact negatively on the water quality of the nearby watercourse. The River Suck is an important amenity and fishery river requiring appropriate protection against constructional impacts .

The following identifies the main potential impacts that may be caused by the construction phase of the proposed development scheme.

- Silty/soiled water can arise from excavations, exposed ground, stockpiles of soil and excess material, plant and wheel washings, site roads and disturbance of drains and streambeds (i.e. in-drain construction of culverts and channel diversions/improvement works), topsoil placing and landscaping of fill embankments
- Liquid cement due to its high alkalinity and corrosive nature is highly polluting and in the past has given rise to major fish kills. The accidental spillage of oils and hydraulic fluids can have significant water quality consequences on watercourse and fisheries.
- Generation of soiled runoff waters through pumped dewatering of excavations particularly during the winter period

The constructional phase has the potential to locally pollute the underlying vulnerable aquifer through accidental spillages of fuel oils, diesel, liquid cement and other construction chemicals. This impact could represent a significant local long term impact.

During construction there will be a requirement in the winter months to protect the construction site form flood waters through either filling or bunding the flood prone section of the site.

Mitigation During Construction

Good site works practice in accordance to the NRA guideline, the Department of the Marine, Communication and Natural resources, CIRI and EPA guidelines should reduce such environmental impacts arising from large construction sites.

- National roads Authority (2000) – Design Manuals for Roads and Bridges
- CIRIA Report 142: Control of Pollution from Highway Discharges
- CIRIA Report C648: Control of water pollution from linear construction projects

The following mitigation measures should be implemented during the construction period.

- To avoid soil erosion during construction provision should be made for the protection of open soil surfaces from rainfall erosion. Appropriate stockpiling of topsoil material and aggregate/unconsolidated material heaps will minimise the surface area exposed to rainfall erosion. Such stockpiles and spoil heaps will be located well away from watercourses.
- It is essential to ensure the use of cement and wet concrete in or close to any watercourse is carefully controlled.
- A wheel wash system should be in place for all heavy construction vehicles so as to prevent excess sediment being carried out of the site and deposited on the public roads in the town.
- Foul drainage from temporary site offices and lavatories should be connected either directly to the nearby public foul sewer or removed from the site for suitable treatment and disposal.
- Storage of fuels and oils on-site should be situated on an impervious base protected by a bund. Refuelling of plant will be undertaken away from excavation areas and water courses in a designated bunded area. Any spillages will be immediately contained and appropriate clean-up operations implemented.
- A buffer area of existing vegetation should be retained alongside watercourses where possible and the site boundary fenced off .
- There should be no direct surface discharges from the works site to the nearby streams. Runoff will be diverted away from excavated areas; and sediment-laden wash down from aggregate heaps and dust control should be directed to and contained within a settlement area before being discharged to nearby watercourse.

17.4.2 Hydrogeology

17.4.2.1 Operational impacts

There may be a reduction in the quality of groundwater locally as a result of the proposed large permeable pavement area and the associated stormwater infiltration system located beneath the proposed surface car parking areas. During rainfall events, runoff from the road pavement that is likely to contain some degree of silt/dust and pollutants from atmospheric deposition, vehicle emission, litter and general road maintenance, as well as from possible accidental road spillage incidents will infiltrate into the underlying sub-soil and could potentially migrate to the groundwater. The potentially soiled areas associated with loading bay areas will be separated from the infiltration system and its surface water passed through a grit removal unit and a petrol interceptor after which it will gravity feed directly to the river.

Given that the underlying sub-soil is a sandy gravel of reasonable thickness, the particulate nature of the contaminants in the surface runoff and the fact that there are no nearby groundwater source protection schemes located in the Ballinasloe area the potential impact to the groundwater and the regionally important bedrock aquifer is considered to represents a slight local impact not requiring mitigation.

There are no proposed discharges directly to or abstractions from groundwater on the site with both foul and water supply to and from the public system.

Mitigation Measures

There are no mitigation measures proposed as the potential impact to groundwater quality from surface water infiltration is considered to represent a slight local impact.

17.4.2.2 Constructional impacts

Given the proposed formation levels for the development, the fact that foundations are to be piled, and the reasonably shallow depths of excavation to achieve formation level, dewatering of the watertable is unlikely to be an issue for the excavation works.

The potential risk of the leaching of concrete during the construction of bored piles is considered to be slight given the nature of the soils and subsoils present.

The removal of the overburden during construction will increase the vulnerability of the underlying aquifer. Where the depth above the underlying aquifer is reduced to less than 3m, an extreme vulnerability rating will result. Given the reasonably deep depth of subsoil overlying the bedrock aquifer such impacts are expected to be short term slight negative impacts. In the longer term the development will replace the overburden by putting in place landscaped grassed areas and impervious paved areas.

Groundwater will be potentially impacted by various activities involving spillages and leakages from construction plant and at refuelling and any storage depots located on site. These generally represent temporary to short-term, slight to moderate negative impacts.

Mitigation - Protection of Groundwater
Site clearing works and excavation of the formation level will reduce the protective soil cover, increasing the vulnerability of the underlying aquifers to pollution. As a reduction mitigation measure guidelines associated with the operation of constructional sites, designed to minimise adverse water quality and fisheries impacts (CIRIA 2001 and Dept of the Marine and Natural Resources, 1998), should be implemented.

Provision should be made for the protection of soil surfaces from rainfall erosion.

The use of cement and wet concrete in or close to any exposed excavation areas must be carefully controlled.

Storage of fuels, oils and chemicals if necessary on site should be situated on an impervious base protected by a bund. Refuelling of plant should be undertaken well away from excavation areas, and any spillages should immediately be contained on site and the contaminated soil removed from the site for suitable treatment and disposal.

Foul drainage from site offices and temporary lavatories should either be directly connected into the nearby public foul sewer or removed to a suitable treatment facility.

17.5 Residual Impacts

The long-term residual impacts arising from this development after mitigation are;

- An overall loss of flood storage to the River Suck as a result of raising the ground levels in a flood plain section on the north side of the site so as to accommodate a vehicular access road to the site. The impact of this flood storage loss on flood levels and flow rates in the River Suck will be imperceptible.
- There are no perceived long-term residual impacts to the hydrogeology which includes groundwater, soils and bedrock geology, arising from the proposed development.

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18.0 Material Assets – Retail Environment

18.1 Introduction

This section of the Environmental Impact Assessment comprises a qualitative and quantitative assessment of the trading characteristics of the proposed development and its likely effect on trading patterns in the surrounding area. In particular, consideration is given as to whether the proposed development would undermine the vitality and viability of existing stores within the catchment area. The proposed development is also fully assessed in the context of the relevant retail planning policy as set out below.

18.2 Planning Policy

Retail Planning Guidelines for Planning Authorities 2005

Retail planning policy at both national and sub-national level is shaped by the Retail Planning Guidelines (RPGs) for Planning Authorities published by the Department of the Environment and Local Government in December 2000 and amended in 2005. The aim of the Guidelines is to provide a comprehensive framework to assist planning authorities to prepare policies for incorporation in development plans, to assist the assessment of development proposals and to help retailers and developers in formulating development schemes.

There are five key policy objectives of the Retail Planning Guidelines. These are:

- Ensure plans incorporate clear retail policies and proposals for retail development;
- Facilitate a competitive and healthy environment for the retail industry;
- Promote forms of retailing that are easily accessible – i.e. public transport in a location, which encourages multi-purpose shopping and business and leisure trips on the same journey;
- Support the continuing role of the town centre as a preferred location for retail development;
- Establish a presumption against large retail centres located adjacent or close to existing or planned national roads/ motorways.
  (Retail Planning Guidelines 2005)

The Guidelines consist of four main strands. Namely:

- **General Policies and Objectives**: All Development Plans should contain clear policies and proposals for the development of retailing and these should reinforce the continuing role of urban centres as the preferred location of retail development.

- **The Retail Hierarchy**: Support for the consolidation and promotion of retail infrastructure is recommended across a range of centres extending from large-scale urban areas to local and village centres.

- **Retail Environment Health and Accessibility Checks**: Refer to the need to secure the viability and vitality of existing town centres. The promotion of sustainable forms of development that are easily accessible, particularly by public transport, is advocated to facilitate a healthy and competitive environment for the retail industry of the future.

- **Retail Strategy and Floor-Space Limits**: Sets out the required content of retail strategy in development plans. It also indicates methodologies for the preparation of retail strategies and criteria for the assessment of retail development proposals. Application of these methodologies and criteria

enables theoretical shopping population catchments to be identified for existing centres of population and facilitates forecasting of future requirements for additional retail space in the individual centres of population.

According to the Guidelines, four tiers of retail hierarchy can be identified in Ireland. The first tier is Metropolitan Dublin; the second tier includes Cork, Limerick, **Galway** and Waterford; the third tier cannot be precisely defined but includes Athlone, Carlow and Castlebar among a total of 33 towns some of which function as third tier towns to a greater extent than others. The fourth tier of the hierarchy comprises a large number of small towns in the 1,000 to 5,000 population category.

The Retail Planning Guidelines outline three core aspects which are to be evaluated when assessing a retail application i.e. location, size and impact.

