APPENDIX 8 MICRO CLIMATE STUDY

Coolagad Wind Microclimate

Wind Microclimate Study

Report For: Cairn Homes Properties Ltd

Project No: 16036

Version History

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Integrated Environmental Solutions Limited
International Sustainability Consulting Developers of the IES **<Virtual Environment>**

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P1-02	15/03/2022	Updated Report	Colin Rees
P1-03	28/03/2022	Minor nomenclature updates	Colin Rees

Table of Contents

List of Figures

1 Executive Summary

IES Consulting have been commissioned to investigate the impact from wind around the proposed residential development at the Coolagad, Greystones in Co. Wicklow. The site consists of 6 apartment blocks (to include 203 units), 32 duplexes and 351 houses.

For the analysis, 8 steady state Computational Fluid Dynamics (CFD) simulations were performed for the main wind directions (N, NE, E, SE, S, SW, W and NW) and annual average wind speed obtained from the Casement Aerodrome weather data set. The results obtained from the simulations were extrapolated along the annual weather data to obtain the most probable local air speed for each hour of the year. Statistical analysis was performed on this dataset to check compliance against the Lawson's Pedestrian Comfort criterion.

The following table provides values for the Lawson's Pedestrian Comfort Assessment criteria for various activities.

Category	Pedestrian Activity	Threshold mean hourly wind speed not to be exceeded for more than 5% of the time (m/s)
C1	Business Walking	10
C2	Leisurely Walking	8
C3	Standing	6
C4	Sitting	4

The following table provides values for Lawson's Pedestrian Safety Assessment criteria.

Category	Pedestrian Type	Threshold mean hourly wind speed not to be exceeded more than once per annum [2](m/s)
S1	Typical Pedestrian	20
S2	Sensitive Pedestrian	15

The results are presented in the form of false colour contour images of the percentage of year that the local air speed is likely to exceed a certain value at every point on the locations of interest. The air speed threshold value is mentioned in the title of the colour legend at the top right corner of each image. Do note that the scale for the images for results of the comfort criteria goes from 0.1% to 100%, and the scale for images for results of the safety criteria goes from 0.001% to 1%.

The median wind speed recorded was more than 5 m/s for weather location's climatic conditions. That means, for 50% of year, the wind speed is higher than 5 m/s. The Lawson's Sitting Criterion requires the local air speed be more than 4m/s for no more than 5% of the year. Thus, the Lawson's Sitting Criterion presents a task of being 10 times better than the climatic conditions at location of interest.

1.1 Sitting and Standing Comfort Criteria

The Lawson's sitting comfort criteria states that the local air speed at designated locations should not exceed 4m/s for more than 5% of the duration analysed. The Lawson's standing comfort criteria states that the local air speed at designated locations should not exceed 6m/s for more than 5% of the duration analysed.

The results of the annual analysis for sitting and standing criterion are observed in the top left and right corners of the images in section 7.1 respectively.

1.1.1 Balconies

It was observed that almost 65% of balconies show excellent results and fully met requirements of the Lawson's sitting criterion for the full year. The local air speed is generally lower than 4m/s for more than 95% of the year as per the criterion's requirement.

The remaining 35% of balconies do not show full compliance with the requirements of the Lawson's Sitting Comfort criterion, i.e. the local air speed exceeds 4m/s for more than 5% of the year. Some balconies lie on the west façade of blocks A1, A2, B1, B2 and C2. Few balconies lie on the south most façade of block A1 and block A2.

1.1.1.1 Balconies of Block A1 and Block A2

Figure 1 and Figure 2 show the balconies on the west façade of block A1 with results for the Lawson's Sitting and Standing Comfort Criteria assessment. These show excellent compliance with the requirements of the Lawson's Sitting and Standing Comfort Criterion, i.e. the local air speed does not exceed 4m/s for more than 5% of the year. There are unlikely to be any effects on the private amenity spaces here, with no further mitigation measures required.

Figure 1 and Figure 2 also show the balconies on the west façade of block A2. These balconies show limited compliance with the requirements of the Lawson's Sitting Comfort criterion. These balconies are circled yellow in Figure 1. The local air speed is likely to exceed 4m/s for more than 20% of the year at these locations. Few balconies show limited compliance with the requirements of the Lawson's Standing Comfort criterion. The local air speed also exceeds 6m/s for up to 20% of the year at these locations, see Figure 2. These balconies are impacted due to direct wind flowing from the prevailing southwest and west direction.

The remainder of the balconies are fully compliant with the requirements of the Lawson's Sitting and Standing Comfort Criteria, i.e. the local air speed does not exceed 4m/s for more than 5% of the year.

The balcony spaces are the private spaces which are used by the people residing in the respective flat. They will be expected to use their own discretion in judging the comfortable weather conditions. It is not a space that can be treated as a public open space where people have to use it frequently. So, no further mitigation measures required as such.

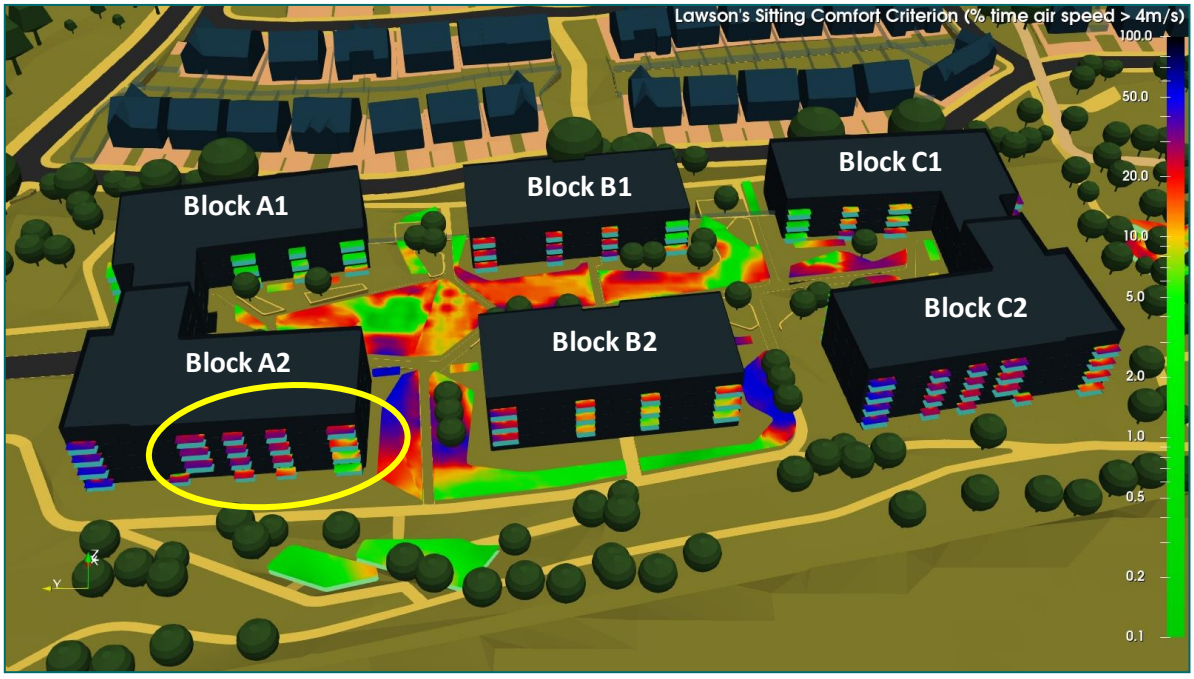

Figure 1: Sitting Comfort Criterion: View of the balconies on the west façade

Figure 2: Standing Comfort Criterion: View of the balconies on the west façade

1.1.1.2 Balconies of Block B1 and Block B2

Figure 3 and Figure 4 show the balconies on the west façade of block B1 and block B2. These balconies show limited compliance with the requirements of the Lawson's Sitting Comfort criterion. These balconies are circled in yellow in Figure 3. The local air speed is likely to exceed 4m/s for up to 20% of the year at these locations. These balconies are impacted due to direct wind flowing from the prevailing southwest and west direction.

However, on comparing the results for these locations to Lawson's Standing Comfort Criterion results, they show good compliance, i.e. the local air speed does not exceed 6m/s for more than 5% of the year, see Figure 4. Of the 20% of year when the local air speed exceeds 4m/s, three quarters of that collective time (i.e. 15% of the year) it does not exceed 6m/s. The local air speed on balconies will be less than 4m/s for 80% of the year and between 4-6m/s for 15% of the year. Any exceedance noted can be considered very marginal and it will not lead to an environment which is unpleasant to use. The local air speed is only going to be greater than a gentle breeze but most frequently less than a moderate breeze. Such conditions are unlikely to have any impact on usability of this private space for personal recreation.

The remainder of the balconies are fully compliant with the requirements of the Lawson's Sitting and Standing Comfort Criteria, i.e. the local air speed does not exceed 4m/s for more than 5% of the year.

The balcony spaces are the private spaces which are used by the people residing in the respective flat. They will be expected to use their own discretion in judging the comfortable weather conditions. It is not a space that can be treated as a public open space where people have to use it frequently. So, no further mitigation measures required as such.

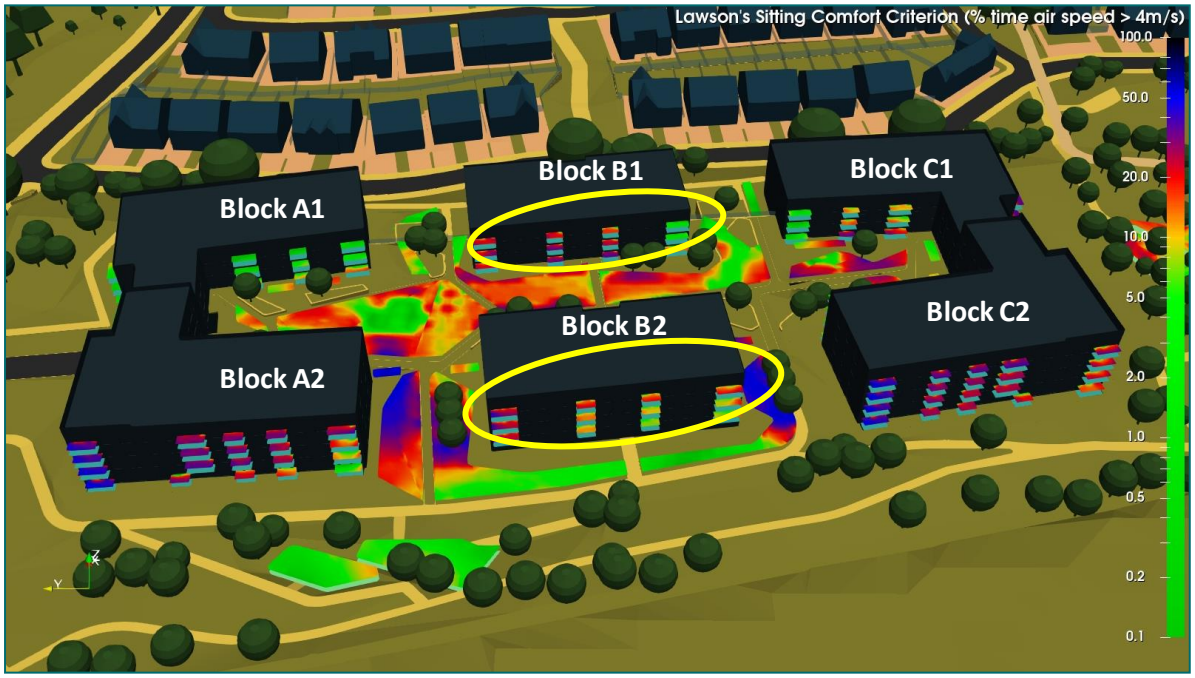

Figure 3: Sitting Comfort Criterion: View of the balconies on the west façade

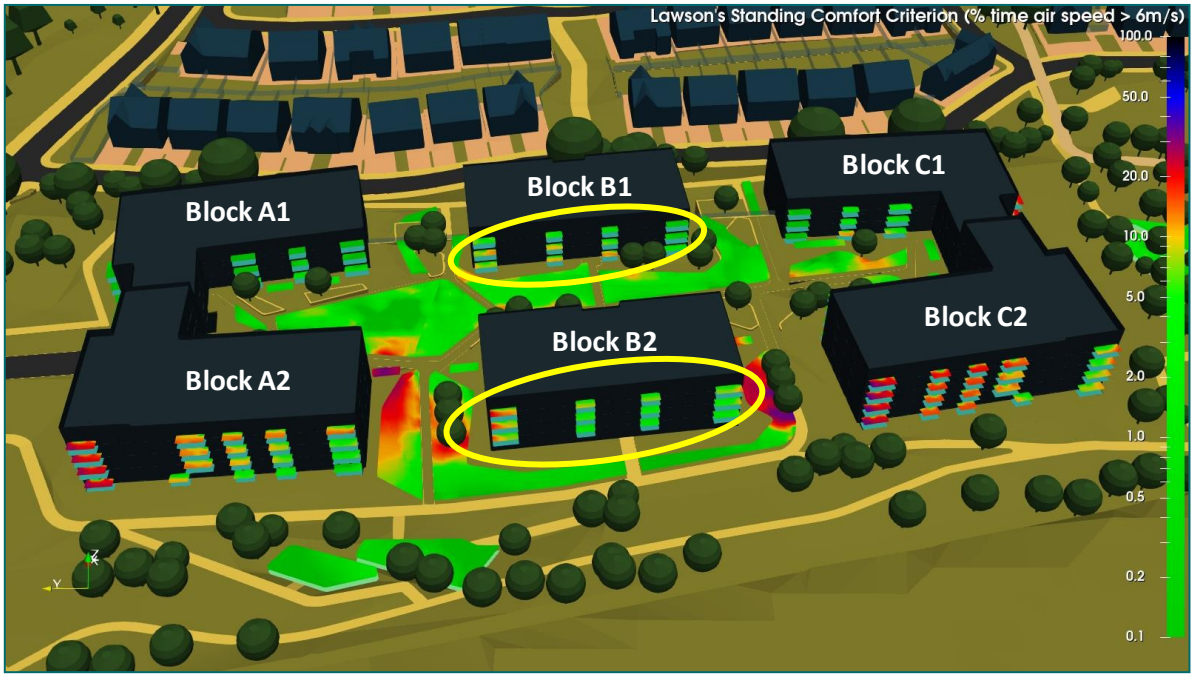

Figure 4: Standing Comfort Criterion: View of the balconies on the west façade

1.1.1.3 Balconies of Block C1 and Block C2

Figure 5 to Figure 8 show the balconies on the west and south façade of block C1 and block C2. These balconies show the limited compliance with the requirements of the Lawson's Sitting Comfort criterion. These balconies are circled in yellow in Figure 5 and Figure 6. The local air speed is likely to exceed 4m/s for more than 20% of the year at these locations. These balconies also show limited compliance with the requirements of the Lawson's Standing Comfort criterion. The local air speed also exceeds 6m/s for up to 20% of the year at these locations, see Figure 7 and Figure 8. These balconies are directly impacted due to a strong wind breeze flowing from the prevailing southwest and west direction.

The remainder of the balconies are fully compliant with the requirements of the Lawson's Sitting and Standing Comfort Criteria, i.e. the local air speed does not exceed 4m/s for more than 5% of the year.

The balcony spaces are the private spaces which are used by the people residing in the respective flat. They will be expected to use their own discretion in judging the comfortable weather conditions. It is not a space that can be treated as a public open space where people have to use it frequently. So, no further mitigation measures required as such.

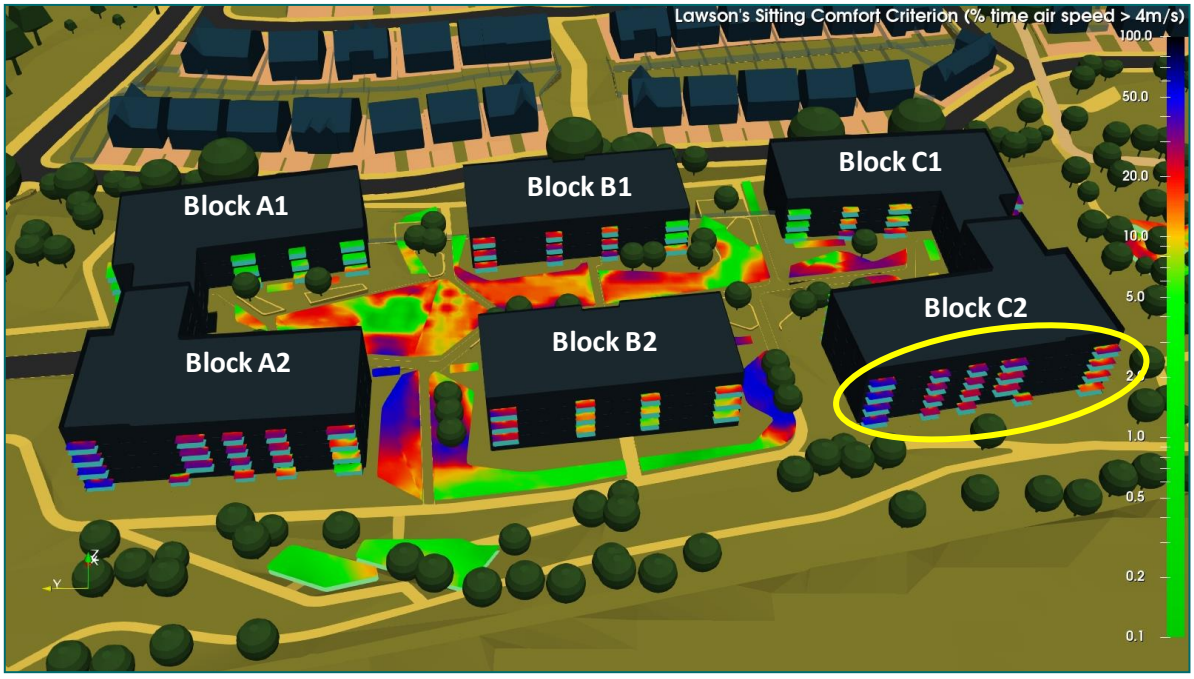

Figure 5: Sitting Comfort Criterion: View of the balconies on the west façade

Figure 6: Sitting Comfort Criterion: View of the balconies on the south façade

Figure 7: Standing Comfort Criterion: View of the balconies on the west façade

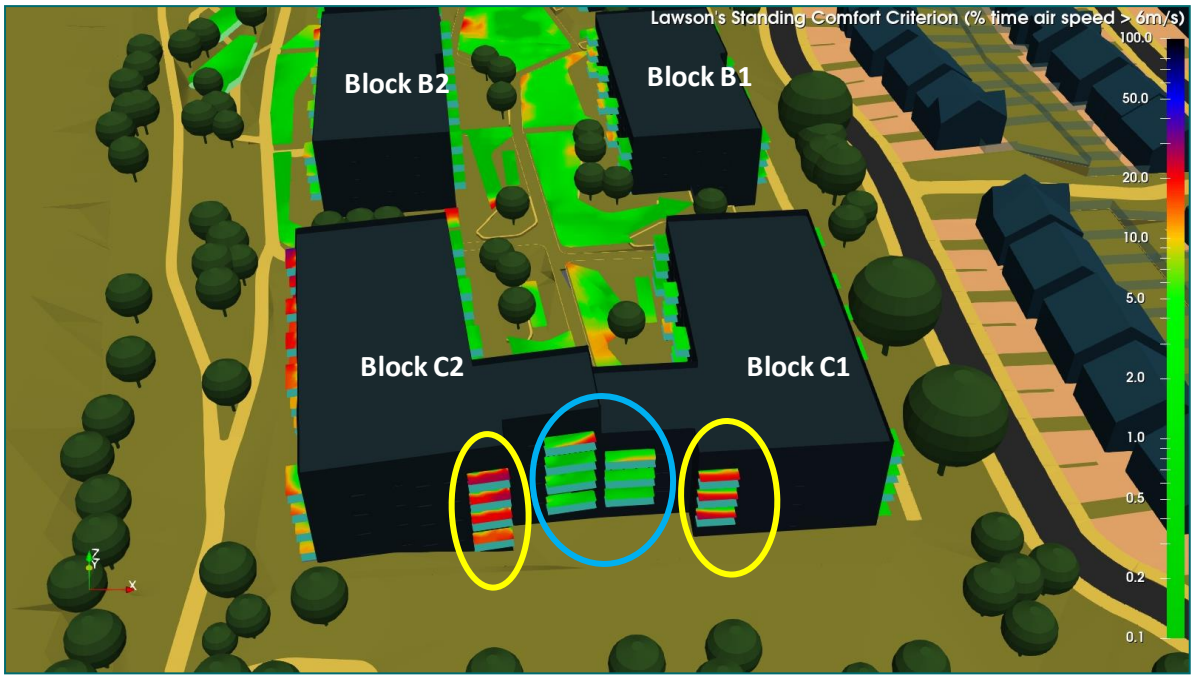

Figure 8: Standing Comfort Criterion: View of the balconies on the south façade

1.1.2 Ground Amenities

1.1.2.1 Residential Blocks

Figure 9 and Figure 10 show the results of sitting and standing comfort on the ground amenity spaces surrounded by the residential blocks.

These ground amenity spaces show limited compliance with the requirements of the Lawson's Sitting Comfort criterion. The local air speed is likely to exceed 4m/s for up to 20% of the year at these locations.

However, on comparing the results for these locations to Lawson's Standing Comfort Criterion results, they show excellent compliance, i.e. the local air speed does not exceed 6m/s for more than 5% of the year. See Figure 10. Of the 20% of year when the local air speed exceeds 4m/s, three quarters of that collective time (i.e. 15% of the year) it does not exceed 6m/s. The local air speed on these spaces will be less than 4m/s for 80% of the year. Any exceedance noted can be considered very marginal and it will not lead to an environment which is unpleasant to use. The local air speed is only going to be greater than a gentle breeze but most frequently less than a moderate breeze. Such conditions are unlikely to have any impact on usability of space for recreation.

A portion of these ground spaces demonstrate the local air speed exceeding 6m/s for more than 5% of the year, see Figure 10. These spaces are impacted due to prevailing southwesterly wind and are subject to acceleration that can occur due to flow through narrow passage between blocks. But these locations are more likely to be used as an access path to the central courtyard. Sitting/Standing type activities are unlikely in these locations. So no further mitigation measures will be required.

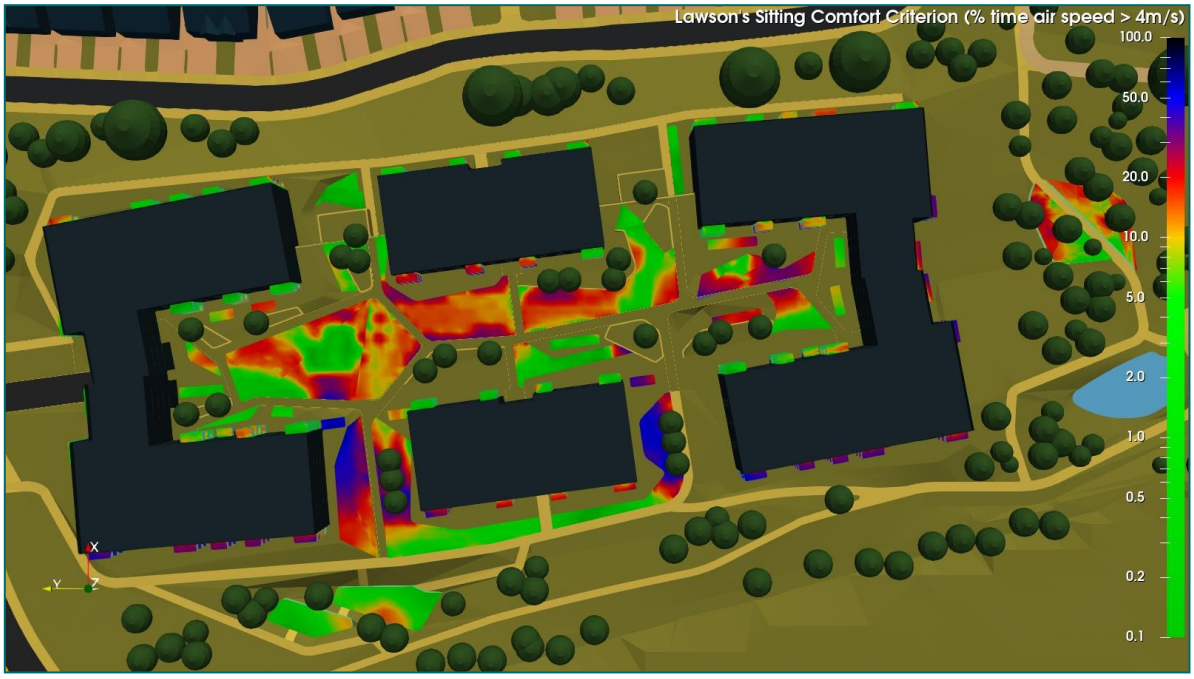

Figure 9: Sitting Comfort Criterion: Ground Amenities: Courtyard

Figure 10: Standing Comfort Criterion: Ground Amenities: Courtyard

1.1.2.2 Creche and Community Buildings

Figure 11 and Figure 12 show the results of sitting and standing comfort on the ground amenity around the crèche and community.

These ground amenity spaces show limited compliance with the requirements of the Lawson's Sitting Comfort criterion. The local air speed is likely to exceed 4m/s for up to 20% of the year at these locations. These spaces are impacted due to prevailing southwesterly wind.

However, on comparing the results for these locations to Lawson's Standing Comfort Criterion results, they show excellent compliance, i.e. the local air speed does not exceed 6m/s for more than 5% of the year, see Figure 12. Of the 20% of year when the local air speed exceeds 4m/s, three quarters of that collective time (i.e. 15% of the year) it does not exceed 6m/s. The local air speed on these spaces will be less than 4m/s for 80% of the year. Any exceedance noted can be considered very marginal and it will not lead to an environment which is unpleasant to use. The local air speed is only going to be greater than a gentle breeze but most frequently less than a moderate breeze. Such conditions are unlikely to have any impact on usability of this space.

Figure 11: Sitting Comfort Criterion: Ground Amenities: Creche and Community buildings

Figure 12: Standing Comfort Criterion: Ground Amenities: Creche and Community buildings

1.2 Walking Comfort

The Lawson's Leisure Walking comfort criteria states that the local air speed at designated locations should not exceed 8m/s for more than 5% of the duration analysed, on the various paths around the development. The Lawson's Business Walking comfort criteria states that the local air speed at designated locations should not exceed 10m/s for more than 5% of the duration analysed, on the various paths around the development.

Figure 13 to Figure 16 show the results of walking comfort criteria.

Figure 13: Leisure Walking Comfort Criterion: View of the residential blocks

Figure 14: Leisure Walking Comfort Criterion: View of the Creche and Community buildings

Figure 15: Business Walking Comfort Criterion: View of the residential blocks

Figure 16: Business Walking Comfort Criterion: View of the Creche and Community buildings

These show excellent compliance with the requirements of the Lawson's Leisure walking, and Business walking Comfort Criteria. The local air speed does not exceed 8m/s, and 10 m/s for more than 5% of the year, respectively.

1.3 Safety Criteria

The Lawson's Normal Pedestrian safety criteria states that the local air speed at designated locations should not exceed 20m/s for more than 0.01% of the duration analysed. The Lawson's Sensitive Pedestrian safety criteria states that the local air speed at designated locations should not exceed 15m/s for more than 0.01% of the duration analysed. The Sensitive pedestrian safety criterion applies to the vulnerable population such as pensioners and children. Note the limit of the criterion is 0.01% and not 5% as with the comfort criterion.

These criteria are also intended for various paths, and grounds around the development, as access is required at all times irrespective of weather conditions to enter or exit the various buildings. Figure 17 to Figure 20 show the results of safety criteria assessment. The criterion for the normal and sensitive pedestrian is achieved throughout the site. None of the paths around the development show even 0.01% prevalence of local air speeds exceeding 20m/s i.e. Normal Safety Criterion threshold.

Few spots around the development exceeds the 0.01% prevalence of local air speeds exceeding 15m/s as required by the Sensitive Pedestrian Safety Criterion threshold. These are visible in red, contour color. The green areas in Figure 19 and Figure 20 are fully compliant with the requirements of the Sensitive Pedestrian Safety Criterion.

The site can be considered as safe for all residents including those that would be considered vulnerable.

