DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

UNIT 5C
ELM HOUSE
MILLENNIUM PARK
NAAS
CO. KILDARE

PHONE
+353 45 984 042

INFO@DOBRIEN-ENGINEERS.IE
WWW.DOBRIEN-ENGINEERS.IE

Lucan Community College

Civil & Structural Engineering Report in Support of Planning Application

February 2022

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

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& ASSOCIATES CONSULTING ENGINEERS

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1 Introduction

This report has been prepared by Donnachadh O'Brien & Associates, Consulting Engineers, in support of the planning application for the proposed extension to Lucan Community College.

The site of the proposed development is located off Esker Drive, Lucan, Co. Dublin. The site currently hosts an existing secondary school building as well as a number of prefabricated temporary accommodation buildings, a playing field and some car parking facilities.

The proposed extension is to be located to the East of the existing main building and is to replace the existing temporary accommodation in the long term. It is also proposed to improve parking facilities on site as well as to provide an on-site set-down area for buses and parents dropping off students.

The existing and proposed site layouts are indicated on drawings LCC-DOB-XX-SI-DR-C-0001 and LCC-DOB-XX-SI-DR-C-0009 & 0010 respectively.

This report outlines the proposed development works under the following areas:

- Surface Water Drainage
- Foul Water Drainage
- Water Supply
- Roads Infrastructure (Internal & Access)

This report should be read in conjunction with the following engineering drawings, which are submitted in support of the planning application:

C-0001	Topographical Survey	C-0011	Proposed Autotrack Layouts
C-0002	GPR Survey	C-0012A	Typical Watermain Details – Sheet 1
C-0003	Surface Water Drainage - Sheet 1	C-0012B	Typical Watermain Details – Sheet 2
C-0004	Surface Water Drainage - Sheet 2	C-0012C	Typical Watermain Details – Sheet 3
C-0005	Foul Drainage - Sheet 1	C-0013	Typical Manhole Details
C-0006	Foul Drainage - Sheet 2	C-0014	Typical Attenuation Tank Details
C-0007	Watermain Layout - Sheet 1	C-0015	Typical Siteworks Details Sheet 1
C-0008	Watermain Layout - Sheet 2	C-0016	Typical Siteworks Details Sheet 2
C-0009	Site Layout - Sheet 1	C-0017	Fire Fighting Water Storage Tank Details
C-0010	Site Layout - Sheet 2		

2 Surface Water Drainage

2.1 Existing Surface Water Drainage

The existing surface water drainage system serving the college is connected to a 225mm diameter public surface water sewer which runs in the footpath on the south side along Esker Drive. This discharges into a 450mm diameter sewer which heads north, crosses Esker Drive and runs along Cannonbrook Avenue.

Some of the existing drainage sewers will be removed / diverted to allow construction of the proposed extension and the drainage infrastructure associated with it. Where existing SW drainage sewers are to be removed, local drainage outlets will be connected into the new SW drainage network.

There is no evidence of any existing attenuation systems on the site of the school.

2.2 Proposed Surface Water Drainage

The surface water drainage strategy for the proposed development consists of a number of key design features as follows:

- A new surface water drainage network for the proposed extension building and new hardstanding play areas
- Attenuation of storm water run-off using below ground attenuation systems in conjunction with a flow control device to limit surface water discharge from the site to Qbar rates
- A dedicated separate surface water network for Rainwater Harvesting for use in Greywater systems within the school with surplus run-off overflowing to the new SW system
- A class 1 bypass petrol interceptor installed prior to discharge of the new development to the public sewer

2.2.1 New SW Drainage Network

The new Surface Water Drainage Network extends from the North of the site around the proposed extension to the proposed new ball courts located in the Southwest corner of the site. The network collects run-off from the new hardstanding areas and new school building roof. Where elements of the existing surface water drainage network overlap with the proposed new network, the existing sewers will be removed and local discharge points from the existing building will also be connected into the new SW sewers.

Infiltration testing carried out on the site as part of the initial site investigation indicates that the rate of infiltration available on the site does not favour discharge of collected run-off water to ground. Therefore

collected run-off will discharge, via a flow control device, into the existing SW network before discharging from the site via the existing connection to the public SW network below Esker Drive.

The layout of the proposed SW drainage network is indicated on drawings LCC-DOB-XX-SI-DR-C-0003 & 0004, and network micro drainage calculations are included in the appendices of this report. Pipe sizes and gradients are designed so as to achieve self-cleansing velocities as per the requirements of the Building Regulations Part 'H'.

2.2.2 Attenuation System

Surface water attenuation, limiting run off rates to Qbar rates is to be constructed for the proposed development. Surface water attenuation will be designed for the 1:30 and 1:100 year events and the rate of discharge from the site shall be controlled via a hydrobrake located in a discharge manhole prior to the discharge to the public sewer which limits discharge to 9.4 ltrs/sec.

An attenuation tank (690m^3) is required and is proposed to be located below the ball courts to the east of the site. The attenuation tank will be constructed from modular storage systems with open bases and same can provide for infiltration of surface water into the ground thus recharging it and reducing discharge volumes in accordance with SUDS guidelines. However, as noted above, due to ground conditions encountered on site during the investigations, it is unlikely that there will be any significant infiltration available.

Attenuation Calculations are included in the appendices of this report. Typical details of the proposed attenuation system are included on drawing LCC-DOB-XX-SI-DR-C-0014.

In calculating the volume required for attenuation storage it was agreed in principle with SDCC that only new areas of construction would be provided for. A large portion of the existing development will be removed, including; 3 temporary accommodation buildings and the existing car park and internal road. The net increase in developed areas is as follows:

Total New Area of Roof	**3235 m2**
Total New Area of Hardstanding	**3128 m2**
Total New Area of Landscaping and Green space	**2457 m2**

However, due to the layout of the proposed new SW network, the actual area drained (including portions of the existing main building and the existing extension) is greater than the net increase in developed area as follows:

Areas Served by New System		
Extension		395 m2
Proposed New Extension		4145 m2
Portion of Existing School Roof to New Network		1100 m3
	Total	**5640 m2**
Ball Courts		3060 m2
Roads and Hardstanding		690 m2
	Total	**3750 m2**
Landscaping & Planting		3076 m2
		295 m2
		901 m2
	Total	**4272 m2**

Therefore the total area served is greater than the net new area of development.

Existing unattenuated discharge rates from the site can be calculated as follows:

Existing Areas		Factor	Equivilent area
Total Roof Area	**7360 m2**	**1**	**7360 m2**
Total Hardstanding	**4945 m2**	**0.8**	**3956 m2**
Total Green & Landscaped Space	**5455 m2**	**0.3**	**1636.5 m2**
		Total	**12952.5 m2**

At 50mm rainfall per hour the theoretical discharge from site = 180ltrs / sec.

Following the proposed development, the unattenuated area of the site can be calculated as follows:

Proposed Areas			
Total Roof Area	**10595 m2**		
Total Hardstanding	**8073 m2**		
Total Green & Landscaped Space	**7912 m2**		
Proposed Attenuated Areas			
Total Roof Area	**5640 m2**		
Total Hardstanding	**3750 m2**		
Total Green & Landscaped Space	**4272 m2**		
Net Unattenuated Areas		**Factor**	**Equivilent area**
Total Roof Area	**4955 m2**	**1**	**4955 m2**
Total Hardstanding	**4323 m2**	**0.8**	**3458.4 m2**
Total Green & Landscaped Space	**3640 m2**	**0.3**	**1092 m2**
		Total	**9505.4 m2**

Therefore at 50mm rainfall per hour, the theoretical discharge from the site = 132 ltrs / sec + 9.4 ltrs/sec = 141 ltrs/sec which represents a 22% net reduction in discharge from the site, thus improving upon the existing surface water drainage arrangement.

2.2.3 Water Quality

A class 1 bypass petrol interceptor will be provided prior to the discharge to the public network as indicated on the layout drawings.

2.2.4 Rainwater Harvesting

Rainwater harvesting will be incorporated in the scheme for use in greywater applications in the school. The rainwater harvesting tanks will be located proximate to the water tanks in the school and will be served by a separate and dedicated drainage network which only drains run-off from roof areas. This network is indicated on the surface water layout drawings. The tanks will be preceded by a suitable leaf filter and overflow from the tanks will drain into the general SW drainage network. Rainwater harvesting will also contribute as a SUDS element for the new school development. The rainwater harvester will provide some reduction during term times to the run-off from the new roof areas entering the surface water system. The rainwater network will be connected to the surface water network be means of an overflow at the harvester unit.

2.3 Consultation with SDCC

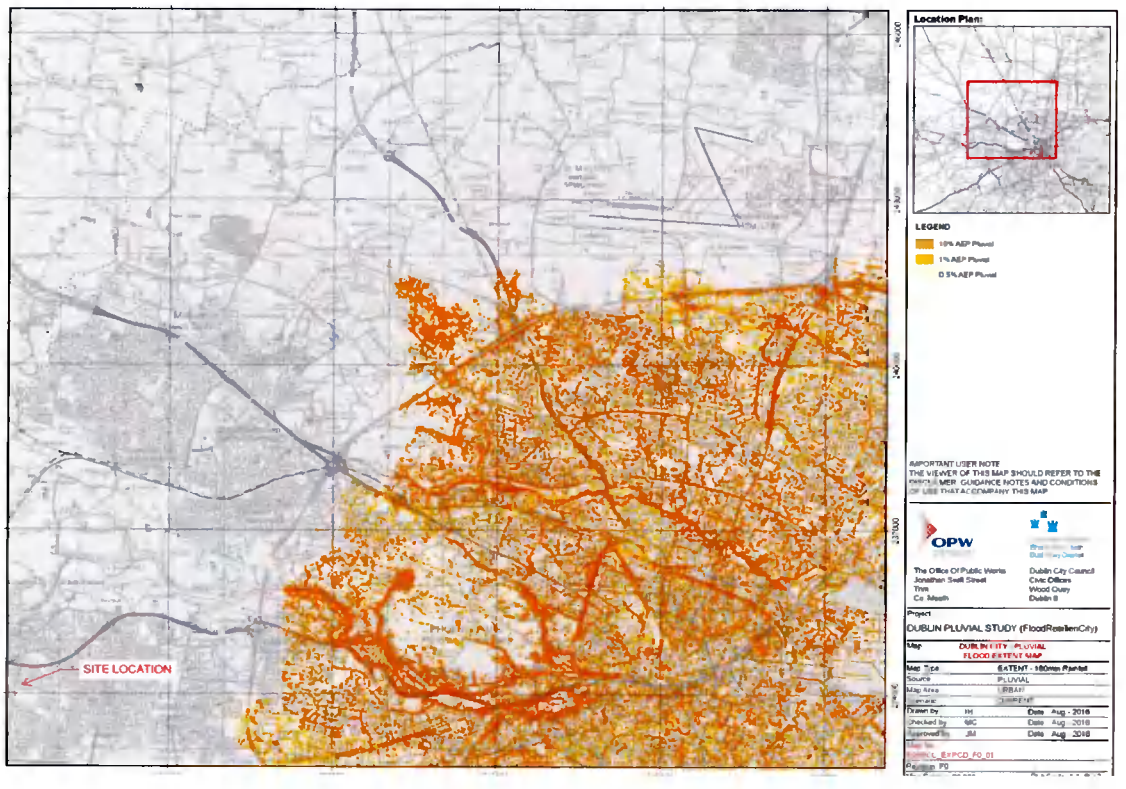
We have conducted preliminary pre-planning discussions with Mr. Graham Murphy of SDCC Drainage division in relation to the principal of the extension and have agreement in principal in relation to our proposals to reuse the existing surface water connection.

We have outlined our proposals to generally improve upon the existing arrangement by reducing discharge rates from the site and to provide attenuation in accordance with GDSDS for the new paved and roof areas of the site and SDCC are agreeable to this in principal. SDCC requested that all discharges from paved areas be passed through a petrol interceptor prior to discharge. A petrol Interceptor has been located on the discharge route from the new SW network.

3 Flood Risk Assessment

3.1 Flood Risk to Site

The CFRAM Studies produced informative maps of areas indicating their susceptibility to flooding. The below extract includes the area of the proposed site (highlighted in red). This map indicates the risk of Pluvial flooding to the area. The site is located outside of the areas on any maps indicating fluvial flooding risk



The map indicates that the proposed site has no risk of flooding up to and including the 0.1% AEP (1 in 1000 chance of occurrence in any given year) event, which is the upper limit of the study.

3.2 Conclusion

Based on the above information we can designate the site as within a Flood Zone C in accordance with section 2.23 of 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' as there is no evidence of flooding occurring on the site for events up to the 0.1% AEP. We can also class the development as less vulnerable. The table below from the guidelines illustrates those types of development which would be appropriate to each flood zone and those which would be required to meet the Justification test.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Vulnerability of Development vs. Flood Zone

Therefore, we would consider that the development is appropriate and that a detailed Justification test is not required for the development.