Firstly the guidelines express that the preferred **location** for new retail development where practical and viable is within a town centre (or district/major village centre). Where it is not possible to provide the scale and form of development required on a town centre site then consideration may be given to an edge of centre site. Out of centre sites should only be considered where it is shown that there is no available town centre or edge of centre sites which are suitable, viable and available. This assessment of location is referred to as the sequential approach (paragraph 58-63).

Secondly the **size of the retail component** of a development is to be restricted. A cap of 3,000 sq m will apply to the total net retail sales space of superstores in the Republic of Ireland with the exception of the Greater Dublin Area where an allowance is made for an additional 500 sq m (paragraph 50-51). In this proposed retail development the supermarket component accounts for 2,800 sq. m. net floor area and thus meets the conditions set out in the Guidelines.

Thirdly a development is assessed in terms of the possible **impact** it will exert on the **vitality and viability** of the town/district/village centre and existing retail provision (paragraph 64-65). It is not the role of the Local Authority to restrict competition but the principals of proper planning and sustainable development include the promotion of healthy town centres. Where a proposed development will compromise this goal it should be rejected.

The RPGs encourage local planning authorities to accommodate additional retail development in a way that is efficient, equitable and sustainable. The guidance document reiterates that the optimum locations for new retail development should be accessible to all and of a scale and nature that still facilitates the continued prosperity of traditional city and town centres.

The Retail Guidelines expressly identify preferred locations for retail development. In summary, the preferred location is within a town, district or major village centre and only where such options are not possible can consideration be given to other locations removed from these areas. Determining how well a proposed or existing retail development meets this requirement, is called the *Sequential Test.*

Regional Planning Guidelines for the West Region

Ballinasloe, Tuam and Loughrea are identified as the principal towns in County Galway under the Regional Planning Guidelines.

For the purpose of the Regional Planning Guidelines, the West Region has been subdivided into zones. Each zone is identified by the policy requirements that are relevant to its present state of development. Ballinasloe is identified as being located in Zone F: Roscommon/East Galway. Zone F stretches from the Athlone outskirts Westwards to the Ballinasloe hinterland, North-westwards to the Tuam hinterland, Northwards to the Ballyhaunis hinterland and South-eastwards to the Roscommon hinterland.

Tuam is identified as the hub town in Zone F, while the key towns include Roscommon, **Ballinasloe**, Mountbellew, Ballyhaunis, Monksland (Athlone).

Section 6.7 states that:

> "*There is potential for a broad area of this zone stretching from the general Ballinasloe area to the greater Roscommon town area to benefit from and utilise the Athlone Gateway*";
>
> "*Potential exists for the promotion of economic development in this zone, such as through the promotion of enterprise parks and possible partnership arrangements to facilitate the further development of incubation units for start up businesses and enterprises*"; and
>
> "*Decentralisation will greatly benefit a number of towns in this zone, this gives them potential to achieve a higher level of critical mass for many developments*".

Section 6.2 states that:

> "*Decentralisation is to be welcomed and will have a positive impact on the region. For the towns now chosen the biggest impact will be in Roscommon Town, Claremorris and* ***Ballinasloe****. All of these towns have the capacity to cater for these developments. It will give extra impetus to their growth and will help them reach a higher level of critical mass, thus making them more attractive as higher order service and* ***retail locations***".

The government's decentralisation programme is by far the largest and most wide ranging in the history of the state, involving the relocation of 10,300 civil and public service jobs to 53 centres in 25 counties. For the first time, entire Departments will move their Headquarters from Dublin to various regional locations. The potential benefits of the programme are immense from the wide range of career opportunities created to the significant boost to the local economies.

Table 4 below, which has been extrapolated from section 6.2, indicates that the decentralisation process will create 110 no. new jobs in Ballinasloe Town.

Table 4: Decentralisation – Impact on Employment in Ballinasloe

TOWN	CURRENT POPULATION	NEW JOBS	POTENTIAL POPULATION ADDITION.
BALLINASLOE	5984	110	275

18.3 Galway City & County Retail Strategy

Following the publication of the Retail Planning Guidelines (2000) it was a requirement that Planning Authorities prepare Retail Strategies for their respective areas. Galway City Council and Galway County Council prepared a joint strategy. While the City Council adopted the Strategy, the County have not done so. The overall objective of the Retail Strategy is to investigate retail demand and provide strategic guidance on the location and scale of new retail developments in a way, which is in accordance with the RPGs and is "effective, equitable and sustainable".

Table 3.2 of the Galway Retail Strategy shows the breakdown of retail floorspace in the settlements outside of the City. The three major county towns of Ballinasloe, Tuam and Loughrea together control 54% of the entire retail floorspace recorded in the County (excluding the City). Ballinasloe has a relatively low percentage of floorspace for its population and has only 45% of its floorspace dedicated to comparison/bulky goods. Tuam has almost 70% of its retail floorspace dedicated to comparison/bulky goods.

This suggests that Ballinasloe may have a poor retail provision and that expenditure generated in the town and environs leaks elsewhere.

Section 4 of the Strategy outlines the results of a Shopper Survey conducted in Galway City and in the towns of Ballinasloe, Loughrea, Portumna, Clifden, Tuam, Gort and Oranmore. It notes that *"there was a higher significance of comparison shopping registered in Ballinasloe and Loughrea above the other County towns but this was still very low"*

Section 4 also states that "*Ballinasloe and Gort both registered a significant proportion of shoppers going outside of the county, 35% and 25% respectively. From this and anecdotal reporting it can be assumed that Athlone being only a 20 minutes drive from Ballinasloe is likely to be the main other attraction for Ballinasloe shoppers while using the same logic, Ennis is that for Gort*".

Figure 4.1 of the strategy outlines the result of the shopping survey in terms of the shopping environment of Galway City and each of the surveyed county towns. The strategy notes that "*a general lack of shops was a significant dislike associated with Ballinasloe and Gort*" and in terms of good features of the town "*in general Ballinasloe performs badly*".

The survey concludes that "*there is a notable dissatisfaction with facilities in Ballinasloe, particularly with regard to the range of shops, leisure/ entertainment facilities and other issues. The shopper survey shows that few shoppers visit restaurants/cafes/pubs in Ballinasloe, which may suggest a lesser development of these services rather than non-patronage of the existing facilities. Ballinasloe would also be the town, which has the greatest incidence of 'other' centres being visited*".

18.4 Galway County Development Plan 2003-2009

Section 2.6.2 of the Galway County Development Plan (CDP) 2003-2009 states that:

> "*Ballinasloe is the largest urban area in the County outside of Galway City and is strategically located on the Galway Dublin National Primary Route and the Galway Dublin railway line. The town has a significant service capacity and acts as a service hub for East Galway where it serves a substantial catchment. In addition it has the potential to benefit from its proximity to Athlone's growth as a regional gateway. Ballinasloe also has a newly developed I.D.A. Business and Technology Park*".

Sections 2.19 and 2.20 of the CDP refer to the Retail Planning Guidelines 2005 and Policy 24 states that it is the intention of the Council to:

> *"Recognise the principles established in the Retail Planning Guidelines for Planning Authorities, January 2005 as the primary basis for the control of future retail development. This will be augmented by the retail strategy, which the Council is preparing".*

18.5 Ballinasloe Development Plan 2003-2009

Ballinasloe is located 30.5 km west of Athlone and 67.5 km east of Galway City, 104 km north of Limerick and 152 km from Dublin. It is located on the N6 National Primary Route, which links Galway to Dublin. A network of regional and local roads, including the R358 and R355, further link the town to the north and south. The county border of Roscommon lies just 1 km from the town centre.

Section 1.2.3 states that:

> *"Ballinasloe has traditionally been an important urban centre serving a wide agricultural hinterland. Historically, it has been a social and trading focal point in east County Galway/west County Roscommon. Ballinasloe still retains an important sub-regional role regarding retail provision, community facilities*

(particularly education and health care) and employment. Both Athlone and Galway occupy higher positions in terms of retail hierarchy as they have larger populations with significantly larger catchment areas, they offer more variety, diversity and greater choice. This is true for all sectors of the economy (retail, industry, culture, tourism, education and employment) and even in the provision of community and recreation facilities".

Under the provisions of the Ballinasloe Development Plan 2003-2009 the majority of the subject lands are zoned C1 – Town Centre uses, *"To protect and provide for Town Centre Uses"*. A portion of the subject lands exceeds the existing boundaries of the existing town centre lands at this location and a material contravention of the current Ballinasloe Town Development Plan will be required in order to grant permission for the proposed development.

Section 2.3.1 states that:

"Ballinasloe has an important sub-regional role in terms of shopping in Galway and is the main urban centre in the east of the County. In order to maintain this role it is necessary to intensify land use in the established town core and continue to focus on meeting the needs of the expanding local population.