Figure 17: Normal Pedestrian Safety Criterion: View of the residential blocks

Figure 18: Normal Pedestrian Safety Criterion: View of the Creche and Community buildings

Figure 19: Sensitive Pedestrian Safety Criterion: View of the residential blocks

Figure 20: Sensitive Pedestrian Safety Criterion: View of the Creche and Community buildings

2 Introduction

IES Consulting have been commissioned to study the impact from wind around the proposed residential development at the Coolagad, Greystones in Co. Wicklow. In summary, the proposed development consists of 586 residential units (351 houses; 203 apartments and 32 duplex units) at a site c. 26.03 ha at Coolagad, Greystones. The development will also include the provision of a community building, a creche, a sport field and a MUGA. A proposed new vehicular entrance with signalised junction from the R761 Rathdown Road to the north of Gate Lodge, Rathdown Road opposite Sea View and Redford Cemetery, providing a distributor road as part of the long-term objective to provide a northern access route from Greystones to the N11 is also proposed. The development also includes site development infrastructure, a hierarchy of internal streets including bridges, cycle paths & footpaths; new watermain connection and foul and surface water drainage; the development also provides for the upgrading of the public sewer within the wayleave of the R761/R762 (Rathdown Road) from the site entrance as far as the R762 in front of St. Kevin's National School , Rathdown Road, Greystones.

The analysis is performed to study the effect from the building layout on pedestrian comfort as well as safety for people using the public and various amenity spaces around the site. The analysis will look at the air movement around the buildings for eight wind directions (SW, W, NW, N, NE, E, SE and S) with the wind velocity set to the mean value obtained from the weather file.

The following simulation report describes the modelling methodology used in the study, including assumptions made and calculations used to determine the boundary conditions and results obtained from the simulations.

3 Weather Data

The analysis is based on the 'Casement Aerodrome' weather file. The variation of wind speed recorded in the weather file is shown in Figure 21 below. Figure 22 show the wind direction variation and Figure 23 show the wind rose.

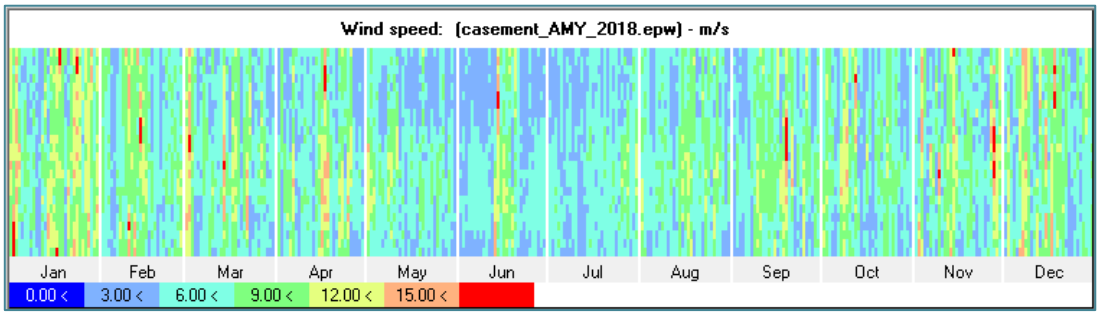

Figure 21: Wind speed variation as per casement_AMY_2018.epw

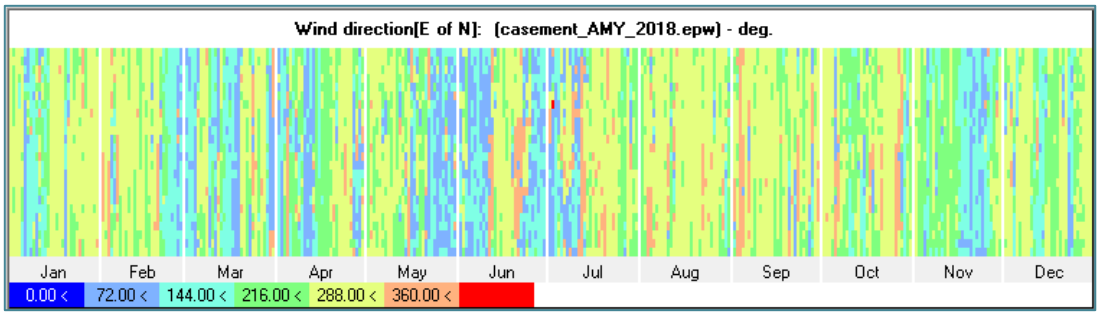

Figure 22: Wind direction variation as per casement_AMY_2018.epw

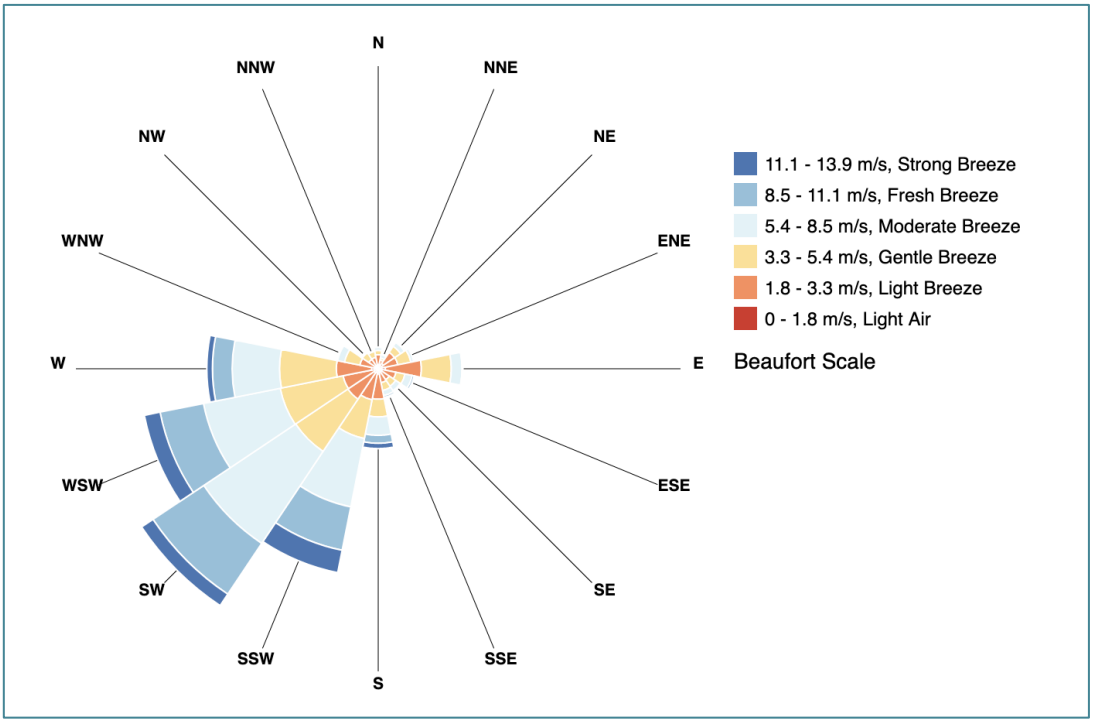

Figure 23: Wind rose as per casement_AMY_2018.epw

4 Wind Boundary Layer

In an atmospheric boundary layer, wind speed increases with height due to the influence of surface roughness (i.e. the presence of buildings, trees, roads etc. on the ground), see Figure 24.

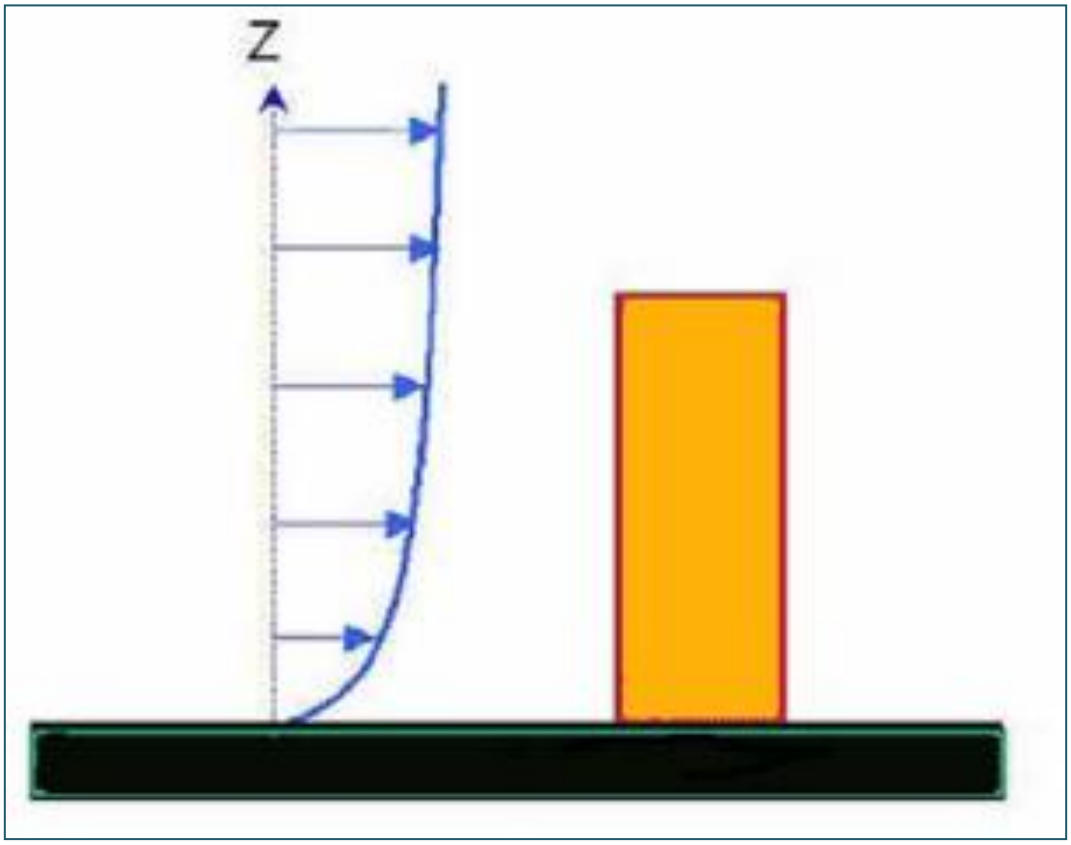

Figure 24: Typical velocity profile of an atmospheric boundary layer

In the current CFD modelling, the velocity profile was generated according to the parameterised ASHRAE methodology described below. This allows for different wind profiles across various terrain types: Open country; urban; and city centre.

The wind speed $\mathbf{U_H}$ at height **H** above the ground is given by:

$$U_H = U_{met}\left(\frac{\delta_{met}}{H_{met}}\right)^{a_{met}}\left(\frac{H}{\delta}\right)^{a} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.1)$$

Where,

a = Exponent in power law wind speed profile for local building terrain
δ = fully developed strong wind atmospheric boundary layer thickness (m)
$\mathbf{a_{met}}$ = Exponent for the meteorological station

δ_{met} = Atmospheric boundary thickness at the meteorological station (m)
H_{met} = Height at which meteorological wind speed was measured (m)
U_{met} = Hourly meteorological wind speed, measured at height H_{met} (m/s)

The parameters for different types of terrain are given as in table 1.

Table 1: Atmospheric boundary layer parameters

Terrain Category	Description	a	δ
1	Large city centres 50% of buildings above 21m over a distance of at least 2000m upwind.	0.33	460
2	Urban, suburban, wooded areas.	0.22	370
3	Open, with scattered objects generally less than 10m high.	0.14	270
4	Flat, unobstructed areas exposed to wind flowing over a large water body (no more than 500m inland).	0.10	210

For the current project, we used the atmospheric boundary layer corresponding to the terrain category 2 i.e. Urban/Suburban type of site. The met data was taken on category 3 terrain at a height of 10m.

5 Methodology for Pedestrian Comfort Calculation

The methodology for the analysis was as follows:

1) The annual mean wind speed was determined from the 'casement_AMY_2018.epw' weather file.
2) 8 steady state CFD simulations were performed corresponding to the 8 directions – SW, W, NW, N, NE, E, SE and S respectively.
3) The local air speed at various designated locations around the site was recorded for each of the simulations.
4) This value was compared to the meteorological wind speed used and the magnification factor at that location for the corresponding wind direction was determined.
5) The magnification factor was used to determine the air speed at the designated locations for the various recorded values of the wind speed and direction in the weather file, thus generating the local air speeds at designated locations for a year.
6) These recorded values were compared to the Lawson Pedestrian Comfort/Safety Criteria.

5.1 Lawson Pedestrian Comfort/Safety Criteria

The Lawson Criteria[1] was used as a reference to assess the wind effects. It is the most widely used reference for assessment of pedestrian comfort. It considers the air speed at the location as well as the frequency of the occurrence of this air speed. It consists of two assessment criteria:

1. The first criteria assess whether the air movement will be comfortable for the pedestrian for different types of activities.
2. The second criteria assess the feeling of safety or distress by the pedestrian at higher air speeds.

The following table gives the values for the Lawson's pedestrian comfort assessment criteria for various activities.

Category	Pedestrian Activity	Threshold mean hourly wind speed not to be exceeded for more than 5% of the time (m/s)
C1	Business Walking	10
C2	Leisurely Walking	8
C3	Standing	6
C4	Sitting	4

The following table gives the values for Lawson's Pedestrian Safety Assessment criteria.

Category	Pedestrian Type	Threshold mean hourly wind speed not to be exceeded more than once per annum[2](m/s)
S1	Typical Pedestrian	20
S2	Sensitive Pedestrian	15

[1]T. V. Lawson (2001) *Building Aerodynamics*, Imperial College Press, London.

[2]Once per annum means the safety threshold is not be exceeded 0.01% of the year.

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6 CFD Model

The CFD model was created based on the CAD drawings provided.

6.1 Model Geometry

Figure 25 to Figure 48 show the geometry as modelled.