4 Foul Drainage

4.1 Existing Foul Drainage Network

There is an existing foul drainage network serving the existing school buildings on the site. The existing foul drainage system serving the college is connected to a 225mm diameter public foul sewer which crosses Esker Drive and travels along Cannonbrook Avenue.

4.2 Proposed New Foul Drainage Network

The new school extension will be served by a new piped network which will connect to the existing foul network towards the north of the site. The proposed layout of the network is indicated on drawing LCC-DOB-XX-SI-DR-C-0005 & 0006 and foul network micro drainage calculations are included in the appendices of this report. No new foul connection is required for the development.

Pipe sizes and gradients will be designed so as to achieve self-cleansing velocities as per the requirements of the Building Regulations Part 'H'. A review of levels of the outfall sewer as it leaves the site would indicate that there is sufficient depth in the existing foul pipe at the last manhole to cater for the proposed extension using gravity drainage.

The school currently enrols approximately 868 students and 82 staff. The long term projection for the school is to have 1,005 students and approximately 100 staff. The foul loading associated with the proposed development are as follows:

Existing Foul Loading Calculation		
Number of Students	868	
Number of Staff	82	
DoES loadig figures for schools (no canteen)		20 l/person/day
Total discharge	19000 l/day	
	0.66 l/s	Based on 8-hour day
6xDWF	3.96 l/s	
Proposed Foul Loading Calculation		
Number of Students	1005	
Number of Staff	100	
DoES loadig figures for schools (no canteen)		20 l/person/day
Total discharge	22100 l/day	
	0.77 l/s	Based on 8-hour day
6xDWF	4.60 l/s	
Increase	0.11 l/s	16%
	0.65 l/s (6xDWF)	

This represents a 16% increase in expected foul flows leaving the site associated with the proposed development. The proposed new foul network will discharge into an existing 250mm dia. foul pipe (1: 40 falls) prior to discharging from the site. This pipe has a capacity of 95 l/s. The increase in the foul flow through this pipe is representative of only 0.6% of the capacity of the existing pipe.

We have conducted preliminary pre-planning discussions with Mr. Graham Murphy in SDCC Drainage division in relation to the extension and have agreement in principal in relation to our proposals to reuse the existing foul connection.

5 Water Supply

The existing watermain serving the school is connected to a 150mm diameter uPVC main running in the footpath on the north side along Esker Drive. Given the size of the proposed school expansion we propose that a new 150mm diameter looped watermain is provided around the new school buildings works and connected to the existing loop mains around the existing school. The proposed layout of the water main is indicated on drawing LCC-DOB-XX-SI-DR-C-0007 & 0008.

It is proposed to promote water conservation for the extension proposed by providing rainwater harvesting in accordance with Department of Education & Skills requirements and technical guidance notes. The rainwater run-off from new roof areas will be collected by external downpipes and discharged into a separate rainwater drainage system. The rainwater network will convey runoff to a rainwater harvester unit. The rainwater will then be pumped from the harvesting unit to storage tanks in the attic for use in grey-water applications throughout the new building such as toilet and urinal flushing.

5.1.1 Fire-fighting

Pressure and flow tests carried out on site indicate an existing flow pressure of 1.5 Bar and a flow rate of 11.6 l/s. For fire-fighting purposes, a flow rate of 35 l/s for 1 hour is required meaning there is a shortfall of 23.4l/s. A water storage tank is required to be installed on the site to store sufficient water for fire-fighting purposes. We have undertaken preliminary discussions with Mr. Keith Bolan of Dublin Fire Brigade where it was noted that the tank should be sized to provide capacity for 35l/s for 1 hour rather than providing capacity for the shortfall only. The tank is sized based on the full fire low requirement of 35l/s for 1 hour of fire-fighting giving a required storage volume of 126m^3.

It is proposed to provide this storage in an underground tank located within the green space to the front of the school adjacent to the set-down area in order to provide adequate access in case of fire. The tank will consist of a concrete tanks connected in series to provide the required capacity of 126m^3. A connection from the watermain is required to serve the tank.

Due to the substantial increase in footprint, additional fire hydrants are required to the school. The number of fire Hydrants required on the site is calculated in accordance with part B of the Building Regulations TGDs as follows:

1 No. Fire Hydrant required for each 1,000m2 of building footprint at ground floor level.

Ground Floor area of Existing School Building (approximately) 4,681m2

Ground Floor area of Proposed Extension (approximately) 3,925m2

Therefore total floor area at ground floor = 8,606m2

Therefore 9 No. Hydrants required on site.

6 Roads Infrastructure

6.1 Existing Infrastructure

The existing community college is served by a single entrance off Esker Road which runs east to west and is connected to Newcastle Road to the west and Hayden's Lane to the east. There is a vehicular entrance/exit to the school from Esker Drive. Set-down currently occurs along Esker Drive, which is quite congested at morning and evening peak times. There is no set-down facility within the school site currently.

There are 53 No. parking spaces on the school grounds currently with other existing hardstanding areas (ball courts etc.) used by teachers for additional parking.

There are pedestrian gates located at the vehicular entrance off Esker Drive. There is also an additional pedestrian access located off the Newcastle Road to the Southwest of the site.

6.2 Proposed Improvements

A number of site layouts and potential road improvements were considered and we have undertaken consultation with SDCC Roads Department on 2 occasions to discuss our proposals. It was agreed that the overall approach to the roads infrastructure for the site would be to improve safety and traffic flow in and around the school site.

The following are the main improvements to the school's existing road infrastructure and site layout which have been agreed with SDCC Roads /Traffic Engineers and are to be adapted as part of the overall site layout:

- New in only entrance off Esker Drive to serve school in the form of a staggered junction with the existing road network.
- One-way in-out looped road layout and set-down for buses serving the SEN and cars – staff cars and parent drop off. All traffic will exit at the location of the existing site access which will be exclusively used as an out-only access. This will improve circulation within the site and reduce congestion on the public road by providing a safe stopping place within the school grounds and facilitate turn-around manoeuvres off the main road.
- Public buses are provided for with the existing arrangement of public bus stops on the Newcastle road adjacent to the school. Pedestrians from buses can enter the side via the gate on Newcastle road.
- Segregation of pedestrian & vehicular movements
- Dedicated staff parking area to west of site

- Provide Bicycle parking facilities on site (200 No.)
- Improved internal footpath routes, minimising pedestrian & vehicular interaction points from approaches to both East & West

6.3 Travel Survey & Set-Down Design

A travel survey was undertaken at the school and the key findings are tabulated in Fig. 1 below.

Key Survey Findings	
1	survey based on **90%** of student population
2	**56%** of students walk to school
3	**4%** of students cycle to school
4	**5%** of students take bus service to school
5	**35%** of students drive to school

Figure 1 Travel Survey Key Survey Findings

Using this survey information, we are able to interpret the requirements for the proposed school for 1000 pupils. Figure 2 below outlines the estimate of the number of parent drop off spaces required to serve the proposed school population based on a theoretical assessment. This is estimated at 18 spaces based on a 3min turnaround over a 40min drop off period. For secondary schools it is considered that a 3min turnaround is reasonable. In practice, this will assist in improving the overall traffic congestion in the area and will promote drop off on the school grounds where a one way in-out road network will be provided. As with all schools, it is not possible to provide a space at all times for every parent drop off – this is not feasible. However, the provision of dedicated spaces on site is a major improvement from the current situation and promotes safer motorist behaviour.

Assessment of No. of drop off spaces required for New School development

Student Occupancy	Students that travel by Car	No of trips					
1	111	111.0	Car trip factor per student based on survey numbers		0.24		Total Car Trips
2	102	51.0	Current No. of car trips for		868	pupils	211
3	17	5.7	Estimated No of car trips for		1000	pupils	243
4	2	0.5					
2	42	21.0	EXISTING				
	274	189	drop off period	40	40	40	mins
			average space turnaround	5	3	2	mins
			no of spaces required	26	16	11	spaces
			PROPSOED				
			drop off period	40	40	40	mins
			average space turnaround	5	3	2	mins
			no of spaces required	30	18	12	spaces

Figure 2 assessment of parent drop off spaces

There are a significant number of other external factors which will impact on traffic congestion in the area including general heavy commuter traffic at AM and PM peak times, other adjoining land uses- (shopping centre, residential etc.), the proximity of the adjoining school and weather conditions. The proposed road and infrastructural works at Lucan Community College are designed to provide a safer road environment in the vicinity of the school, but cannot exclusively resolve peak time congestion on the existing road network.

6.4 Local Authority Consultation: Roads Department

Donnachadh O'Brien & Associates met & discussed the principal of the proposed scheme and draft proposals were issued to Helena Fallon & Adrian Barrett of South Dublin Co. Council Roads Department. SDCC have agreed in principle with the new entrance, set down or parking configuration. DOBA noted and explained the issues being encountered with the existing traffic congestion and SDCC agreed with all the measures described above. SDCC have discussed and agreed with us that a Traffic Impact Assessment is not required for planning but a Road Safety Audit and a Mobility Management Plan will be required to be submitted as part of the proposed planning application. These documents are included in the appendices of this report.

The main comments from SDCC were as follows:

1. Review requirement for a pedestrian crossing to the east of the school
2. Review sight visibility at the exit, particularly in relation to the existing trees
3. Provide left and right only arrows at exit point
4. A stage 1/2 Road Safety Audit is to be carried out on the proposed development

6.5 Sightlines

The sightlines at the proposed school exit have been assessed for a distance of 49m at a setback of 2.4m from the road edge as per the requirements of DMURS. There are a number of trees lining the footpath which will need to be removed to allow unobstructed sightlines. The sightlines have been indicated on drawing LCC-DOB-XX-SI-DR-C-0009 & 0010.

6.6 Auto-track Analysis

An autotrack analysis has been carried out for a large single deck bus entering the school at the proposed new entrance off Esker Drive, parking in the proposed bus set-down zone and exiting the school at the existing access point. The analysis indicates that the vehicle can successfully navigate the proposed internal road layout. The analysis is included on drawing LCC-DOB-XX-SI-DR-C-0011.

6.7 Car Parking

Car parking provision on the existing site is insufficient. There are currently 53 car formal parking spaces and additional parking spaces are taken up on ball courts and other hardstanding areas, blocking access. The Department of Education have outlined 92 number spaces required to serve the requirements of the school. The proposed site layout provides a total of 110 number spaces with 10 number spaces dedicated to electric vehicle parking. The spaces have been located to the North and West of the site. Additionally the proposed ball courts will serve as overflow parking facilities for special events.

6.8 Bicycle Parking

SDCC require that 200 bicycle parking is required for the proposed new development. Currently only 3.6% of the student population cycle to school (36 for the projected population of 1,000). This would provide six times the amount of parking spaces currently used. The bicycle parking spaces will be provided at the front of the school.

6.9 Road Safety Audit

As requested by South Dublin County Council a Stage 1/2 Road Safety Audit was commissioned for the proposed development. The RSA was carried out by Roadplan Consulting and the report is included in the appendices of this report. The primary recommendations of the RSA are summarised below:

- The mouth of the existing entrance (proposed to serve as the 2 lane exit) is to be narrowed to reduce pedestrian crossing distances
- Adequate road markings and signage to be provided at proposed exit

- Remove or cut back trees lining the road at the proposed exit to improve visibility & sightlines
- Relocate advanced warning signs on Esker Drive to suit proposed new entrance location
- Provision of uncontrolled pedestrian crossing between site exit and Canonbrook Avenue to cater for pedestrians approaching from the housing estate to the North of the school.
- Provide adequate turning space at dead-end of staff car park
- Provide adequate signage and road markings to internal roads
- Resurface junction mouth at proposed exit.