*An increase in the commuter population in Ballinasloe and the expansion of both Athlone and Galway has diminished the vitality and viability of the town's commercial core. Both Galway and Athlone occupy prominent positions in terms of regional retail importance and as a result Ballinasloe is not in a position to compete on a regional basis. **However, the town must increase the critical mass of it's shopping to maintain its current catchment population and strengthen its position within the region's retail hierarchical structure**".*

18.6 Current Role & Qualitative Assessment of Ballinasloe Town Centre

The range of commercial facilities available in the town generally provide for the day to day needs of the local catchment population with most people travelling to Athlone and Galway for higher order goods such as clothing, electrical and specialist goods. Section 2.3.1 of the Ballinasloe Development Plan states that *"There is approximately 39,000 square meters of commercial floorspace in the town providing a range of services from restaurants, pubs and hotels to clothes shops, general merchants, communications, hardware, convenience goods, etc"*. **Table 5** below, which has been extrapolated from the Development Plan, highlights a breakdown of the town's commercial services:

Table 5: Summary of Commercial Services in Ballinasloe

Category	***Total Net (sq. m.)***	***Total Gross (sq. m.)***
General Retail	8,108.25	17,479
Restaurants, pubs & Hotels	3,653.75	9,459
Supermarkets	4,628.50	6,681
Miscellaneous	2,204.05	3,652
Service Providers	505.50	922
Professionals	208.00	834
Total	**18,669.05**	**39,097**

The Ballinasloe Development Plan estimated that *"The total amount of convenience floorspace was approximately 6,681 sq. m. (gross) comprising a total of 7 no. stores. Tesco and Lidl are the largest convenience providers and account for 2,659 sq. m. and 1,225 sq. m. respectively. Together these stores represent a significant retail facility in the town and play a major role in securing the town's position as the premier shopping centre of the sub-region. The total floor area devoted to the sale of comparison goods*

is approximately 17,479 sq. m., the main component of which includes 17 no. clothes shops, 6 no. shoe shops, 6 no. electrical stores and 2 no. general merchants".

It is estimated that since 2003 (i.e. after the adoption of the Plan) there has been approximately 753 sq. m. of net convenience floorspace and 3,916.02 sq. m. of net comparison floorspace permitted within Ballinasloe. **Table 6** below illustrates the existing and permitted retail floor areas for Ballinasloe since the adoption of the Plan.

Table 6: Existing and Permitted Shopping and Service Space in Ballinasloe Town

Status of Floorarea	Retailing/Service Category	Net Retail Floor Area
Existing	Convenience	4,628.50
	Comparison	8,108.25
Permitted	Convenience	753
	Comparison	3,916.02
Total	**Convenience**	5,382
	Comparison	12,024

Section 2.3.1 of the Development Plan states that "*Ballinasloe has shown an increase in demand for comparison goods floorspace. This may be attributed to the current buoyant state of the national economy and the growing trend toward urbanisation. The demand for services and comparison goods are the first to rise with the expanding income and this tend is currently noticeable at national level where demand for comparison goods has grown by 6.9% a year. Demand for convenience goods has increased by 3.3% a year. Working studies[5] have shown that there is currently the capacity for additional 5,957 square meters of net commercial/retail capacity in the town between the year 2000 and 2006. It is important that the town achieves its commercial/retail capacity in the interest of preventing loss of commercial revenue to the surrounding larger urban centres of Galway and Athlone*".

The town's commercial activity has tended to shift towards the Relief Road in recent years with the completion of the Lidl discount foodstore. This coupled with the completion of the marina has resulted in the general expansion of the town centre in an easterly direction. Commercial development to the east of the town consists of Lidl and a number of small commercial units such as a butcher, a computer store and a hardware store. The Development Plan notes that the "*availability of parking facilities is ample in this area but due to poor pedestrian links to St. Michael's Square, it is not fully integrated into the town core*".

Overall the existing shopping/retail provision whilst having increased in recent years remains limited. Ballinasloe needs to exploit its potential and realise retail, commercial and local investment within the town if it is to evolve into a third tier settlement in the RPG's hierarchy and as a competitive centre in the west region. Most third tier level two towns have national supermarket chain representation and also significant comparison goods shopping.

The present provision for retail shopping in Ballinasloe is insufficient to meet current demand. The retail space is of a restricted style and size that provides for a more constrained choice. This would encourage potential local consumers to do their main shopping in alternative centres where provision is more varied and more attractive such as Athlone. An upgrading of retail provision is thus desirable.

[5] N.B.A. Working Paper on Retail Provision, November 2000.

18.6.1 Quantitative Impact Assessment

18.6.1.1 Retail Floor Area & Design Year

Under the guidance notes of the Retail Planning Guidelines 2005 it is only necessary for a Retail Impact Assessment to consider net retail floor area. Accordingly the gross and net retail floor areas proposed under the attached application are set out in **Table 7** below. As seen in **Table 7** the proposed development includes 2,800 sq. m. of net convenience floor space and 4,742[6] sq. m. of net comparison floor space and the quantitative assessment is therefore based on theses figures.

Table 7: Retail Floor Area Proposed Under This Application

Retail Unit	Gross Floor Area sq. m.	Net Floor Area sq. m.
Convenience Retail Area Anchor Store	2,800	2,800
Comparison Retail Area Anchor Store	1,850	1,850
Comparison Retail Units	3,615	2,892
Total convenience Floorspace	**2,800**	**2,800**
Total Comparison Floorspace	**5,465**	**4,742**

In Retail Impact Assessments a design year for the impact assessment requires to be set. This is taken as the assumed year that the pattern of trading will be established and is normally taken to be the first or second full year of trading. In setting the design year a number of assumptions have to be made:

- Timescale for securing full planning permission for the development;
- Planning and contracting of the construction phase;
- Completion if the development and all associated infrastructure; and
- In addition to the above occupiers may take up rented floorspace in a phased fashion.

The following assumptions have been made in setting a suitable design year:

- Securing planning permission will take 18 months;
- Planning and contracting construction phase will require 12 months; and
- Construction of the development and all associated infrastructure will demand 18 months.

This results in a 2012 design year being seen as suitable for this Retail Impact Assessment.

18.7 Sequential Test

In considering the location of new retail developments, the Retail Planning Guidelines 2005 introduces the principals of the sequential approach which promotes existing town centres as the preferred locations for retail developments. Under the sequential approach, a retail development should be located; firstly in a town or city centre (or district centre or large village centre); secondly on the edge of a centre and lastly, alternative out of centre sites should be considered only where it can be demonstrated that there are no suitable centre or edge of centre sites. The proposed development is to be located on a central site which is zoned for Town Centre Land Use as shown on **Map 01**. As such the proposed development will enhance and consolidate the retail provision in the town centre and add to its vitality and competitiveness.

As the proposal is located in a town centre location it is clearly compliant with the sequential test and while there are a number of other vacant sites within the town

[6] The net comparison floorspace for the comparison units is calculated at 80% of the Gross Floor Area in line with Industry Standards. The comparison floorspace for the Anchor Unit has been clearly indicated on the associated layout drawing.

centre these sites are a composition of smaller plots under wide ranging ownership. Problems and resulting delays associated with site acquisition and assembly would render a development at these locations unviable. The subject site is therefore the most optimal location for the proposed retail development, having regard to the site size requirements of the scheme and its town centre location.

The subject development will clearly enhance Ballinasloe Town Centre. The Retail Planning Guidelines have an objective that all retail developments should be located where they are readily accessible both by foot/cycle, public transport and by car (Section 24). The retail provision is close to existing residential areas and is accessible to residents and visitors of the town by sustainable means of transport. Therefore, the proposed development fully satisfies the Sequential Test.

18.7.1.1 Catchment Area

There are two distinct ways in which to calculate the catchment area of a proposed development in terms of retail and / or service provision. These are "The Gravity Model" and "The Theoretical Estimation Model".

The Gravity Model works on the basis of the relative weightings of centres of populations calculated by their size and distance from the centre in question. The Gravity model defines a trade area based on its attractiveness relative to other trade areas and provides an approximation of store trade area by putting the distribution of all locations (including competitors) into a geographical context and evaluating each location's relative attractiveness. The presence of large urban areas close to a study area can result in distorted and inaccurate results. By its very nature the model is conservative and restrictive.

The Theoretical Estimation Model can allow for greater flexibility as it deals with travel patterns and can allow for consideration of other issues such as quality of the road system and preferred routes. In some areas the Theoretical Estimation Model allows greater flexibility particularly with the presence of a very large centre of population. This model reflects a more factual representation as to the decisions taken by individuals in relation to distances that they are likely to make in meeting their regular shopping needs. However, it is important to note that the Theoretical Estimation Model does not take into account retail competition or the lack of retail provision outside the defined catchment area. In this regard the model can be viewed as somewhat narrow and restrictive. Using drivetimes only would significantly understate the realistic catchment population for retail provision in Ballinasloe Town.

This Retail Impact Assessment is based upon a hybrid catchment model which draws upon both of the primary models. The Retail Planning Guidelines do not specify which model to use in the formulation of a proposed catchment area for a Retail Impact Assessment. Similarly the Retail Strategy for Galway City & County gives no guidance on which model to use. The delineated catchment area is realistic for the town of Ballinasloe and has been adjusted accordingly to take account of settlements with existing retail provision in the wider catchment area such as Roscommon and Athlone.

The delineated catchment area selected encompasses a circa 20-25 minute isochrone surrounding Ballinasloe Town. The catchment area includes 53 Electoral Divisions (or parts of) as set out under **Table 8** (overleaf), would give a population of 31,503 persons for 2006. This catchment area is outlined in **Map 02** at the end of this chapter.

Ballinasloe is a reasonably vibrant town with high levels of pedestrian flows and low levels of vacancy. It has been designated a County Town in the Retail Study for Galway City and County 2002, and is identified on the second tier (county towns) of the retail hierarchy along with Tuam and Loughrea after Galway City.