Figure 25: Plan view of the site

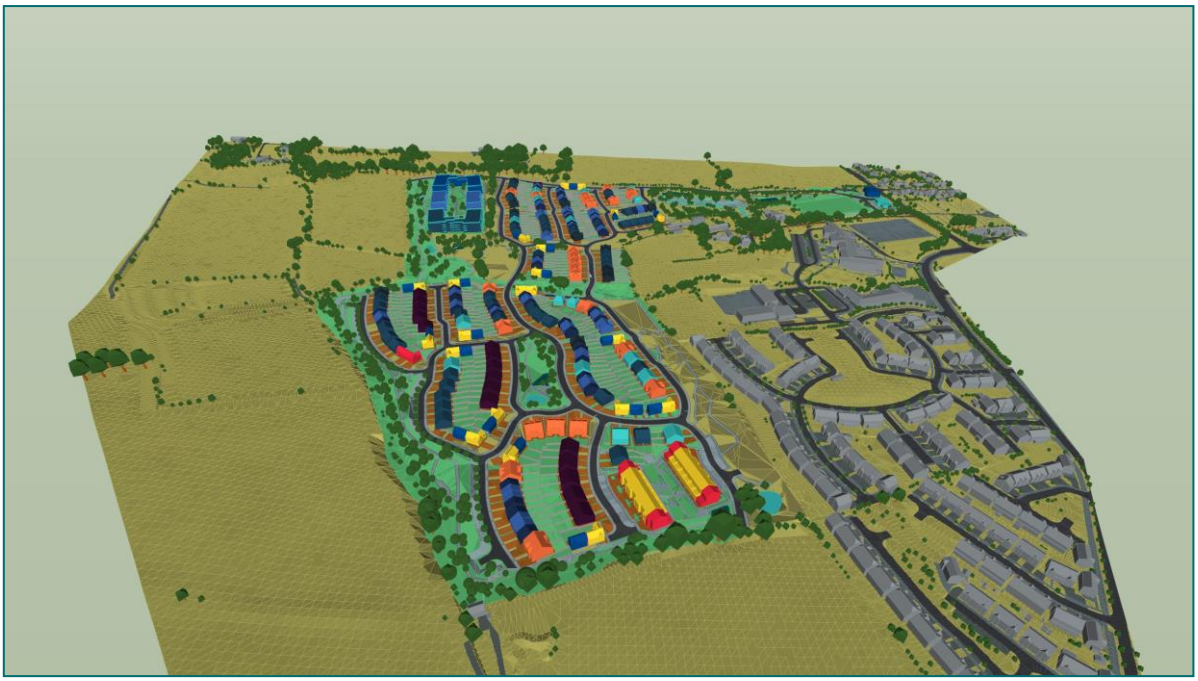

Figure 26: View of the site from the south

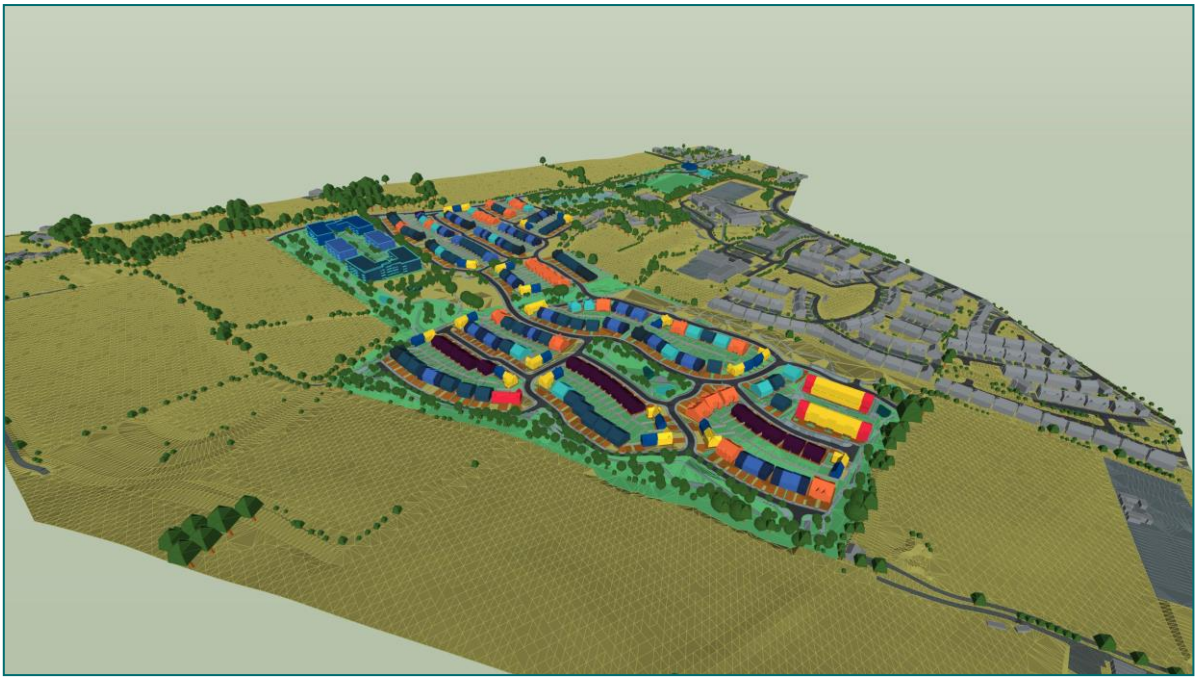

Figure 27: View of the site from the southwest

Figure 28: View of the site from the west

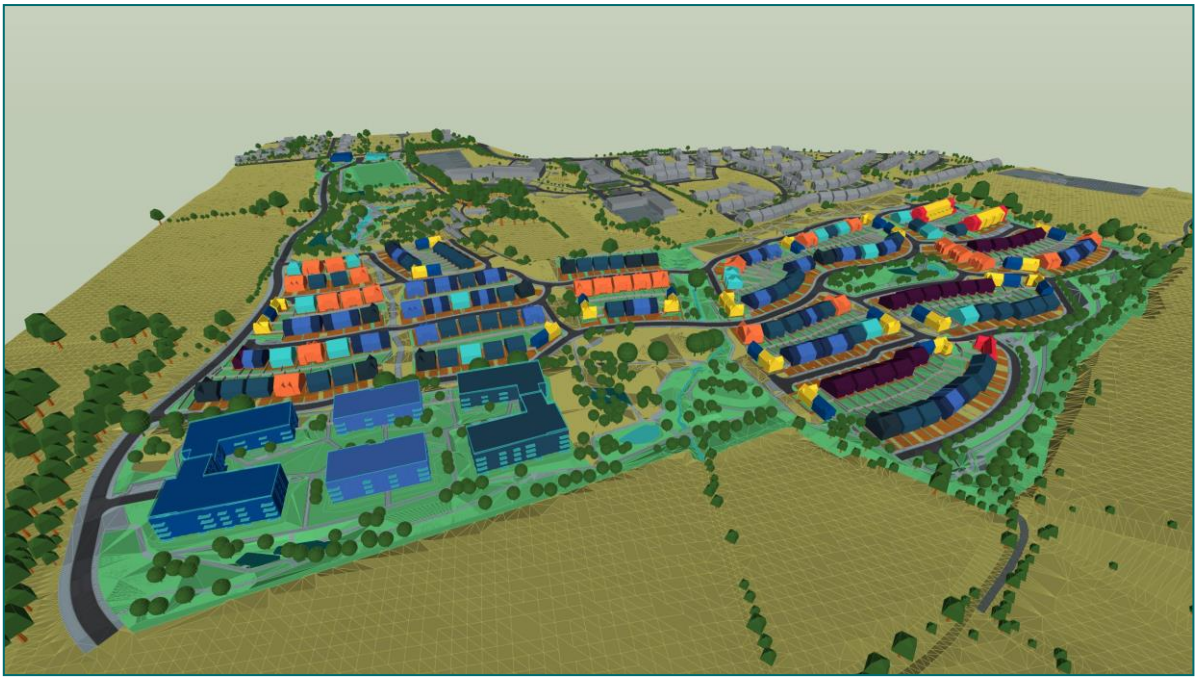

Figure 29: View of the site from the northwest

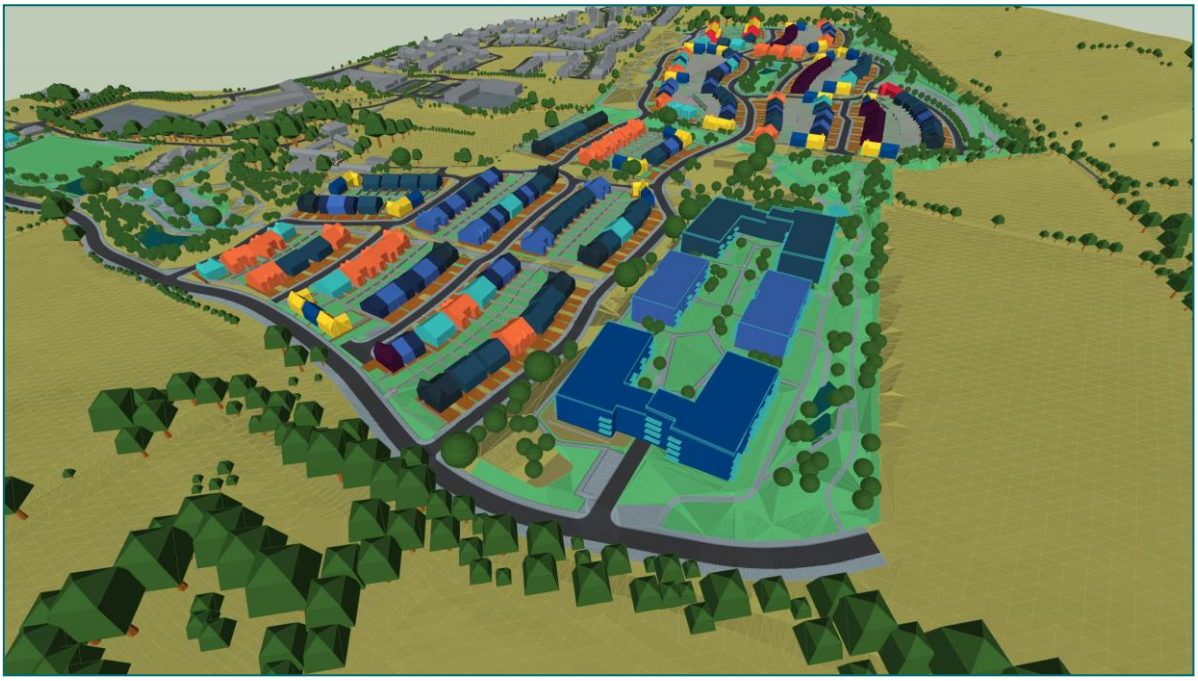

Figure 30: View of the site from the north

Figure 31: View of the site from the northeast

Figure 32: View of the site from the east

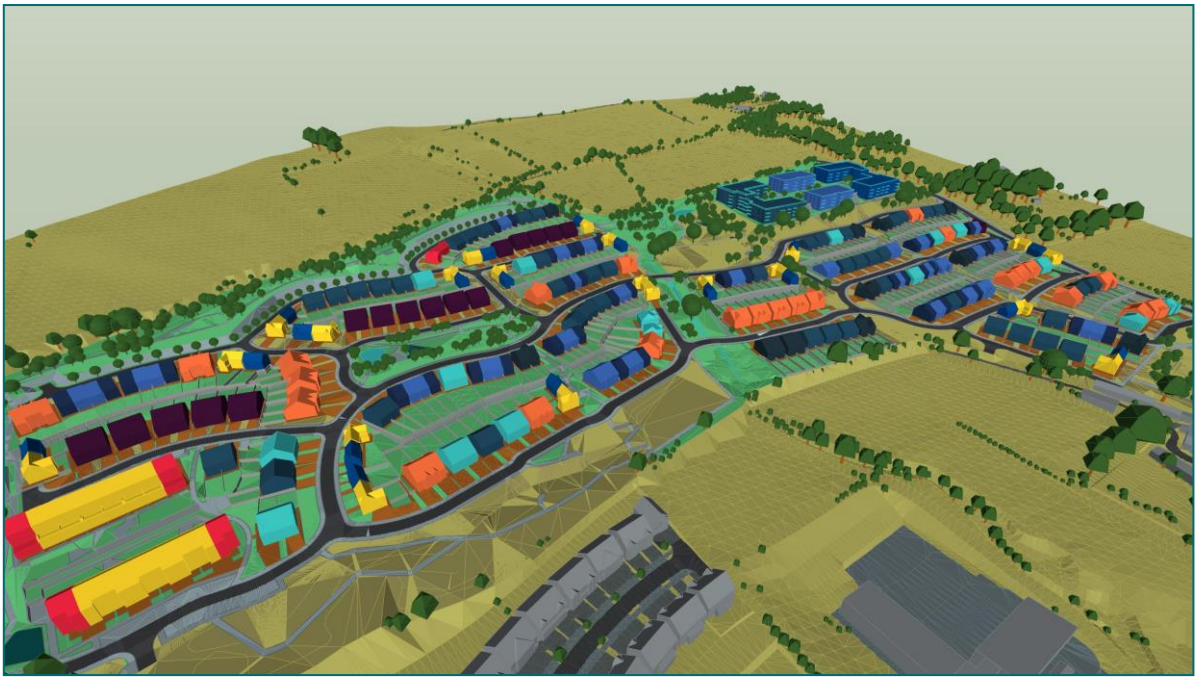

Figure 33: View of the site from the southeast

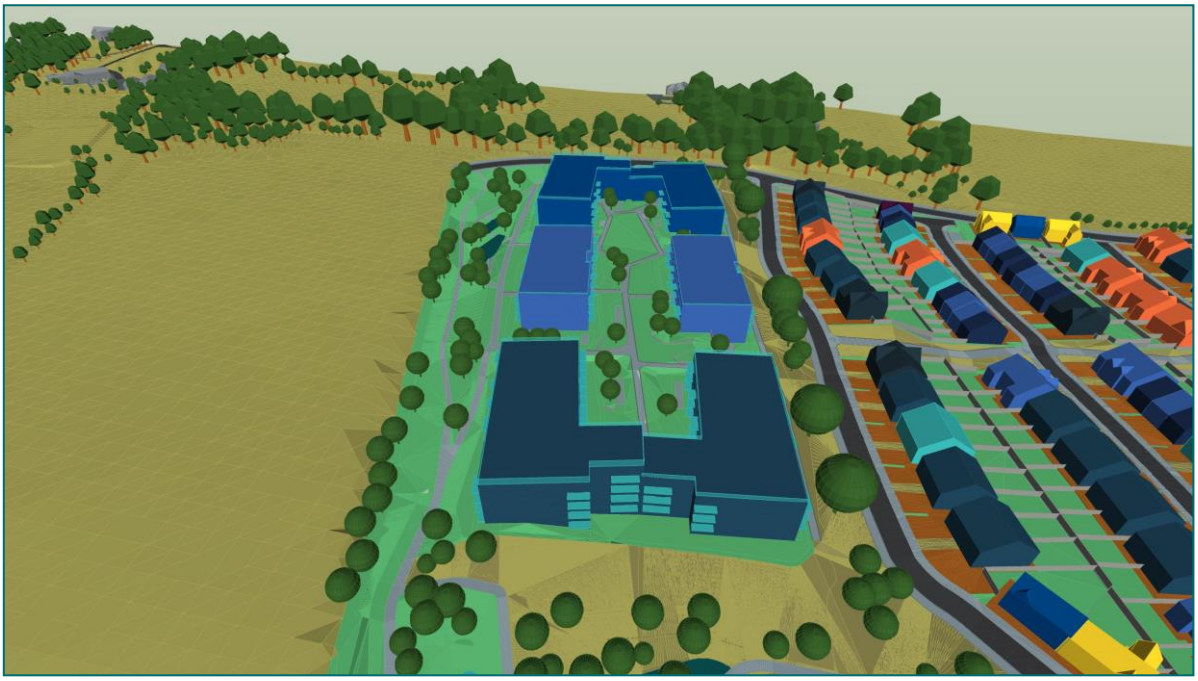

Figure 34: View of the residential blocks from the south

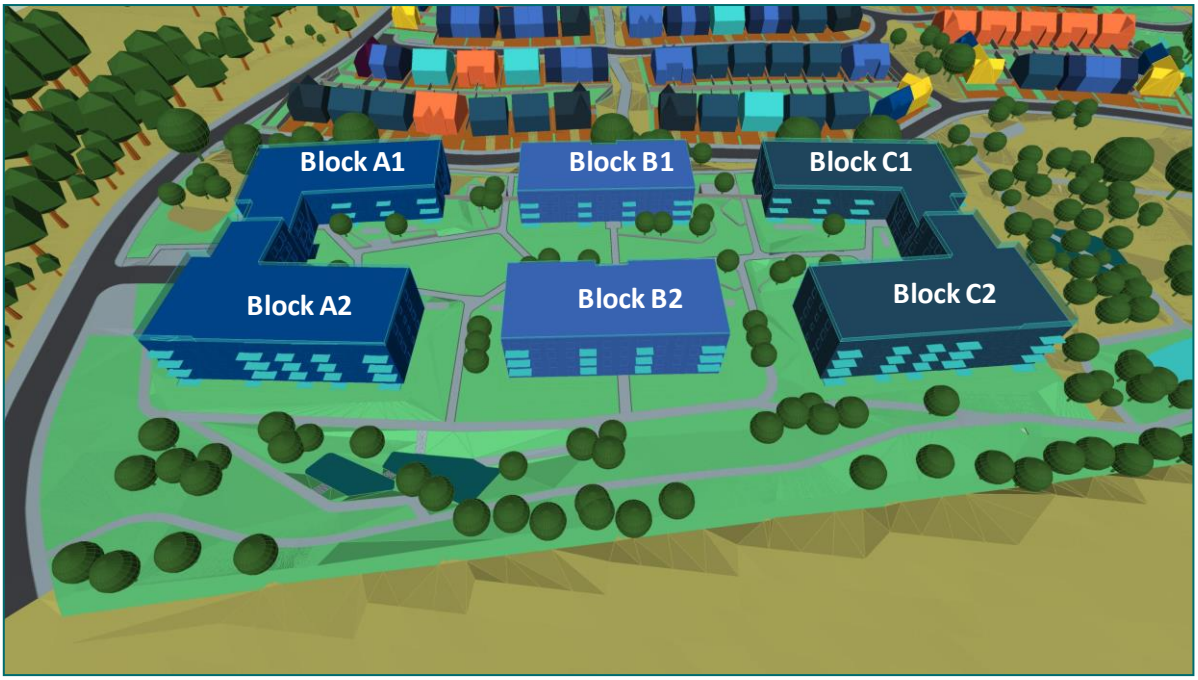

Figure 35: View of the residential blocks from the west

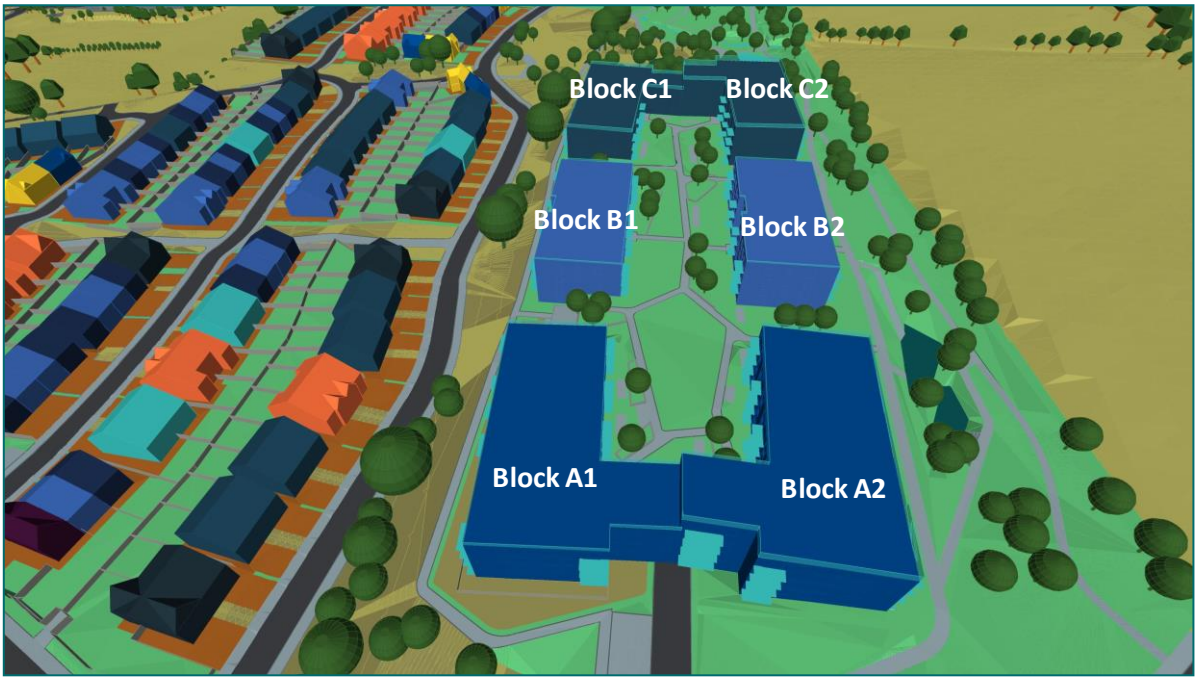

Figure 36: View of the residential blocks from the north

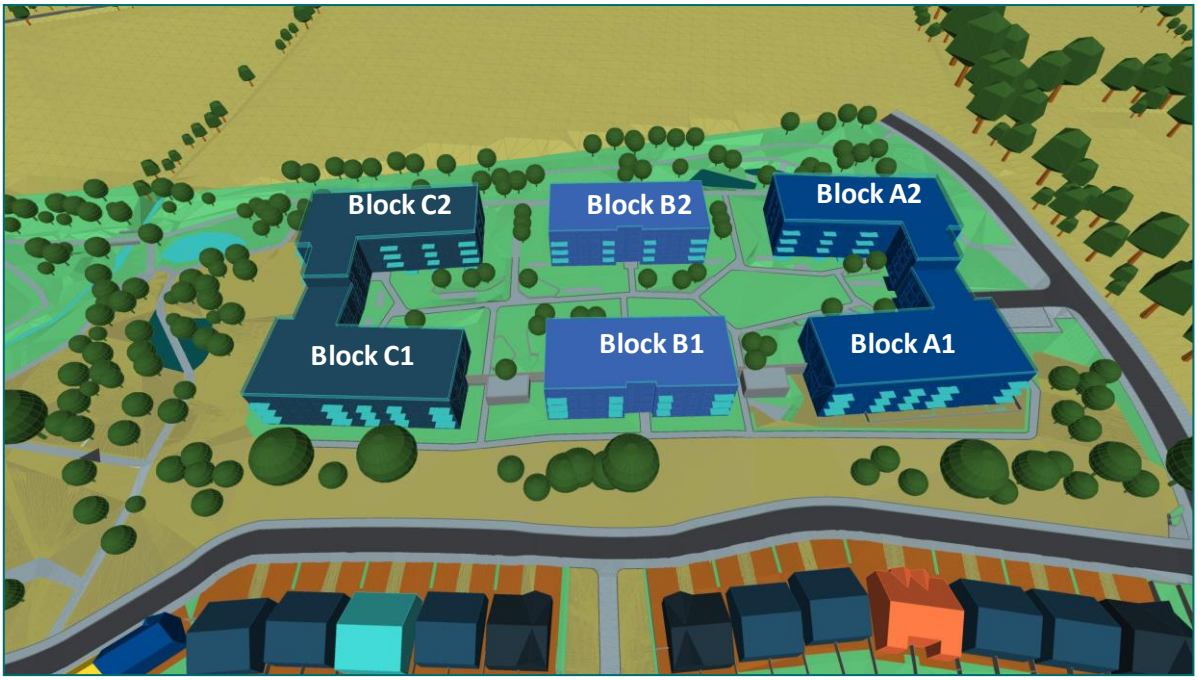

Figure 37: View of the residential blocks from the east

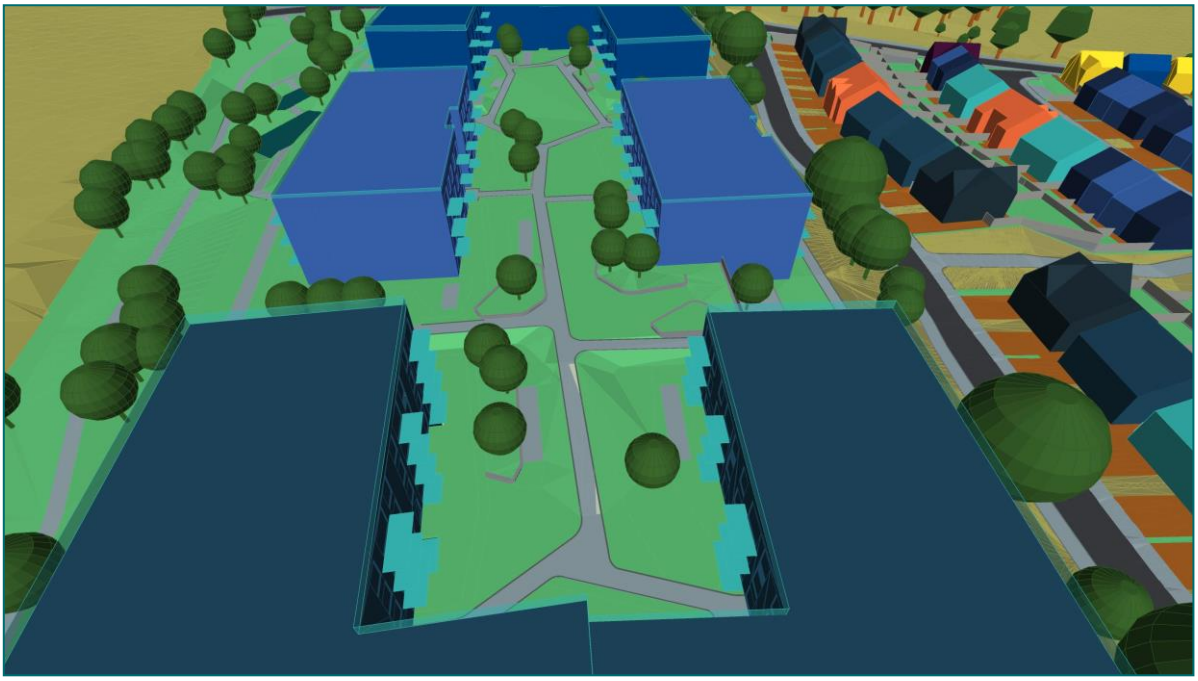

Figure 38: View of the amenity spaces inside the residential blocks

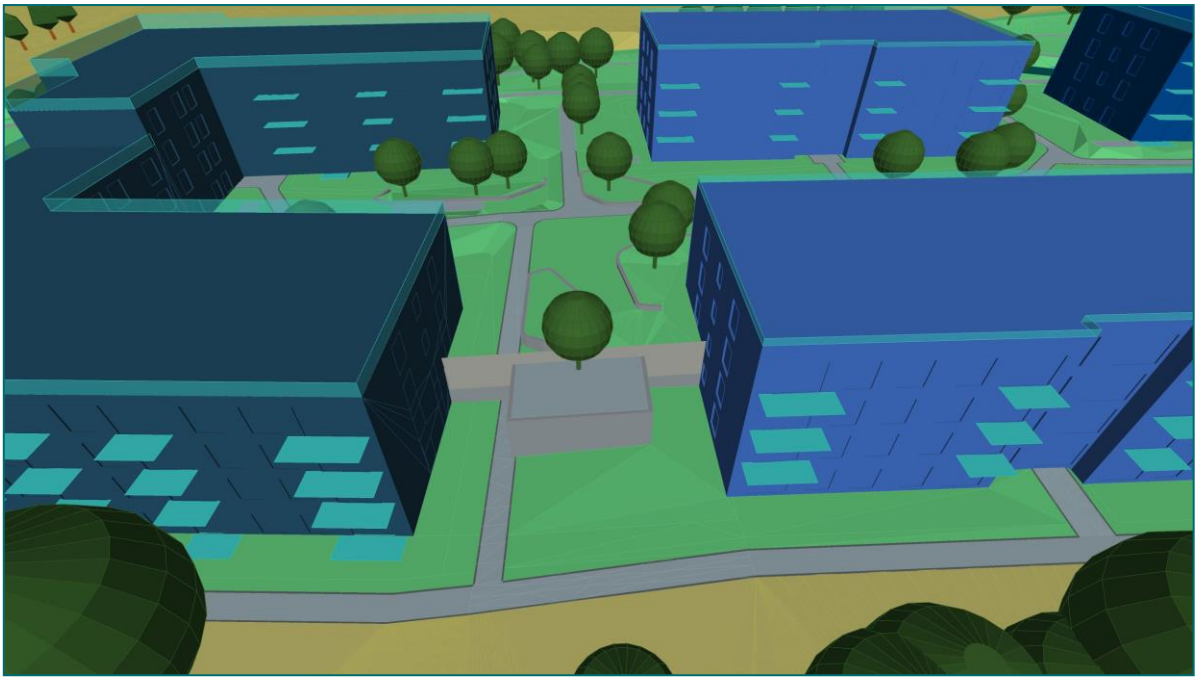

Figure 39: View of the amenity spaces inside the residential blocks

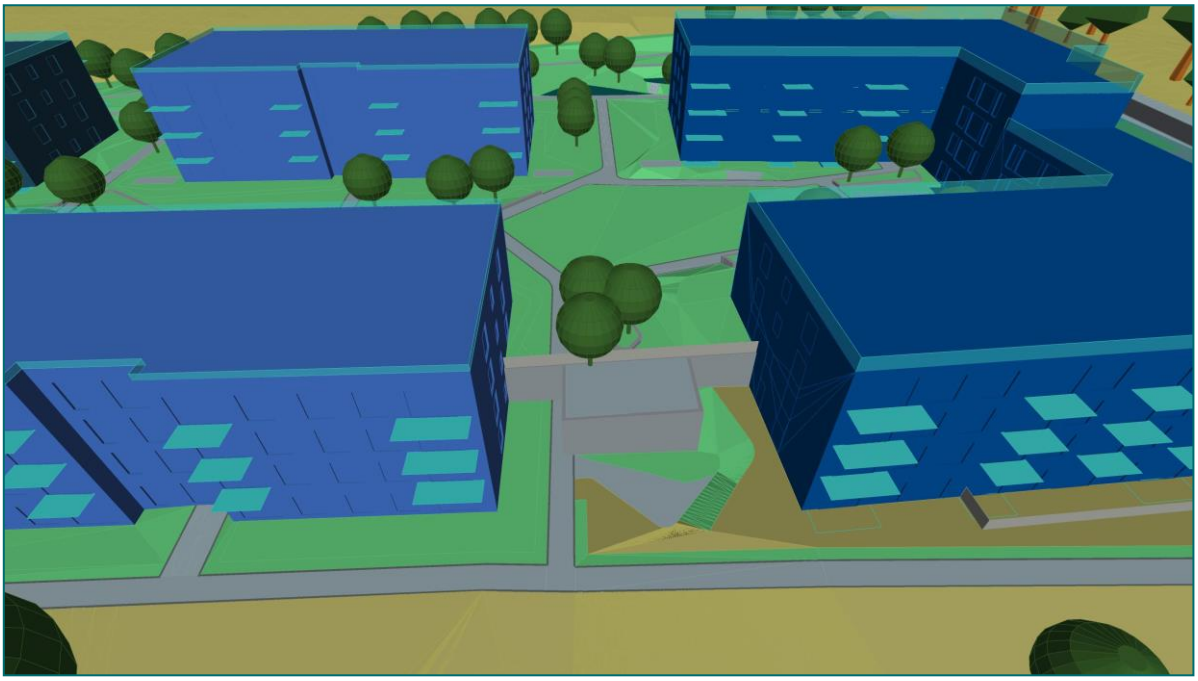

Figure 40: View of the amenity spaces inside the residential blocks

Figure 41: View of the duplex blocks

Figure 42: View of the duplex blocks

Figure 43: View of the duplex blocks

Figure 44: View of the duplex blocks

Figure 45: View of the duplex blocks

Figure 46: View of the Creche and Community buildings spaces

Figure 47: View of the duplex blocks and surrounding blocks

Figure 48: View of the entire site

7 Results

7.1 Comfort Criteria

Figure 49 to Figure 58 show the percentage of the year the hourly wind speed exceeds the threshold value for the comfort criteria such as Sitting, Standing, Leisurely Walking and Business Walking for all seasons. The threshold values are 4m/s, 6m/s, 8m/s and 10m/s respectively.

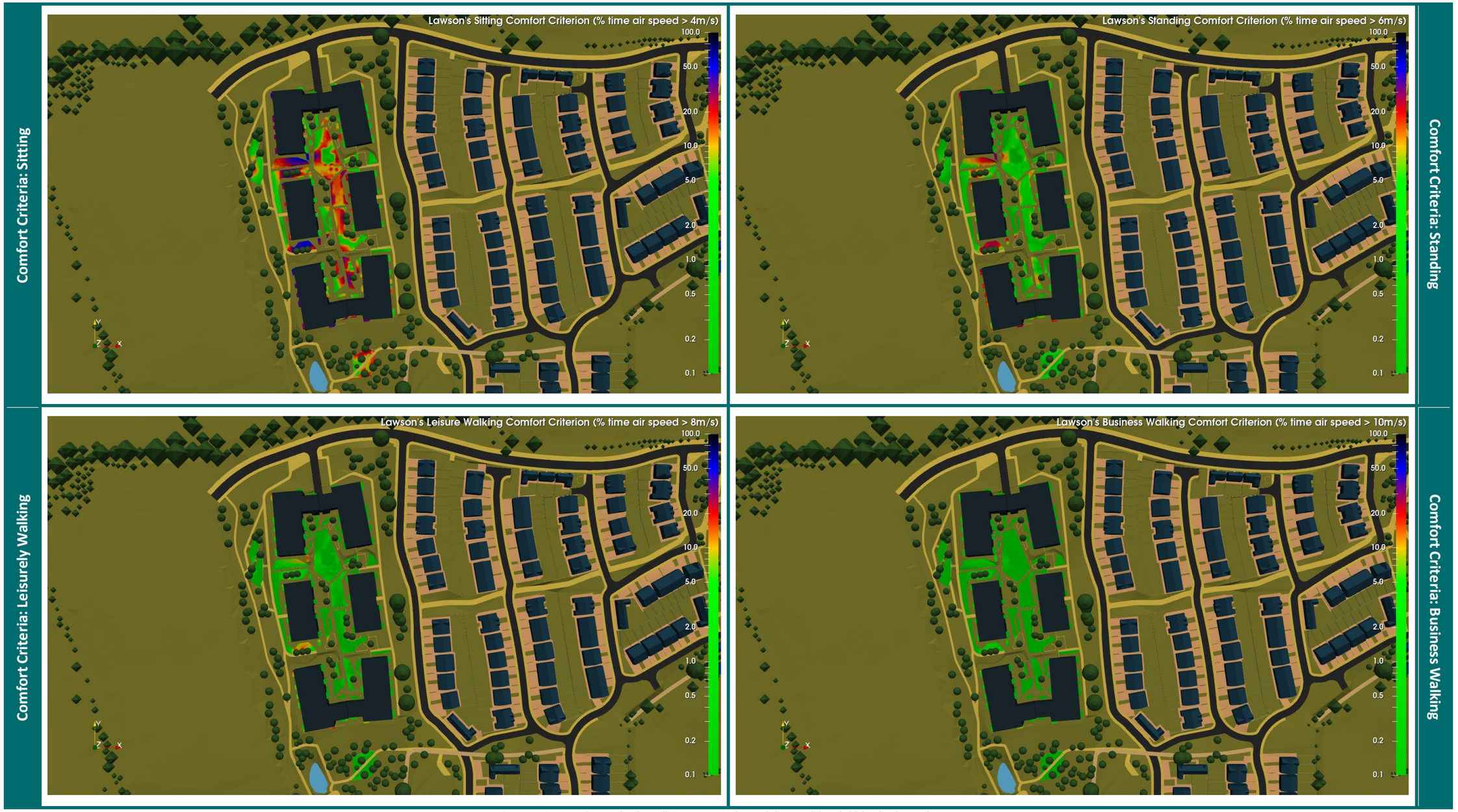

Figure 49: Comfort Criteria: All Seasons: View of the residential blocks from the top

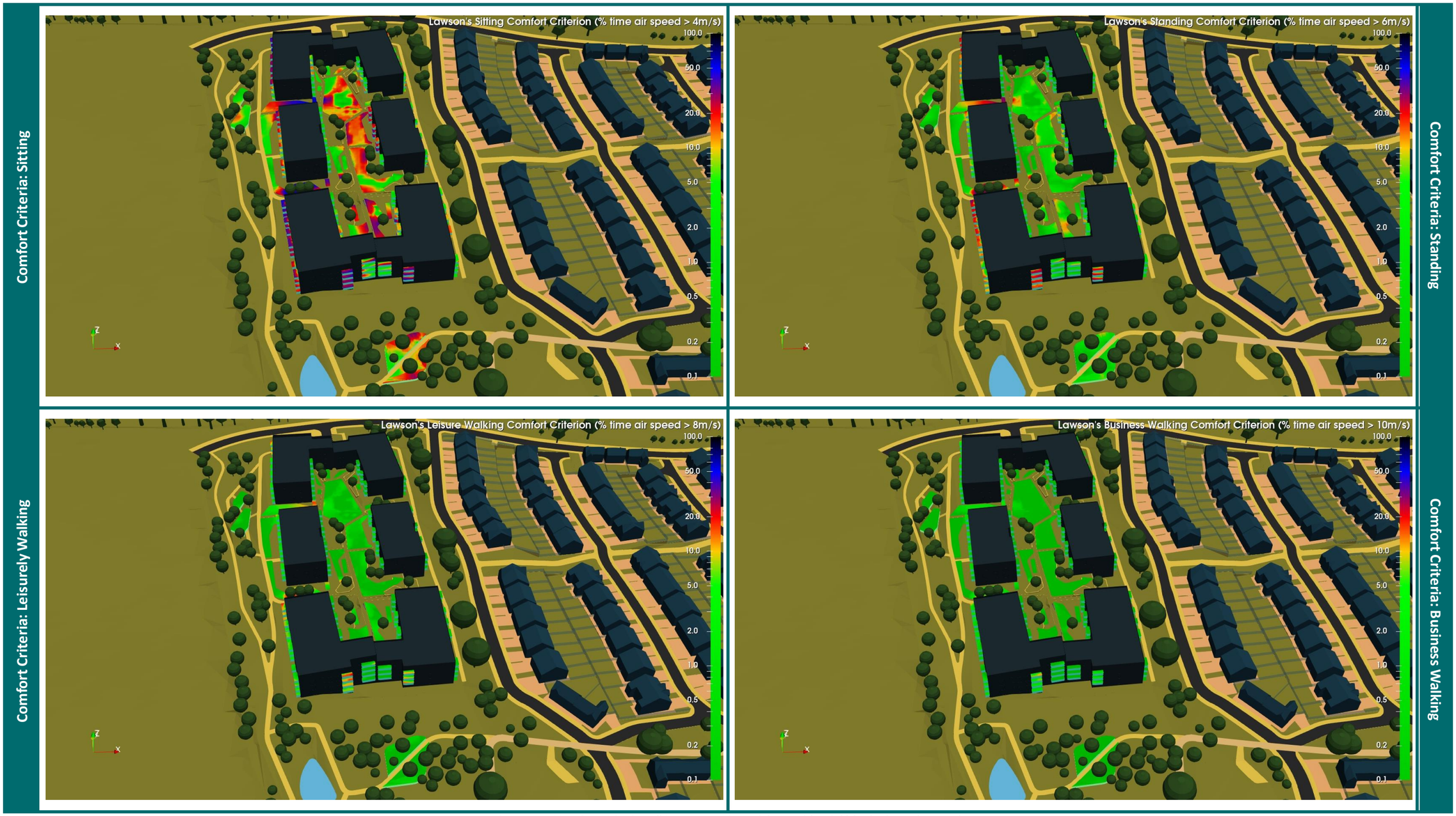

Figure 50: Comfort Criteria: All Seasons: View of the residential blocks from the south

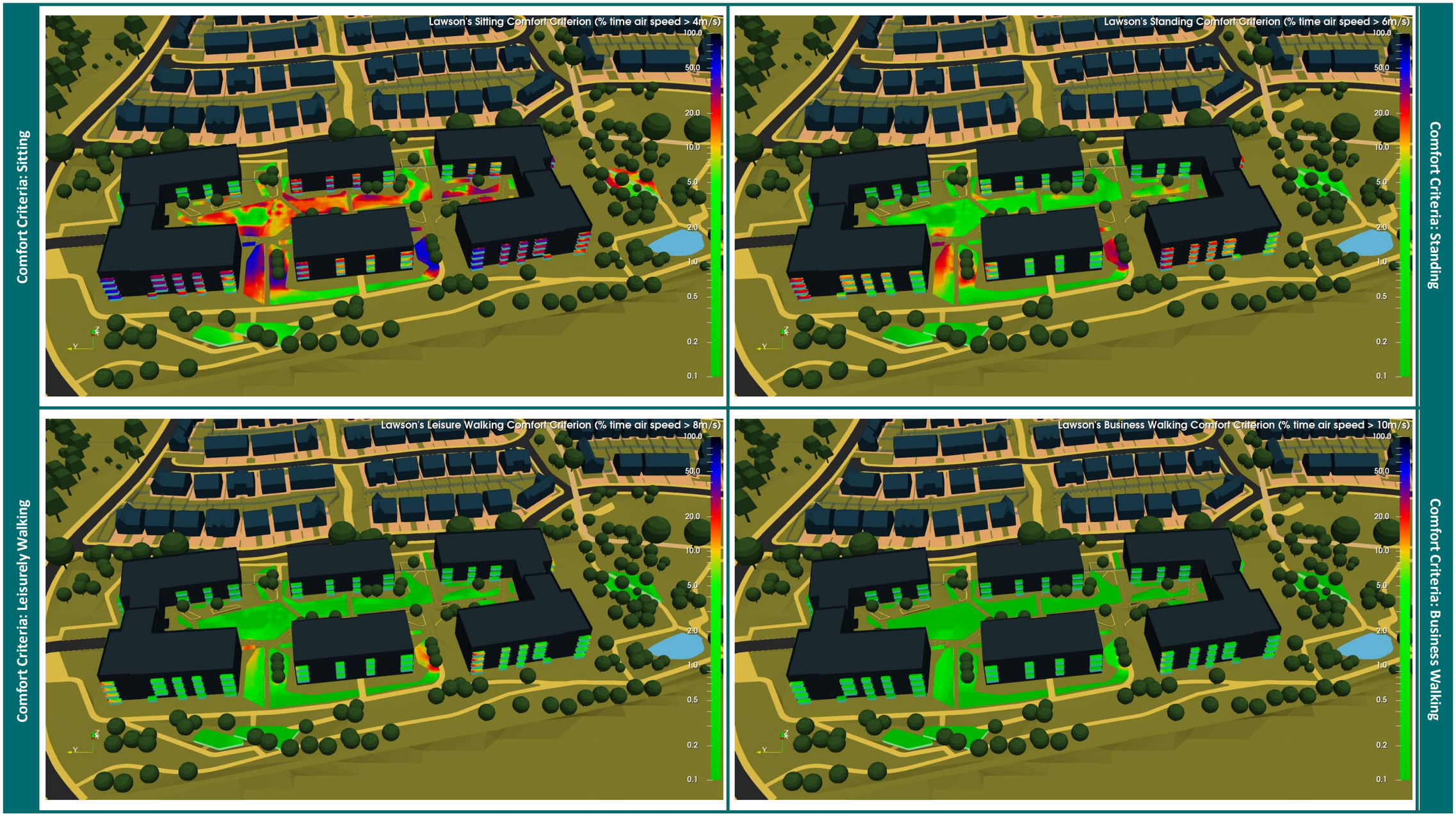

Figure 51: Comfort Criteria: All Seasons: View of the residential blocks from the west