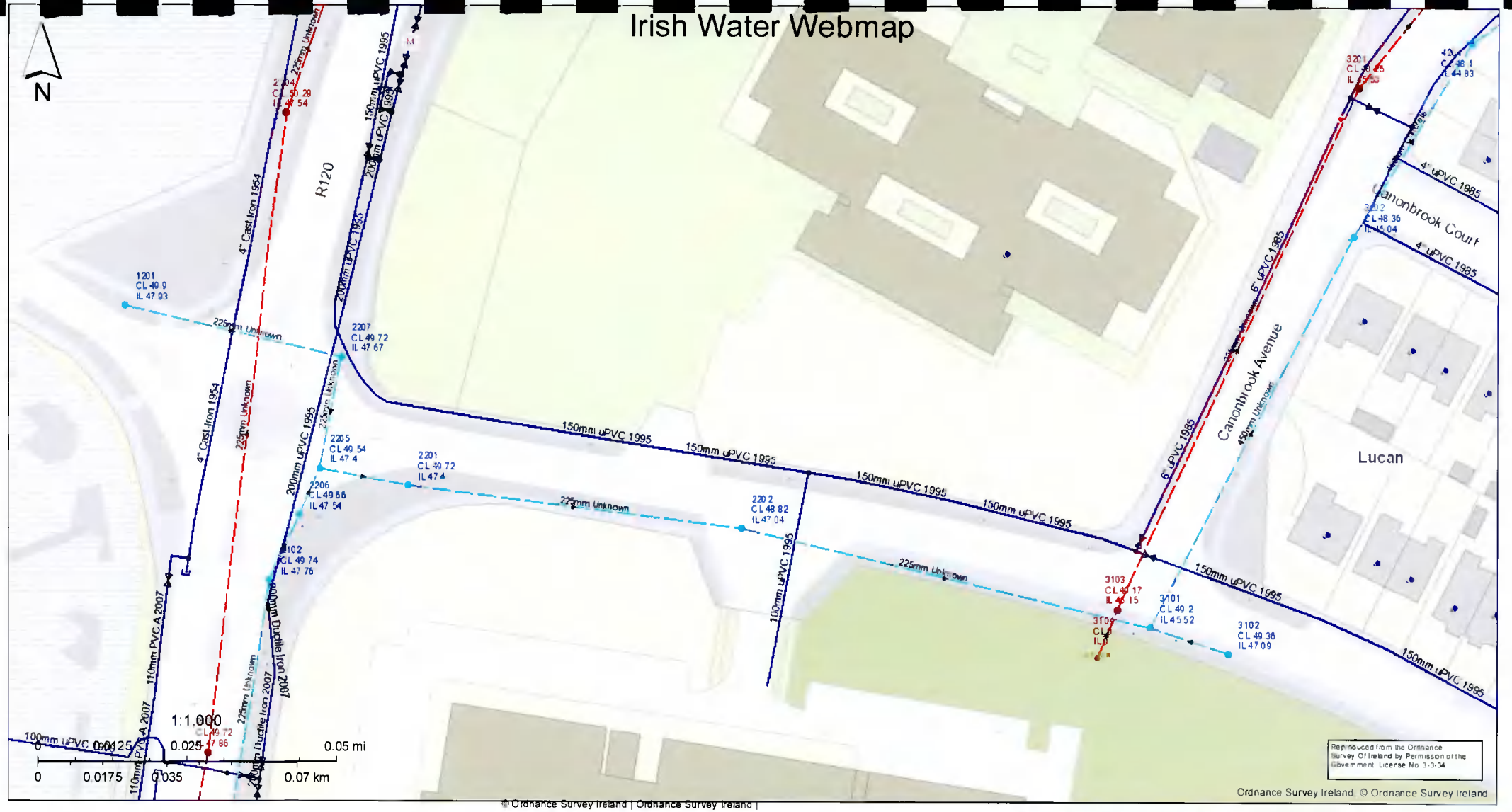
The above recommendations noted in the road safety audit have been included within the proposed development.

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix A

Public Drainage Drawings

Irish Water Webmap



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Legend

Surface	Gully	Other, Unknown	Foul	Other, Unknown	Other, Unknown	Vent/Col	
Surface	Standard	Storm Culverts	Overflow	Outfall	Sewer Flow Control Valves	Other, Unknown	
Cascade	Other, Unknown	Storm Clean Outs	Unknown	Overflow	Treatment plant		
Catchpit	Vent/Col	Combined	Cascade	Soakaway	Pump station		
Hatchbox	Other, Unknown	Foul	Catchpit	Standard Outlet	Catchpit		
Lamphole	Outfall	Overflow	Hatchbox	Other, Unknown	Gully		
Standard	Overflow	Unknown	Lamphole	Rodding Eye	Standard		
Other, Unknown	Soakaway	Combined	Standard	Flushing Structure	Other, Unknown		

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

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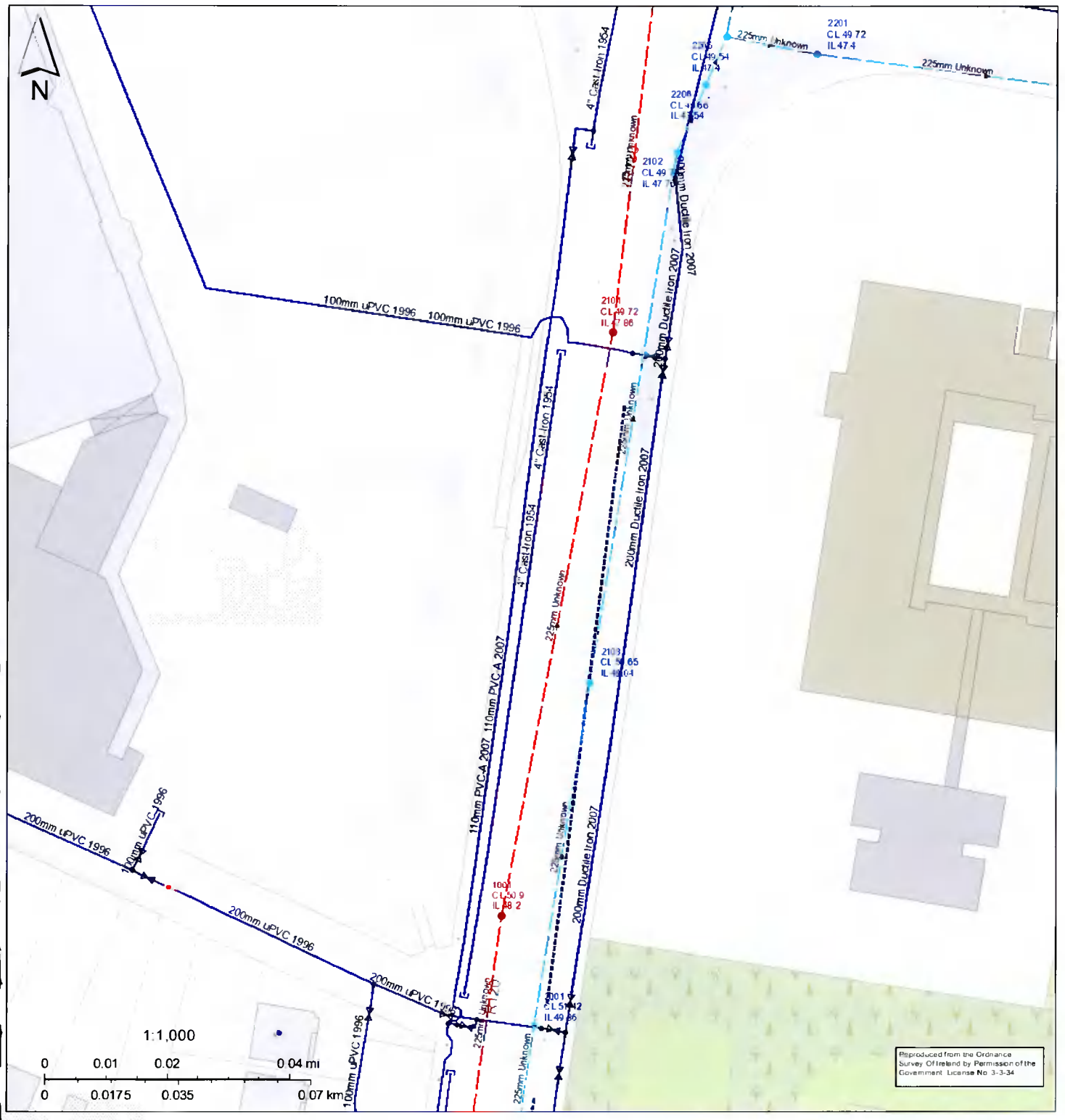
Irish Water Webmap



September 29, 2016

gend

Surface	Outfall	Unknown	Flushing Structure
Surface	Overflow	Cascade	Other: Unknown
Cascade	Soakaway	Catchpit	Sewer Flow Control Valves
Catchpit	Other, Unknown	Hatchbox	Treatment plant
Hatchbox	Storm Culverts	Lamphole	Pump station
Lamphole	Storm Clean Outs	Standard	Catchpit
Standard	Combined	Other, Unknown	Gully
Other, Unknown	Foul	Outfall	Standard
Gully	Overflow	Overflow	Other, Unknown
Standard	Unknown	Soakaway	Vent/Col
Other, Unknown	Combined	Standard Outlet	Other, Unknown
Vent/Col	Foul	Other, Unknown	
Other, Unknown	Overflow	Rodding Eye	

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated.

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"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix B

Surface Water Network Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	16.700	Add Flow / Climate Change (%)	0
Ratio R	0.276	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.535	4-8	0.618	8-12	0.037