Table 8: DED's in Catchment

Ballinasloe Retail Catchment Area							
ED	Proportion of ED in Catchment Area	2002	2002 Revised	2006	2006 Revised	# Increase 2002-2006	% Increase 2002-2006
Carrowreagh	1.00	446	446	468	468	22	4.9%
Creagh	1.00	1,060	1,060	1,084	1,084	24	2.3%
Ballydangan	1.00	623	623	653	653	30	4.8%
Culliagh	1.00	197	197	191	191	-6	-3.0%
Dysart	0.90	213	192	229	206	14	7.5%
Castlesampson	0.65	371	241	342	222	-19	-7.8%
Cloonburren	0.80	199	159	232	186	26	16.6%
Moore	0.45	266	120	311	140	20	16.9%
Taghmaconnell	0.90	268	241	254	229	-13	-5.2%
Thomastown	0.70	733	513	743	520	7	1.4%
Ahascragh	1.00	645	645	628	628	-17	-2.6%
Aughirn	1.00	546	546	573	573	27	4.9%
Clontuskert	1.00	427	427	447	447	20	4.7%
Kiltormer	1.00	605	605	574	574	-31	-5.1%
Kellysgrove	1.00	343	343	343	343	0	0.0%
Kylemore	1.00	177	177	172	172	-5	-2.8%
Lismanny	1.00	261	261	241	241	-20	-7.7%
Oatfield	1.00	363	363	412	412	49	13.5%
Killure	1.00	714	714	800	800	86	12.0%
Laurencetown	1.00	407	407	371	371	-36	-8.8%
Clonfert	0.90	427	384	447	402	18	4.7%
Eyrecourt	1.00	532	532	477	477	-55	-10.3%
Meelick	0.50	231	116	258	129	14	11.7%
Tiranascragh	0.50	164	82	170	85	3	3.7%
Kilquain	1.00	300	300	291	291	-9	-3.0%
Killimor	1.00	674	674	702	702	28	4.2%
Derrew	1.00	173	173	156	156	-17	-9.8%
Abbeygormacan	1.00	426	426	415	415	-11	-2.6%
Killoran	0.70	323	226	286	200	-26	-11.5%
Killallaghtan	1.00	418	418	432	432	14	3.3%
Killaan	1.00	524	524	520	520	-4	-0.8%
Kilconnell	1.00	674	674	680	680	6	0.9%
Ballymacward	0.50	288	144	319	160	16	10.8%
Annagh	0.80	340	272	343	274	2	0.9%
Clonbrock	1.00	499	499	505	505	6	1.2%
Taghboy	0.60	218	131	209	125	-5	-4.1%
Turrock	0.25	287	72	317	79	8	10.5%
Lorrha West	0.40	319	128	347	139	11	8.8%
Redwood	0.65	143	93	131	85	-8	-8.4%
Rathcabban	0.35	222	78	243	85	7	9.5%
Lusmagh	0.85	459	390	506	430	40	10.2%
Banagher	0.25	1789	447	1950	488	40	9.0%
Shannonharbour	0.15	329	49	321	48	-1	-2.4%
Kilmacshane	0.90	202	182	230	207	25	13.9%
Huntston	0.95	372	353	369	351	-3	-0.8%
Shannonbridge	1.00	329	329	321	321	-8	-2.4%
Lumcloon	0.45	395	178	368	166	-12	-6.8%
Hinds	0.10	281	28	291	29	1	3.6%
Clonmacnoise	0.70	316	221	321	225	4	1.6%
Crannagh	0.20	1058	212	1148	230	18	8.5%
Drumlosh	1.00	304	304	319	319	15	4.9%
Ballinasloe Urban	1.00	5,984	5,984	6049	6,049	65	1.1%
Ballinasloe No. 1 rural area	1.00	8,169	8,169	8,240	8,240	71	0.9%
Total		36033	31,071	36,749	31,503	432	1.4%

Since the population of the catchment area is increasing, it becomes more important for future convenience, comparison and bulky goods shopping needs to be met. Improvement and enlargement of Ballinasloe's retail offer will encourage more sustainable shopping patterns. Whilst the town appears to be both vital and viable it has inadequate retail floorspace to address its future needs or population increases.

18.7.1.2 Population Projections

Current Regional Population Distribution is outlined under section 2.4.6 of the National Spatial Strategy (NSS). The population of the Western Region was predicted to reach 380,000 persons in 2002 from 352,000 in 1996 of which 36% was located in Galway City and its hinterland. The Western Region is targeted to accommodate 445,000 persons by 2020 and it is hoped that Galway City and its hinterland will have the capacity to accommodate 180,000 of these people (40.4%).

Since the publication of the NSS these population projections have been proven to be overly restrictive as they are derived from a national population of 4.4m in 2020 whereas it appears national population will surpass 5m in 2020.

Hughes[7] addresses the population projections used in the development of the National Spatial Strategy (NSS) which in turn informed estimates in most county development plans and the projected needs for housing requirements in county housing strategies. He states that the current spatial plans are based on population projections which used the *"defective compound growth rate of only 0.7% per annum where as since 2001 Ireland's population growth continues to accelerate beyond the 1.6% per annum compound mark"*. The NSS projections would put Ireland's population at 4.7million persons by 2021, whereas the current CSO projections are looking at a national population of 5.07 million. Growth peaks are likely to be most prevalent in urban areas.

The publication by the CSO of the "Population and Labour Force Projections 2006-2036", indicate that significant population growth is currently taking place and that this trend is likely to persist for some time to come. These figures revise previous population estimations by the CSO in 1999, and new projections are based on these revised figures, growth trends from the 2002 Census of Population, and trends on subsequent birth rates, death rates and migration rates. In fact a more realistic growth rate for the Western Region is now assumed to be 1.7% per annum ("Population and Labour Force Projections 2006-2036", CSO).

In spring of 2005 in their Quarterly Economic Commentary the ESRI upped their estimated economic growth to 5.7% for 2005 and 5.5% for 2006 with relatively low rates of inflation and unemployment. In FÁS' Quarterly Labour market Commentary they further state that the Irish labour market "will have to rely partially on immigration from the new member States to fill the job opportunities that are projected for this year" (p 2). This is likely to impact on the housing markets in a wide range of urban areas throughout the country including Ballinasloe. This level of demand growth is likely to increase the need for additional service provision in the retail sector and it is likely to increase significantly the quantity of money available for expenditure on retailing activities.

For the purpose of projecting the catchment population to the 2010 design year both past and County Council population trends are used. Ballinasloe Town and the remainder of the catchment area are calculated at different rates and both a high and low population projection scenario are presented.

Low Growth Rate:
The Low Growth Rate utilised in this RIS is a straight line population projection based on the past trend population growth over the last number of years. A Low Growth Rate

[7] Paper delivered by Brian Hughes of the Dublin Institute of Technology to the Forum for Irish Urban Studies in TCD in January 2004 and updated in June 2005

is considered in order to provide an impartial analysis; hence a more conservative population growth is considered as well as a High Growth Rate.

The population of the retail catchment area has increased by 1.4% in the 4 years to 2006 representing a growth of 0.35% per annum. Using a straight line population projection based on the Past Growth rate of 0.35% results in an estimated 32,170 persons within the catchment area by 2012 (see **Table 9** below).

Table 9: Past Growth Rate Projected to 2011

Past Growth Rate	
2006	31,503
2007	31,613
2008	31,724
2009	31,835
2010	31,946
2011	32,058
2012	32,170

High Growth Rate:
The High Growth Rate utilised in this RIS takes into account the Settlement Strategy Population Projections for Ballinasloe contained in the CDP. Ballinasloe is identified as a satellite town/service hub on the 1st tier of the Ballinasloe Electoral Area Settlement Hierarchy. Under the provisions of the CDP Settlement Strategy Ballinasloe has been allocated 450 dwelling units from 2003-2009.

Policy 18 of the Plan states that:

> *"In order to control the scale of the development a deviation in the allocated population of up to 30% will generally be acceptable, between 30% and 50% will be assessed in the context of the group of settlements and the growth experienced by each, over 50% generally will not be accepted. Regard will also be had to the rate of growth in each settlement".*

Based on this policy a total of 675 dwelling units could theoretically be granted in Ballinasloe from 2003-2009. According to the CSO's[8] Census 2006 the average number of persons per household in rural County Galway is 2.98 persons. Calculating the predicted population growth of Ballinasloe at 2.98 persons per dwelling would result in 2,011 persons within the catchment in addition to the straight line population projection.

The rural catchment population is then projected forward using a straight line population projection of 0.35% per anum (i.e. the rural catchment growth rate takes into account the rural catchment area only excluding Ballinasloe Town), which results in a population of 32,170 persons. **Table 10**, below, illustrates that using the High Growth Rate projection results in an estimated 34,181 persons within the catchment area by 2012.

[8] CSO stands for Central Statistics Office.