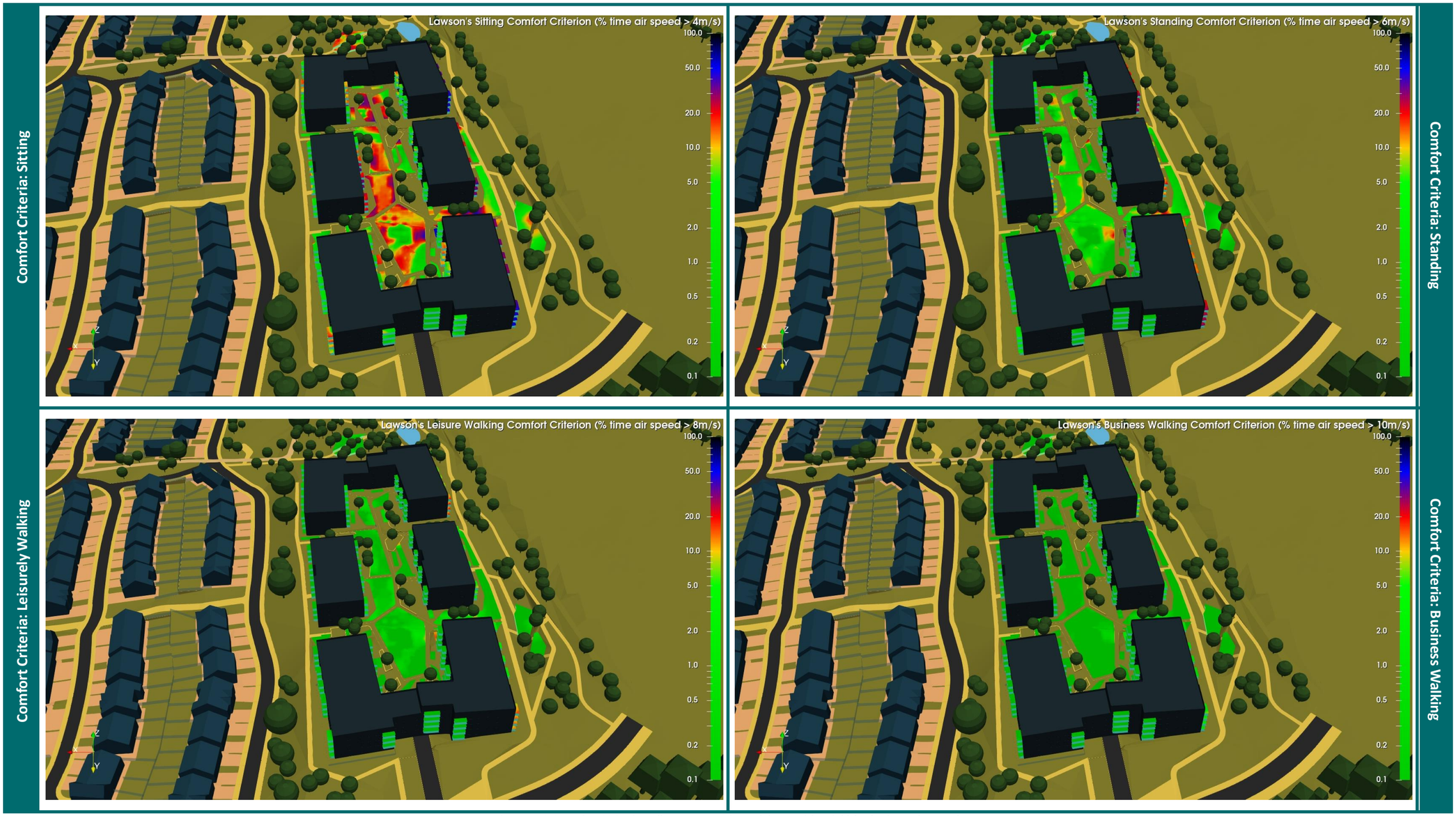

Figure 52: Comfort Criteria: All Seasons: View of the residential blocks from the north

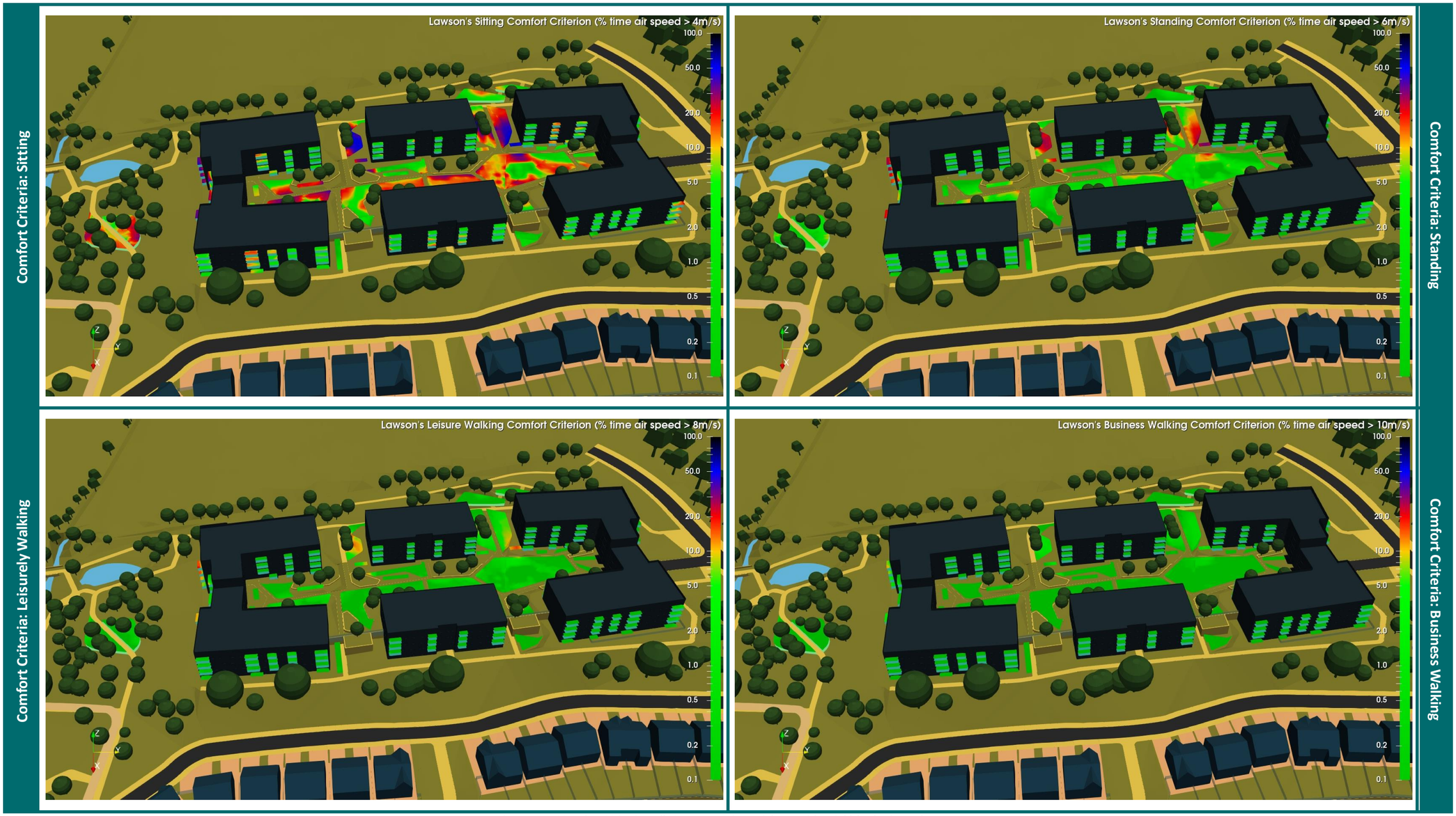

Figure 53: Comfort Criteria: All Seasons: View of the residential blocks from the east

Comfort Criteria: Sitting

Comfort Criteria: Standing

Comfort Criteria: Leisurely Walking

Comfort Criteria: Business Walking

Figure 54: Comfort Criteria: All Seasons: View from the playgrounds and Creche and Community buildings from the top

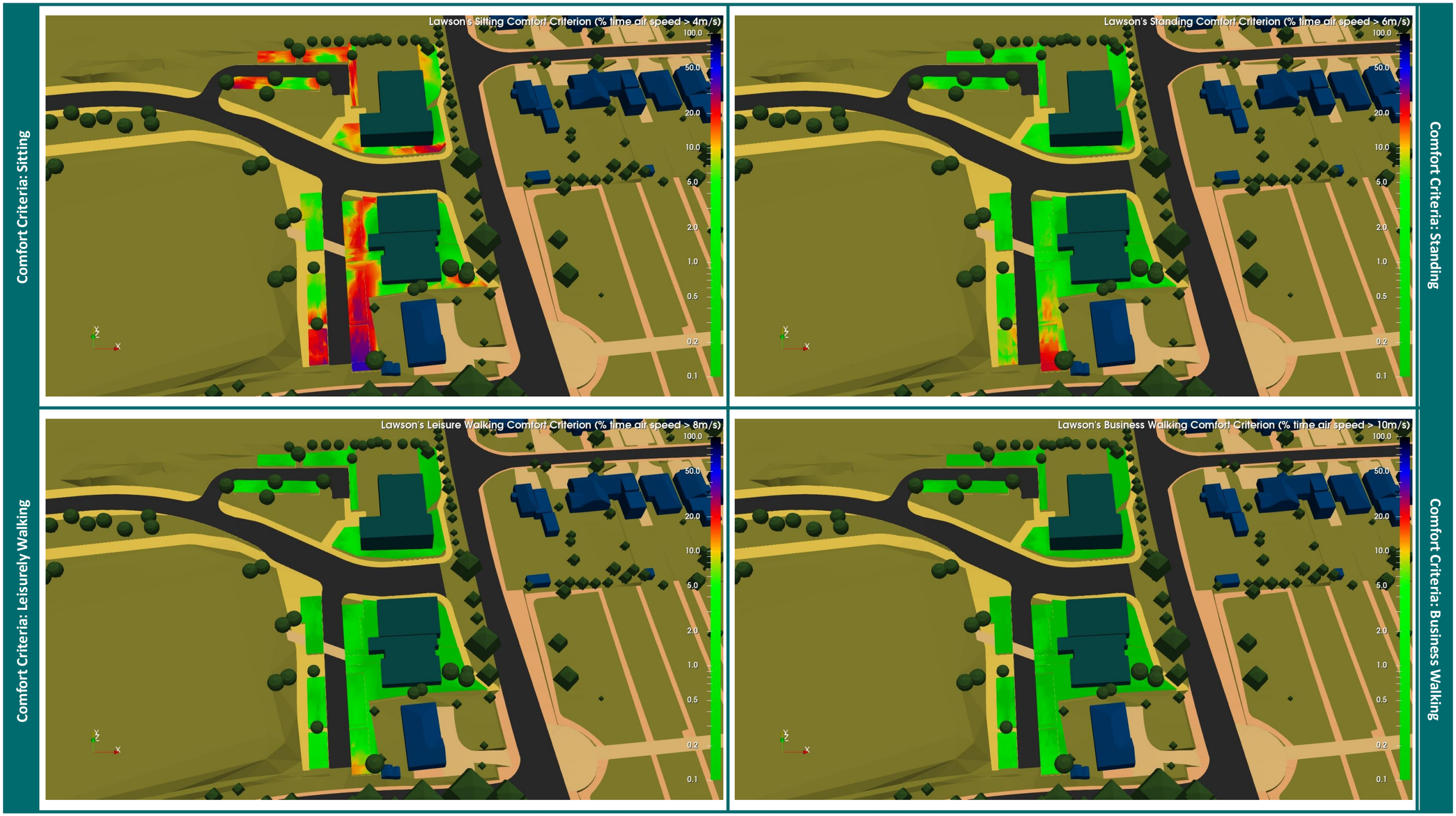

Figure 55: Comfort Criteria: All Seasons: View of the Creche and Community buildings from the south

Comfort Criteria: Sitting

Comfort Criteria: Standing

Comfort Criteria: Leisurely Walking

Comfort Criteria: Business Walking

Figure 56: Comfort Criteria: All Seasons: View of the Creche and Community buildings from the west

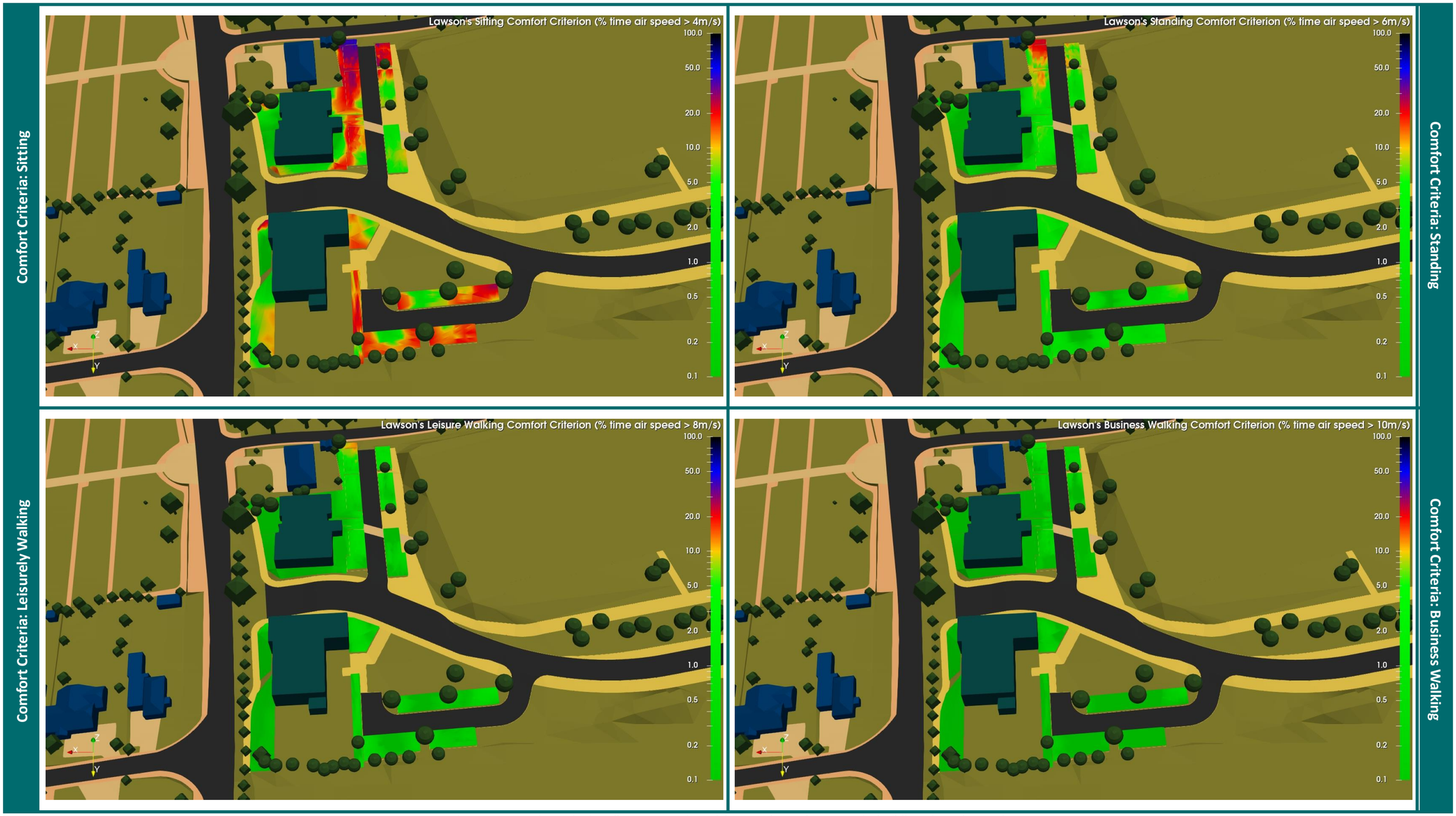

Figure 57: Comfort Criteria: All Seasons: View of the Creche and Community buildings from the north

Comfort Criteria: Sitting

Comfort Criteria: Standing

Comfort Criteria: Leisurely Walking

Comfort Criteria: Business Walking

Figure 58: Comfort Criteria: All Seasons: View of the Creche and Community buildings from the east

7.2 Safety Criteria

Figure 59 to Figure 68 show the percentage of the year the hourly wind speed exceeds the threshold value for the safety criteria for all seasons. The threshold values are 20m/s for normal pedestrian and 15m/s for sensitive pedestrian.

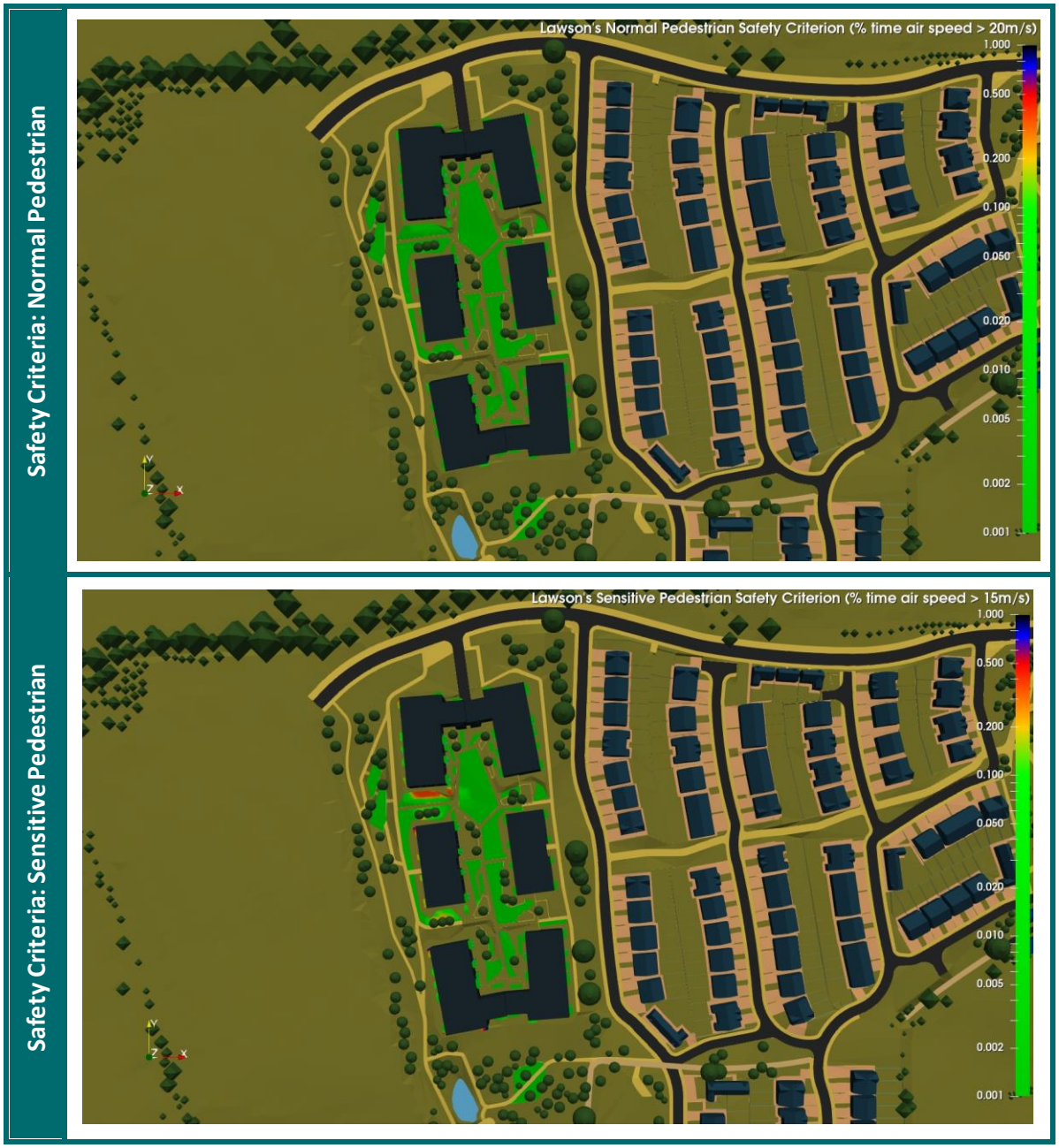

Figure 59: Safety Criteria: All Season: View of the residential blocks from the top

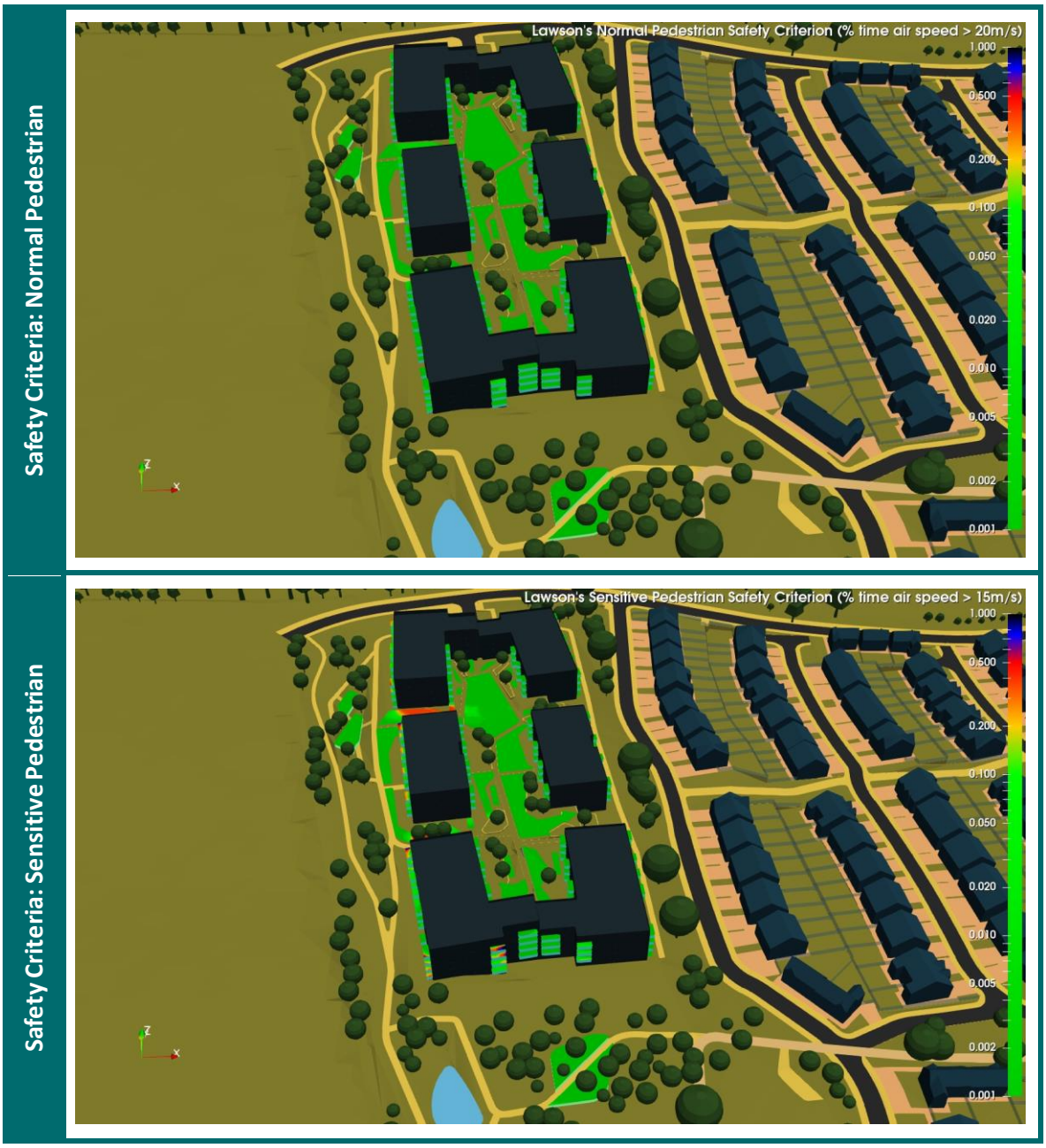

Figure 60: Safety Criteria: All Season: View of the residential blocks from the south

Figure 61: Safety Criteria: All Season: View of the residential blocks from the west

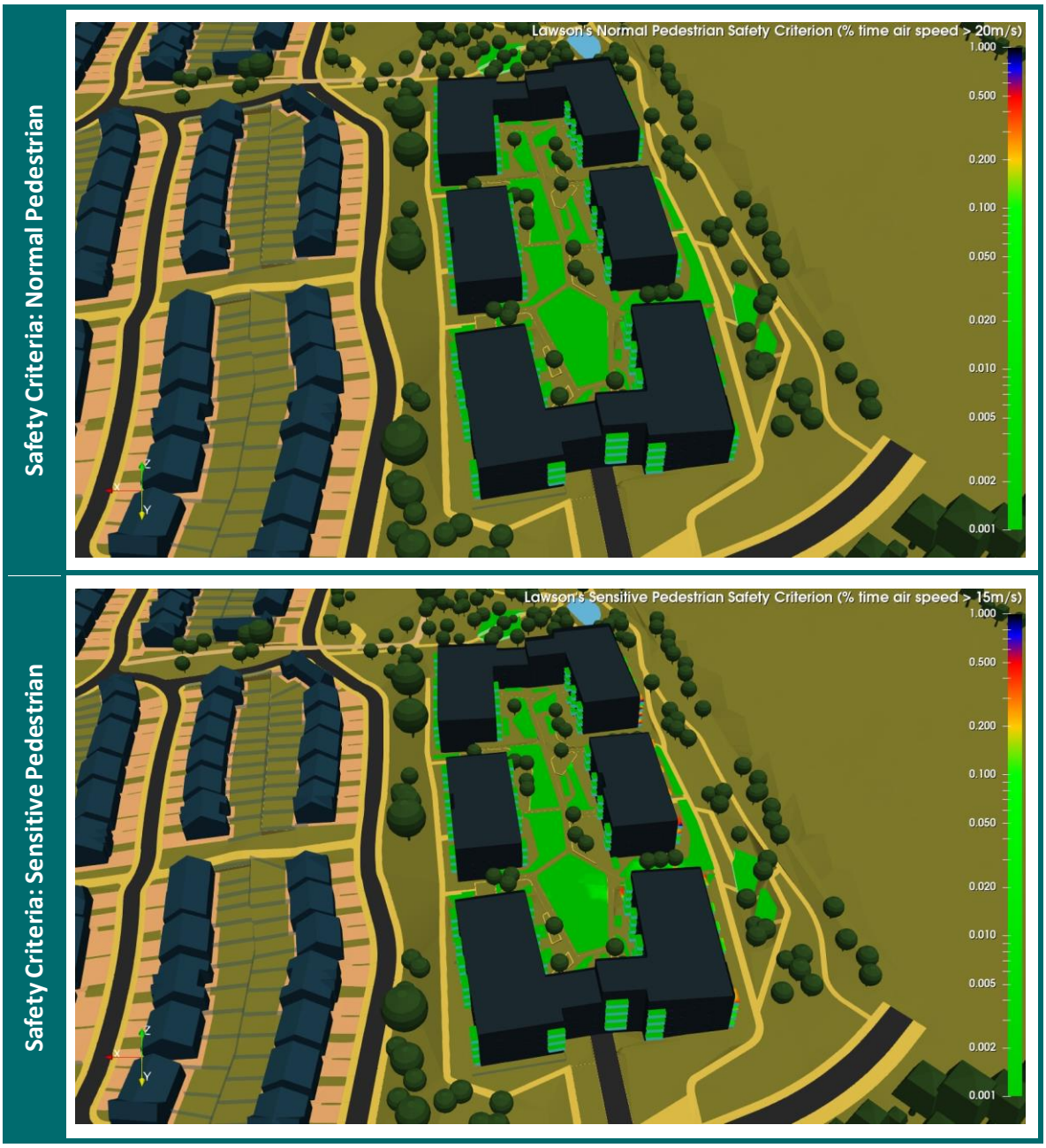

Figure 62: Safety Criteria: All Season: View of the residential blocks from the north