Total Area Contributing (ha) = 1.190

Total Pipe Volume (m³) = 29.654

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	30.402	0.203	150.0	0.028	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	16.901	0.113	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	30.494	0.203	150.0	0.042	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	12.619	0.084	150.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	48.13	5.62	49.080	0.028	0.0	0.0	0.0	0.82	14.5	3.6
S1.001	47.02	5.96	48.877	0.028	0.0	0.0	0.0	0.82	14.5	3.6
S2.000	48.12	5.62	49.080	0.042	0.0	0.0	0.0	0.82	14.5	5.5
S1.002	46.23	6.22	48.765	0.087	0.0	0.0	0.0	0.82	14.5	10.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	30.475	0.203	150.0	0.055	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	27.425	0.220	124.5	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	13.975	0.093	150.3	0.041	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	18.840	0.126	149.5	0.054	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	43.029	0.287	150.0	0.113	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	17.800	0.119	150.0	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	10.188	0.068	150.0	0.054	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	5.485	0.037	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	9.001	0.060	150.0	0.055	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	15.742	0.105	150.0	0.047	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.011	14.238	0.095	150.0	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	43.739	0.292	150.0	0.061	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	93.892	0.626	150.0	0.057	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.001	53.596	0.357	150.0	0.091	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	33.298	0.222	150.0	0.080	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	10.006	0.067	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	4.925	0.033	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	48.12	5.62	49.080	0.055	0.0	0.0	0.0	0.82	14.5	7.2
S1.003	45.09	6.61	48.681	0.180	0.0	0.0	0.0	1.17	46.5	22.0
S4.000	49.50	5.22	48.600	0.041	0.0	0.0	0.0	1.06	42.3	5.5
S1.004	44.42	6.86	48.460	0.275	0.0	0.0	0.0	1.28	90.7	33.1
S1.005	42.96	7.42	48.334	0.388	0.0	0.0	0.0	1.28	90.6	45.1
S1.006	42.39	7.65	48.047	0.438	0.0	0.0	0.0	1.28	90.6	50.3
S1.007	42.08	7.78	47.929	0.492	0.0	0.0	0.0	1.28	90.6	56.1
S1.008	41.91	7.85	47.861	0.492	0.0	0.0	0.0	1.28	90.6	56.1
S1.009	41.64	7.97	47.824	0.547	0.0	0.0	0.0	1.28	90.6	61.7
S1.010	41.17	8.17	47.764	0.594	0.0	0.0	0.0	1.28	90.6	66.2
S1.011	40.76	8.36	47.659	0.621	0.0	0.0	0.0	1.28	90.6	68.6
S1.012	39.56	8.93	47.564	0.682	0.0	0.0	0.0	1.28	90.6	73.1
S5.000	44.26	6.91	48.850	0.057	0.0	0.0	0.0	0.82	14.5	6.8
S5.001	42.14	7.75	48.224	0.148	0.0	0.0	0.0	1.07	42.4	16.9
S5.002	40.95	8.27	47.867	0.228	0.0	0.0	0.0	1.07	42.4	25.3
S5.003	40.61	8.43	47.645	0.228	0.0	0.0	0.0	1.07	42.4	25.3
S1.013	39.45	8.98	47.273	0.910	0.0	0.0	0.0	1.48	163.1	97.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.000	29.906	0.199	150.0	0.047	5.00	0.0	0.600	o	150	Pipe/Conduit	
S6.001	19.404	0.129	150.0	0.121	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.002	10.224	0.068	150.0	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	38.522	0.257	150.0	0.086	5.00	0.0	0.600	o	150	Pipe/Conduit	
S6.003	10.918	0.073	150.0	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	39.906	0.266	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	48.16	5.61	48.800	0.047	0.0	0.0	0.0	0.82	14.5	6.1
S6.001	47.18	5.91	48.601	0.168	0.0	0.0	0.0	1.07	42.4	21.5
S6.002	46.68	6.07	48.471	0.176	0.0	0.0	0.0	1.07	42.4	22.2
S7.000	47.59	5.78	48.800	0.086	0.0	0.0	0.0	0.82	14.5	11.1
S6.003	46.16	6.24	48.403	0.280	0.0	0.0	0.0	1.07	42.4	35.0
S1.014	38.57	9.43	47.240	1.190	0.0	0.0	0.0	1.48	163.1	124.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	50.200	1.120	Open Manhole	1200	S1.000	49.080	150				
S2	50.200	1.323	Open Manhole	1200	S1.001	48.877	150	S1.000	48.877	150	
S3	50.300	1.220	Open Manhole	1200	S2.000	49.080	150				
S4	50.100	1.335	Open Manhole	1200	S1.002	48.765	150	S1.001	48.765	150	
								S2.000	48.877	150	112
S5	50.300	1.220	Open Manhole	1200	S3.000	49.080	150				
S6	50.000	1.319	Open Manhole	1200	S1.003	48.681	225	S1.002	48.681	150	
								S3.000	48.877	150	121
S7	49.500	0.900	Open Manhole	1200	S4.000	48.600	225				
S8	49.500	1.040	Open Manhole	1200	S1.004	48.460	300	S1.003	48.460	225	
								S4.000	48.507	225	
S9	49.500	1.166	Open Manhole	1200	S1.005	48.334	300	S1.004	48.334	300	
S10	49.450	1.403	Open Manhole	1200	S1.006	48.047	300	S1.005	48.047	300	
S11	49.450	1.521	Open Manhole	1200	S1.007	47.929	300	S1.006	47.929	300	
S12	49.450	1.589	Open Manhole	1200	S1.008	47.861	300	S1.007	47.861	300	
S13	49.450	1.626	Open Manhole	1200	S1.009	47.824	300	S1.008	47.824	300	
S14	49.450	1.686	Open Manhole	1200	S1.010	47.764	300	S1.009	47.764	300	
S15	49.450	1.791	Open Manhole	1200	S1.011	47.659	300	S1.010	47.659	300	
S16	49.450	1.886	Open Manhole	1200	S1.012	47.564	300	S1.011	47.564	300	
S17	49.450	0.600	Open Manhole	1200	S5.000	48.850	150				
S18	49.450	1.226	Open Manhole	1200	S5.001	48.224	225	S5.000	48.224	150	
S19	49.450	1.583	Open Manhole	1200	S5.002	47.867	225	S5.001	47.867	225	
S20	49.450	1.805	Open Manhole	1200	S5.003	47.645	225	S5.002	47.645	225	
S21	49.450	2.177	Open Manhole	1350	S1.013	47.273	375	S1.012	47.273	300	
								S5.003	47.578	225	155
S22	49.400	0.600	Open Manhole	1200	S6.000	48.800	150				
S23	49.400	0.799	Open Manhole	1200	S6.001	48.601	225	S6.000	48.601	150	
S24	49.400	0.929	Open Manhole	1200	S6.002	48.471	225	S6.001	48.471	225	
S25	49.400	0.600	Open Manhole	1200	S7.000	48.800	150				
S26	49.400	0.997	Open Manhole	1200	S6.003	48.403	225	S6.002	48.403	225	
								S7.000	48.543	150	65
S27	49.400	2.160	Open Manhole	1350	S1.014	47.240	375	S1.013	47.240	375	
								S6.003	48.330	225	940
S	49.800	2.826	Open Manhole	0		OUTFALL		S1.014	46.974	375	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	50.200	49.080	0.970	Open Manhole	1200
S1.001	o	150	S2	50.200	48.877	1.173	Open Manhole	1200
S2.000	o	150	S3	50.300	49.080	1.070	Open Manhole	1200
S1.002	o	150	S4	50.100	48.765	1.185	Open Manhole	1200
S3.000	o	150	S5	50.300	49.080	1.070	Open Manhole	1200
S1.003	o	225	S6	50.000	48.681	1.094	Open Manhole	1200
S4.000	o	225	S7	49.500	48.600	0.675	Open Manhole	1200
S1.004	o	300	S8	49.500	48.460	0.740	Open Manhole	1200
S1.005	o	300	S9	49.500	48.334	0.866	Open Manhole	1200
S1.006	o	300	S10	49.450	48.047	1.103	Open Manhole	1200
S1.007	o	300	S11	49.450	47.929	1.221	Open Manhole	1200
S1.008	o	300	S12	49.450	47.861	1.289	Open Manhole	1200
S1.009	o	300	S13	49.450	47.824	1.326	Open Manhole	1200
S1.010	o	300	S14	49.450	47.764	1.386	Open Manhole	1200
S1.011	o	300	S15	49.450	47.659	1.491	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	30.402	150.0	S2	50.200	48.877	1.173	Open Manhole	1200
S1.001	16.901	150.0	S4	50.100	48.765	1.185	Open Manhole	1200
S2.000	30.494	150.0	S4	50.100	48.877	1.073	Open Manhole	1200
S1.002	12.619	150.0	S6	50.000	48.681	1.169	Open Manhole	1200
S3.000	30.475	150.0	S6	50.000	48.877	0.973	Open Manhole	1200
S1.003	27.425	124.5	S8	49.500	48.460	0.815	Open Manhole	1200
S4.000	13.975	150.3	S8	49.500	48.507	0.768	Open Manhole	1200
S1.004	18.840	149.5	S9	49.500	48.334	0.866	Open Manhole	1200
S1.005	43.029	150.0	S10	49.450	48.047	1.103	Open Manhole	1200
S1.006	17.800	150.0	S11	49.450	47.929	1.221	Open Manhole	1200
S1.007	10.188	150.0	S12	49.450	47.861	1.289	Open Manhole	1200
S1.008	5.485	150.0	S13	49.450	47.824	1.326	Open Manhole	1200
S1.009	9.001	150.0	S14	49.450	47.764	1.386	Open Manhole	1200
S1.010	15.742	150.0	S15	49.450	47.659	1.491	Open Manhole	1200
S1.011	14.238	150.0	S16	49.450	47.564	1.586	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.012	o	300	S16	49.450	47.564	1.586	Open Manhole	1200
S5.000	o	150	S17	49.450	48.850	0.450	Open Manhole	1200
S5.001	o	225	S18	49.450	48.224	1.001	Open Manhole	1200
S5.002	o	225	S19	49.450	47.867	1.358	Open Manhole	1200
S5.003	o	225	S20	49.450	47.645	1.580	Open Manhole	1200
S1.013	o	375	S21	49.450	47.273	1.802	Open Manhole	1350
S6.000	o	150	S22	49.400	48.800	0.450	Open Manhole	1200
S6.001	o	225	S23	49.400	48.601	0.574	Open Manhole	1200
S6.002	o	225	S24	49.400	48.471	0.704	Open Manhole	1200
S7.000	o	150	S25	49.400	48.800	0.450	Open Manhole	1200
S6.003	o	225	S26	49.400	48.403	0.772	Open Manhole	1200
S1.014	o	375	S27	49.400	47.240	1.785	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.012	43.739	150.0	S21	49.450	47.273	1.877	Open Manhole	1350
S5.000	93.892	150.0	S18	49.450	48.224	1.076	Open Manhole	1200
S5.001	53.596	150.0	S19	49.450	47.867	1.358	Open Manhole	1200
S5.002	33.298	150.0	S20	49.450	47.645	1.580	Open Manhole	1200
S5.003	10.006	150.0	S21	49.450	47.578	1.647	Open Manhole	1350
S1.013	4.925	150.0	S27	49.400	47.240	1.785	Open Manhole	1350
S6.000	29.906	150.0	S23	49.400	48.601	0.649	Open Manhole	1200
S6.001	19.404	150.0	S24	49.400	48.471	0.704	Open Manhole	1200
S6.002	10.224	150.0	S26	49.400	48.403	0.772	Open Manhole	1200
S7.000	38.522	150.0	S26	49.400	48.543	0.707	Open Manhole	1200
S6.003	10.918	150.0	S27	49.400	48.330	0.845	Open Manhole	1350
S1.014	39.906	150.0	S	49.800	46.974	2.451	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.028	0.028	0.028
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.042	0.042	0.042
1.002	-	-	100	0.017	0.017	0.017
3.000	-	-	100	0.055	0.055	0.055
1.003	-	-	100	0.038	0.038	0.038
4.000	-	-	100	0.041	0.041	0.041
1.004	-	-	100	0.054	0.054	0.054
1.005	-	-	100	0.113	0.113	0.113
1.006	-	-	100	0.050	0.050	0.050
1.007	-	-	100	0.054	0.054	0.054
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.055	0.055	0.055
1.010	-	-	100	0.047	0.047	0.047
1.011	-	-	100	0.027	0.027	0.027
1.012	-	-	100	0.061	0.061	0.061
5.000	-	-	100	0.057	0.057	0.057
5.001	-	-	100	0.091	0.091	0.091
5.002	-	-	100	0.080	0.080	0.080
5.003	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.047	0.047	0.047
6.001	-	-	100	0.121	0.121	0.121
6.002	-	-	100	0.008	0.008	0.008
7.000	-	-	100	0.086	0.086	0.086
6.003	-	-	100	0.018	0.018	0.018
1.014	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.190	1.190	1.190

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.014	S	49.800	46.974	0.000	0	0

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Appendix C

Attenuation Calculations

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Project *Lucan Community College*
Project No *DOBA 1446*
Title: *SW Attenuation* (Net New Area)
Calcs By *AL* Date: 10-05-17

PRELIMINARY SURFACE WATER STORAGE ESTIMATE (NO LONG TERM STORAGE)

Catchment Characteristics

Greenfield Runoff Flows (Sites < 50 Ha)

denotes Input Value

Standard Average Annual Rainfal (SAAR) =	773	mm
Soil Index =	0.35	
Total Site Area =	0.9733	Hectares (ha)
Storm Return Period =	30	Years
Permissible Outflow per hectare, QBAR =	2.9	l/s/ha
* Total Permissible Outflow=	2.78	l/s
Proposed Impermeable Area:		
Hardstanding	0.3128	ha
Roofs	0.3235	ha
Proposed Open Space	0.3370	ha

Soil Classification for Runoff Potential

Based on FSR Maps

Soil 1	0	%
Soil 2	50	%
Soil 3	50	%
Soil 4	0	%
Soil 5	0	%

Infiltration

(2)	80	% Impermeable
(3)	100	% Impermeable
(1)	30	% Impermeable

Rainfall Intensity from Met Eireann

1 hectare = 10,000m²

return period	*grow curve factor*
1	0.85
10	1.7
30	2.1
100	2.6
200	2.9

Duration (min)	Rainfall 1/30 Dublin (mm)	Intensity (mm/hr)	Factored Intensity *** (mm/hr)	Factored Rainfall *** (mm)	Rainfall (m^3/ha)	Volume (m^3)	Permissable Outflow (m^3)	Storage Required (m^3)
5	11.3	135.6	149.2	12.4	124.3	84	1	83
10	15.8	94.8	104.3	17.4	173.8	117	2	116
15	18.5	74.0	81.4	20.4	203.5	137	3	135
30	23.2	46.4	51.0	25.5	255.2	172	5	167
60	29.1	29.1	32.0	32.0	320.1	216	10	206
120	36.4	18.2	20.0	40.0	400.4	270	20	250
180	41.5	13.8	15.2	45.7	456.5	308	30	278
240	45.6	11.4	12.5	50.2	501.6	338	40	298
360	52.0	8.7	9.5	57.2	572.0	386	60	326
540	59.3	6.6	7.2	65.2	652.3	440	90	350
720	65.1	5.4	6.0	71.6	716.1	483	120	363
1080	74.3	4.1	4.5	81.7	817.3	552	180	371
1440	81.5	3.4	3.7	89.7	896.5	605	240	365
2880	92.0	1.9	2.1	101.2	1012.0	683	481	202
4320	100.6	1.4	1.5	110.7	1106.6	747	721	25

Value of storage required = 371 m^3 h 1.5 area 247.45 L1 20.00 L2

Notes

*Total Permissible Outflow calculated in accordance with GDSDS - Regional Drainage Policies (Volume 2 - Chapter 6)

**Permissable Outflow per Hectare multiplied by growth factors

i.e. $QBAR(m^3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

SOIL Soil Index Values in range 0.15-0.5 of Catchment values Available from the FSR The Index derived from

$$\frac{(0.15Soil\ 1+\ 0.30Soil\ 2\ +\ 0.40Soil\ 3+\ 0.45Soil\ 4+\ 0.50Soil\ 5)}{(Soil\ 1+\ Soil\ 2+\ Soil\ 3+\ Soil\ 4+Soil\ 5)}$$

*** Rainfall Intensity increased by 10% to comply with global warming effects as described in the GDSDS - Regional Drainage Policies (Volume 2 - Section 6.3.2.4 - Table 6.2)

Oversized Pipe Requirements for On-line Storage

Pipe dia. (mm)	Length (m)
2100	107
1500	210
1200	328
1050	429
900	583

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Project *Lucan Community College*
Project No *DOBA 1446*
Title: *SW Attenuation* (Net New Area)
Calcs By *AL* Date: 10-05-17

PRELIMINARY SURFACE WATER STORAGE ESTIMATE (NO LONG TERM STORAGE)

Catchment Characteristics

Greenfield Runoff Flows (Sites < 50 Ha)

denotes Input Value

Standard Average Annual Rainfal (SAAR) =	773	mm
Soil Index =	0.35	
Total Site Area =	0.9733	Hectares (ha)
Storm Return Period =	100	Years
Permissible Outflow per hectare, QBAR =	2.9	l/s/ha
* Total Permissible Outflow=	2.78	l/s
Proposed Impermeable Area:		
Hardstanding	0.3128	ha
Roofs	0.3235	ha
Proposed Open Space	0.3370	ha