Table 10: High Growth Rate

Settlement Strategy Population Projection		
	Ballinasloe Urban	Rural Catchment
2006		31,503
2007		31,613
2008		31,724
2009	2011	31,835
2010		31,946
2011		32,058
2012		32,170
Total		34,181

18.8 Expenditure Available Within the Catchment Area

Based on the Galway City Retail Strategy convenience expenditure per head within the County was €2,503 in 2001 and comparison expenditure was €2,614. These rates of expenditure were expected to increase by 0.69% and 4.58% per annum respectively as outlined in table 6.7 of the Galway City and County Retail Strategy. This results in €2,699.67 convenience expenditure per head and €4,278.00 comparison expenditure per head by 2012 as seen in **Table 11** below.

Table 11: Expenditure per Head for County Galway

Ex/head Co Galway	Year	Convenience Ex	Comparison Ex
	2001	€2,503.00	€2,614.00
0.69=Convenience Growth Rate	2002	€2,520.27	€2,733.72
4.58=Comparison Growth Rate	2003	€2,537.66	€2,858.93
	2004	€2,555.17	€2,989.86
	2005	€2,572.80	€3,126.80
	2006	€2,590.55	€3,270.01
	2007	€2,608.43	€3,419.77
	2008	€2,626.43	€3,576.40
	2009	€2,644.55	€3,740.20
	2010	€2,662.80	€3,911.50
	2011	€2,681.17	€4,090.65
	2012	€2,699.67	€4,278.00

In order to estimate the total available expenditure within the catchment the population is multiplied by the expenditure per head as seen in **Table 12** and **Table 13** below. The resulting total available expenditure ranges from €86.89m to €92.06m for convenience goods and €137.70m to €145.88m for comparison depending on which population trend is employed. In this regard it is considered that it is reasonable to assume that Ballinasloe will grow in line with the Settlement Strategy figures and in all likelihood it will actually surpass these figures.

Table 12: Total Convenience Expenditure within the catchment area at 2011

Convenience Goods	Catchment Population 2012	Expenditure per Head at 2012	Total Available Expenditure at 2012
Past Growth Rate	32,170	€2,699.67	€86,891,579
Settlement Strategy Growth Rate	34,181	€2,699.67	€92,061,447

Table 13: Total Comparison Expenditure within the catchment area at 2011

Comparison Goods	Catchment Population 2011	Expenditure per Head at 2011	Total Available Expenditure at 2010
Past Growth Rate	32,170	€4,278.00	€137,691,708
Settlement Strategy Growth Rate	34,181	€4,278.00	€145,884,078

18.9 Turnover of Existing Stores

Turnover figures per square meter of retail floorspace for the GTPS area of County Galway are outlined under table 6.8 of the Galway City Retail Strategy. These are estimated to have been €10,251 per sq. m. of convenience retail floorspace in 2002 and €4,100 for each sq. m. of pure comparison trading. The strategy forwards that these rates will increase by 0.5% per annum (convenience) and 1% per annum (comparison) to 2012. As seen in T**able 14** below turnover for 2012 is extrapolated to be €10,775 (convenience) and €4,529 (comparison).

Table 14: Turnover per sq. m.

Convenience Turnover /sqm		Comparison Turnover/sqm	
2002	€10,251	2002	€4,100
2003	€10,302	2003	€4,141
2004	€10,354	2004	€4,182
2005	€10,406	2005	€4,224
2006	€10,458	2006	€4,266
2007	€10,510	2007	€4,309
2008	€10,562	2008	€4,352
2009	€10,615	2009	€4,396
2010	€10,668	2010	€4,440
2011	€10,722	2011	€4,484
2012	€10,775	2012	€4,529

In order to calculate the turnover per sq. m. of the existing stores two different calculations are used. Firstly it is assumed that the stores in operation prior to 2002 are generally of an older format and are not likely to have increased the floorspace efficiency in line with newer modern format stores. Therefore these stores are most likely currently retailing at 2002 levels. However the floorspace permitted after 2002 is calculated at 2012 turnover levels as these stores will in all likelihood increase their efficiency levels up to the 2012 design year. **Table 15** below, illustrates the total turnover of both stores in operation prior to 2002 and stores permitted after 2002 (see section 6.3.3 for further details).

Table 15: Total Turnover of Existing Stores

Type of Goods	Time at which store came into operation	Existing Net Retail Floorspace	Turnover/ sq m € at 2012	Turnover € at 2012
Convenience Goods	Stores in operation pre 2002	4,629	€10,251	€47,451,879
Comparison Goods		8,108	€4,100	€33,242,800
Convenience Goods	Stores operating/permitted post 2002	753	€10,775	€8,113,575
Comparison Goods		3,916	€4,529	€17,735,564

The total turnover of the existing stores is approximately €55.57m convenience and €50.98m comparison.

18.10 Turnover of the Proposed Development

The turnover of the proposed development can be calculated in a similar manner. As seen in **Table 16**, below, the proposed development has a net floor area of 2,800 sq. m. convenience and 4,927 sq. m. comparison and will retail approximately €30.17m in convenience goods and €21.47m in comparison goods by 2012.

Table 16: Turnover of the Proposed Development

Retail Type	Proposed net Retail Floorspace	Turnover/ sq m € at 2012	Total Turnover € at 2012
Convenience Goods	2,800	€10,775	€30,170,665
Comparison Goods	4,742	€4,529	€21,476,518

18.11 Trade Impact

Table 16 and **Table 17**, below, set out the predicted trade diversion from the existing stores within the catchment to the proposed development in the 2011 design year. As the increase in available and surplus expenditure within the catchment area will exceed the turnover of the proposed development by 2012 there will be no immediate or long term impact on the trading patterns of existing/permitted facilities within the area. This statement applies regardless of whether the high or low population projection actually occurs. It is expected that Ballinasloe will surpass the Settlement Strategy housing allocation and as such it is considered that the High Population Trend/Growth Rate is the most appropriate figures for assessing the impact that the proposed development will have.

Table 16: Convenience Impact at 2012

Convenience Impact 2012	Past Growth Rate	Settlement Strategy Growth Rate
Available Expenditure	€86,891,579	€ 92,061,447
Turnover within catchment	€ 55,565,454	€ 55,565,454
Residual Expenditure	€ 31,326,125	€ 36,495,993
Turnover of proposed development	€ 30,170,665	€ 30,170,665
Residual Expenditure	€ 1,155,460	€ 6,325,328
Diversion from catchment area	€ 0	€ 0
Impact	€ 0	€ 0

Table 17: Comparison Impact at 2012

Comparison Impact 2012	Past Growth Rate	Settlement Strategy Growth Rate
Available Expenditure	€137,691,708	€145,884,078
Turnover within catchment	€50,978,364	€50,978,364
Residual Expenditure	€86,713,344	€94,905,714
Turnover of proposed development	€21,476,518	€21,476,518
Residual Expenditure	€65,236,826	€73,429,196
Diversion from catchment area	€0	€0
Impact	€0	€0

18.12 Trade Draw and Market Share

Trade Draw is defined in the Retail Planning Guidelines as an *"estimation of the quantum of consumer retail spending available in the catchment area which will be diverted from the existing centres to the new retail development; this assessment usually highlights the diversion of expenditure by zone within the catchment area".* Essentially trade draw is the amount of trade within a catchment area that will be attracted to the proposed development. It is assumed that 100% of the turnover of the proposed development will be drawn from the catchment area. However this trade will not be diverted from existing centres within the catchment but it will claw back expenditure which is currently leaking from the catchment area.

Market Share is defined as *"an aggregation of the zonal diversions from each centre to the new development to provide an estimate of trade diversion; trade diversion is then expressed as a proportion of a centres turnover at the target year to provide a measure of impact".* The convenience element of the proposed development will command a market share between 34.72% and 32.77% depending on which growth rate actually occurs. The comparison market share will range between 15.60% and 14.72%.

Table 18: Convenience Trade Draw and Market Share

Convenience Catchment Share 2011	Trade Draw	Turnover of Proposed Development €	Available Expenditure €	Market %
Past Growth Rate	100%	€30,170,665	€86,891,579	34.72%
Settlement Strategy Growth Rate	100%	€30,170,665	€92,061,447	32.77%

Table 19: Comparison Trade Draw and Market Share

Comparison Catchment Share 2011	Trade Draw	Turnover of Proposed Development €	Available Expenditure €	Market %
Past Growth Rate	100%	€21,476,518	€137,691,708	15.60%
Settlement Strategy Growth Rate	100%	€21,476,518.00	€145,884,078	14.72%

Impact

The proposed retail development satisfies the requirements of the Retail Planning Guidelines 2005, the Galway County Development Plan 2003-2009 and the Policies and Objectives set out in the Ballinasloe Development Plan.

The Local Government (Planning and Development) General Policy Directive 1998 indicates that the retail sales area of all supermarkets (outside the Greater Dublin Area) should be less than 3,000 sq. metres. In this retail development the total supermarket component accounts for a total 2,800 sq. m net floor area and thus meets with the conditions set out by the Directive.

The Directive and Retail Planning Guidelines also apply to all retail developments that would represent a substantial addition to existing retail facilities and indicate that such development should be guided by specified criteria. A number of these are considered below.

A. **Adequacy of existing shopping outlets in the area:**
As outlined under this report there will be a shortfall of retail space available in Ballinasloe by 2012. Retail provision at present is inadequate for current need. Additional retail provision is required to offset this shortfall.