Figure 63: Safety Criteria: All Season: View of the residential blocks from the east

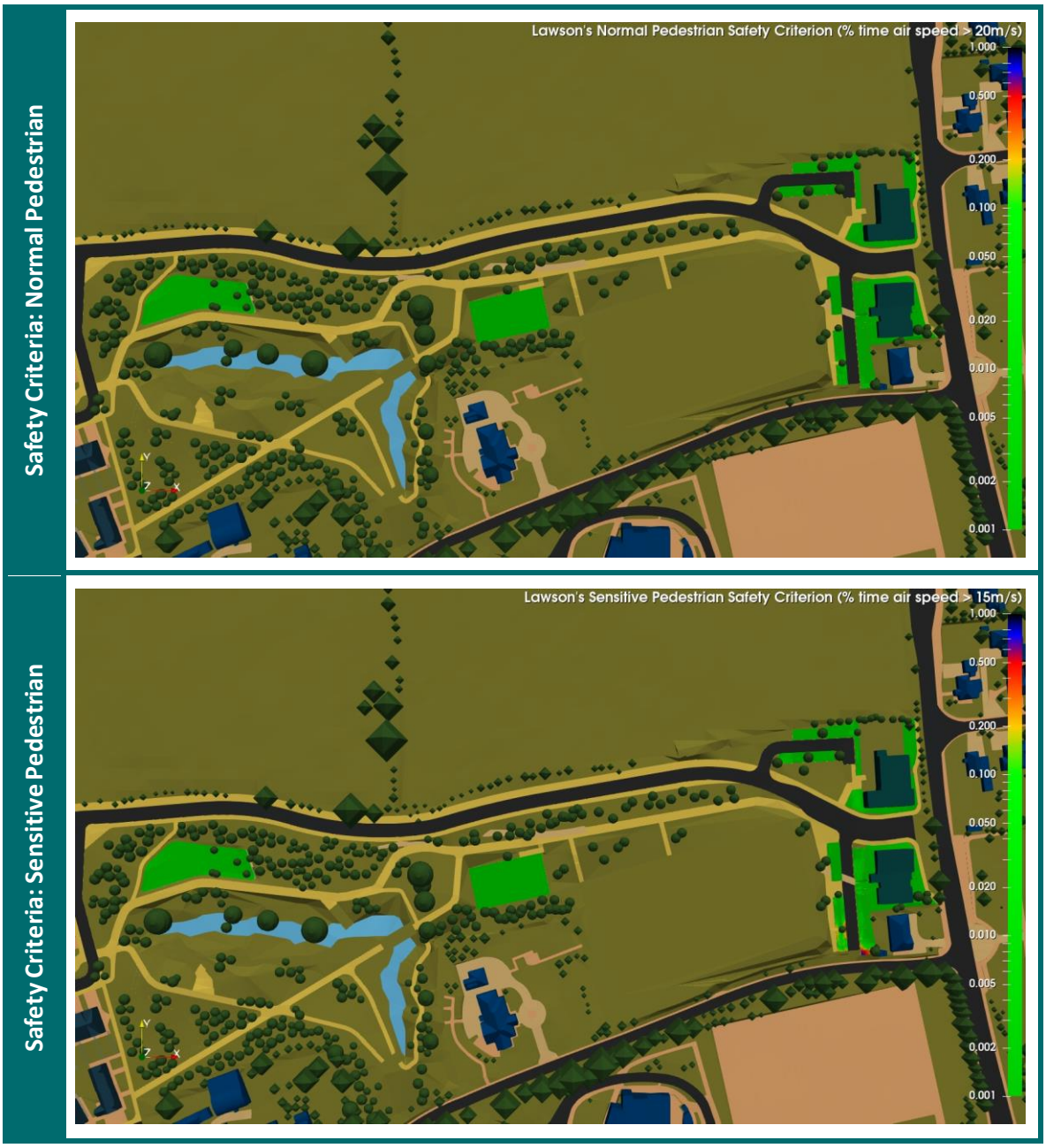

Figure 64: Safety Criteria: All Season: View from the playgrounds and Creche and Community buildings from the top

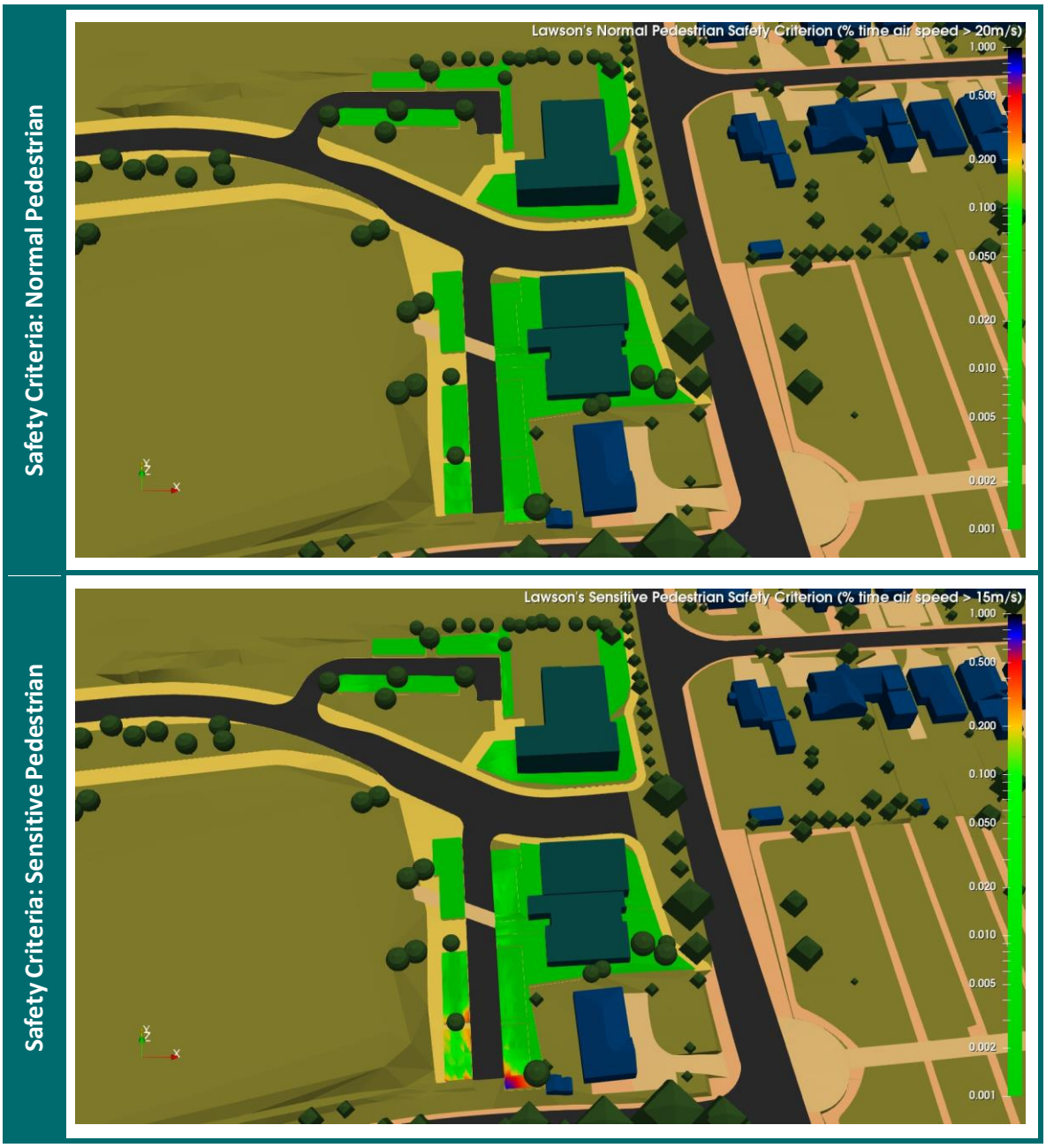

Figure 65: Safety Criteria: All Season: View of the Creche and Community buildings from the south

Figure 66: Safety Criteria: All Season: View of the Creche and Community buildings from the west

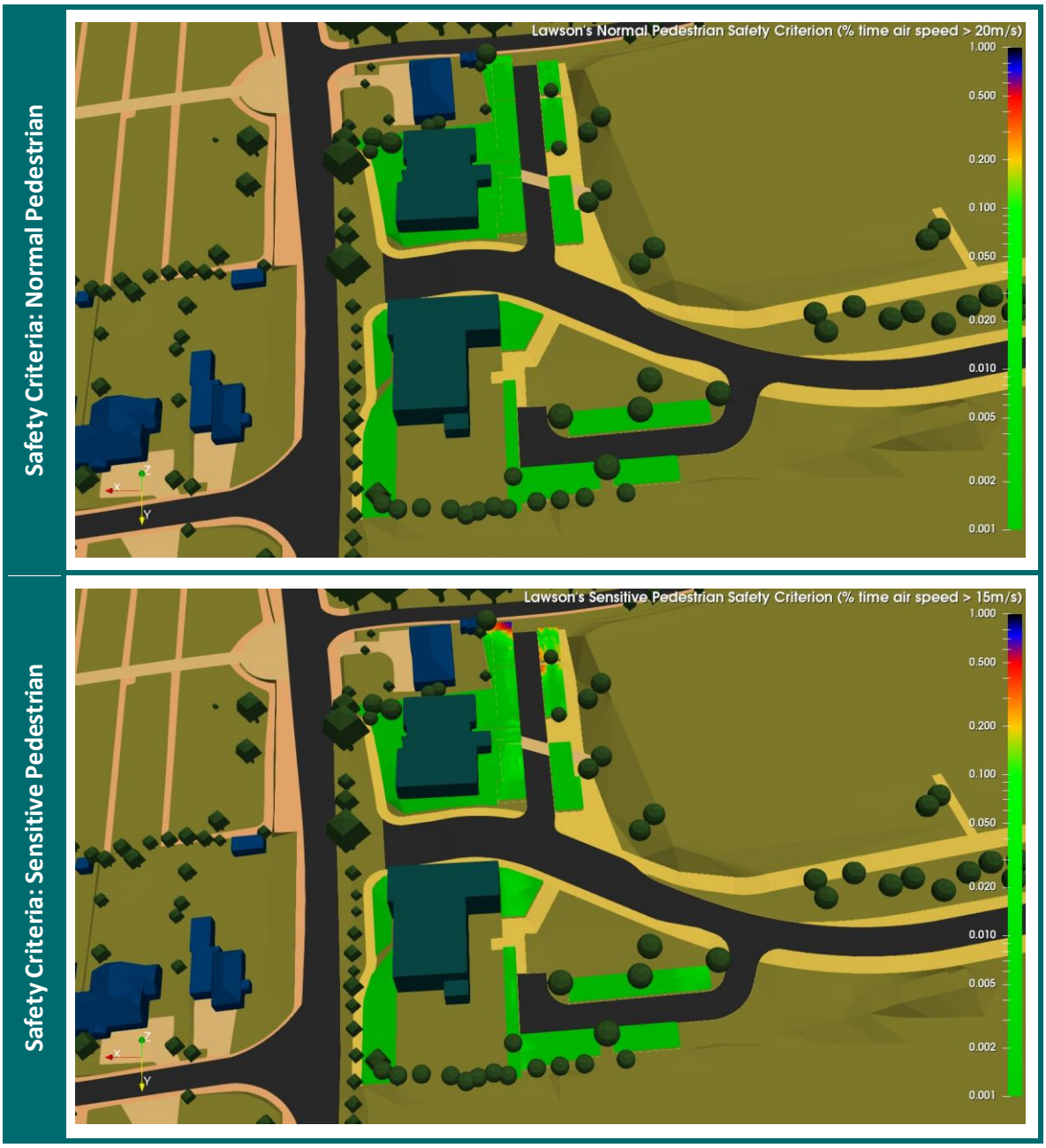

Figure 67: Safety Criteria: All Season: View of the Creche and Community buildings from the north

Figure 68: Safety Criteria: All Season: View of the Creche and Community buildings from the east

8 Conclusion

The site is generally affected by the topology i.e. the hill to the west of the site. It causes the air speed to increase higher than meteorological measurements, as the air moves down the slope of the site.

The site is still generally safe for pedestrians. It also meets the Lawsons's Walking criteria requirements. It generally meets requirements of Lawsons's Standing and Sitting criteria in conjunction with each other.

Some balconies are seen to experience exceedance of the Lawson's Sitting and Stadning criteria. However, the balcony spaces are the private spaces which are used by the people residing in the respective flat. They will be expected to use their own discretion in judging the comfortable weather conditions. It is not a space that can be treated as a public open space where people have to use it frequently. So, no further mitigation measures required as such.


IES

APPENDIX 11 A GEOPHYSICAL SURVEY REPORT

GEOPHYSICAL SURVEY

REPORT

Coolagad,

Greystones,

County Wicklow

Date:
04/12/2020

Licence: 20R0212

J. M. Leigh Surveys Ltd.
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Leixlip
County Kildare
www.jmlsurveys.com
01 615 4647

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124 Oaklawn West,
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GEOPHYSICAL SURVEY SUMMARY SHEET
COOLAGAD, GREYSTONES, COUNTY WICKLOW

Site Name	Greystones	**Ref No.**	20050
Townland	Coolagad	**Licence No.**	20-R-0212
County	Wicklow	**Licence Holder**	Joanna Leigh
ITM (centre)	E727697, N713014	**Purpose**	Pre-planning
Client	IAC Ltd.	**Reference No.**	N/A

Ground Conditions	Survey ground conditions varied from short pasture to tall vegetation.
Survey Type	Detailed gradiometer survey totalling c.24 hectares.

Summary of Results

Responses indicative of a large enclosure have been identified running through Areas A, E and F. The probable enclosure is truncated by multiple field boundaries and a farm laneway. Nevertheless, the responses identified suggest a large enclosure (c. 95m diameter) with a probable further internal circular enclosure.

A small circular response and trend to the east of the probable enclosure is indicative of a small (c.11m diameter) circular enclosure. Further to the south, there are vague trends and an area of increased magnetic response. In addition, two isolated responses are indicative of burnt features. It is possible that plough damaged archaeological features are represented here. This is speculative as there is no clear archaeological pattern.

Field Staff Joanna Leigh & Susan Curran

Report Date 04/12/2020 **Report Author** Joanna Leigh

Contents

Geophysical Survey Report
Coolagad, Greystones, County Wicklow

1 Introduction

1.1 A geophysical survey has been conducted by J. M. Leigh Surveys Ltd. at a site in the townland of Coolagad, Greystones, County Wicklow. The survey was requested by IAC Ltd. on behalf of Cairn Homes. The survey forms part of a wider pre-planning site investigation by IAC Ltd.

1.2 The application area is contained within nine fields (Fields 1-9) to the west of the R761 and to the north of Greystones. The fields are located to the north and west of a farm which is located centrally within the application area. Detailed gradiometer survey (Areas A-F) were conducted in all available fields within the application area. Figure 1 (not to scale) presents the site and survey location.

1.3 There are no recorded monuments within the application area. A 'Ringfort - rath' (WI008-073) lies c. 220m to the north-east of the application area. A 'Church' (WI008-012001) and 'Graveyard' (WI008-012002) are situated c. 430m to the north-east. Several excavations have also been undertaken c. 400m-500m to the north-east of the application area, these are recorded as 'Kiln - corn-drying' (WI008-074) and as ' Excavation - miscellaneous' (WI008-058, WI008-068, WI008-0780, WI008-071). A 'Road - hollow-way' (WI008-072) which was identified through geophysical survey and excavation is also recorded in this area.

1.4 The main aim of the survey was to identify any responses which may represent previously unknown archaeological remains within the application area. It is the objective of the survey to identify the location, nature and extent of any responses of potential archaeological interest.

1.5 The detailed gradiometer survey was conducted under licence 20R0212 issued by the Department of Culture, Heritage and the Gaeltacht.

2 Survey ground conditions and further information (Figure 1)

2.1 Access to the survey areas was along farm trackways and through the existing farm. Ground conditions throughout the application area varied and all available areas were subject to detailed survey.

2.2 Fields 1, 2 and 3 comprised of short pasture. Detailed survey Areas A, B, and C were conducted here.

2.3 Field 4 was located along a farm laneway, with dense gorse vegetation obstructing much of the area. The laneway also comprised of hardcore material in places. Detailed survey Area D was conducted where possible.

2.4 Field 5 comprised of long pasture and detailed survey Area E was conducted here.

2.5 Field 6 is located in the south of the application area and comprised of a large open field with rough ground in places. The vegetation was somewhat overgrown and a small area in the south-west of the field could not be surveyed.

2.6 Newly constructed houses are located to the east of Field 6 and an area of disturbed ground was noted along the eastern edge of the field. The modern ground disturbance was magnetically disturbed and not suitable for survey. Nevertheless, most of the field was surveyed (Area F).

2.7 Fields 7 and 8 comprised of tall overgrown vegetation separated by a broad mature hedgerow and trees. Field 8 is located to the immediate north of farm buildings which result in magnetic interference. Fields 7 and 8 were not suitable for survey.

2.8 Field 9 is located at the eastern extent of the application area, adjacent to the main road. The farm trackway runs along the south of the field and a modern dwelling is located to the south-west. Tall fencing bounds the southern extent of the field, resulting in some magnetic disturbance. Detailed survey Area G was positioned in Field 9.

2.9 The topography of the site has a dominant east facing aspect. Fields 1-5 comprised of a gentle slope. The western half of field 6 comprises of a much steeper east facing slope. Field 9 has a gentle east facing slope.

3 Survey Methodology

3.1 A detailed gradiometer survey detects subtle variations in the local magnetic field and measurements are recorded in nano-Tesla (nT). Some archaeological features such as ditches, large pits and fired features have an enhanced magnetic signal and can be detected through recorded survey.

3.2 Data was collected with a Bartington Grad 601-2 instrument. This is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey fast and effective.

3.3 The instrument is calibrated in the field to ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to

0.01nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

3.4 All data was collected in 'zigzag' traverses. Grid orientation remained constant throughout all the survey areas to facilitate the data display and interpretation.

3.5 Data was collected with a sample interval of 0.25m and a traverse interval of 1m, providing 6400 readings per 40m x 40m grid. The survey grid was set-out using a GPS VRS unit. Survey tie-in information is available upon request.

3.6 The survey methodology, data presentation and report content adheres to the European Archaeological Council (EAC) (2016) 'Guidelines for the use of Geophysics in Archaeology'.

4 Data display

4.1 An overall summary greyscale image and accompanying interpretation diagram of the entire site are presented in Figures 2 and 3, at a scale of 1:3,000.

4.2 Figures 4-8 present a series of greyscale images and interpretation diagrams, all at a scale of 1:1,500.

4.3 Numbers in parenthesis in the text refer to specific responses highlighted in the interpretation diagrams (Figures 3, 5, 7 and 8).

4.4 Isolated ferrous responses highlighted in the interpretation diagram most likely represent modern ferrous litter and debris and are not of archaeological interest. These are not discussed in the text unless considered relevant.

4.5 The raw gradiometer data is presented in archive format in Appendix A1.01 – A1.05. The raw data is displayed as a greyscale image and xy-trace plot, all at a scale of 1:500. The archive plots are used to aid interpretation of the results and are used for reference only. These are available as PDF images upon request.

4.6 The display formats referred to above and the interpretation categories are discussed in the summary technical information section at the end of this report.

5 Survey Results

Areas A, B, C, D and E (Figures 4 & 5)

5.1 Areas A and B are dominated by modern ploughing trends. Within this there are some responses of potential interest.

5.2 In the north of Area A there are two short linear responses (1) and a curvilinear trend forming a U-shaped pattern. This measures c.5m in width. The responses may represent the remains of a small sub-circular feature. Although the responses are of possible archaeological interest, interpretation is cautious. It is possible that the responses result from the modern ploughing activity.

5.3 Numerous isolated responses are scattered throughout Area A. Although it is possible that these represent isolated pit-type features, there is no clear archaeological pattern evident. It is equally likely that these reflect natural variations in the sub-soil and are not of archaeological origin.

5.4 In Area B there are numerous linear and curvilinear trends (2) and a linear negative response (3). Although these may represent ephemeral archaeology, interpretation is cautious. These form an irregular pattern and are considered to be more likely agricultural in origin. They may represent former field divisions related to the adjacent farm.

5.5 The irregular trends and responses continue into Area C. Some of the negative responses appear well defined (4) with broader negative responses (5) forming a vague rectilinear pattern. The responses and trends suggest some form of activity, although there is no clear archaeological pattern. It is possible that these responses reflect agricultural activity. The broad mature tree line forming the boundary for Fields 7 and 8 to the east has a similar orientation to the negative responses (5). It is speculated that the mature tree line extended into this area and the responses may represent subsequent clearing. This interpretation is tentative and the origin of the negative responses is unknown.

5.6 Faint linear trends and clusters of responses (6) in Areas B and C most likely represent former field divisions.

5.7 Curvilinear responses and trends (7) in Areas A and E are of clear interest. The responses are indicative of archaeological ditched features and appear to form a sub-circular pattern extending into Field F and are interpreted as representing an

archaeological enclosure. The responses (7) in Field E suggest a double ditched feature.

5.8 Although the responses (7) have been clearly identified in Area E, a broad ferrous response (8) appears to truncate the response. This results from a modern service pipe, the magnetic disturbance of which is noted at the southern limits of Area A.

5.9 Detailed survey in Area D has not identified any responses of interest. It is noted that this area is a farm laneway and comprised of hardcore in places. Modern disturbance may mask any more subtle responses of interest in Area D.

Area F (Figures 6 & 7)

5.10 A curvilinear response (9) appears to form the southern extent of the responses (7), recorded in Areas A and E. This suggests the location of a large sub-circular ditched enclosure, measuring c. 95m in diameter. The probable enclosure is truncated by the mature hedgerows and farm laneway.

5.11 A curvilinear response (10) may represent the remains of an internal feature. The extent of this is unclear as any responses in Area D and E would be obscured by the modern disturbance resulting from ground disturbance and a modern pipe. Nevertheless, the response (10) is indicative of an internal circular enclosure, possibly measuring c.50m to 60m in diameter. This is speculative but must be considered.

5.12 In addition to the enclosure responses (7), (9) and (10), there is a curvilinear response and trend (11) of clear archaeological potential. The responses suggest a small circular enclosure with a diameter of c.11m. Within this are some pit-type responses and a response with a magnetic signature indicative of a burnt feature, such as a hearth.

5.13 Similar sized faint curvilinear trends (12) are recorded in Area F. Interpretation of these is less clear as the trends are poorly defined. Although they may represent plough damaged features, they may equally represent natural variations in the sub-soil.

5.14 Isolated responses are recorded in the vicinity of the probable enclosure (9). In particular responses (13) located to the south and east may represent clusters of large pit features. Although interpretation is tentative, these are considered to be of clear archaeological potential.

5.15 Two responses (14) in the south of Area F are curious. Although they appear to be isolated, they both have a magnetic signature indicative of a burnt feature such as a hearth or kiln. It is possible that the responses represent the remains of plough damaged archaeology and they are considered to be of archaeological potential.

5.16 A small area of increased response (15) is located in the south of Area F. Although it is possible that this represents modern ground disturbance, it is equally possible that a spread of burnt archaeological material is represented here. It is noted that incoherent trends and the isolated responses (14) are located in the south of Area F and it is possible that these all represent the remains of plough damaged archaeology. This is speculative but must be considered.

Area G (Figure 8)

5.17 Few responses were recorded in Area G. A broad isolated response (16) may be of interest. However, there is no clear pattern and this may result from more deeply buried ferrous debris.

5.18 A faint curvilinear trend (17) runs north to south. Archaeological interpretation is cautious. This may result from the change in slope and is interpreted as topographical in origin.

6 Conclusion

6.1 Detailed gradiometer survey in seven areas (Area A-G) has identified responses of clear archaeological interest.

6.2 Responses indicative of a large enclosure have been identified running through Areas A, E and F. The probable enclosure is truncated by multiple field boundaries and a farm laneway. Nevertheless, the responses identified suggest a large enclosure (c. 95m diameter) with a further internal circular enclosure.

6.3 A small circular response and trend to the east of the probable enclosure is indicative of a small (c.11m diameter) circular enclosure. Isolated responses within it suggest probable pits and a possible hearth feature.

6.4 Further to the south of the probable enclosure, there are vague trends and an area of increased magnetic response. In addition, two isolated responses have a magnetic signature indicative of burnt features. It is possible that plough damaged archaeological features are represented here. This is speculative as there is no clear archaeological pattern.

6.5 In the north of the application area (Areas B and C) linear trends and negative responses form an irregular pattern. There is no clear archaeological interpretation and it is speculated that these may represent agricultural activity. The origin of these responses is unknown.

6.6 Consultation with a licensed archaeologist and with the Department of Culture, Heritage and the Gaeltacht is recommended to establish if any additional archaeological works are required.

7 Technical Information Section

Instrumentation & Methodology

Detailed Gradiometer Survey

Detailed gradiometer survey can either be targeted across a specific area of interest or conducted as a blanket survey across an entire application area, often as a standalone methodology.

Sampling methodologies can vary but a typical survey is conducted with a sample interval of 0.25m and a traverse interval of 1m. This allows detection of potential archaeological responses. Data is often collected in grids measuring 40m x 40m, with the data displayed accordingly. A more detailed survey methodology may be applied where archaeological remains are thought likely. This can sometimes produce results with a more detailed resolution. A survey with a grid size of 20m x 20m and a traverse interval of 0.5m will provide a data set with high resolution.

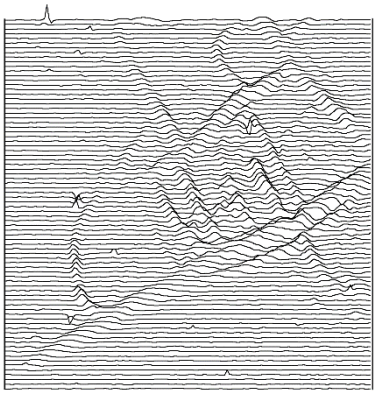
Bartington GRAD 601-2

The Bartington Grad 601-2 instrument is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey very fast and effective. The sensors have a separation of 1m allowing greater sensitivity.

Frequent realignment of the instruments and zero drift correction ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.1nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

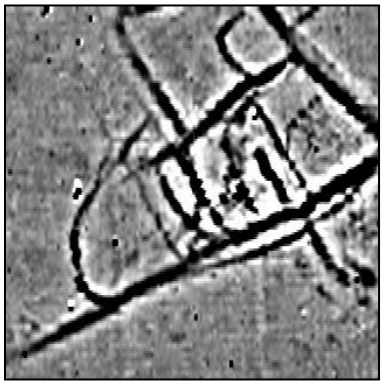
Gradiometer Data Display & Presentation

XY Trace



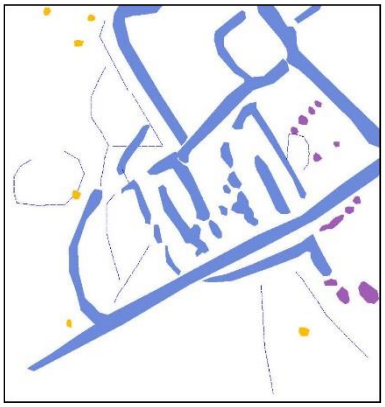
The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.

*Greyscale**



As with dot density plots, the greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection. In the summary diagrams processed, interpolated data is presented. Raw un-interpolated data is presented in the archive drawings along with the xy-trace plots.

Interpretation



An interpretation of the data is made using many of the plots presented in the final report, in addition to examination of the raw and processed data. The project managers' knowledge and experience allows a detailed interpretation of the survey results with respect to archaeological potential.

**XY Trace and raw greyscale plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation. The archive plots are provided as PDF images upon request.*

Glossary of Interpretation Terms

Categories of responses may vary for different data sets. The list below are the most commonly used categories for describing geophysical responses, as presented in the summary interpretation diagrams.

Archaeology

This category refers to responses which are interpreted as of clear archaeological potential and are supported by further archaeological evidence such as aerial photography or excavation. The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, pits and associated features.

?Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent or archaeological cultivation activity.