Soil Classification for Runoff Potential
Based on FSR Maps

Soil 1	0	%
Soil 2	50	%
Soil 3	50	%
Soil 4	0	%
Soil 5	0	%

Infiltration

	80	% Impermeable
	100	% Impermeable
	30	% Impermeable

Rainfall Intensity from Met Eireann

1 hectare = 10,000m²

return period	grow curve factor
1	0.85
10	1.7
30	2.1
100	2.6
200	2.9

Duration (min)	Rainfall 1/100 Dublin (mm)	Intensity (mm/hr)	Factored Intensity *** (mm/hr)	Factored Rainfall *** (mm)	Rainfall (m^3/ha)	Volume (m^3)	Permissable Outflow (m^3)	Storage Required (m^3)
5	16.4	196.8	216.5	18.0	180.4	122	1	121
10	22.8	136.8	150.5	25.1	250.8	169	2	168
15	26.8	107.2	117.9	29.5	294.8	199	3	196
30	33.2	66.4	73.0	36.5	365.2	246	5	241
60	41	41.0	45.1	45.1	451.0	304	10	294
120	50.7	25.4	27.9	55.8	557.7	376	20	356
180	62.7	20.9	23.0	69.0	689.7	465	30	435
240	71	17.8	19.5	78.1	781.0	527	40	487
360	80.4	13.4	14.7	88.4	884.4	597	60	537
540	87.8	9.8	10.7	96.6	965.8	652	90	562
720	99.4	8.3	9.1	109.3	1093.4	738	120	618
1080	108.5	6.0	6.6	119.4	1193.5	805	180	625
1440	119.5	5.0	5.5	131.5	1314.5	887	240	647
2880	128.8	2.7	3.0	141.7	1416.8	956	481	475
4320	137.1	1.9	2.1	150.8	1508.1	1018	721	296

Value of storage required = 647 m^3 h 1.5 area 431.06 L1 20.00 L2

Notes

*Total Permissible Outflow calculated in accordance with GDSDS - Regional Drainage Policies (Volume 2 - Chapter 6)

**Permissable Outflow per Hectare multiplied by growth factors

i.e. $QBAR(m^3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

SOIL Soil Index Values in range 0.15-0.5 of Catchment values Available from the FSR. The Index derived from:

$$\frac{(0.15Soil\ 1 + 0.30Soil\ 2 + 0.40Soil\ 3 + 0.45Soil\ 4 + 0.50Soil\ 5)}{(Soil\ 1 + Soil\ 2 + Soil\ 3 + Soil\ 4 + Soil\ 5)}$$

*** Rainfall Intensity increased by 10% to comply with global warming effects as described in the GDSDS - Regional Drainage Policies (Volume 2 - Section 6.3.2.4 - Table 6.2)

Oversized Pipe Requirements for On-line Storage

Pipe dia. (mm)	Length (m)
2100	187
1500	366
1200	572
1050	747
900	1016

Lucan Community College
Site Area Reconcilliation

Total Site Area	32760 m2

Existing

Main Building Roof	6055 m2
Extension	395 m2
Temp Building 1	562 m2
Temp Building 2	185 m2
Temp Building 3	163 m2
Hardstanding incl: Car park, Ball courts and pathways etc:	4945 m2
Green space to West of site (not drained)	15000 m2
Green & Landscapped space around school	5455 m2
Total Roof Area	**7360 m2**
Total Hardstanding	**4945 m2**
Total Green & Landscaped Space	**5455 m2**

Proposed

Main Building Roof	6055 m2
Extension	395 m2
Proposed New Extension	4145 m2
Car Parking, Footpaths & Roads	5013 m2
Ball Courts	3060 m2
Green space to West of site (not drained)	6180 m2
Green & Landscapped space around school	7912 m2
Total Roof Area	**10595 m2**
Total Hardstanding	**8073 m2**
Total Green & Landscaped Space	**7912 m2**

Total Area of New Roof	**3235 m2**
Total Area of New Hardstanding	**3128 m2**
Total Area of New Landscaping and Green space	**2457 m2**

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix D

CFRAMS Map

Location Plan:

LEGEND

- 10% AEP Pluvial
- 1% AEP Pluvial
- 0.5% AEP Pluvial

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

The Office Of Public Works
Jonathan Swift Street
Trim
Co. Meath

Dublin City Council
Civic Offices
Wood Quay
Dublin 8

Project:
DUBLIN PLUVIAL STUDY (FloodResilienCity)

Map: DUBLIN CITY - PLUVIAL FLOOD EXTENT MAP

Map Type:	EXTENT - 180min Rainfall	
Source:	PLUVIAL	
Map Area:	URBAN	
Scenario:	CURRENT	
Drawn by:	IH	Date: Aug - 2016
Checked by:	MC	Date: Aug - 2016
Approved by:	JM	Date: Aug - 2016

Map No.
E09DCC_EXPCD_F0_01

Revision: F0

Map Scale: 1:50,000 Plot Scale: 1:1 @ A3

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix E

Foul Network Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	40.00	Maximum Backdrop Height (m)	1.500
Persons per House	17.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	38.243	0.382	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F1.001	21.076	0.211	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F1.002	36.318	0.363	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F1.003	49.423	0.494	100.0	0.000	4	0.0	0.600	o	150	Pipe/Conduit	
F1.004	14.437	0.144	100.0	0.000	4	0.0	0.600	o	150	Pipe/Conduit	
F1.005	14.053	0.141	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F1.006	28.270	0.283	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F1.007	19.901	0.199	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F2.000	43.700	0.437	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F2.001	22.648	0.226	100.0	0.000	8	0.0	0.600	o	150	Pipe/Conduit	
F2.002	23.501	0.235	100.0	0.000	1	0.0	0.600	o	150	Pipe/Conduit	
F2.003	25.631	0.256	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	48.850	0.000	0.0	0	0.0	0	0.00	1.00	17.8	0.0
F1.001	48.468	0.000	0.0	0	0.0	0	0.00	1.00	17.8	0.0
F1.002	48.257	0.000	0.0	0	0.0	0	0.00	1.00	17.8	0.0
F1.003	47.894	0.000	0.0	4	0.0	11	0.33	1.00	17.8	0.2
F1.004	47.400	0.000	0.0	8	0.0	16	0.41	1.00	17.8	0.4
F1.005	47.255	0.000	0.0	8	0.0	16	0.41	1.00	17.8	0.4
F1.006	47.115	0.000	0.0	8	0.0	16	0.41	1.00	17.8	0.4
F1.007	46.832	0.000	0.0	8	0.0	16	0.41	1.00	17.8	0.4
F2.000	48.550	0.000	0.0	0	0.0	0	0.00	1.00	17.8	0.0
F2.001	48.113	0.000	0.0	8	0.0	16	0.41	1.00	17.8	0.4
F2.002	47.887	0.000	0.0	9	0.0	16	0.42	1.00	17.8	0.4
F2.003	47.652	0.000	0.0	9	0.0	16	0.42	1.00	17.8	0.4

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.008	25.162	0.252	100.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.008	46.633	0.000	0.0	17	0.0	22	0.51	1.00	17.8	0.8

Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	49.450	0.600	Open Manhole	1200	F1.000	48.850	150				
F2	49.450	0.982	Open Manhole	1200	F1.001	48.468	150	F1.000	48.468	150	
F3	49.450	1.193	Open Manhole	1200	F1.002	48.257	150	F1.001	48.257	150	
F4	49.450	1.556	Open Manhole	1200	F1.003	47.894	150	F1.002	47.894	150	
F5	49.450	2.050	Open Manhole	1200	F1.004	47.400	150	F1.003	47.400	150	
F6	49.450	2.195	Open Manhole	1200	F1.005	47.255	150	F1.004	47.255	150	
F7	49.450	2.335	Open Manhole	1200	F1.006	47.115	150	F1.005	47.115	150	
F8	49.450	2.618	Open Manhole	1200	F1.007	46.832	150	F1.006	46.832	150	
F9	49.450	0.900	Open Manhole	1200	F2.000	48.550	150				
F10	49.450	1.337	Open Manhole	1200	F2.001	48.113	150	F2.000	48.113	150	
F11	49.450	1.563	Open Manhole	1200	F2.002	47.887	150	F2.001	47.887	150	
F12	49.450	1.798	Open Manhole	1200	F2.003	47.652	150	F2.002	47.652	150	
F13	49.450	2.817	Open Manhole	1200	F1.008	46.633	150	F1.007	46.633	150	
								F2.003	47.395	150	762
F	0.000		Open Manhole	0		OUTFALL		F1.008	46.382	150	

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	150	F1	49.450	48.850	0.450	Open Manhole	1200
F1.001	o	150	F2	49.450	48.468	0.832	Open Manhole	1200
F1.002	o	150	F3	49.450	48.257	1.043	Open Manhole	1200
F1.003	o	150	F4	49.450	47.894	1.406	Open Manhole	1200
F1.004	o	150	F5	49.450	47.400	1.900	Open Manhole	1200
F1.005	o	150	F6	49.450	47.255	2.045	Open Manhole	1200
F1.006	o	150	F7	49.450	47.115	2.185	Open Manhole	1200
F1.007	o	150	F8	49.450	46.832	2.468	Open Manhole	1200
F2.000	o	150	F9	49.450	48.550	0.750	Open Manhole	1200
F2.001	o	150	F10	49.450	48.113	1.187	Open Manhole	1200
F2.002	o	150	F11	49.450	47.887	1.413	Open Manhole	1200
F2.003	o	150	F12	49.450	47.652	1.648	Open Manhole	1200
F1.008	o	150	F13	49.450	46.633	2.667	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	38.243	100.0	F2	49.450	48.468	0.832	Open Manhole	1200
F1.001	21.076	100.0	F3	49.450	48.257	1.043	Open Manhole	1200
F1.002	36.318	100.0	F4	49.450	47.894	1.406	Open Manhole	1200
F1.003	49.423	100.0	F5	49.450	47.400	1.900	Open Manhole	1200
F1.004	14.437	100.0	F6	49.450	47.255	2.045	Open Manhole	1200
F1.005	14.053	100.0	F7	49.450	47.115	2.185	Open Manhole	1200
F1.006	28.270	100.0	F8	49.450	46.832	2.468	Open Manhole	1200
F1.007	19.901	100.0	F13	49.450	46.633	2.667	Open Manhole	1200
F2.000	43.700	100.0	F10	49.450	48.113	1.187	Open Manhole	1200
F2.001	22.648	100.0	F11	49.450	47.887	1.413	Open Manhole	1200
F2.002	23.501	100.0	F12	49.450	47.652	1.648	Open Manhole	1200
F2.003	25.631	100.0	F13	49.450	47.395	1.905	Open Manhole	1200
F1.008	25.162	100.0	F	0.000	46.382		Open Manhole	0

Area Summary for Foul - Main

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
1.001	0.000	0.000
1.002	0.000	0.000
1.003	0.000	0.000
1.004	0.000	0.000
1.005	0.000	0.000
1.006	0.000	0.000
1.007	0.000	0.000
2.000	0.000	0.000
2.001	0.000	0.000
2.002	0.000	0.000
2.003	0.000	0.000
1.008	0.000	0.000
	Total	Total
	0.000	0.000

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.008	F	0.000	46.382	0.000	0	0

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix F

Road Safety Audit

16065-01-004

Lucan Community College, Lucan, Co. Dublin

ROAD SAFETY AUDIT STAGE 1/2

May 2017

ROADPLAN CONSULTING

7, Ormonde Road
Kilkenny
Tel: 056 7795800

1. INTRODUCTION

1.1 This report describes a Stage 1/2 Road Safety Audit carried out at Lucan Community College, Lucan, Co. Dublin on behalf of Donnachadh O'Brien Consulting Engineers. The audit was carried out on 18/11/2016 in the offices of Roadplan Consulting, Kilkenny.

1.2 The audit team members were as follows:-

George Frisby, BE CEng MIEI;

Bratislav Dimitrijevic, MEng CEng MIEI;

1.3 The site was visited on 29th June 2016. The audit comprised an examination of the drawings relating to the scheme supplied by Donnachadh O'Brien Consulting Engineers and an examination of the site.

1.4 This Stage 1/2 Audit has been carried out in accordance with the relevant sections of NRA DMRB HD19. The team has examined only those issues within the design relating to the road safety implications of the road access to the scheme, and has therefore not examined or verified the compliance of the design to any other criteria.

1.5 All of the problems described in this report are considered by the audit team to require action in order to improve the safety of the scheme and minimise accident occurrence.

1.6 Appendix A describes the audited drawings.

2. STAGE 1/2 AUDIT

2.1 **Problem**

The width of the existing junction mouth at the proposed school exit is wide which results in a long crossing distance for pedestrians. As a result pedestrians may be at an increased risk of being struck by a vehicle exiting the school.