B. ***Size and location of existing centres:***
Retail units in Ballinasloe tend to be small, with a few exceptions such as Tesco and Lidl. The proposed retail development in this RIA will improve the viability and vitality of the town centre and will help to consolidate the development of a sustainable commercial core. The supermarket is not excessive in size and its location along with other retail units will provide a strong shopping centre adjacent to the local community. This development will not negatively impact on the vitality or viability of Ballinasloe but will reverse the outflow of expenditure to Galway City and create beneficial synergies with the existing stores.

C. ***Quality and convenience of existing outlets:***
The lack of and restrictive nature of retail provision at present in Ballinasloe would ensure that a considerable leakage of retail spend seeps out of the catchment area to other areas and particularly to

Athlone Town. This proposal will help to reverse this leakage and bring a greater spend into the Village.

D. **Effect on existing communities:**
The present poor provision of retail facilities in the Ballinasloe catchment area results in many local people having to travel longer distances than necessary to do their weekly and daily shopping. Considerable seepage of expenditure is presently going to Athlone Town and Galway City.

The proposed development will reverse this trend and facilitate local people do their shopping in a more convenient place. It will have no adverse impact on the Athlone Town market. Other centres around the region are already prospering in their own right and will not be adversely impacted by the development of new retail provision in Ballinasloe.

E. **Needs of people dependent on the availability of retail shopping outlets within walking distance:**

The proposed retail development is adjacent to the established centre of Ballinasloe and has been designated for town centre development. It is walkable from most parts of the town in a five minute time period. The granting of this retail planning proposal would be of significant advantage to the retail sector and most importantly to the consumer. The proposal will lead to a higher degree of self-sufficiency for Ballinasloe.

F. **Countering urban decline by promoting urban renewal and best use of existing resources in the urban area:**

A modern multifunctional space will be provided that will include a number of retail units – both small and medium sized, offices and 36 no. residential units. This development will be located within the Town Centre of Ballinasloe and will enhance the urban setting by providing a vibrant, multifunctional mixed use development.

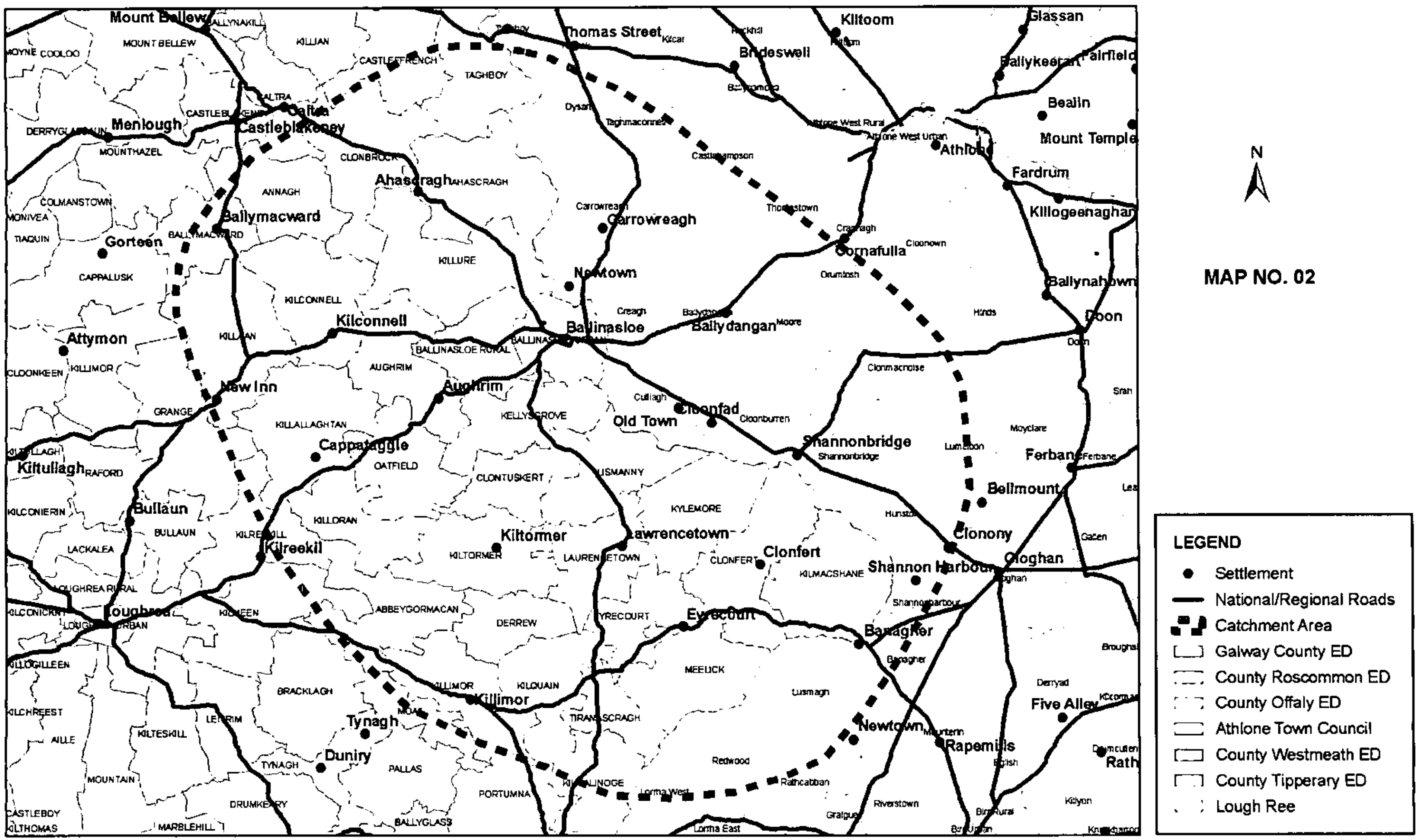
This Retail Impact Assessment has clearly demonstrated that the proposed retail development can be accommodated within the catchment area with no detrimental impacts on the existing centres.

Mitigation

There will be no negative impacts on existing retail facilities as a result of the proposed development and so no mitigation measures are required.

Ballinasloe Catchment Area

Retail Impact Statement



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Prepared 02.10.2007 - GIS Section, AP McCarthy Planning Consultants Ltd., Galway - www.apmccarthy.ie

19.0 Interaction Of The Foregoing

Flora/Landscape

19.1 The development of the site will not have an adverse ecological impact subject to appropriate monitoring. The retention of riverside areas as amenity lands will contribute to the value of the lands as amenity spaces.

Human Beings/Air Quality

19.2 General construction procedures may result in a temporary increase in dust levels and a resultant reduction in the quality of air can be expected in the area immediately surrounding the site. The proposed development will not however, have an adverse impact on the air quality in the area.

Human Beings/Noise

19.3 The proposed development will not cause an adverse impact on the amenity of the area through noise generation.

Human Beings/Landscape/Visibility

19.4 Due to the existing urbanised nature of the site, the viewpoints offered and the relatively constrained Zone of Visual Influence it can be said that the proposed development will have neutral visual impact upon the surrounding area.

Human Beings – Material Assets (Traffic/Parking)

19.5 The development will generate an element of construction traffic during the initial development phase. Additional increases in traffic generated by the proposed development can be mitigated by junction improvements.

Human Beings/Material Assets

19.6 The proposed development will have a positive impact on the town centre and residents of the town by providing for a defined retail need and through the creation of a high quality urban space. Significant economic opportunities will be provided for local people in both the construction and operational phases. The development will not adversely impact on archaeological assets in the area and the scheme has been carefully designed to allow for adjacent sites to link to the proposal and developed an enhanced sense of space and place, contributing to the overall character of the town.

Appendix 1 **Ambient Air Quality Standards**

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC) (see Table 12.1 – 12.3). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. Council Directive 1999/30/EC, as relating to limit values for sulphur dioxide, nitrogen dioxide, lead and particulate matter, is detailed in Table 12.1. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air as set out in Table 12.2. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling. These various thresholds have been incorporated into the significance criteria for the development and will be appropriate for assessing the significance of the combined impact of the development plus the background environment.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 16 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other factors, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations(10). Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB has recently undergone an extensive validation exercise(13) as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK DEFRAs national air quality monitoring network. The validation exercise was carried out for NO_X, NO_2 and PM_{10}, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations(13).

In relation to NO_2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO_2 mirrors that of NO_X showing that the over-prediction is due to NO_X calculations rather than the NO_X:NO_2 conversion. Within most urban situations, the model overestimates annual mean NO_2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict $PM_{10.}$ Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable(13).

APPENDIX 2 Dust Minimisation Plan

A dust minimisation plan will be formulated for the construction phase of the project, as 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 speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

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 while 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 must be regularly watered, as appropriate, during dry and/or windy conditions.

Vehicles using site roads shall have their speeds restricted where there is a potential for dust generation. This speed restriction must be enforced rigidly. Vehicles delivering material with dust potential to an off-site location shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

All vehicles exiting the site shall make use of a wheel wash facility, preferably automatic, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

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.

At all times, the procedures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, satisfactory procedures will be implemented as a matter of priority in order to rectify the problem.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practise and procedures.

APPENDIX 3 Photomontage Report

Ballinasloe Town Centre

Photomontage Report

-

Report prepared by:

O'Callaghan Visualisation Ltd.