?Natural

A broad response resulting from localised natural variations in the magnetic background of the subsoil; presenting as broad amorphous responses most likely resulting from geological features.

Ferrous Response

These anomalies exhibit a typically strong magnetic response, often referred to as ‘iron spikes,’ and are the result of modern metal debris located within the topsoil.

Area of Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.

Bibliography

European Archaeological Council (EAC) (2016) '*Guidelines for the use of Geophysics in Archaeology*' by Armin Schmidt, Paul Linford, Neil Linford, Andrew David, Chris Gaffney, Apostolos Sarris and Jörg Fassbinder.

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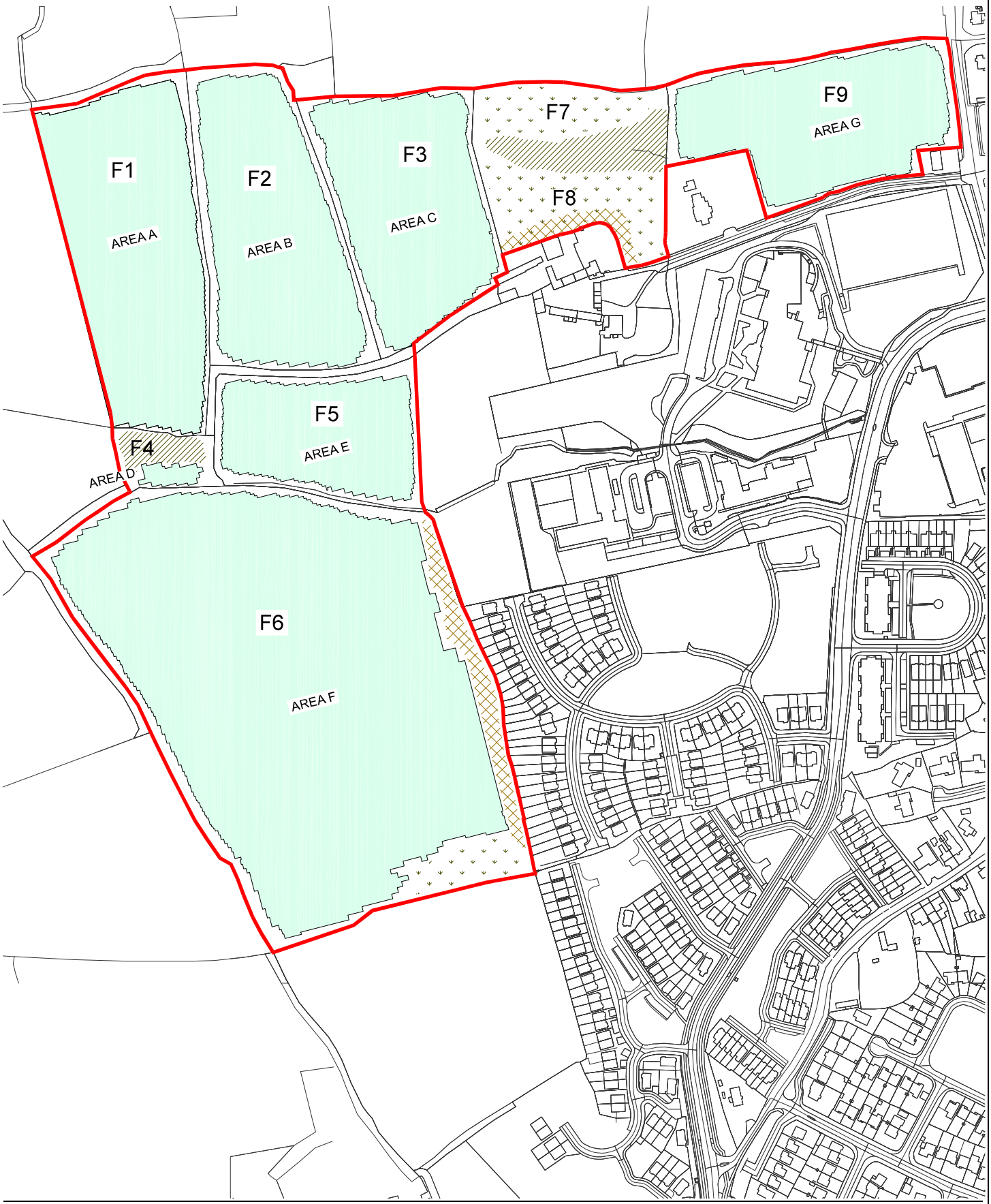
List of Figures

Archive Data Supplied as a PDF Upon Request



Application Area

Gradiometer Survey

Not suitable for survey - Overgrown Vegetation

Not suitable for survey - Dense vegetation / Hedgerow

Modern magnetic Interference

Client: IAC Ltd.	Project: Geophysical Survey Coolagad, Greystones County Wicklow	Title: Site & Survey Location	J.M. Leigh Surveys Ltd. www.jmlsurveys.com

Scale @ A4: N.T.S.
Figure: 1
Licence No.: 20R0212
Issue Date: 04.12.2020

Mapping supplied by the client

0 metres 120

Client: IAC Ltd.

Project: Geophysical Survey
Coolagad, Greystones, County Wicklow

Title: Overall Summary Greyscale Image

J.M. Leigh Surveys Ltd.
www.jmlsurveys.com

Scale @ A3:	1:3,000
Figure:	2
Licence No.:	20R0212
Issue Date:	04.12.2020

Mapping supplied by the client

0 metres 120

Client: IAC Ltd.

Project: Geophysical Survey
Coolagad, Greystones, County Wicklow

Title: Overall Summary Interpretation

J.M. Leigh Surveys Ltd.
www.jmlsurveys.com

Scale @ A3:	1:3,000
Figure:	3
Licence No.:	20R0212
Issue Date:	04.12.2020

Mapping supplied by the client

AREA A

AREA B

AREA C

AREA D

AREA E

-1.5 nT 2.5

Not suitable for survey - Overgrown Vegetation

Not suitable for survey - Dense vegetation / Hedgerow

Modern magnetic Interference

0 metres 60

Client: IAC Ltd.	Project: Geophysical Survey Coolagad, Greystones County Wicklow	Title: Gradiometer Survey Greyscale Image: Areas A, B,C, D and E	J.M. Leigh Surveys Ltd. www.jmlsurveys.com

Scale @ A3:	1:1,500
Figure:	4
Licence No.:	20R0212
Issue Date:	04.12.2020

Mapping supplied by the client

AREA A

AREA B

AREA C

AREA D

AREA E

BH

?Archaeology

?Archaeology / ?Natural

?Archaeology - Burnt feature

Area of Increased magnetic response

Negative response - ?Archaeology / Agricultural

Trend

Ploughing

Ferrous

Magnetic Disturbance

0 metres 60

Client: IAC Ltd.	Project: Geophysical Survey Coolagad, Greystones County Wicklow	Title: Gradiometer Survey Interpretation Diagram: Areas A, B,C, D and E	J.M. Leigh Surveys Ltd. www.jmlsurveys.com

Scale @ A3:	1:1,500
Figure:	5
Licence No.:	20R0212
Issue Date:	04.12.2020

Mapping supplied by the client

-1.5 nT 2.5

0 metres 60

Client: IAC Ltd.	Project: Geophysical Survey Coolagad, Greystones County Wicklow	Title: Gradiometer Survey Greyscale Image: Area F	J.M. Leigh Surveys Ltd. www.jmlsurveys.com	Scale @ A3: 1:1,500 Figure: 6 Licence No.: 20R0212 Issue Date: 04.12.2020

Mapping supplied by the client

AREA A

AREA B

AREA D

AREA E

AREA F

7

8

9

10

11

12

13

14

15

BH

?Archaeology

?Archaeology / ?Natural

?Archaeology - Burnt feature

Area of Increased magnetic response

Negative response - ?Archaeology / Agricultural

Trend

Ploughing

Ferrous

Magnetic Disturbance

N

0 metres 60

Client: IAC Ltd.

Project: Geophysical Survey Coolagad, Greystones County Wicklow

Title: Gradiometer Survey Interpretation Diagram: Area F

J.M. Leigh Surveys Ltd.
www.jmlsurveys.com

Scale @ A3: 1:1,500
Figure: 7
Licence No.: 20R0212
Issue Date: 04.12.2020

Mapping supplied by the client

Client: IAC Ltd.	Project: Geophysical Survey Coolagad, Greystones County Wicklow	Title: Gradiometer Survey Summary Greyscale Image & Interpretation: Area G	J.M. Leigh Surveys Ltd. www.jmlsurveys.com	Scale @ A3: 1:1,500 Figure: 8 Licence No.: 20R0212 Issue Date: 04.12.2020

APPENDIX 11 B ARCHAEOLOGICAL TEST EXCAVATIONS REPORT

IAC Archaeology

ARCHAEOLOGICAL TEST EXCAVATION AT COOLAGAD, GREYSTONES, CO. WICKLOW

LICENCE: 21E0083

ON BEHALF OF: CAIRN HOMES PLC

I.T.M.: 727697/ 713014

LICENCEE & AUTHOR: MUIREANN NÍ CHEALLACHÁIN

REPORT STATUS: FINAL
DATE: FEBRUARY 2022

IAC PROJECT REF.: J3684

IRISH ARCHAEOLOGICAL CONSULTANCY LTD
ARCHAEOLOGY & CONSERVATION CONSULTANTS

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Dublin I Belfast IAC.ie

DOCUMENT CONTROL SHEET

DATE	DOCUMENT TITLE	REV.	PREPARED BY	REVIEWED BY	APPROVED BY
26.04.21	Archaeological Test Excavation at Coolagad, Greystones, Co. Wicklow	0	F. Murtagh	M. Ní Cheallacháin	R. Lynch
16.07.21	Archaeological Test Excavation at Coolagad, Greystones, Co. Wicklow	1	M. Ní Cheallacháin	P. Duffy	R. Lynch

ABSTRACT

IAC Archaeology has prepared this report on behalf of Cairn Homes LTD, to study the impact, if any, on the archaeological and historical resource of a proposed development, which is located at Coolagad, Greystones, Co. Wicklow (ITM 727697/ 713014; OS Sheet 08). The preliminary report was undertaken by Muireann Ní Cheallacháin under licence 21E0083. Testing follows on from a geophysical survey of the site, which was carried out by Joanna Leigh in 2020 (Licence 20R0212). The survey identified responses indicative of a large enclosure (c.95m diameter) with a further internal circular enclosure. The probable enclosure is truncated by multiple field boundaries, a farm laneway and is bisected by a small watercourse. Further isolated responses identified across the site may represent plough damaged archaeological features.

There are no recorded monuments within the proposed development area and a total of 12 sites are recorded within a 500m radius of the site. The proposed development area is contained within nine agricultural fields that are located to the north and west of a 20th century farmyard which is located centrally.

Archaeological testing was carried out over the course of nine days from 12th April 2021 using a mechanical excavator fitted with a flat grading bucket. The 84 trenches targeted geophysical anomalies and open green space to fully investigate the archaeological potential of the proposed development site. Testing revealed eight areas of archaeological significance, which have been designated as Archaeological Areas 1–8.

- AA 1: Testing at AA1 confirmed the presence of a partially disturbed, plectrum-shaped enclosure (possible original int. diameter: 95m x 90m). A smaller central, possibly oval enclosure (possible original int. diameter: 55m x 50m) was also identified. In addition, testing confirmed the presence of internal features including slot trenches, pits, postholes and hearths. External features including hearths, gullies and a concentration of industrial activity probably associated with cereal drying activity were also identified. No diagnostic artefacts were retrieved. It is tentatively suggested that, given the form, landscape and archaeological setting, that the bi-vallate enclosure is of early medieval date, though a prehistoric date cannot be precluded at this stage.

  Some areas of the enclosure appear to have been heavily disturbed/truncated by the installation of water pipes feeding from the stream at the east and the construction of the farm laneway at the west. The construction of the tree-lined field boundaries, visible on the first edition OS mapping, and dividing the four fields will also have had an adverse impact on the enclosure ditches.

  While the outer enclosure ditch ranges in width from 2.5m to 4m, and the inner enclosure ditch from 2.1 to 3.2m, the relatively shallow nature of the ditches (Outer:0.84m-1m deep, Inner: 0.76m), as well as the shallowness of some of

the internal and external features (average depth 0.18m-0.3m), suggests the site has been truncated from prolonged agricultural activity.

- AA 2a–c: Probable prehistoric activity in the form of troughs and pits associated with burnt mound activity along with pits and in-situ burning of unknown date,
- AA 3a–e: A burnt spread of probable prehistoric date, a slot trench windbreak surrounding in-situ burning, a possible kiln and various linear features and pits of unknown date,
- AA 4a–b: An irregular pit with burnt bone and charcoal inclusions, a cluster of hearths and a pit of unknown date,
- AA 5a–c: Prehistoric activity in the form of a large pit with prehistoric pottery sherds along with pits, postholes and hearth features,
- AA 6: A potential field system of possible prehistoric date,
- AA 7: Probable prehistoric activity in the form of a burnt spread and trough,
- AA 8: A pit and linear feature of possible prehistoric date.

Ground disturbances associated with the proposed development will have a direct impact upon the majority of Archaeological Areas identified through geophysical survey and archaeological test trenching. Archaeological Areas 2, 3a-e, 4a, 5a & b, 6, 7, 8 and the southern 40% of the large double-ditched enclosure at Archaeological Area 1 will be directly impacted upon by the construction of residential and educational development, provision of access roads and footpaths along with areas of landscaping. It is recommended that Archaeological Areas 2, 3a-e, 4a, 5a & b, 6, 7 and 8 and the southern 40% of the double-ditched enclosure at AA1 be subject to preservation by record (archaeological excavation). This should be undertaken under licence to the National Monuments Service (NMS) and a comprehensive methodology developed for this work in consultation with the NMS archaeologist with responsibility for the area.

It is recommended that the northern 60% of the double-ditched enclosure at AA1 be preserved in-situ. In order to prevent any inadvertent impact to this area during the construction stage of works, it is recommended that a Construction Exclusion Zone be established around the northern 60% of AA1. This should be delineated by a 1m high post and sheepwire fence. It is proposed to establish this fence a minimum of 5m distant from the recorded remains. The fence will be removed upon completion of the construction phase of the project. It is recommended that a Heritage Induction outlining the nature and significance of the archaeology in AA1 be a mandatory component of all contractors site inductions throughout the life of the project. The nature of the archaeology at AA1 and its location onsite should be addressed along with the details of the Construction Exclusion Zone. Signage should be erected in order to identify the Construction Exclusion Zone as having archaeological sensitivity and to notify any personnel that access to the exempt lands is strictly forbidden. It is recommended that no construction plant or heavy vehicles with the exception of those detailed above, be allowed to enter the exclusion zone nor may any materials or plant be stored in this area.

Installation of a public amenity greenspace along with landscaping and planting across the northern 60% of the double-ditched enclosure at Archaeological Area 1 has the potential to impact upon subsurface remains that have been shown to survive in this

area. It is recommended that landscaping works to be undertaken in the northern area of AA1 be carried out using lightweight dump truck (8 tonnes) and lightweight mechanical excavator (5-8 tonnes). It is recommended that this work be carried out during a period when the ground is dry. It is recommended that the use of displacement mats be considered should there be a requirement to track over any soft ground.

Ground disturbances may also negatively impact on isolated archaeological features or deposits that have the potential to survive outside of the footprint of the excavated test trenches and identified Archaeological Areas. It is recommended that archaeological monitoring of the topsoil stripping across the site be undertaken in order to identify any archaeological features that have the potential to survive outside of the identified Archaeological Areas. While stockpiled soil may be managed with bulldozers, the removal of the topsoil across the site will be carried out using back acting 360 degree tracked excavators fitted with toothless grading buckets. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the DoHLGH.

Following the completion of the development and establishment of greenspaces, there is potential for maintenance works, extension / refurbishment of services, future planting regimes etc. to negatively impact upon any archaeological features that are preserved in-situ beneath the public amenity greenspace. A lack of knowledge as to the location. Extent and nature of the archaeology is likely to result in neglect or damage over the long-term, during the operational phase of the development. During the operational phase of the development, it is proposed to let the area surrounding AA1 grow naturally as meadow. Some initial intervention may be required to seed the area, though this will be restricted to sod level. No cultivation or ground disturbances are required to create this environment. It is recommended that maintenance of the grassland, stream and woodland copses will be low interaction, and will be covered within a 'Taking Charge Strategy' that will be required to be adopted within the contract of the management company that will be appointed to maintain the parks. It is envisaged that maintenance will comprise hay cuts two or three times a year to prevent any large shrubs or trees taking root, pruning of the broadleaf copses and maintaining the stream free of rubbish or detritus. It is recommended that an appropriate information signage and wayfinding be erected in order to inform the public of the significant nature of the enclosure site and the surrounding landscape. The form and content of such should be agreed in advance with the NMS. It is recommended that the area of archaeology to be preserved in-situ is assessed on a biennial basis, using the system of OPW monument inspection as a template for this process. This inspection should be undertaken by a suitably qualified archaeological consultant on behalf of the management company. Any potential future works involving ground disturbance in AA1 will require an archaeological impact assessment prior to going ahead and may be subject to archaeological conditions.

It is the developer's responsibility to ensure full provision is made available for the resolution of any archaeological remains, both on site and during the post excavation process, should that be deemed the appropriate manner in which to proceed.

Please note that all recommendations are subject to approval by the National Monuments Service of the Heritage and Planning Division, Department of Housing, Local Government, and Heritage.

CONTENTS

LIST OF FIGURES

LIST OF PLATES

1 INTRODUCTION

1.1 GENERAL

The following report details the preliminary results of a programme of archaeological testing undertaken at Coolagad, Greystones, Co. Wicklow, prior to proposed residential development. The test trenching has been undertaken as part of a process of Environmental Impact Assessment Report (EIAR) in support of a Strategic Housing Development (SHD) planning application for the development.

Test trenching commenced at the site on the 12th of April and continued for nine days. This was carried out using a 13 tonne 360 degree tracked excavator, with a flat, toothless bucket, under strict archaeological supervision. A total of 84 trenches were mechanically investigated across the test area which measured c.3878 linear metres. This report follows on from a geophysical survey of the site, which was carried out by Joanna Leigh in 2020 (Licence 20R0212). Gradiometer scanning identified responses indicative of a large enclosure (c.95m diameter) with a further internal circular enclosure (Figure 4). The probable enclosure is truncated by multiple field boundaries and a farm laneway. Further isolated responses identified across the site may represent plough damaged archaeological features.

The assessment was undertaken by Muireann Ni Cheallacháin of IAC Archaeology (IAC), under licence 21E0133 as issued by the National Monuments Service of the Department of Housing, Local Government and Heritage (DoHLGH).

1.2 THE DEVELOPMENT

The proposed development will be residential in nature (Figure 3). The results of the geophysical survey and archaeological testing assessment have informed the proposed development layout which will include:

- 640 residential units,
- a community facility and creche,
- car, bike and motorcycle parking spaces,
- a new vehicular access onto the Regional Road R761, new roads, footpaths and cycle paths and connections within the site.
- un-landscaped zones of ecological conservation.
- The development also includes landscaped private and public open space, boundary treatment, lighting, play area, an ESB substation, site drainage works, and all ancillary site development works above and below ground.

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 BACKGROUND

The proposed development area is contained within nine fields (Fields 1-9) to the west of the R761 and to the north of Greystones. The fields are located to the north and west of a farm, which is located centrally within the proposed development area (Plate 1). The topography of the site has a dominant east facing aspect. To the southeast is the built-up area of Blacklion. To the north and west are agricultural lands. The site consists of agricultural fields (sandstone and shale till) mainly bordered by hedges and trees apart from the northwest boundary of the site, which dissects a field in a north-south direction. The lands are used as pasture for sheep and cattle. An existing track exists on site, linking the farm buildings located southeast of the site to other farm buildings in Templecarrig (Plate 2). A stream flows in an east-west direction centrally on the site along the northern boundary of the largest field discharging into the sea at Greystones.

A total of 12 sites are recorded in the Sites and Monuments Record within a 500m radius of the area (Figure 1). Of these sites three are scheduled for inclusion in the next revision of the RMP. These comprise a Church (WI008-012001), Graveyard (WI008-012002), and a ringfort (WI008-073).

Prehistoric Period

Mesolithic Period (c. 7000–4000BC)

Until recently the Mesolithic period was believed to have been the earliest time for human occupation of the island of Ireland, however, recent research suggests there may have been human activity in the southern half of Ireland as early as the Upper Palaeolithic (Dowd and Carden 2016). However, the Mesolithic period is still accepted as the first time there is evidence for widespread occupation in Ireland, as a large portion of the north of the country would have been beneath extensive glaciation earlier than this. During the Mesolithic Period, people lived transient lives, hunting, fishing, and foraging for subsistence. Coastal and riverine resources were of key importance to these communities. As a result of this mobile lifestyle, there is little settlement evidence in the archaeological record from this period. Often the only trace of these groups are lithic scatters and shell middens. There is, however, no direct evidence for Mesolithic activity within the site or receiving environment.

Neolithic Period (c. 4000–2500BC)

During the Neolithic period communities became less mobile and their economy became based on the rearing of stock and cereal cultivation. This transition was accompanied by major social change. Agriculture demanded an altering of the physical landscape. Forests were rapidly cleared, and field boundaries constructed. There was a greater concern for territory, which saw the construction of large communal ritual monuments called megalithic tombs, which are characteristic of the period. There are four types of Neolithic tomb known in Ireland: Court, Portal, Passage and Wedge. The main focus of Neolithic tomb building in Wicklow is located in the north of the county,

close to the Dublin border. Twenty passage tombs are located within this area alone, most of which are situated above the 240m contour (Stout 1994: 8).

Excavations carried out in advance of development at Charlesland and Killincarrig have revealed evidence for settlement activity dating to the Neolithic period. A number of pits containing early Neolithic pottery and saddle quern stones were retrieved during excavations in Charlesland (WI013-076), c. 3.1km south-southeast of the proposed development area. Further Neolithic activity in the wider landscape includes early Neolithic habitation sites at Sea Road, Kilcoole, c. 5.5km to the south-southeast (Licence 06E0670 ext., Bennett 2008:1318) and sites along the shores of the Poulaphuca Reservoir (Corlett 2009).

Bronze Age Period (c. 2500–800BC)

The Bronze Age was marked by the production and use of metals in Ireland for the first time. As with the earlier Mesolithic–Neolithic transition, the Neolithic–Bronze Age transition was accompanied by significant change in material culture and society. The construction of megalithic tombs ceased after the wedge tombs of the early Bronze Age with a focus on individual burials emerging. Bronze Age burials occurred in subterranean cist or pit burials that were either in isolation or in small cemeteries. These burials contained inhumed or cremated remains and were often accompanied by a pottery vessel.

The most common indicator of Bronze Age activity is the burnt mound or *fulacht fiadh*. These sites consist of a horseshoe-shaped mound of heat-affected stone and charcoal in close proximity to a trough. Often the trough is wood or wicker-lined. The function of these sites was to heat water, possibly for a variety of purposes, such as cooking, dyeing, brewing, tanning, or bathing. A substantial early Bronze Age burnt mound associated with four troughs and numerous pits and postholes was excavated at Charlesland, 3.2km south-southeast of the site (WI013-079). A set of possible music pipes carved from yew wood were found at the base of the one of the wicker-lined troughs. Activity during this period is well attested in the archaeological record within the immediate vicinity of the proposed development area. Two ring ditches as well as multiple funerary urns and cremation pits were excavated at Farrankelly c. 3km south-southeast (WI013-128/129). A significant Bronze Age ritual landscape, including a ring-ditch, funerary urns, cremation pits, cremation deposits, and animal burials, was excavated as part of the Charlesland development (Licence 03E0018, Bennett 2003:2073; Licence 03E0146, Bennett 2003:2076; Licence 03E0147, Bennett 2003:2077; Licence 04E0153, Bennett 2004:1857).

Occupation in the Charlesland area continued into the Late Bronze Age with several excavated sites dating to this period. A Late Bronze Age socketed looped axe and Beaker pottery were retrieved from a habitation site (WI013-075) c. 3.5km to the south-southeast of the proposed development site.

The Bronze Age has been established as the main period of hillfort construction in Ireland and excavation confirms these were centres of high-status residence, specialist crafts and trade, used for military purposes and assembly, as well as for ritual and

ceremony. Their prominent siting was strategic, connected not only to control of routeways but part of a highly visible display of political and military power in the landscape. (O'Driscoll et al 2019). The Class 1 partial contour univallate hillfort at Coolagad (WI008-015) lies directly to west, overlooking the proposed development area.

Iron Age Period (c. 800BC – AD400)

Compared to the rest of Irish prehistory, there is very little evidence in Ireland as a whole, representing the Iron Age. As in Europe, there are two phases of the Iron Age in Ireland: the Hallstatt and the La Tène. The Hallstatt period generally dates from 700BC onwards and spread rapidly from Austria, across Europe, and then into Ireland. It saw the rise and fall of elite hierarchical dynasties that derived their wealth from control of trade with the Mediterranean. It is only represented in Ireland by a small number of bronze swords and other items of Hallstatt type (Raftery 1994, 107). The later Iron Age, or La Tène, also originated in Europe during the middle of the 5th Century BC, so called after the site of a significant votive deposit on Lake Neuchâtel in Switzerland. For several centuries, the La Tène Celts were the dominant people in Europe, until they were finally overcome by the might of the Roman Empire. La Tène art is defined by its curvilinear design, which has flowing abstract compositions. While many ring-ditches may have continued in use into the Iron Age, there are no confirmed Iron Age sites within the vicinity of the proposed development area.

Early Medieval Period (AD400–1100)

The early medieval period is depicted in the surviving sources as entirely rural characterised by the basic territorial unit known as *túath.* Byrne (1973) estimates that there were probably at least 150 kings in Ireland at any given time during this period, each ruling over his own *túath.* During this sometimes-violent period, roughly circular defensive enclosures known as ringforts were constructed to protect farmsteads. Although most of the ringforts that have been excavated are shown to date to this period, some have earlier origins and may have been originally constructed during the Iron Age, or possibly even earlier. During this period, the area surrounding Greystones was located within the territories of the *Uí Dúnchada*, the ruling branch of which was the *Mac Gilla Mo Cholmóc* (Simpson 1994). At the time of the Anglo-Norman invasion the ruler *Domhnall* sided with the Anglo-Normans and as such managed to retain much of his land.

The ringfort, or rath, is considered to be the most common indicator of settlement during this time. The most recent study of the ringfort (Stout 1997) has suggested that there are over 45,000 potential ringforts or enclosure sites throughout Ireland. They are typically enclosed by an earthen bank and exterior ditch and range from 25m to 50m in diameter. The smaller sized and single banked type (univallate) were more likely to be home to the lower ranks of society while larger examples with more than one bank (bivallate/trivallate) housed the more powerful kings and lords. When the radiocarbon and dendro-chronological dates from ringfort excavations are compared (Stout 1997, 22-31), not only is the ringfort clearly an early medieval phenomenon, but a strong case emerges for dating the phase of ringfort construction to a period between the 7th and 9th centuries AD. The most common structures found within ringforts,

usually through excavation, are the remains of buildings, generally houses, either circular or rectangular. A ringfort (WI008-073) is recorded c. 220m to the northeast.

The earliest evidence for Viking activity in Wicklow is found in an annalistic entry for 827 AD, which reports the destruction of a Leinstermen camp by 'heathens.' A Viking presence is known at Arklow (c. 38km south of the area of proposed development) and Wicklow Town (c. 18km south of the site of proposed development) where trading stations, which developed into more extensive settlements, were established. Arklow town is situated at the mouth of the Avoca River and has the suffix '-lo' which is of Scandinavian origin (meaning 'meadow') and a 9th century Viking burial in the vicinity indicate an early settlement (Bradley and King 1989, 1). The name Wicklow is derived from *Vikingalo* meaning 'Meadow of the Vikings' or *Vik-lo* meaning 'meadow of the bay'. Possible Hiberno-Norse influence can be detected in the townland name of Coolagad which possibly includes the Norse word *gata* meaning a path or road (Etchingham 1994). The *gata* referred to in Coolagad and in nearby Windgate may well be the ancient roadway joining Bray and Delgany (Murphy & Potterton 2010).