Recommendation

Reduce the crossing distance by providing kerbed radii either side of the existing junction mouth and provide adequate dropped kerbs and tactile paving along the pedestrian desire line.

2.2 **Problem**

A two lane exit is proposed at the school exit. Drivers exiting the school may mistakenly enter the incorrect lane when exiting which may lead to side swipe collisions at the exit. In additional drivers entering the school may mistake the second lane as an entry lane into the school resulting in collisions at the school exit.

Recommendation

- Provide a "*Turn Left*" arrow marking in the nearside lane and a "*Turn Right*" arrow marking in the offside lane at the school exit.
- Provide "*No Entry*" signs at the school exit facing drivers approaching the exit on Esker Drive.

2.3 **Problem**

Trees are located within the verge along the front of the school site. Visibility of the "*Roundabout Ahead*" warning sign and the signal heads of the pedestrian crossing may be obscured by these trees for westbound drivers approaching the roundabout and pedestrian crossing west of the school exit on Esker Road.

Recommendation

Cut back or remove the trees in order to provide adequate visibility of the "*Roundabout Ahead*" warning sign and the signal heads of the pedestrian crossing.

2.4 **Problem**

There is an existing "*School Ahead*" warning sign located approximately 10m east of the new school entrance and as a result westbound drivers approaching the new school entrance may not have sufficient warning of the school entrance ahead.

Recommendation

Relocate the existing "*School Ahead*" warning sign further downstream of the new school entrance so that westbound drivers approaching the new school entrance have sufficient warning of the school entrance ahead.

2.5 **Problem**
Pedestrians approaching the new school entrance on the north side of Esker Road are not provided with a pedestrian crossing facility in the vicinity of the new school entrance.

Recommendation
Provide an adequate pedestrian crossing facility along the pedestrian desire lines in the vicinity of the new school entrance.

2.6 **Problem**
The proposed turning area at the end of the car park may not adequately cater for vehicles turning which may result in a vehicle reversing along the internal access road within the car park.

Recommendation
Provide an adequate turning head within the proposed car park.

2.7 **Problem**
There are no "*No Entry*" sings or road markings provided at the exit from the one-way set-down area and at the junction of the one-way school access and two way link to the Grass Playing pitch. Additionally straight ahead arrow provided on the two-way link from the Grass Playing pitch may confuse some drives to proceed straight ahead in the opposite direction.

Recommendation
Provide "*No Entry*" signs and road markings on both locations. Also, replace straight ahead arrow with left turn arrow on the two-way link from the Grass Playing Pitch.

2.8 **Comment**
The existing road pavement within the junction mouth at the school exit is in poor condition and should be re-surfaced.

2.9 **Comment**
Ensure that the tactile pavement proposed for the pedestrian crossing at the start of the set-down area and at the end of the set-down area is aligned on both sides.

3. AUDIT TEAM STATEMENT

3.1 We certify that we have examined the drawing listed in Appendix A and have inspected the site. This examination has been carried out with the sole purpose of identifying any features of the design that could be removed or modified to improve the safety of the scheme.

Signed..... George Frisby

Date 18-11-2016

Signed ..... Bratislav Dimitrijevic

Date 18-11-2016

APPENDIX A

List of Drawings Examined:

Drawing 1400-025 Rev B 'Site Plan' provided electronically in pdf. format by Donnachadh O'Brien Consulting Engineers.

SAFETY AUDIT FEEDBACK FORM

Scheme: Lucan Community College, Lucan, Co. Dublin

Document Number: 16065-01-004

Audit Stage: 1/2

Date Audit Completed: 18-11-2016

Paragraph No. in Safety Audit Report	To Be Completed By Designer			To Be Completed by Audit Team Leader
	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Describe alternative measure(s). Give reasons for not accepting recommended measure	Alternative measures or reasons accepted by auditors (yes/no)
2.1	YES	YES	—	—
2.2	YES	YES	—	—
2.3	YES	YES	—	—
2.4	YES	YES	—	—
2.5	YES	YES	—	—
2.6	YES	YES	—	—
2.7	YES	YES	—	—

Safety Audit Signed off ..... **Design Team Leader** **Date** 08/05/2017

Safety Audit Signed off ..... **Employer** **Date** 08/05/2017.

Safety Audit Signed off ..... **Audit Team Leader** **Date** 8/5/17

Please complete and return to:

Roadplan Consulting Ltd
7, Ormonde Road
Kilkenny
E-mail: info@roadplan.ie

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix G

Mobility Management Plan

16065-01-001

Lucan Community College,
Lucan, Co. Dublin

Mobility Management Plan

for

Donnachadh O'Brien Consulting Engineers

on behalf of

Board of Management, Lucan Community College

May 2017

ROADPLAN CONSULTING

7, Ormonde Road
Kilkenny
Tel: 056 7795800

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1 Introduction

Roadplan Consulting has been commissioned by Donnachadh O'Brien Consulting Engineers to prepare a Mobility Management Plan for Lucan Community College in Lucan, Co. Dublin.

1.1 THE SCHOOL

The existing school has 862 pupils and 60 staff members. It is proposed to construct a 2 storey extension to the school to cater for additional pupils. Works will also include a new entrance, a new car set down area, a new special needs education (SNE) bus set down area, a new car park and 6 new ball courts that can act as overflow parking. The extended school will have approximately 1,000 pupils.

The school is located on the Esker Road, Lucan as shown on Figure 1 '*Location Map*' and the schools site (red line) is shown on Figure 2 *'Site Map'*.

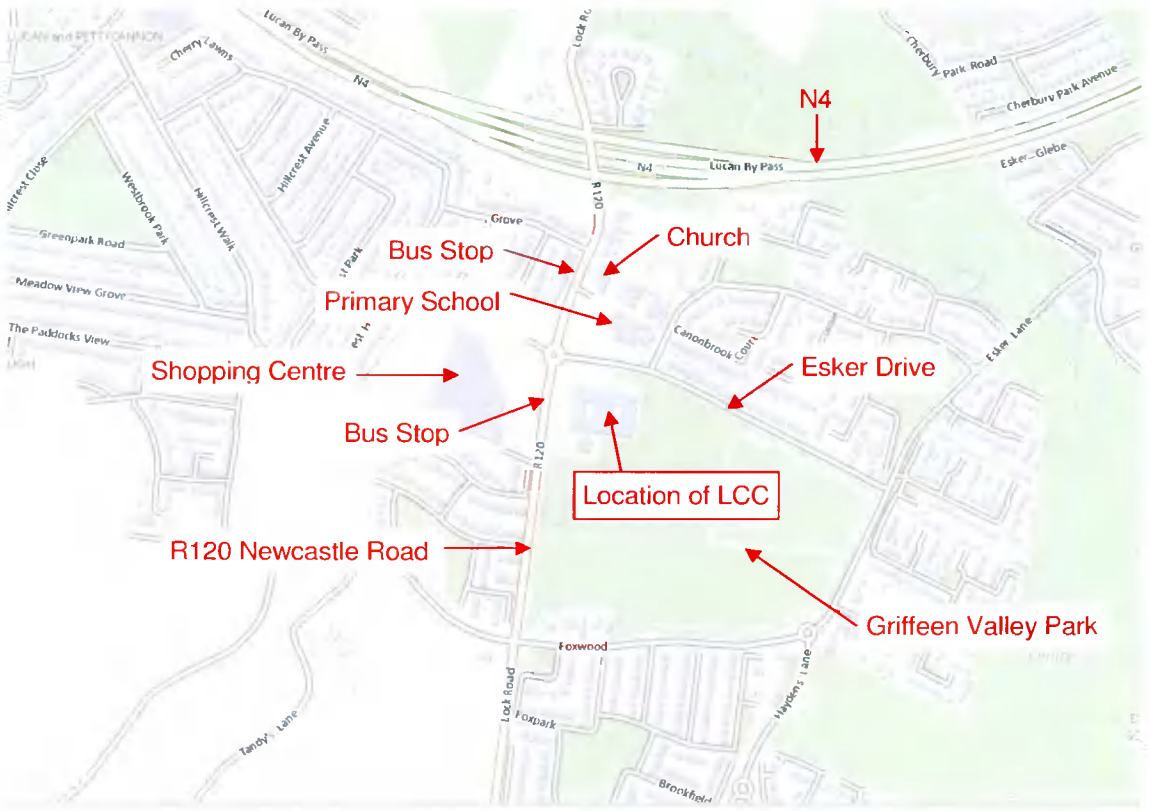


Figure 1: Location Map

Figure 2: Site Map

Lucan Community College is bounded by the Newcastle Road to the west, The Esker Drive road to the north, the Griffeen Valley Park to the east and by the Weston Hockey Club to the south. Vehicular and pedestrian access to the school is from Esker Drive Road.

The proposed school layout is shown on drawings contained in Appendix A – Drawings.

2 Travel Characteristics

2.1 SCHOOL YEAR

Secondary schools operate in three terms each year and while the exact dates will vary from year to year the typical terms are:

1. First week of September to third week of December;
2. Second week of January to one week before Easter;
3. One week after Easter to the end of May (with exams in June).

The traffic generated by the school is therefore seasonal.

2.2 SCHOOL HOURS

The standard opening times for both schools are as follows:

- 09:00 to 16:00 Monday, Tuesday, Thursday and Friday;
- 09:00 to 13:10 Wednesday.

The traffic generated by the school is therefore confined to certain periods of the day from Monday to Friday. The a.m. peak is the critical period; all students arrive at the one time and the background traffic levels are therefore likely to be highest in the morning peak. By contrast, school closing in the afternoon happens before the p.m. peak for background traffic.

2.3 SCHOOL CATCHMENT

The school attracts pupils from Lucan town and the surrounding areas. Information in relation to the school catchment was provided by the school principal and details are provided in Section 4.

3 Travel Facilities

3.1 ROADS AND PARKING

Vehicular access to the existing school is from the Esker Drive Road, as shown on Figure 2. Located opposite the Lucan Community College is a Primary School "Scoil Aine Naofa", with vehicular access from the same road. This road is congested during school times, especially during the a.m. peak hour.

Within the school ground parking is provided for staff only – 53 spaces. Along the Newcastle Road there is an existing Dublin bus bay and no bus set down is provided within the school grounds. At present, set-down occurs along Esker Drive Road and the surrounding road network.

The proposed school will keep the existing vehicular access to the school. New access will be provided approx. 120m to the east of the existing one. Between these two access points a new set down area will be provided with a one-way system implemented. The proposed access will be 'Entry only', while the existing access will be 'Exit only'.

Within the new set down area there will be 19 car spaces and a SNE bay 26.4m long, fronting the new SNE building. With efficient use each space can be used several times, maximising its potential.
Existing car park will be modified to provide 92 car parking spaces and 1 disabled parking space, all located west of the existing access, where two-way system will be in operation.

All these facilities are shown on the architects drawing contained in Appendix A.

3.2 FOOTPATHS

Access for pedestrians to the school is from Esker Drive Road. The existing and proposed vehicular access points will serve pedestrians also. Esker Drive Road and the surrounding road network have footpaths on both sides of the road and will cater for students walking to and from the school.

There is a pedestrian gate located on the R120 Newcastle Road which provides pedestrian access to the school.

These facilities are shown on the architects drawing contained in Appendix A.

3.3 CYCLE FACILITIES

There are no existing cycle facilities on the road network adjacent to school. However, the surrounding roads are wide enough to accommodate cycling.
Within the school grounds there are 80 bicycle spaces provided: 5 bicycle stands with 8 spaces each located at front of the school and the same at the back of the school.
We were informed by the Architect that 100 bicycle parking spaces will be provided for the proposed school.

3.4 PUBLIC TRANSPORT SERVICES

Students use public transport service and the bus stops are just 2 min walking distance from the school, located at the Newcastle Road. These bus stops provide direct connections between the Lucan area and Blanchardstown and Merrion Square.
At present there are no bus arrivals to school. On occasions when standard buses are hired for school trips, extra-curricular activities or tours, the school uses the bus stop on Newcastle Road.

4 Travel Surveys

A survey of how the pupils travel to school at present was carried out by the school staff. The survey was carried out in September of 2016.

Out of 862 pupils, 801 pupils were present and 61 absent. This is approximately 93% of school population surveyed, which is deemed an adequate sample. The detailed findings of the survey are summarised in the Survey Results Sheet in Appendix B and the principal findings are shown hereunder.

4.1 TRAVEL MODAL SPLIT

The survey provided the following existing travel modal split for pupils:

Table 1: Modal Split for pupils

Mode of Travel	No. of Pupils	Percentage
Walk	471	59%
Cycle	39	5%
Bus	31	4%
Car	260	32%
Total	**801**	**100%**

The number of pupils walking to school is high - 59%. The average percentage of secondary school students travelling to school by foot nationally is 23% (based on Census 2011 Profile 10 – Door to door). See Figure 3.