To design by:

Wilson Architecture

-

Issued 10.07

PHOTOMONTAGE REPORT

Project

Ballinasloe Town Centre
Ballinasloe,
Co. Galway

Clients

Harte Holdings

Clancy Construction

Prepared by

O Callaghan Visualisation Ltd
Tait Business Centre
Dominic Street
Limerick

On behalf of

Wilson Architecture
6 Lapps Quay
Cork

Date of issue

October 2007

PHOTOMONTAGE METHODOLOGY

Modelling

In this case the buildings were modelled using the drawings provided by Wilson Architecture. These included the plans, elevations, site layout & survey.

Base Model

The provided site survey and proposed site layout were over-laid and aligned to create a 'Base' model file to include all relevant information. This Base model allowed for the laying out of the proposed buildings, camera positions and reference points. This Base model was updated throughout the design process. The individual building models were then placed / linked into the Base model at the orientation and levels indicated.

Photography

All photographs were taken with a Canon EOS 1Ds camera using a 35mm lense. At each location the camera was setup at a height above ground of 1.60m and levelled using a bubble level on the camera stand. The camera location was recorded along with the time the photograph was taken. Additional detail photographs of the site area and surrounds were also taken for reference purposes using a variety of lenses.

Survey Information

In all cases the camera positions and levels were surveyed using a total station. Reference points visible in the photographs were surveyed to serve as control points. The coordinates of the camera positions and the control points were then input into the Base model.

Photomontages

Perspective views of the proposed development were computer generated for each camera position and overlaid onto the corresponding background photographs. An accurate fit was achieved by matching the surveyed control points to the corresponding points in the background photograph. Using the detail photographs for reference, the images were then cropped to remove any parts, which would be screened by existing topography, leaving only the parts which would be visible.

Presentation

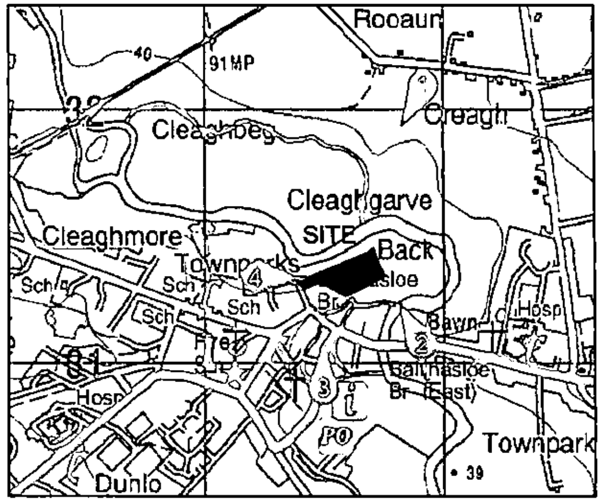
As photography cannot present what the eye sees in reality, it is intended that the photomontages are used as a tool to aid visual assessment, and should be viewed on site and compared with the real scene.
Each view is presented on 2 sheets;

- Sheet 1 - Proposed development.
- Sheet 2 - Comparison sheet showing;
  1. Existing state image un-edited.
  2. Proposed development.
  3. Existing state with redline.

Included in this document are 2 computer generated image from within the site.

Conclusion

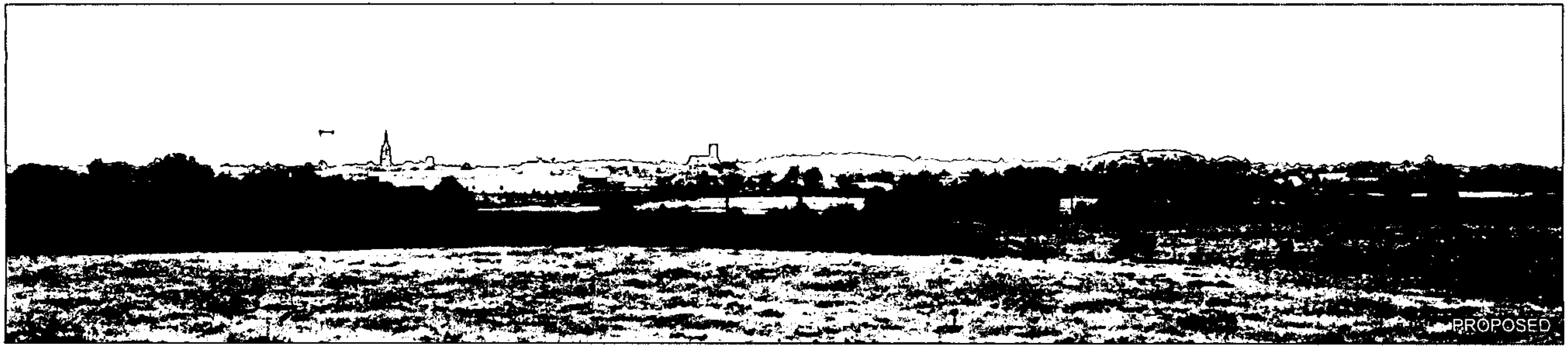
We have outlined our procedure for the generation of each of these photo-matches. In each case we have re-verified our results and we are confident that these images accurately represent the proposed development.