Medieval Period (AD1100–1600)

The beginning of the medieval period is characterised by political unrest that originated from the death of Brian Borumha in 1014. Diarmait MacMurchadha, deposed King of Leinster, sought the support of mercenaries from England, Wales and Flanders to assist him in his challenge for kingship. Norman involvement in Ireland began in 1169, when Richard de Clare and his followers landed in Wexford to support MacMurchadha. Two years later de Clare (Strongbow) inherited the Kingdom of Leinster and by the end of the 12th century the Normans had succeeded in conquering much of the country (Stout and Stout 1997, 53). The local tribe that controlled much of the land surrounding Greystones sided with the Anglo-Normans and as such managed to retain much of their land. In 1207, the son of the leader *Díarmait Mac Gilla Mo Cholmóc* was granted these lands from King John in fee for the service of one knight. As such, the invasion passed this area by relatively peacefully as few people moved and Irish tenants stayed on their land. It was not until the end of the 13th century that the political situation became uneasy in the area due to pressure from the native Irish, the O'Byrnes and O'Tooles in the Leinster Mountains (*ibid.* 150).

A 'Church'(WI008-012001) and 'Graveyard' (WI008-012002) are situated c. 430m to the northeast. Known locally as St. Crispin's cell, the present remains consist of a small single cell church that appears to be an 18th century reconstruction using masonry from a medieval church. Stones projecting beneath the present church suggest that the medieval church was located partially beneath St. Crispin's cell. There are references to a graveyard (WI008-012002), which may have occupied the site until the 17th century AD. This graveyard is supposed to have been cleared and the disinterred bodies and gravestones buried elsewhere (O'Flanagan 1928, 39-41). The former site of Rathdown Castle (WI008-011) and deserted medieval settlement (WI008-011002) are located 200m to northeast of the church.

Post-medieval Period (AD1600-1900)

Palladianism was to dominate architecture in both Ireland and Britain in the half century after 1714. County Wicklow possesses two of the finest examples of large Palladian mansions to be seen anywhere in both countries, Powerscourt House (1731-40) and Russborough House (1741-48), both the work of the German-born architect, Richard Castle (1690-1751). Although few landowners could aspire to the exuberant grandeur of a Powerscourt or a Russborough, many of the succeeding generations of landowners were affluent enough to make important architectural statements. The boom in country house building, which characterised much of the first half of the 19th century, and indeed, the century before that, tailed off almost completely by the 20th century. During the post-medieval period, the proposed development was situated to the immediate north and west of Coolagad House in a rural landscape, the main house is still present today.

2.2 SUMMARY OF PREVIOUS ARCHAEOLOGICAL FIELDWORK

A review of the Excavations Bulletin (1970–2020) has revealed that no excavations have been undertaken within the site.

A 'Ringfort - rath'(WI008-073), which was revealed by Geophysical survey and archaeological testing, lies c. 220m to the northeast. The feature was not subsequently excavated as it lay outside the area for development (Bennett 1993:231, Licences 93E0187, 94E0033).

A possible earthwork (WI008-045), located directly to the south and east of the area, was subject to testing in 2005 (Bennett 2005:1701, Licence 05E0522) but no features of archaeological significance were identified, and the site was subsequently reclassified as a redundant record. Three nodules of flint were recovered from the site but showed no evidence of having been worked. Clay pipe fragments and post-medieval pottery were also recovered. Dumped material was evident across the site to a depth of c. 1m.

Testing was undertaken in 2013 (Bennett 2013:511, Licence 13E0394) in advance of construction of a post primary school directly adjacent to the area tested in 2005. No features of archaeological potential were identified. A few modern drainage features were noted in some of the cuttings.

Several excavations have been undertaken c. 400-500m to the northeast of the proposed area in the townlands of Templecarrig Lower and Rathdown Upper. Excavation carried out at a residential development at Templecarrig Lower, c. 426m northeast of the proposed development, identified a charcoal spread and pit (Bennett 2002:1990, Licence 02E0227, SMR WI008-058) and six pits, one of which contained prehistoric pottery (Bennett 2003:2095, Licence 03E0886, SMR WI008-068).

Excavation carried out at a residential development at Rathdown Upper (Bennett 1997:612, Licence 97E0075), c.435m northeast of the site identified prehistoric occupation in the form of pits, gullies, ditches etc. with the presence of Beaker pottery and early Iron Age artefacts (SMR WI008-071), an early Neolithic platform and pits

dated from several diagnostic flint artefacts (SMR WI008-070) and a corn drying kiln (SMR WI008-074). A 'Road - hollow-way' (WI008-072) which was identified through geophysical survey and excavation is also recorded in this area, to the east of St Crispin's cell (WI008-012001). Limited excavation in 1993 (Bennett 1993:231, Licence 93E0187) revealed that the primary phase of the feature consisted of a shallow ditch, which when partially backfilled had been re purposed as a route way. Two sherds of glazed medieval pottery and a sherd of medieval cooking ware were recovered from the upper fills of the ditch, but no diagnostic finds were made in the primary fills, so the date of the feature remains unknown (Eogan and O'Brien 2007).

Testing carried out at a proposed dwelling-house in Templecarrig/Rathdown Lower to the southwest of St. Crispin's cell and c. 232m to the northeast of the proposed development identified no features of archaeological significance (Bennett 2000:1093, Licence 00E0152). Archaeological monitoring of the placement of two ESB poles at Redford Park, Rathdown, c. 300m east of the proposed development, also identified nothing of archaeological significance (Bennett 1998:691, Licence 97E0075 ext.).

2.3 CARTOGRAPHIC ANALYSIS

Jacob Neville, *Map of County Wicklow*, 1760

The county of Wicklow is depicted in with a road network and topographical features. Coolagad House is annotated and depicted to the west of the Rathdown Road. Redford House is depicted to the east and Kindlestown House is marked to the south. There are no other features depicted within the approximate area of the site at Coolagad House.

First Edition Ordnance Survey Map, 1840, scale 1:10560 (Figure 2)

This is the first accurate historic mapping coverage of the area containing the proposed development which is contained within nine open fields to the immediate north and west of Coolagad House.

Ordnance Survey Map, 1909, scale 1:2500

The large agricultural fields, farm buildings and farm laneway located within and surrounding the proposed development area have not changed since the first edition six-inch OS map of 1840.

2.4 AERIAL PHOTOGRAPHIC ANALYSIS

A review of the aerial photographic coverage of the proposed development area held by the Ordnance Survey (1995-2013), Google Earth (2009-2020), and Bing Maps (2020) showed that the location of the large agricultural fields, farm buildings and farm laneway have not changed which corresponds with the evidence from the historic mapping. No previously unrecorded features of archaeological potential were identified in the aerial photography coverage.

2.5 SUMMARY OF GEOPHYSICAL RESULTS

A geophysical survey was carried out within the proposed development area by Joanna Leigh in 2020 (Licence 20R0212). Detailed gradiometer scanning identified responses f

clear archaeological interest in 7 areas. Response's indicative of an enclosure were identified running through (Areas A, E and F. The probable enclosure is truncated by multiple field boundaries and a farm laneway. Nevertheless, the responses identified suggest a large enclosure (c. 95m diameter) with a further internal circular enclosure. A small circular response and trend to the east of the probable enclosure is indicative of a small (c. 11m diameter) circular enclosure. Isolated responses within it suggest probable pits and a possible hearth feature. Further to the south of the probable enclosure, there are vague trends and an area of increased magnetic response. In addition, two isolated responses have a magnetic signature indicative of burnt features. It is possible that plough damaged archaeological features are represented here. This is speculative as there is no clear archaeological pattern. In the north of the application area (Areas B and C) linear trends and negative responses form an irregular pattern. There is no clear archaeological interpretation, and it is speculated that these may represent agricultural activity. The origin of these responses is unknown. Fields 7 and 8 were not suitable for survey due to the presence of tall overgrown vegetation and magnetic interference from the farm buildings located directly to the south of field 8. The geophysical results are illustrated in Figures 4–12.

2.6 TOPOGRAPHICAL FILES

Information on artefact finds from the study area in Wicklow has been recorded by the National Museum of Ireland since the late 18th century. Location information relating to these finds is important in establishing prehistoric and historic activity in the study area.

MUSEUM NO	1981:2
TOWNLAND	Belmont Demesne
PARISH	Delgany
BARONY	Rathdown
FIND	Bronze Axe head, Palstave
REFERENCE	NMI Topographical Files

MUSEUM NO	1977:3
TOWNLAND	Rathdown Upper
PARISH	Delgany
BARONY	Rathdown
FIND	Jetton
REFERENCE	NMI Topographical Files

MUSEUM NO	1977:2
TOWNLAND	Templecarrig Lower
PARISH	Delgany
BARONY	Rathdown
FIND	Sliver Medieval Coin
REFERENCE	NMI Topographical Files

2.7 FIELD INSPECTION

A field inspection of the site was carried out in January 2021. The proposed development area is contained within nine fields (Fields 1-9). Fields 1, 2 and 3 at the west comprised of short pasture while field 4 was located along a farm laneway, with dense gorse vegetation obstructing much of the area. The laneway/field also comprised of hardcore material in places. Field 5 comprised of long pasture and field 6 comprised of a large open field with rough ground in places. A west–east aligned stream divides field 5 and field 6 and runs through field 4 across the laneway. Newly constructed houses are located to the east of Field 6 and an area of disturbed ground was noted along the eastern edge of the field. Fields 7 and 8 comprised of overgrown vegetation separated by a broad mature waterlogged hedgerow and trees. Field 8 is located to the immediate north of farm buildings. Field 9 is located at the eastern extent of the proposed development area, adjacent to the main road. The farm trackway runs along the south of the field and a modern dwelling is located to the south-west. No upstanding evidence of the enclosure identified in the geophysical survey was identified during the inspection. No cropmarks or vegetation patterns representing other possible sub-surface archaeological features were noted across the nine fields.

3 ARCHAEOLOGICAL TESTING

3.1 GENERAL

Test trenching was carried out over the course of nine days from 12th April using a 13 tonne 360 degree tracked excavator equipped with a flat, toothless bucket under strict archaeological supervision. Any investigated deposits were preserved by record. This was by means of written, drawn and photographic records. Archaeological features identified on site have been grouped into Archaeological Areas (AA 1 etc) for ease of description and the extent of these areas, as annotated on the trench figures, are for illustrative purposes only.

A total of 84 trenches were excavated across the site measuring 3878 linear metres targeting geophysical anomalies and open green space to fully investigate the archaeological potential of the proposed development lands. Ten of the trenches were extended to better investigate the exposed archaeological features. (Figures 4–12, Plates 3–36, Appendix 1).

The test trenches were excavated to determine, as far as reasonably possible, the location, extent, date, character, condition, significance and quality of any surviving archaeological remains in order to formulate an impact assessment and mitigation strategies. Several of the trenches were extended in order to record the full extent of identified features and Trench 4 was shortened due to the presence of a metal borehole along its alignment.

3.2 TESTING RESULTS

The topsoil across the site consisted of a light to mid-brown clayey silt that contained moderate amounts of small stone at times. The depth of topsoil varied due to the undulating nature of the site but on average measured 0.3m in depth. An orangey brown clayey silt plough soil was recorded in some of the trenches to an average depth of 0.15m. The natural subsoil consisted of compact whiteish yellow clayey sands and dark browns and black gravel patches. In waterlogged areas the natural subsoil consisted of a light grey marl.

Trenches and archaeological contexts are described in detail in Appendix 1 while artefacts and samples recovered are listed in Appendix 2.

Archaeological Features

All archaeological features have been grouped together based on their physical proximity and have called Archaeological Areas in order to provide structure and to facilitate the description and discussion of the features. Boxes have been placed around the Archaeological Areas for illustrative purposes only and to allow the reader to locate them within the overall site (Figures 4–12).

3.2.1 Archaeological Area 1 Figure 5, Plates 2–12

Nine trenches were excavated to define the nature and extent of the potential enclosure as shown on the geophysical survey. The results of the testing confirmed the presence of a truncated plectrum shaped ditched enclosure (possible original int. diameter: 95m x 90m). A smaller central, possibly oval enclosure (Possible original int. diameter: 55m x 50m was also identified. Testing also confirmed the presence of internal and external features including slot trenches, pits, postholes and hearths.

Trenches 37 and 46 produced no evidence of the inner or outer enclosure ditches and have revealed that a broad east–west running swathe (c. 25m wide) of disturbance cuts through the central area of the enclosure, truncating the site in this location (see Figure 5). This truncation appears to have been caused by the installation of water pipes feeding from the stream at the east and the construction of the farm laneway at the west. The historic field boundaries that traverse the site will also have had an adverse impact on the enclosure ditch.

While the outer enclosure ditch ranges in width from 2.5m to 4m, and the inner enclosure ditch from 2.1 to 3.2m, the relatively shallow nature of the ditches (Outer:0.84m-1m deep, Inner: 0.76m), as well as the shallowness of some of the internal and external features (average depth 0.18m-0.3m), suggests the site has been truncated by agricultural activity.

Outer enclosure ditch: The outer enclosure ditch was recorded in seven of the trenches and measures on average 3m wide and 0.84–0.95m deep with multiple sandy clay fills containing moderate charcoal and occasional animal bone inclusions.

Inner enclosure ditch: The inner ditch was recorded in Trenches 41, 51 and 52 and measures on average 2.5m wide and 0.76m deep with multiple sandy clay fills with occasional charcoal inclusions. A possible metalled surface or stone dump was recorded on the surface of the inner ditch in Trench 41.

The space between the enclosure ditches varied from 9.5m in length in Trench 52 to 17.5m in Trench 51. Pit features (C49.1, C49.2, C53.1) were recorded within 1m of the inner edge of the outer ditch in Trenches 49 and 53 indicating that if the pits are contemporary with the enclosure there may not have been an accompanying bank to the outer ditch. A small pit (C15.2) is located 3.5m from the inner edge of the outer ditch in Trench 15.

Internal features: A cluster of pits, a hearth and a slot trench (C38.1, C38.3, C51.1–C51.3, C52.1–C52.3, C52.9 and C52.10) were recorded in the interior of the inner ditch. A gap of 5m was recorded between the internal features and the internal edge of the ditch in trenches 51 and 52, indicating that a bank associated with the inner ditch may have been located here. A possible posthole C51.4 is recorded abutting the inner edge of the inner ditch which may be associated with a possible revetment for the bank.

External Features: Several external archaeological features were recorded in proximity to the enclosure. Trenches 39 and 42 confirmed the presence of a 0.4–0.6m wide curvilinear gully feature (C39.3 and C42.2) that appears to respect the external edge of

the outer enclosure ditch at the northeast while Trench 52 identified a hearth feature C52.12 located 4m to the south of the external edge of the outer ditch.

Trench 54 confirmed the presence of multiple archaeological features (C54.1–C54.16) associated with some form of industrial activity, probably cereal drying. The features include a large central stone lined feature C54.3 that contains moderate to frequent charcoal inclusions and occasional flint debitage that appears to be partially enclosed by several curvilinear slot trenches (C54.2, C54.13, C54.15 and C54.16). A stone hone and possible manuport were recovered from slot trench C54.13 and several charred cereal grains were recovered from slot trench C54.16. A hearth (C54.5) and adjacent possible structure consisting of post and stakeholes (C54.9, C54.10, C54.12, C54.14) is located to the southeast of the central feature.

Trench 40 confirmed the presence of an irregular pit (C40.1) that contains a clayey silt fill with frequent stone inclusions, some of which appear to be heat shattered.

Trench 50 confirmed the presence of a spread (C50.1) of charcoal rich material with burnt clay inclusions.

3.2.2 Archaeological Area 2 Figure 6, Plates 13–15

Area 2a: Trench 3 confirmed the presence of two archaeological features interpreted as possible troughs. Rectangular trough C3.1 has gradually sloping sides and contains burnt mound material with occasional large unburnt stone. Oval trough C3.3, has steep to vertical sides and filled with burnt mound material and is located 6.5m to the west. A sub-circular pit C3.2, interpreted as a possible pot boiler with near vertical sides and filled with a charcoal rich stony greyish brown clayey silt is recorded between the two troughs. Circular geophysical anomalies were targeted.

Area 2b: Trench 5 identified two adjacent oval pits C5.1 & C5.2, with steep to vertical sides filled with a charcoal rich clayey silt and moderate amount of stone. Circular geophysical anomalies and agricultural trends were targeted.

Area 2c: Trench 12 confirmed the presence of an archaeological feature identified as a small area of in-situ burning (C12.3) while Trench 13 confirmed the presence of archaeological features identified as pits (C13.1–C13.3). Oval pit C13.1 has steep sides and is filled with a dark-brown clayey silt with charcoal. A linear pit with steep sides C13.2, is located directly adjacent and may form part of the same feature as the geophysical survey denotes a large figure of eight shaped pit at this location. C13.2 is filled by dark greyish brown clayey silt with charcoal and stone. A linear feature C13.3 with steep, near vertical sides was identified in the geophysical survey as a large pit. It has two fills; the upper fill consists of a 0.4m thick brown clayey silt with moderate amounts of charcoal and stone seen on the surface of the feature. The 0.2m thick basal fill consists of gritty grey clayey sand with occasional charcoal.

3.2.3 Archaeological Area 3 Figures 7–8, Plates 16–20

Area 3a: Trench 66 confirmed the presence of an archaeological feature identified as a possible kiln or charcoal production pit C66.1. It is filled with frequent charcoal and a concentration of stone with evidence for *in-situ* burning also present.

Area 3b: Trench 55 confirmed the presence of archaeological features identified as a narrow shallow curvilinear slot trench (C55.1) with steep sides filled with a dark grey-brown clayey silt with frequent charcoal and occasional stone. An area of *in-situ* burning (C55.2) and a possible clay surface with charcoal throughout is enclosed by slot trench C55.1.

Area 3c: Trench 56 confirmed the presence of a large irregular archaeological feature identified as a spread of burnt mound material (C56.1) measuring 9.5m in length, 5.6m wide and 0.25m deep. A west–east aligned linear field drain (C56.2) cuts through the spread.

Area 3d: Trench 59 confirmed the presence of archaeological features identified as a possible oval stone lined kiln (C59.1) and an L-shaped ditch feature (C59.2) with near vertical sides located directly to the west. A north–south aligned linear ditch (C59.3) with gradually sloping sides is located 1m to the west. It is filled by a greyish brown sandy silt C59.3a. with a charcoal lense recorded at 0.15m depth.

Area 3e: Trench 58 identified a sub-oval pit (C58.1) with gradually sloping sides and filled with a dark grey-black sandy silt with frequent charcoal and heat affected stone. An oval shaped pit C58.2 is located 9m to the southeast with gradually sloping sides and filled by a loose blackish-brown sandy silt with moderate charcoal chunks, roots, occasional medium sized stone and very occasional heat affected stone.

3.2.4 Archaeological Area 4 Figure 9, Plates 21, 22

Area 4a: Trench 68 confirmed the presence of an archaeological feature identified as a large irregular pit (C68.1) that contains a loose stony mid-brown clayey silt. At the southern end of the feature there is a concentration of charcoal and to the east of this there is *in-situ* burning evident. Directly north of the charcoal deposits is a concentration of burnt bone with occasional burnt bone inclusions spread out to the north of this.

Area 4b: Trench 69 confirmed the presence of archaeological features at the northwest end of the trench identified as a hearth or area of *in-situ* burning (C69.1) measuring 1.51m in length and 1.34m wide with a concentration of charcoal noted to the northwest. A second area of in-situ burning (C69.4) is recorded 1m to the south and measures 1.07m in length and 0.7m wide. A shallow sub-oval pit with steep sides (C69.2) is recorded 3m to the southeast is filled by a soft blackish-brown sandy clay with charcoal throughout.

3.2.5 Archaeological Area 5 Figure 10, Plates 23–26

Area 5a: Trench 32 identified a square pit with rounded corners (C32.1) measuring 1.3m in length, 1.2m wide and investigated to a depth of 0.22m. This pit was not bottomed as large sherds of coarse prehistoric pottery was uncovered amidst an

orangey grey brown clayey silt with frequent stone, charcoal and fibrous root inclusions.

Area 5b: Trench 34 identified a possible posthole C34.1 of 0.3m diameter filled with a greyish brown soft sandy clay and a small adjacent spread of charcoal rich material C34.2.

Area 5c: Trenches 35 and 36 confirmed the presence of archaeological features identified as pits (C35.2–35.4, C36.1–36.8) of varying size and a hearth (C35.1). All the pits are filled with a mid to dark brown clayey sand with frequent charcoal and moderate heat shattered stone inclusions.

3.2.6 Archaeological Area 6 Figure 11, Plate 27

Trench 78 identified two parallel ditches C78.3 and C78.6 that may represent a prehistoric field system. The ditches are aligned north–south with steep to near vertical sides measuring 1.83–2.14m wide and 0.44–0.61m deep and contain two fills. The upper fill is a greyish brown clayey sand with some larger stone at the bottom of the layer while the lower fill is a waterlogged compact plastic grey clay. Frequent charcoal and occasional butchered animal bone was noted in both the fills.

A sub-circular pit C78.4 is recorded within the 25m wide space between the two ditches. The most easterly feature identified in the trench is a northeast–southwest linear ditch C78.10 located c.6m to the east of ditch C76.6. It has gradually sloping sides and measures 1.63m wide and was not bottomed at 0.54m. It is filled by the same two fills as the western ditches an abraded flint core/pebble was recovered from the top fill. A possible gunflint was recovered from the topsoil in this trench

3.2.7 Archaeological Area 7 Figure 11, Plate 28

Trench 80 identified a washed out burnt spread (C80.4) at the eastern extent of the trench. It measures 8m long, 7m wide and 0.12m deep. A possible vertical sided oval trough (C80.2) abuts the spread at the west and is filled by a waterlogged sandy silt with frequent heat shattered stone.

3.2.8 Archaeological Area 8 Figure 12, Plate 29

Trench 84 confirmed the presence of archaeological features in the centre of the trench identified as a linear ditch feature (C84.1) aligned north–south with a light grey sandy silt upper fill with moderate charcoal flecks, small pebbles and fibrous roots and a light–mid brown sandy silt lower fill. A sub-oval pit C84.2 was recorded 1m to the east filled with a mid-brown sandy silt with occasional charcoal flecks and small angular pebbles. A possible broken flint scraper was recovered from the topsoil.
Trench 83 identified a ditch feature C83.1 which has been interpreted as the continuation of ditch C84.1.

Non-Archaeological Features Figure 4, Plates 31 & 32

Multiple earth cut agricultural features identified as field drains and furrows were identified across the site aligned in multiple directions. They range between 0.2–1.28m wide and 0.09–0.38m deep and are filled with a sterile clayey sand. Several modern drains consisting of plastic pipes were also recorded in Trenches 71 and 83.

Evidence of land clearance and root burning was recorded in Trenches 12 and 25 while a 20th century waste pit was recorded in Trench 80.

3.3 CONCLUSIONS

There are no recorded monuments within the proposed development area, which is located in the townland of Coolagad, Greystones, Co. Wicklow, and a total of 12 sites are recorded within a 500m radius of the site. The proposed development area is contained within nine agricultural fields that are located to the north and west of a 20th century farmyard which is located centrally. A review of the historic mapping and the aerial photographic resource show that the large agricultural fields, farm buildings and farm laneway have not changed since the first edition six-inch map of 1840 (surveyed in 1837).

A geophysical survey was carried out within the proposed development area by Joanna Leigh in 2020 (Licence 20R0212). Gradiometer scanning identified responses indicative of a large enclosure (c. 95m diameter) with a probable further internal circular enclosure (Figure 6). A small circular response and trend to the east of the probable enclosure is indicative of a small (c. 11m diameter) circular enclosure. Fields 7 and 8 were not suitable for survey due to the presence of tall overgrown vegetation and magnetic interference from the farm buildings located directly to the south of field 8.

Testing revealed eight areas of archaeological potential, which have been designated as Archaeological Areas 1–8.

- AA 1: Testing at AA1 confirmed the presence of a partially disturbed, plectrum-shaped enclosure (possible original int. diameter: 95m x 90m). A smaller central, possibly oval enclosure (possible original int. diameter: 55m x 50m) was also identified. Testing also confirmed the presence of internal features including slot trenches, pits, postholes and hearths. External features including hearths, gullies and a concentration of industrial activity probably associated with cereal drying activity were also identified. No diagnostic artefacts were retrieved. No diagnostic artefacts were retrieved. It is tentatively suggested that, given the form, landscape and archaeological setting, that the bi-vallate enclosure is of early medieval date.

  Trenches 37 and 46 have revealed that at a broad east–west running swathe (c. 25m wide) of disturbance cuts through the central area of the enclosure (see Figure 5). This truncation appears to have been caused by the installation of water pipes feeding from the stream at the east and the construction of the farm laneway at the west. The historic field boundaries that traverse the site will also have had an adverse impact on the enclosure ditch.

  While the outer enclosure ditch ranges in width from 2.5m to 4m, and the inner enclosure ditch from 2.1 to 3.2m, the relatively shallow nature of the ditches (Outer:0.84m-1m deep, Inner: 0.76m), as well as the shallowness of some of the internal and external features (average depth 0.18m-0.3m), suggests the site has been truncated by agricultural activity.

- AA 2a–c: Probable prehistoric activity in the form of troughs and pits associated with burnt mound activity along with pits and in-situ burning of unknown date,
- AA 3a–e: A burnt spread of probable prehistoric date, a slot trench windbreak surrounding in-situ burning, a possible kiln and various linear features and pits of unknown date,
- AA 4a–b: An irregular pit with burnt bone and charcoal inclusions, a cluster of hearths and a pit of unknown date,
- AA 5a–c: Prehistoric activity in the form of a large pit with prehistoric pottery sherds along with pits, postholes and hearth features,
- AA 6: A potential field system of possible prehistoric date,
- AA 7: Probable prehistoric activity in the form of a burnt spread and trough,
- AA 8: A pit and linear feature of possible prehistoric date.

4 IMPACT ASSESSMENT AND MITIGATION STRATEGY

Impacts can be identified from detailed information about a project, the nature of the area affected, and the range of archaeological resources potentially affected. Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping; disturbance by vehicles working in unsuitable conditions; and burial of sites, limiting access for future archaeological investigation.

The proposed development comprises the construction of residential units along with all ancillary site development works above and below ground and includes Cut-Fill actions – rebalancing of the profile which will involve the movement of some 427,000 cubic metres of soil within the site.

The proposal in relation to mitigation of impacts upon the archaeological resource, was a collaborative process with the design team and included consultation with the National Monuments Service and incorporates both preservation in-situ and preservation by record. This process has resulted in a redesign of certain areas of the development and the expansion of un-landscaped ecological zones to allow for the preservation in-situ of the northern 60% of AA1.

4.1 IMPACTS

4.1.1 Construction Phase

Ground disturbances associated with the proposed development will have a direct impact upon the majority of Archaeological Areas identified through geophysical survey and archaeological test trenching.

- The southern 40% of the large double-ditched enclosure at Archaeological Area 1 will be directly impacted upon by the construction of residential and educational development, provision of access roads and footpaths along with areas of landscaping.
- Installation of a public amenity greenspace along with landscaping and planting across the northern 60% of the double-ditched enclosure at Archaeological Area 1 has the potential to impact upon subsurface remains that have been shown to survive in this area.
- Archaeological Areas 2, 3a-e, 4a, 5a & b, 6, 7 and 8 will be directly impacted upon by the construction of residential and educational development, provision of access roads and footpaths along with areas of landscaping / Cut-Fill.
- Ground disturbances may also negatively impact on isolated archaeological features or deposits that have the potential to survive outside of the footprint of the excavated test trenches and identified Archaeological Areas.

4.1.2 Operational Phase

Following the completion of the development and establishment of greenspaces, there is potential for maintenance works, extension / refurbishment of services, future planting regimes etc. to negatively impact upon any archaeological features that are preserved in-situ beneath the public amenity greenspace. A lack of knowledge as to the

location. Extent and nature of the archaeology is likely to result in neglect or damage over the long-term, during the operational phase of the development.

4.2 MITIGATION

4.2.1 Preservation by Record

- It is recommended that Archaeological Areas 2, 3a-e, 4a, 5a & b, 6, 7 and 8 and the southern 40% of the double-ditched enclosure at AA1 be subject to preservation by record (archaeological excavation). This should be undertaken under licence to the National Monuments Service (NMS) and a comprehensive methodology developed for this work in consultation with the NMS archaeologist with responsibility for the area.

4.2.2 AA1 Construction Phase

- It is recommended that a Construction Exclusion Zone be established around the northern AA1. This should be delineated by a 1m high post and sheepwire fence. It is proposed to establish this fence a minimum of 5m distant from the recorded remains. The fence will be removed upon completion of the construction phase of the project.