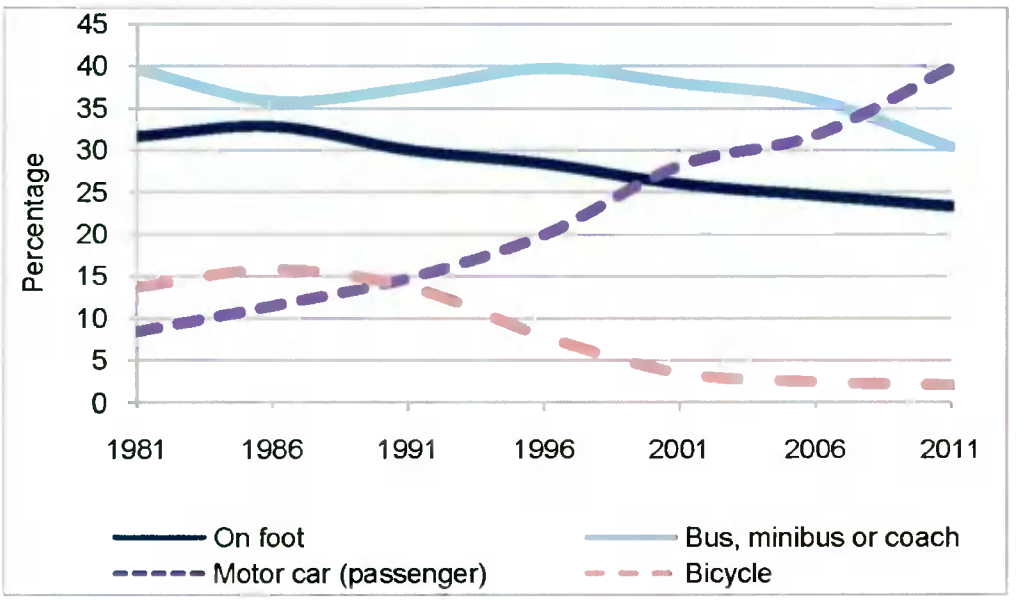


Figure 3: Main modes of travel for secondary students, 1981-2011

At the moment 4% of pupils use bus. The average percentage of secondary school students travelling to school by bus nationally is 30% (based on Census 2011 Profile 10 – Door to door). See Figure 3.

The survey showed that 32% of pupils travel to school by car, which is lower than the average 40% for secondary school students travelling to school by car (based on Census 2011 Profile 10 – Door to door). See Figure 3.

Number of pupils cycling is 5%; national average for secondary students is 3%. See Figure 3.

Table 2: Existing modal split versus national average

Mode of Travel	Existing modal split (%)	National average (%)
Walk	59%	23%
Cycle	5%	3%
Bus	4%	30%
Car	32%	40%
Total	**100%**	**100%**

The survey provided the following existing travel modal split of staff:

Table 3: Modal Split for Staff members

Mode of Travel	No. of Staff Members	%
Walk	0	0%
Cycle	0	0%
Bus	2	3%
Car	58	97%
Total	**60**	**100%**

4.2 ORIGIN OF TRIPS

The surveyed origins of trips for pupils that travel by car have been summarised below in *Table 4*.

Table 4: Origin of Trips for pupils that travel by car

Distance	No. of Pupils	Percentage
< 1.0 km	13	5%
1.0 – 1.5 km	33	13%
1.5 – 2.0 km	94	36%
2.0 – 3.0 km	77	29%
3.0 – 5.0 km	10	4%
> 5.0 km	33	13%
Total	**260**	**100%**

From the information above it is noted that the significant number of pupils who travel by car live within a 2km radius of the school (54%) – see table 4, which is considered as acceptable walking distance. These 140 pupils are 16% of the school population and should be initially targeted - distances are not large and improvement in terms of sustainable travel can be made. The remaining 46% travel from areas that are more than a 2km distance; outside preferable walking distance.

Origin of trips for staff members has been provided for 58 staff members that travel by car and results have been summarised in *Table 5*. Detailed findings can be found in Appendix B.

Table 5: Origin of Trips for staff members made by car

Distance	No. of Staff members	Percentage
< 2 km	12	21%
2 – 5 km	-	-
>5 km	46	79%
Total	**58**	**100%**

Most of the staff members come outside the 5km radius.

4.3 CAR OCCUPANCY

The survey also collected information about car occupancy, with the following results:

Table 6: Car Occupancy

	No. of Pupils	Percentage	No. of Staff (total)	Percentage
Not sharing	90	35%	55	95%
Sharing with 1 other	122	47%	3	5%
Sharing with 2 others	31	12%	-	-
Sharing with 3 others	17	6%	-	-
Total	**260**	**100%**	**58**	**100%**

The results show that 35% of the pupils do not share the trip to school with other pupils. The number of car trips to school in the morning can be determined from the above data (90+122/2+31/3+17/4) and is 166. The average car occupancy of those trips is **1.57** pupils per car (260/166), i.e. 166 vehicles for 260 pupils. From

previous travel surveys carried out by Roadplan Consulting on existing secondary schools in greater Dublin area it was noted that the average car occupancy is 1.5 pupils per car.

The average car occupancy for staff members of those trips is **1.03**; most of the staff members - 95% travel in a single occupied cars.

Table 7: Average Car Occupancy

Average Car Occupancy	**Pupils**	**Staff**
	1.57	1.03

In terms of sustainable travel it is desirable to reduce vehicular trips as much as possible and to increase the use of sustainable travel.

5 Opportunities and Objectives

5.1 OPPORTUNITIES

The proposed school is located in the urban area of the town and the features of this area make it feasible to foster walking and cycling. Those features are:

- This is a secondary school and pupils are old enough to walk/cycle to school by themselves;
- The roads have footpaths and traffic speeds are low;
- There are bicycle parking facilities within the school;
- 17% of school population travel by car and live within 2km radius;
- 10% of school population travel by car in a single pupil occupancy cars;
- 97% of staff members travel by car; majority in a single occupied car.

5.2 OBJECTIVES

The overall objectives of this School Travel Plan are:

- Increase walking and cycling to school for pupils and teachers who live within 2km of the school;
- Reduce car travel by encouraging increased walking and cycling;
- Reduce the overall number of one-pupil or one-teacher vehicle trips for journeys to school by increasing car occupancy (by car sharing) for pupils who live more distant from school;
- Increase and promote Bus use;
- Increase awareness of healthy lifestyles and exercise;
- Set up long-lasting partnerships among key participants in the implementation of the Mobility Management Plan.

The table below sets the overall modal split targets to be achieved.

Table 8: Targets for pupils

	Bus	Car	Walk	Cycle	Car occupancy
Existing	4%	32%	59%	5%	1.57
TARGET	5%	20%	65%	10%	1.65

Based on the travel survey, 17% of pupils live within 2km radius from school and travel by car. They should be encouraged to use alternative travel modes, like walking or cycling.

Pupils living more distant from school should be encouraged to cycle, if in higher classes, or increase use of shared transport. It is assumed that the increased car sharing will be with one other pupil only, though increased sharing should be encouraged.

Irelands National Cycle Policy Network 2009-2020 sets out to create a strong cycling culture in Ireland with a target that 10% of all trips will be made by bike in 2020.

Reduction in car usage is expected to be a result of increased cycling and walking, but also due to increased use of shared transport.

If that modal split were achieved the number of existing school trips would decrease from 166 to 108 (a reduction of **35%**) and would have a significant positive impact on traffic conditions in the area at school times.

For school occupancy of 1000 pupils and targets achieved, expected number of school trips is 134 (a reduction of **19%**).

Table 9: Targets for staff members

	Bus	**Car**	**Walk/Cycle**	**Car occupancy**
Existing	3%	97%	-	1.03
TARGET	5%	85%	10%	1.10

20% of staff members are traveling from Lucan, which is within walking/cycling distance. Also, many staff members travel from the same place of origin. More details are provided in Appendix B.

6 Recommended Measures

6.1 WALKING

- Include benefits of walking/ active travel in appropriate school lessons. Pupils will display a greater understanding of issues.
- Organise an actions like 'Walking Bus', 'Walk on Wednesdays' etc.

6.2 CYCLING

- Ensure the provision of cycle parking at the school is sufficient.
- Include benefits of cycling/active travel in school lessons.
- Initialise actions like 'Cycle on Friday', 'Bike Week' etc.
- Investigate how cycle routes can be improved and their use promoted amongst pupils and staff.
- Cycling can be promoted through various schemes:
  - Cycling safety training;
  - Bicycle maintenance classes.
- Staff should also be encouraged to adopt more sustainable travel modes like cycling and walking.

6.3 CAR SHARING

- Groups of parents are put in contact to facilitate car sharing for school trips. The way in which car trips are shared can be tailored to parents travel needs and availabilities.
- The school should facilitate the matching of participants and establish a car sharing database storing information on travel needs, availability and contact details of participants.
- The surveys show that 20% of school population arriving by car share the trip with one or more others; however the impact of those arriving in unshared vehicular transport is high; 10% of school population arrive in a single pupil occupant car. This is the key problem to be tackled and the two principal methods of tackling it are firstly, to promote alternative modes of travel where possible and secondly to increase vehicle occupancy where feasible. Car

sharing has the additional benefits of developing social skills and reducing travel costs.

6.4 INCREASED BUS USE

- The school should review routes and schedules to ensure that a bus service is available to as many pupils and staff members as possible.
- Promote bus use.

6.5 AWARENESS OF HEALTHY LIFESTYLES AND EXERCISE

- Develop school lessons to incorporate healthy lifestyle themes;
- Appoint a Mobility Management Coordinator to promote the targets of this plan within the school.

7 Implementation

To implement the Mobility Management Plan and the proposed measures the following steps would be taken:

- Set up meetings with all the interested parties: Principal, teachers, School Board, parents, Local Area Road Safety Officer, Gardaí, etc.
- Establish a named Mobility Management Coordinator and Steering Group through which all decisions should be made in relation to the implementation of the proposed measures.
- Implement an awareness campaign to promote the Mobility Management Plan giving information on initiatives and benefits.
    - Create leaflets to be distributed to parents, staff and pupils.
    - Organise presentations for parents, staff and pupils.
    - Include information in school newsletter and/or website.

  Information campaigns should be repeated regularly to help to maintain the Mobility Management Plan.
- Implement measures.
- Identify incentives for compliance to ensure that students, parents and teachers enthusiastically adopt the principles of the Plan.
- Monitor and review, by the Steering Group, of the achievement of targets at regular intervals. Recommended interval is once a year.
- Keep records of all sustainable travel initiatives carried out during the year.

For guidance refer to National Transport Authority '*Toolkit for School Travel*' (www.nationaltransport.ie).

8 Green-Schools Ireland

Green-Schools is an environmental education programme, environmental management system and award scheme that promotes and acknowledges long-term, whole-school action for the environment.

An Taisce's Green-Schools Travel programme encourages parents and students to choose active and sustainable modes of transport for the school run. Each year the programme works with schools in rural and urban settings to encourage walking, cycling and scooting to school along with options such as Park 'n' Stride, carpooling and using public transport.

Over 1500 primary and secondary schools countrywide have taken part or are taking part in the Green-Schools Travel programme.

The Lucan Community College was involved in the Green-Schools Travel Programme and achieved a green flag. The school will continue to participate as part of a Transition Year student programme.

9 Conclusion

- The key to the Plan's success will be the appointment of a Mobility Management Coordinator and Steering Group that will manage mobility. They will be vested with total responsibility for implementing the plan. They should be granted the authority and time to execute the Plan, and be provided with sufficient resources to realise the Plan's success. The success of the measures depends on the co-operation of all parties.

- The measures recommended are dependent on origin of pupils. For pupils living within 2km from school an increase in the numbers walking / cycling is the preferred option, with increased car sharing a second option. For those pupils living more distant from the school, increased transport sharing is recommended.