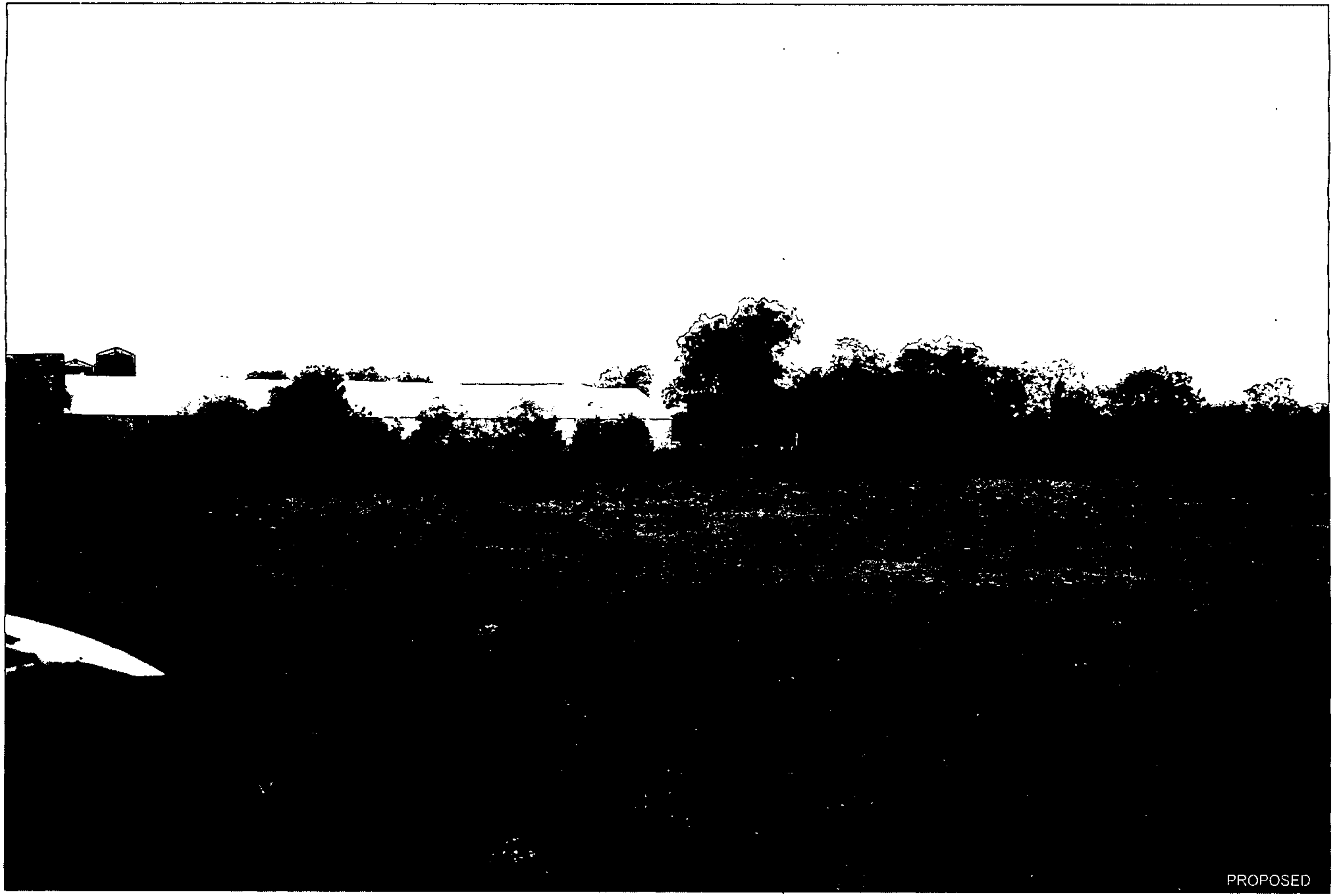


Aerial photoshowing viewpoint positions - Not to scale


PROPOSED

VIEW 1 SHEET 2 OF 2




PROPOSED

VIEW 2 SHEET 2 OF 2

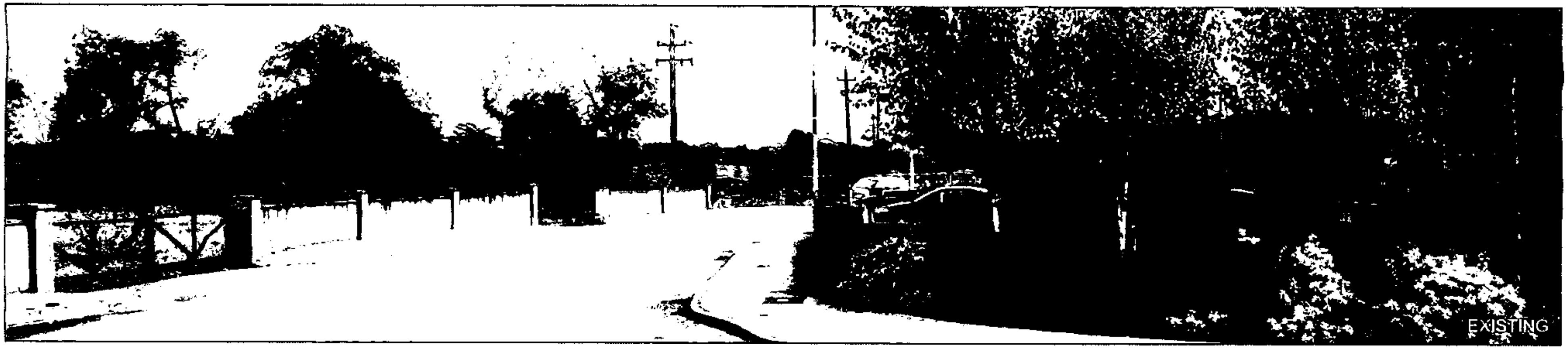

PROPOSED

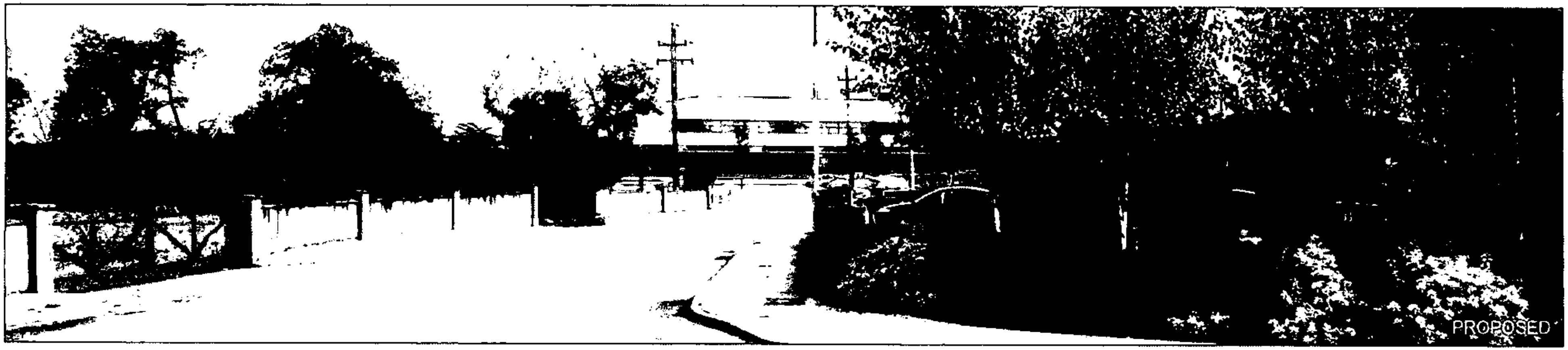

EXISTING

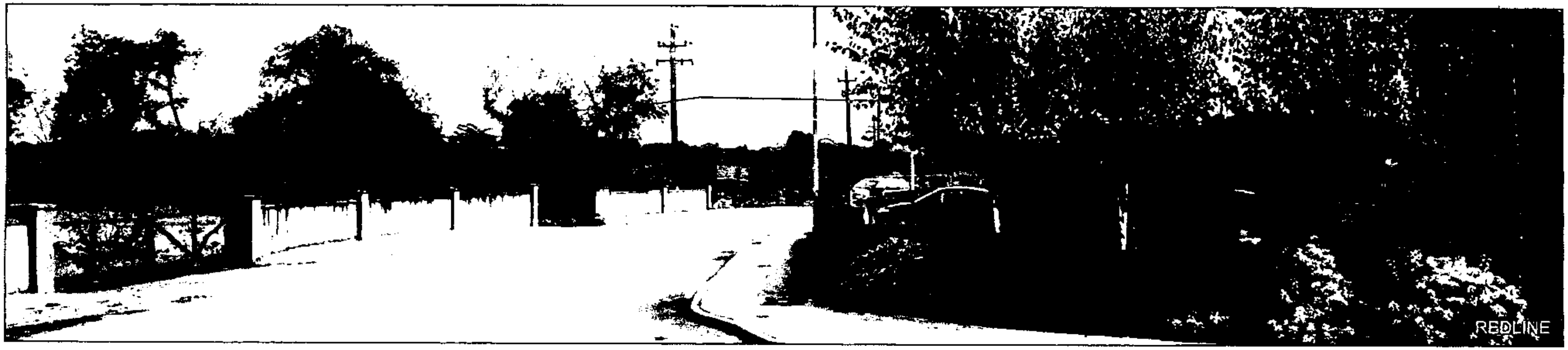

PROPOSED


REDLINE

Date ... 10/10/2007
Camera / Lens ... Canon EOS ...

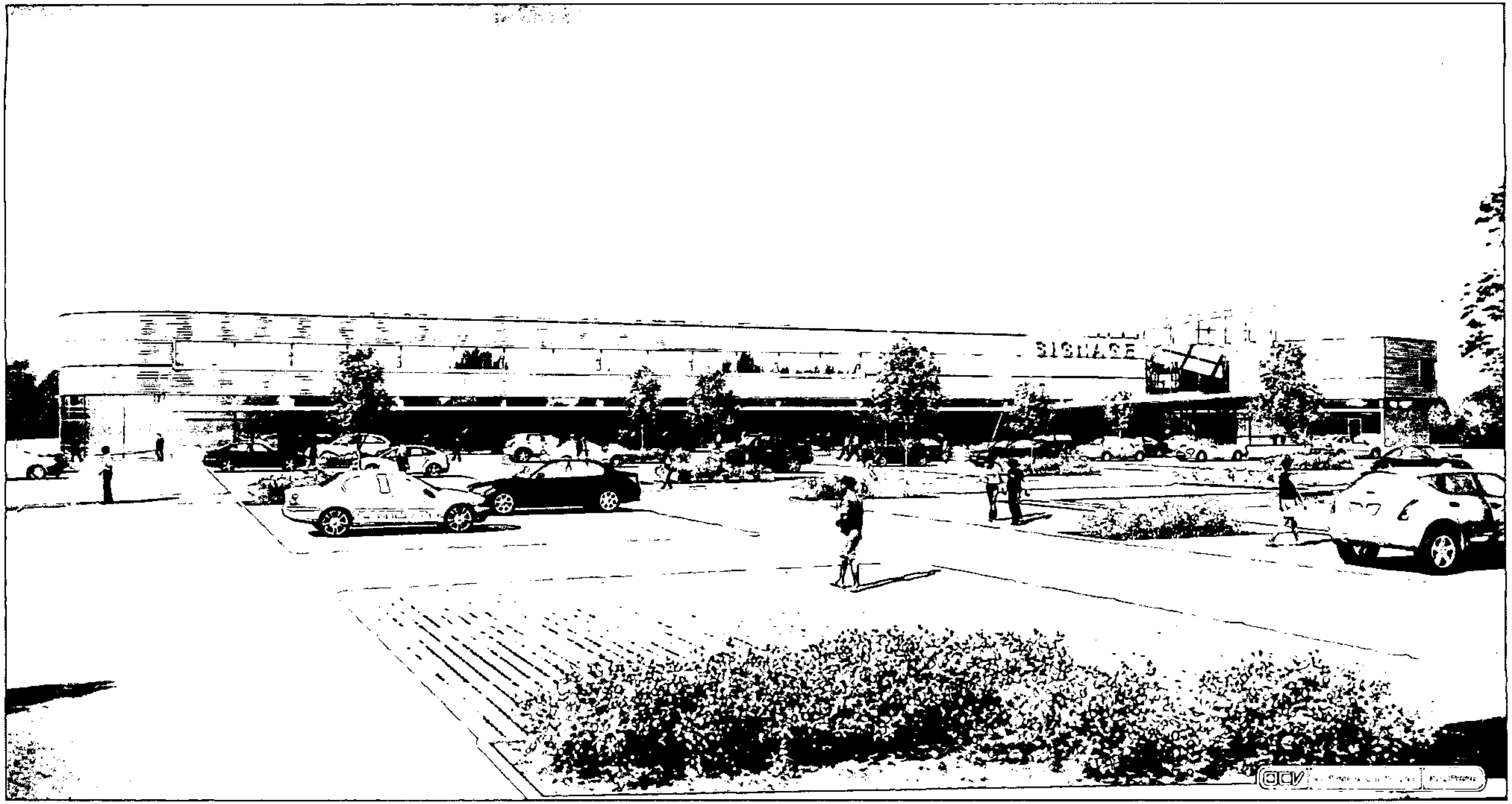






Date
Camera

CGI view 1



CGI view 2