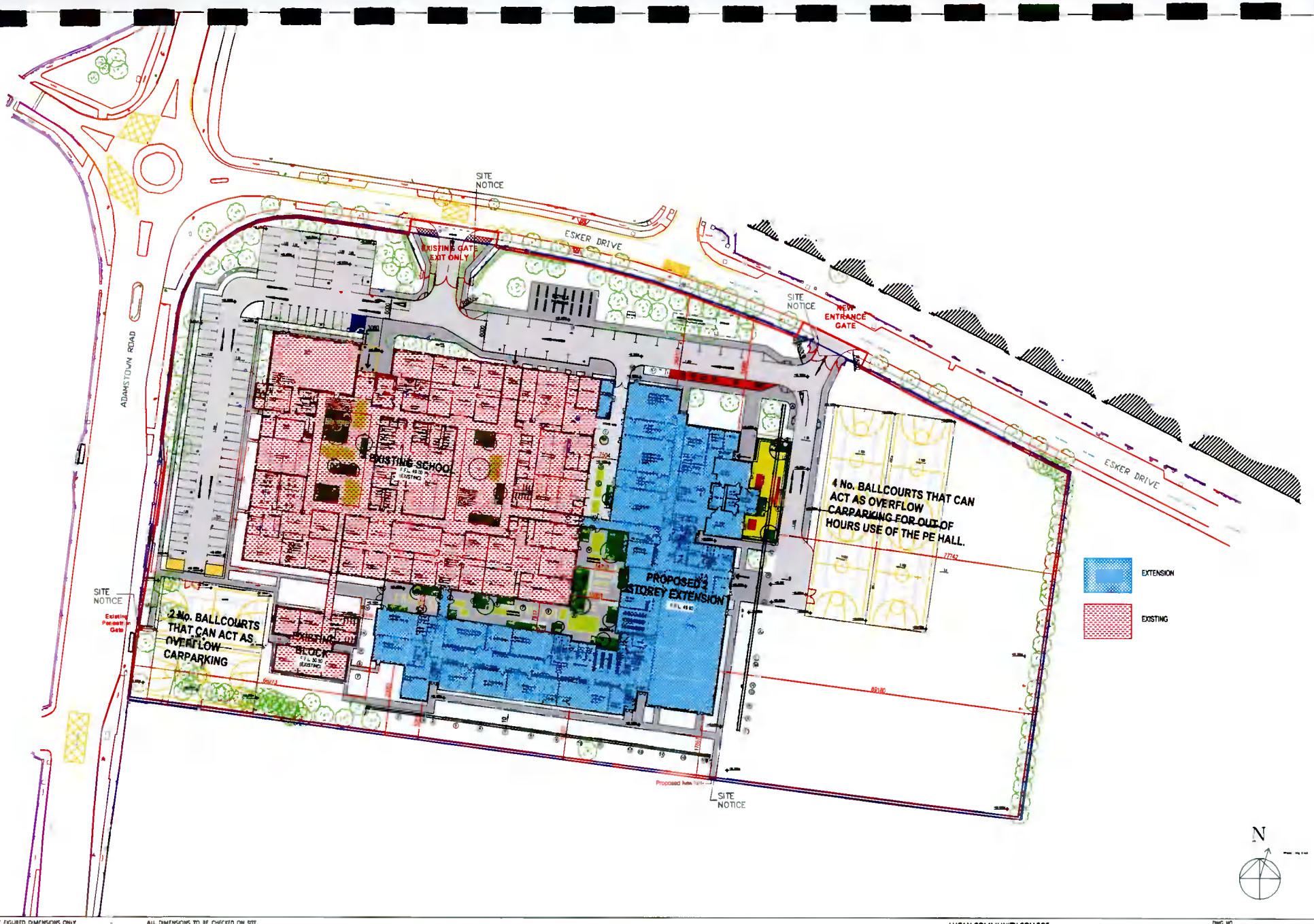
- Realistic targets are provided which will, when implemented, reduce the number of vehicular trips by 35%.

- Surveys should be carried out at regular intervals to confirm the effectiveness of the mobility management measures. Reviews of the plan should include a full survey, providing valuable information for target setting and marketing target groups. Survey form contained in Appendix B can be used.

- It is emphasised that failing to meet initial targets should not be a failing, but rather an opportunity to engage and develop a more sustainable, successful and specific solution for the parents, pupils and staff at the school.

Appendices

Appendix A - Drawings



DO NOT SCALE - USE FIGURED DIMENSIONS ONLY - ALL DIMENSIONS TO BE CHECKED ON SITE

REV	DATE	DRN BY	CKD BY	APP BY	DESCRIPTION
A	16.06.16	PF			GENERAL REVISION TO ADDRESS CLIENT AND CONSULTANT COMMENTS
B	16.08.02	PF			GENERAL REVISION FOLLOWING DES MEETING OF 16.06.21

JOB TITLE: LUCAN COMMUNITY COLLEGE
CLIENT: ETB DDL
DRAWING: SITE PLAN (OVERALL PLAN)

DWG NO: 025
REF: 1400-025
JOB NO: 1400
REV: B
SIZE: A1
DRN BY: PF
SCALE: 1.500
DATE: 2016.07.25
STATUS: STAGE 2B
CKD BY:

WEJCHERT ARCHITECTS
2 TOWER BAGGOT STREET, DUBLIN 2, D02 K089, IRELAND
T +353 (0)1 661 0321 E mail@wejchert.ie W www.wejchert.ie

Appendix B – Survey Form and Results

Teacher Led Pupil Travel Pattern Survey Date: _____

One form per classroom, surveyed by a show of hands in class and ***Please read notes below before completion***

SCHOOL NAME _____

CLASS _____

Number of pupils present in class ☐ **(1)** = (2) + (3) + (4)+ (5) + (6)
Number of pupils absent from class ☐

How do pupils usually travel to school?

1 No. of pupils who walk ☐ **(2)**
2 No. of pupils who cycle ☐ **(3)**
3 No. of pupils who travel by bus ☐ **(4)**
4 No. of pupils who travel by train ☐ **(5)**
5 No. of pupils who travel by car ☐ **(6)** = (7) + (8) + (9) + (10)

Of the pupils who travel by car do they

5.1 Travel on their own ☐ **(7)**
5.2 with 1 other School pupil ☐ **(8)**
5.3 with 2 other School pupils ☐ **(9)**
5.4 with 3 or more other School pupils ☐ **(10)**

Origin of pupils who travel **BY CAR ONLY**

Townsland/Estate	Number of pupils	Townsland/Estate	Number of pupils

Notes
a) Record the normal means of transport used by each pupil.
b) Where a pupil uses more than one mode, please record the mode used over the final part of the journey

Staff Travel Pattern Survey

Date: _____

One form for school and ***Please read notes below before completion***

SCHOOL NAME _____

Number of staff present ☐ **(1)** = (2) + (3) + (4)+ (5) + (6)
Number of staff absent ☐

How do staff usually travel to school?

1	No. of staff who walk	☐ **(2)**
2	No. of staff who cycle	☐ **(3)**
3	No. of staff who travel by bus	☐ **(4)**
4	No. of staffs who travel by train	☐ **(5)**
5	No. of staff who travel by car	☐ **(6)** = (7) + (8) + (9) + (10)

Of the staff who travel by car do they

5.1	Travel on their own	☐ **(7)**
5.2	with 1 other staff member	☐ **(8)**
5.3	with 2 other staff member	☐ **(9)**
5.4	with 3 or more other staff member	☐ **(10)**

Origin of staff who travel **BY CAR ONLY**

Townsland/Estate	Number of staff	Townsland/Estate	Number of staff

Notes

a) Record the normal means of transport used by each staff member.

b) Where astaff member uses more than one mode, please record the mode used over the final part of the journey.

Results of Teacher Led Student Travel Survey

Class details	1st	1st	1st	1st	1st	1st	2nd	2nd	2nd	2nd	2nd	3rd	3rd	3rd	3rd	3rd	3rd	4th	4th	4th	4th	4th	4th	5th	5th	5th	5th	6th	6th	6th	6th	6th	6th	Total	%
Present	24	27	22	29	30	30	28	26	29	21	29	23	24	21	26	25	25	22	23	24	26	24	28	24	25	23	19	28	20	11	22	20	23	**801**	93%
Absent	1	3		1			2			2	1	5	5	3	2	1	4		1		2	3	2	3	1	2	3			6	3	3	2	**61**	7%
No of students who walk	16	18	13	14	17	18	16	16	19	11	9	12	16	11	10	16	12	18	14	16	18	14	15	14	14	21	9	15	11	10	11	11	16	**471**	59%
No of students who cycle		1	1	3	3	3	2	1	1		1	4	1		3				2	1	1	1	1		4		2		1		1	1		**39**	5%
No of students who travel by bus						1		3		2	2			1	1	2	2		2	2	1	1	3	1	1			2	1		2	1		**31**	4%
No of students who travel by car	8	8	8	12	10	8	10	6	9	8	17	7	7	9	12	7	11	4	5	5	6	8	9	9	6	2	8	11	7	1	8	7	7	**260**	32%
a) with no other school student	1	8	2		3	5	6	1	2	3	5	2		5	4	1	4		2		1	3	4	6	2	2	3	4	2	1	4	3	1	**90**	35%
b) with 1 other school student	6		6	9	7		4	4	7		8	1	3	3	5	5	5	4	3	3	3	5	4	1	2		3	5	4		3	4	5	**122**	47%
c) with 2 other school students	1			1		2		1		4	3	1	1	1	1		2			2	2		1	1	2		2	2				1	**31**	12%
d) with 3 other school students				2		1				1	1	3	3		2	1							1	1					1		1			**17**	7%

Blue text denotes values input

Red text denotes adjusted values

No of students surveyed **801**

Existing student population 862

Key Survey Findings		
survey based on	**93%**	of student population
1	59%	of students walk to school
2	5%	of students cycle to school
3	4%	of students arrive by bus to school
4	32%	of students arrive by car to school

Student Occupancy	No of students arriving by car	No of trips	**Car occupancy**
1	90	90	
2	122	61	
3	31	10	**1.57**
4	17	4	
Total	260	166	

Origin of students arriving by car		1st	1st	1st	1st	1st	1st	2nd	2nd	2nd	2nd	2nd	3rd	3rd	3rd	3rd	3rd	4th	4th	4th	4th	4th	4th	5th	5th	5th	5th	6th	6th	6th	6th	6th	6th	Total
Town / Country / Estate	**Distance (km)**																																	
Woodview	1.3	2														1	1							1										5
Earlsfort Lawn, Park, Meadows	1	1						1			1			1																				4
Celbridge, Co. Kildare	7.8	1			2				1				1						2		1													8
Tullyhall Drive, Ave	2	1						2						1									1								2			7
Finnstown	1.6	1	1	1	2		1			1	1	1		1							1			1							1		1	14
Foxborough	2.4	1						3					1	1			2				1			2			2							13
Airlie Heights	2	1																			1							1						3
Weston	3		1						1		1	3			2			1				1	2					2				2	1	17
Maynooth	12		1																			1												2
Rossberry Avenue	1.9		1		1											1																		3
Dodsborough Road	1.4			1							1																		1					3
Fforster (Close, Lawn)	2			1		1									2																			4
Liffey Park, Lawn, Road, Close, Cresent, Walk, Hall, Ave	3.3		1													1								1		1								4
Sarsfield Park	1.4			1																				1							1			3
Westbury	0.5						1																											1
Hansted	1.6						1				1						2	1															1	6
Liffey Valey Park	3.3						1																											1
Rochfort Park	2.7				2																													2
Griffeen Avenue, Park	1.6									1					1				1					1			1		1					6
Moy Glas	1.9				1	3		1			2			1										1							1	2		12
Station Rd	8								1																									1
Saint Andrews	1.9								1	1																					1			3
Palmerstown	6.4							1							1	1															1			4
Glenmaroon Park	6.8																										1							1
Oldbridge Park	2								1																									1
Hillcrest	1														1	1	2										3							7
Haydens Park	1.6			1		1					1															2								5
Clarkville	6.3																														1			1
Rosse Court	3						1																											1
Mount Bellew	2.3		1		1									1																				3
Ballyowen	2.8			2	2		1						1																	1				7
The Old Forge	1.5										2			1								1												4
Penny Hill	2																														1			1
Moortown	20																										1							1
Colthurst	2.6					1										1									2									4
Clonee	8.6																									1								1

Fox Inn	32																								1							1
Larkfield	3											1							1		2					2			1		7
Enfield	29																			1												1
Kilcock, Co. Kildare	20										1									1												2
Lucan Heights	1.9																				1											1
Lucan Village	1.1										2							2														4
Laraghcon	2.5															1																1
Castleriada	1.8																									1						1
Grange Manor	1.6				1	1						1								1	1											5
The Paddocks Grove	1.4															1																1
Summerhill, Co. Meath	30										1																					1
Glenvale, Maynooth	12.6						1			1																							2
Ballgaddy	2.6									1										1												2
Bewley Estate	2.2						1		1			1	1																			1	5
Johnsbridge	1.3						2		2	1				1	1			1								1					1	10
Ballyfermot	7.5													1																		1
Laraghcon	2.5						1			1					1																		3
Gandon	1.5														1																	1
Cooldrinagh	2.8																								1							1
Esker Wood	1.9																		2	1			3									6
Esker Lodge	1.6		1				1			1					1																	4
Esker Meadow	1.4		1					1																								2
Esker Lane	2.2																			1												1
Esker Drive	0.3										1																					1
Hermitage Valley	2.6															1									2							3
Ardeevin Avenue	1.8					1																										1
Ballydowd	3.7					1																										1
Clondalkin	6			1									1							1		1									1	4
Adamstown	1.9							2			1		1		1	1																6
Willsbrook Rd	2.6					1													1		2		1			1					1	7
Leixlip, Co. Kildare	4.1																					2					2					4
Newcastle	7.5												1																1			2
Elmbrook	1.8								1		1		1				1															4
St. Josephs	1.7						1																									1
	Total	8	8	8	12	10	8	10	6	9	8	17	7	7	9	12	7	11	4	5	5	6	8	9	9	6	2	8	11	7	1	8	7	7	260