- It is recommended that a Heritage Induction outlining the nature and significance of the archaeology in AA1 be a mandatory component of all contractors site inductions throughout the life of the project. The nature of the archaeology at AA1 and its location onsite should be addressed along with the details of the Construction Exclusion Zone.

- Signage should be erected in order to identify the Construction Exclusion Zone as having archaeological sensitivity and to notify any personnel that access to the exempt lands is strictly forbidden.

- It is recommended that landscaping works to be undertaken in the northern area of AA1 be carried out using lightweight dump truck (8 tonnes) and lightweight mechanical excavator (5-8 tonnes). It is recommended that this work be carried out during a period when the ground is dry. It is recommended that the use of displacement mats be considered should there be a requirement to track over any soft ground.

- It is recommended that no construction plant or heavy vehicles with the exception of those detailed above, be allowed to enter the exclusion zone nor may any materials or plant be stored in this area.

- It is recommended that archaeological monitoring of the topsoil stripping across the site be undertaken in order to identify any archaeological features that have the potential to survive outside of the identified Archaeological Areas. While stockpiled soil may be managed with bulldozers, the removal of the topsoil across the site will be carried out using back acting 360 degree tracked excavators fitted

with toothless grading buckets. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the DoHLGH.

4.2.3 Operational Phase

- It is proposed to let the area surrounding AA1 grow naturally as meadow. Some initial intervention may be required to seed the area, though this will be restricted to sod level. No cultivation or ground disturbances are required to create this environment.

- Maintenance of the grassland, stream and woodland copses will be low interaction, and will be covered within a 'Taking Charge Strategy' that will be required to be adopted within the contract of the management company that will be appointed to maintain the parks. It is envisaged that maintenance will comprise hay cuts two or three times a year to prevent any large shrubs or trees taking root, pruning of the broadleaf copses and maintaining the stream free of rubbish or detritus.

- It is recommended that an appropriate information signage and wayfinding be erected in order to inform the public of the significant nature of the enclosure site and the surrounding landscape. The form and content of such should be agreed in advance with the NMS.

- It is recommended that the area of archaeology to be preserved in-situ is assessed on a biennial basis, using the system of OPW monument inspection as a template for this process. This inspection should be undertaken by a suitably qualified archaeological consultant on behalf of the management company.

- Any potential future works involving ground disturbance in AA1 will require an archaeological impact assessment prior to going ahead and may be subject to archaeological conditions.

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APPENDICES

APPENDIX 1 TRENCH RESULTS

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
1	40	2	0.4	West–East	No Archaeology found. A circular geophysical anomaly was targeted. Figure 4
2	70	2	0.42	West–East	No Archaeology found. A circular geophysical anomaly was targeted. A single agricultural field drain was noted at the eastern end of the trench running north–south. Figure 4
3	20	2	0.4	Northwest–Southeast	**AA2a:** A rectangular pit **C3.1** interpreted as a possible trough with gradually sloping sides was recorded within trench 3. It contains burnt mound material with occasional large unburnt stone (**C3.1a**) and measures 1.85m in length, 1.3m in width and 0.26m deep. A sub-circular pit **C3.2,** interpreted as a possible pot boiler with near vertical sides and filled with a stony greyish brown clayey silt **C3.2a** with charcoal measures 0.7m in length, 0.6m in width and 0.16 deep. An oval pit **C3.3,** interpreted as a possible trough with steep to vertical sides and filled with a thin layer of loose light brown clayey silt with moderate stone and charcoal (**C3.3a**) measures 1.2m in length, 1.04m wide and 0.28m deep. Circular geophysical anomalies were targeted. Plate 13, Figure 6
4	23	2	0.4	West–East	A northwest–southeast aligned linear feature **C4.1,** interpreted as an earth cut field drain with steep sloping sides filled with mid–dark brown sandy silt with moderate stone **C4.1a** this measured 1.05m wide and 0.36m deep. An NNW–SSE aligned linear feature **C4.2** also interpreted as a drain measures 0.8m wide and 0.2m deep with steep sloping sides and is filled with a mid-brown clayey silt **C4.2a** and was possibly truncated by **C4.1**. Linear geophysical anomalies and the ferrous response from the borehole were targeted. Figure 6
5	80	2	0.4	West–East	**AA2b:** An oval pit **C5.1** with near vertical sides was recorded near the western end of trench 5 measuring 0.95m in exposed length, 0.65m wide and 0.2m deep. It is filled with a greyish brown clayey silt **C5.1a** with frequent charcoal. An oval pit **C5.2** with steep sloping sides is recorded directly to the east and is filled by a greyish brown clayey silt **C5.2a** with frequent charcoal chunks and moderate amount of stone This measures 1.5m

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					in length, 0.52 wide and 0.3m deep. Circular geophysical anomalies and agricultural trends were targeted. Plate 14, Figure 6
6	10	2	0.4	Northwest–Southeast	No Archaeology found. No geophysical anomalies targeted. Plate 33, Figure 4
7	10	2	0.5	West–East	No Archaeology found. Evidence of root burning for land clearance was noted in the trench. Possible agricultural trends and a circular geophysical anomaly were targeted. Figure 4
8	30	2	0.5	West–East	No Archaeology found. Possible agricultural trends were targeted. Figure 4
9	30	2	0.4	West–East	No Archaeology found. A "C" shaped geophysical anomaly was targeted. Figure 4
10	30	2	0.44	West–East	No Archaeology found. Possible agricultural trends and furrows were targeted. Figure 4
11	30	2	0.4	West–East	No Archaeology found. Agricultural trends were targeted. Figure 4
12	60	2	0.62	West–East	AA2c: A small area of *in-situ* burning C12.3 was recorded at the eastern extent of trench 12 and 10m to the north of pits identified in trench 13. It measures 0.76m in length, 0.64m wide and 0.02m in depth. A possible shallow agricultural ditch or gully C12.1 was recorded 22m to the west and is linear in plan with concave sides and measures 1.28m wide and 0.34m deep. It filled with C12.2 a loose gritty yellowish-brown clayey sand. A circular anomaly was targeted from geophysical results. Plate 15 ,Figure 6
13	50	2	0.6	Northeast–Southwest	AA2c: An oval pit with steep sides C13.1, was recorded at the northwest end of trench 13 that measures 0.5m in length, 0.46m in exposed width and 0.1m deep and is filled with a dark-brown clayey silt C13.1a with charcoal. A linear pit with steep sides C13.2, is located directly adjacent and may form part of the same feature as the geophysical survey denotes a large figure of eight shaped pit at this location. C13.2 measures 0.9m in length, 0.55m wide and 0.14m deep and is filled by dark greyish brown clayey silt with charcoal and stone C13.2a. A linear feature with steep, near vertical sides C13.3 was identified in the geophysical survey as a large pit. It measures 1.3m in width and 0.6m deep. It has two fills; the upper fill C13.3a consists of a 0.4m thick brown clayey silt with moderate amounts of charcoal and stone seen on the surface of the feature. The 0.2m thick basal fill C13.3b consists of gritty grey clayey sand with occasional charcoal. An agricultural linear feature with gradually sloping sides C13.4 was recorded 10m to the southwest and measures 2.45m in exposed length, 1.54m wide and 0.37m deep. It is filled by a mid-brown clay silt with occasional stone C13.4a. Agricultural trends and circular anomalies were targeted. Plate 31, Figure 6

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
14	50	2	0.38	Northeast–Southwest	No Archaeology found. Agricultural trends were targeted. Figure 4
15	20	2	0.42	NNW–SSE	AA1: The north-western extent of a plectrum shaped enclosure ditch as identified on the geophysical survey was recorded in the middle of trench 15. Linear in plan with concave sides C15.1 is likely the outer enclosure ditch and measures 3.25m wide and was investigated to a depth of 0.45m but not bottomed. It is filled by a greyish-brown sandy clay C15.3, with moderate charcoal chunk inclusions. A sub-oval pit with concave sides C15.2, was recorded in the interior of the enclosure and measures 0.8m in length, 0.54 wide and 0.13m deep. It is filled by a greyish-brown sandy clay with charcoal C15.4. Plate 3, Figure 5
16	25	2	0.56	Northeast–Southwest	No Archaeology found. A linear geophysical trend was targeted. Figure 4
17	60	2	0.6	Northeast–Southwest	No Archaeology found. Agricultural geophysical trends were targeted. Figure 4
18	60	2	0.4	West–East	No Archaeology found. Linear and agricultural geophysical trends were targeted. Figure 4
19	20	2	0.55	West–East	No Archaeology found. A curvilinear geophysical anomaly was targeted. Figure 4
20	20	2	0.38	West–East	No Archaeology found. A curvilinear geophysical anomaly was targeted. Figure 4
21	20	2	0.56	West–East	No Archaeology found. A curvilinear geophysical anomaly was targeted. Figure 4
22	20	2	0.55	WSW–ENE	No Archaeology found. Linear, agricultural and possible furrow trends were targeted. Figure 4
23	110	2	0.32	Northeast–Southwest	No Archaeology found. Agricultural and possible furrow geophysical trends were targeted. Plate 34, Figure 4
24	90	2	0.5	Northeast–Southwest	No Archaeology found although some black glazed ware was noted in the topsoil. Agricultural trends and a circular anomaly were targeted. Figure 4
25	20	2	0.3	West–East	No Archaeology found. Evidence of post medieval land clearance in the form of a charcoal spread C25.1 with *in-situ* burning to the southern edge was recorded at the western end of trench 25. C25.1 measures 2.85m in length, 1.4m wide and 0.09m deep and consists of a mid-brown sandy clay with frequent charcoal chunks. A linear field drain C25.3 running from northeast–southwest measuring 20m in length, 1.6m wide and 0.3m deep was also recoded here with several sherds of post medieval ceramic noted.

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					A pit **C25.4** associated with land clearance was recorded, possibly where a stone was retrieved and backfilled with a dark grey brown sandy silt with moderate charcoal, roots and angular stone present. Circular anomalies and a linear trend were targeted here. Figure 4
26	50	2	0.3	Northeast–Southwest	No Archaeology found. A linear and agricultural geophysical trends were targeted. Figure 4
27	50	2	0.3	West–East	No Archaeology found. Agricultural geophysical trends were targeted. Figure 4
28	20	2	0.33	North–South	No archaeology found but a shallow depression had concave sides and a stony fill. An agricultural, possibly archaeological trend was targeted. Figure 4
29	40	2	0.4	Northeast–Southwest	No archaeology found but a number of agricultural features average width of 0.6m and depth of 0.1m were noted within the trench. A negative geophysical anomaly was targeted in this trench. Figure 4
30	20	2	0.54	West–East	No archaeology found but a natural depression with concave sides and filled with a greyish-brown sandy clay was noted here. An agricultural or negative geophysical anomaly was targeted in this trench. Plate 35, Figure 4
31	20	2	0.6	North–South	No archaeology found but a natural depression with concave sides and filled with a greyish-brown sandy clay was noted here. An agricultural or negative geophysical anomaly was targeted in this trench. Figure 4
32	20	2	0.32	West–East	**AA5a:** A square pit with rounded corners **C32.1** was recorded at the western end of the trench and measures 1.3m in length, 1.2m wide and investigated to a depth of 0.22m. This pit was not bottomed as large sherds of coarse prehistoric pottery was uncovered amidst an orangey grey brown clayey silt fill **C32.1a,** with frequent stone, charcoal and fibrous roots. The pottery was not excavated and was covered in terram before the trench was backfilled. A negative trend of possible archaeology or agricultural was targeted. Plates 23 & 24, Figure 10
33	90	2	0.6	NNW–SSE	No archaeology found but a field drain was noted running west-southwest–east-northeast. A linear trend and agricultural furrows were targeted. Figure 4
34	40	2	0.38	Northeast–Southwest	**AA5b:** A small circular pit or posthole **C34.1** measuring 0.32 in length, 0.28m wide and 0.08m deep was recorded at the northeastern end of the trench. It was filled with a greyish brown soft sandy clay **C32.3** with occasional charcoal flecks noted. A small shallow circular spread **C34.2,** consisting of a light brown sandy clay with some charcoal was recorded 1.5m to the northeast measuring 0.26m in diameter and 0.02m deep A linear trend was targeted in this trench. Plate 25, Figure 10

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
35	60	2	0.3	Northeast–Southwest	AA5c: A possible hearth C35.1 with *in-situ* burning was recorded in the centre of trench 35 measuring 1.58m in length, 0.86m wide and 0.1 deep. Two small circular pits/postholes C35.2 and C35.4 measuring 0.3m in diameter are located to the immediate east of the possible hearth. A small pit C35.3 also to the east with a diameter of 0.4m was also recorded. These features are filled with a friable brown clayey sand with burnt clay and charcoal throughout. Linear trends and circular anomalies were targeted in this trench. Plate 26, Figure 10
36	59	2	0.56	Northeast–Southwest	AA5c: A cluster of pits were recorded in the centre of trench 36. A sub-circular pit with steep sides C36.1 is the most southerly of the features and measures 1.76m in length, 1.42m wide and 0.26m deep. It is filled with a loose charcoal rich clayey sand C36.2 with frequent pebbles, burnt clay and stone inclusions. A sub-oval pit with near vertical sides C36.3, measures 0.82m in length, 0.80 wide and 0.29m deep and is filled with a charcoal rich sandy clay C36.3a. A sub-oval pit with gradually sloping sides C36.4, measures 1.1m in length, 0.78m wide and 0.15m deep and is filled with a charcoal rich mid brown sandy clay with some pebbles and burnt clay inclusions C36.4a. A circular pit with concave sides C36.5, measures 0.81m in diameter and 0.08m deep and is filled with a mottled light brown charcoal rich sandy clay C36.5a, with some root disturbance visible and frequent angular stones present throughout the fill. A sub-oval pit with concave sides C36.6 measures 0.96m in length, 0.42m wide and 0.05m deep. It is filled by C36.6a a dark brown sandy clay with frequent charcoal and larger angular stones with average diameter of 0.1m. An oval pit with gradually sloping sides C36.7 measures 1.68m in length, 0.96 wide and 0.22m deep. It is filled by C36.7a a mid–dark brown sandy clay with frequent sub-angular stone and charcoal present. A linear pit with concave sides C36.8, aligned northwest–southeast, measures 3.34m in exposed length, 0.96m wide and 0.18 deep. It is filled by a light–mid brown sandy clay C36.8a, with frequent small angular stone and some charcoal present. Linear trends and circular anomalies were targeted in this trench. Figure 10
37	45	2	0.28	WSW–ESE	No Archaeology found. No geophysical anomalies targeted. Figure 4
38	20	2	0.2	West–East	AA1: The location of trench 38 suggests that the archaeological features recorded here are possibly internal features associated with the bivallate enclosure. A linear pit with steep sides C38.1 is recorded at the eastern end of the trench measuring 1.1m in length, 0.5m wide and 0.12m deep and is filled by a charcoal rich grey clayey silt C38.1a.

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					A steep sided furrow **C38.2** measures 0.5m wide and 0.15m deep and is filed with a mottled grey clayey silt **C38.2a**. A shallow denuded linear feature **C38.3,** is recorded in the middle of the trench**,** with gradually sloping sides and measures 2m wide and 0.15m deep. It is filled by a compact stony greyish brown clayey silt **C38.3a**. Ferrous geophysical anomalies targeted. Figure 5
39	20	2	0.36	Southwest–Northeast	**AA1**: The north-eastern extent of a plectrum shaped enclosure as identified on the geophysical survey was recorded in the middle of trench 39. Ditch **C39.1** is likely the outer enclosure ditch and has gradually sloping sides and measures 2.16m wide and investigated to a depth of 0.4m but not bottomed. It is filled with a dark brown clayey silt with occasional stone **C39.1a** and a greyish brown clayey silt with occasional stone **39.1b**. A possible charcoal production pit or hearth **C39.2,** with gradually sloping sides was recorded 2m to the northeast of the ditch, external to the enclosure. It measures 0.79m in length, 0.38m wide and 0.08m deep. It is filled with a mottled dark greyish brown sandy silt with frequent charcoal chunks and occasional stone **C39.2a**. Some *in-situ* burning was visible around the periphery also. A small gully or drain with steep sides **C39.3** is located directly to the north of hearth **C39.2.** It measures 0.4m wide and 0.14m deep and is filled by a mid-brown sandy silt **C39.3a,** with charcoal and occasional pebbles. The outer enclosure ditch, a ferrous anomaly and a linear geophysical trend were targeted. Plate 10, Figure 5
40	10	2	0.3	West–East	**AA1:** A steep sided irregular shaped pit **C40.1,** was recorded in the centre of the trench measuring 2.5m in length and 1.1m wide. It is filled by a mid-brown clayey silt. There is a circular concentration of possibly heat affected or shattered stone **C40.1a** at the west with a large stone located between this and the remainder of the feature. A circular anomaly was targeted from the geophysical results. Figure 5
41	20	2	0.4	Northeast–Southwest	**AA1:** A ditch **C41.1,** recorded at the southwestern end of the trench is likely the inner enclosure ditch as identified on the geophysical survey. It is aligned west–east with steep sides and measures 3.2m wide and was investigated to a depth of 0.5m but not bottomed. The top fill consists of a mid-brown clayey silt **C41.1a,** with a moderate amount of charcoal towards the edge of the cut. A stony layer on the surface at the southwest may be a loose metalled surface or a stone dump. A curvilinear geophysical trend was targeted. Plate 6, Figure 5
42	20	2	0.4	Northeast–Southwest	**AA1:** The eastern extent of a plectrum shaped enclosure as identified on the geophysical survey was recorded in the middle of trench 42. Ditch **C42.1** is likely the outer enclosure ditch and has steep

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					sloping sides and measures 2.6m wide. The top fill consists of a mid-grey brown clayey silt C42.1a, with moderate charcoal, stone and animal bone inclusions. A northwest–southeast aligned gully or drain C42.2, is located 2.5m to the northeast outside the enclosure and is possibly the same as C39.3 in trench 39. It has steep sides, measures 0.64 wide and 0.3m deep and is filled by a mid-brown sandy silt C42.2a. Two curvilinear trends were targeted here. Figure 5
43	50	2	0.35	North–South	No Archaeology found. Agricultural and possible furrow trends were targeted. Figure 4
44	50	2	0.4	North–South	No Archaeology found. Agricultural and possible furrow trends were targeted. Figure 4
45	40	2	0.4	Northeast–Southwest	No Archaeology found. Agricultural and possible furrow trends were targeted. Figure 4
46	50	2	0.7	West–East	No Archaeology found but a number of loose stone land drains 0.3m wide running north–south at the eastern end of the trench. No geophysical anomalies targeted. Figure 4
47	45	2	0.4	Northeast–Southwest	No Archaeology found. A ferrous response was targeted but this was the upstanding pipe from a borehole. Figure 4
48	20	2	0.32	West–East	No Archaeology found. A circular geophysical anomaly was targeted. Figure 4
49	20	2	0.36	Northeast–Southwest	AA1: The southwestern extent of a plectrum shaped enclosure as identified on the geophysical survey was recorded in the middle of trench 49. Ditch C49.4 is likely the outer enclosure ditch and has steep sloping sides and measures 1.42m wide and 0.84m deep. It is filled by a soft mid-brown sand C49.5, with charcoal flecking throughout. A sub oval pit/posthole C49.2 was recorded 1m to the northeast of the ditch internal of the enclosure. It measures 0.39m in length and 0.25m wide with a charcoal rich fill. A shallow linear pit C49.1, is located directly to the northeast of C49.2. It has gradually sloping sides and measures 2m in length, 1m wide and 0.14m deep. It is filled by a black charcoal rich soft sand with red mottling at the edges C49.3. A lower fill C49.6 consists of a greyish brown sand with occasional charcoal flecks. Agricultural and a curvilinear geophysical anomalies were targeted. Plate 7, Figure 5
50	10	2	0.36	West–East	AA1: A shallow irregular shaped burnt spread or hearth feature C50.1 measures 1.12m in length, 0.91m wide and 0.02 deep. The stony silty sand fill C50.1a is charcoal rich on the western side with a

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					higher concentration of burnt clay in the east. Circular anomalies were targeted in this trench. Figure 6
51	40	2	0.4	Northeast–Southwest	AA1: The southern extent of a plectrum shaped enclosure as identified on the geophysical survey was recorded at the southwestern end of trench 51. Ditch C51.6 is likely the outer enclosure ditch and has steep sides and measures 4m in width. It is filled by a light brown silty clay with frequent stone inclusions. The inner enclosure ditch C51.5 was recorded 17.5m to the northeast with steep, stepped sides and measures 2.1m wide and 0.76m deep. Three fills were recorded here, the upper fill is a loosely compacted light-brown clayey gravel C51.5a with frequent charcoal flecks. The middle fill C51.5b found along the side consists of a softly compacted, mottled light beige and light brown clay gravel, possibly redeposited natural subsoil with occasional charcoal flecking with a thickness of 0.42m. The basal fill C51.5c consists of softly compacted mid-grey clayey silt with occasional charcoal flecks with a thickness of 0.05m. A cluster of internal features were recorded c.5m to the northeast. This gap may suggest that an inner bank was associated with the inner enclosure ditch in the past. The internal features include a west–east aligned linear pit C51.1 with near vertical sides that measures 2.5m in length, 1.9m wide and 0.42m deep. It is filled by a mid–dark brown firmly compacted clayey silt C51.1a with frequent inclusions of charcoal flecks, small angular stones and heat fractured stone. This feature appears to be cut by C51.2 and C51.3. A possible stone lined sub circular pit C51.2 measures 2m in length and 0.43m in width. It extends to the northeast beyond the trench and is filled by a black or dark brown softly compacted clayey silt C51.2a with moderate amounts of charcoal flecking and frequent flecks of burnt bone to the northwest end where the possible stone lining is clearest. A curvilinear slot trench C51.3 with gradually sloping sides, measures 1.9m in length, 0.15m wide and 0.06m deep. It is filled by a grey brown–mid-brown clayey silt C51.3a with occasional stone and pebble inclusions. A possible steep sided posthole C51.4, measures 0.26m in length, 0.2m wide and 0.16m deep and is filled with a firmly compacted mid-brown clayey silt C51.4 with occasional charcoal inclusions. It abuts the inner edge of the inner ditch and may be associated with a possible revetment for a bank. No features were recorded between the inner and outer enclosure ditches. The enclosure ditches and a linear anomaly were targeted in this trench. Plate 8, Figure 5
52	40	2	0.42	North–South	AA1: The southern extent of a plectrum shaped enclosure as identified on the geophysical survey was recorded at the southwestern end of trench 52. Ditch C52.4 is likely the outer enclosure ditch and has

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					concave sides and measures 2.54m in width and was not bottomed at 0.58m deep. It is filled with a light–mid brown clayey silt **C52.4a**. The inner enclosure ditch **C52.5** was recorded 9.5m to the north and it measures 2.16m wide and greater than 0.5m deep with gradually sloping sides. It is filled by a mid-brown clayey silt **C52.5a**. No features were recorded between the inner and outer enclosure ditches. A cluster of internal features were recorded 6m to the north. The presence of a similar empty gap between the enclosure ditches as that recorded in trench 51 adds to the likelihood of an inner bank being originally located here. The identified internal features include a possible hearth with concave sides **C52.1** that measures 0.46m in length, 0.44m wide and 0.09m deep. It is filled by a black clayey sand **C52.6,** with red mottling throughout frequent charcoal and a soft compaction with some *in-situ* burning also present. Two sub-oval pits (**C52.2 & C52.3**) are located directly to the north. **C52.2** has concave sides and measures 0.72m in length, 0.4m wide and 0.09m deep. It is filled by very soft greyish-black charcoal rich clayey silt **C52.7**. Pit **C52.3** has near vertical sides and measures 0.84m in length, 0.54m wide and 0.12m deep. It is filled by mid–dark brown sandy clay with occasional charcoal flecks present **C52.8**. A northeast–southwest aligned linear pit with concave sides **C52.9,** measures 2m in length, 1.46m wide and 0.26m deep. A possible pit with concave sides **C52.10** abuts pit C52.9 at the north and measures 0.5m in length, 0.45m wide and 0.16m deep. These features are filled by a soft greyish brown sandy clay **C52.11,** with occasional charcoal An external sub-oval hearth feature **C52.12,** was recorded 3.5m to the south of the outer enclosure ditch. It has concave sides and measures 2.2m in length, 0.68m wide and 0.08m deep. It is filled by a gritty dark brown clay with frequent stones **C52.12a**. There is *in-situ* burning also visible along parts of the edge. The enclosure ditches and some internal circular anomalies were targeted in this trench. Plate 9, Figure 5
53	20	2	0.48	Northeast–Southwest	**AA1**: The south-eastern extent of a plectrum shaped enclosure ditch as identified on the geophysical survey was recorded at the southwestern end of trench 53. Ditch **C53.5** is likely the outer enclosure ditch and has steep sloping concave sides and measures 2.72m in width and 0.95m deep. It is filled by a light–mid brown clayey sand with occasional angular stone **C53.5a**. A sub-oval pit **C53.1** was recorded c.0.8m to the northwest of the ditch, internal of the enclosure. It has concave sides and measures 1.02m in length, 0.45m wide and 0.08m deep. It has two fills, the upper fill **C53.3**, consists of a soft greyish brown silty sand intermixed with burnt clay and the basal fill

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					C53.4, consists of a very soft black silt with frequent burnt clay fragments. If pit C53.1 is contemporary with the enclosure this suggests that the outer enclosure may not have had an accompanying inner bank. The enclosure ditch and burnt anomalies were targeted. Plate 4, Figure 5
54	20	2	0.5	Northwest–Southeast	AA1: A concentration of features likely associated with some form of industrial activity was recorded c.5–10m to the southeast of the outer enclosure ditch. A linear feature C54.1 aligned northwest–southeast with gradual to steep sides was recorded at the northwest of the trench. It measures 4.25m in length, 0.58m wide and 0.1m deep and contains a basal black-brown charcoal rich clayey silt C54.1a mixed with heat shattered stone that forms a circular deposit at the southeast end of C54.1. The upper fill C54.1b consists of mid-brown clayey silt mixed with a moderate amount of heat shattered stone with black charcoal rich pockets throughout and occasional flecks of burnt clay. A north–south linear C54.2, interpreted as a curvilinear slot trench with very steep sides was truncated by C54.1. It measures 1.2m in length, 0.36m wide and 0.2m deep and is filled by a soft black-brown clayey silt C54.2a with frequent pebbles and charcoal flecking, very rare large stones also present. Probably the same as a curvilinear slot trench with near vertical sides C54.13 recorded at the west within the trench extension that measures 4.5m in length, 1.05m wide and 0.4m deep. It is filled by a soft dark blackish brown clayey silt C54.13a with frequent charcoal flecks, heat shattered stone and occasional large stones. A hone stone and possible manuport were retrieved from the slot trench. Two parallel curvilinear slot trenches (C54.15 & C54.16) were recorded at the southeast of the central feature C54.3 which may function as wind breaks, flues or channels associated with the use of this feature as a kiln. Their function may be associated with slot trench C54.2/C54.13 recorded to the northwest of C54.3. C54.15 has steep sides and measures 4.5m in length, 0.37m wide and 0.1m deep. It is filled by a dark-brown clayey silt with frequent charcoal flecks and heat shattered stone C54.15a. The curving nature of the slot trench appears to mostly respect C54.3 and C54.16. The outer curvilinear slot trench C54.16 also with steep sides and measures 5.5m in length, 0.45m wide and 0.16m deep. It is filled by a firm dark blackish-brown clayey silt C54.16a with frequent inclusions of charcoal, some charred cereal grains, burnt clay flecks, heat shattered stone and occasional large angular stone curving nature of the slot trench appears to mostly respect C54.15. A central, possibly stone lined, sub-circular feature C54.3, interpreted as possibly an unusually styled cereal drying kiln or sunken structure was recorded in the centre of the trench. It has very steep sides and measures 6.7m in length, 3.8m wide and was investigated to a depth of 0.4m. There were three

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					fills recorded here, the upper fill **C54.3a** consists of a firm mid-brown clayey silt and measures 0.11m thick. The middle fill **C54.3b** consists of a soft black charcoal rich clayey silt (0.07m thick) and a small piece of flint was also noted here. The basal fill **C54.3c** is a soft dark-brown clayey silt with frequent charcoal flecks and heat shattered stone (0.08m). A large amount of stone were recorded on the surface of C54.3 to the northwest and north and some evidence of red in-situ oxidisation was recorded in one of the investigative slots. Four pieces of flint debitage were recovered from the top fill C54.3a. A possible hearth area consisting of red in-situ oxidisation (**C54.5**) was recorded at the west of the trench extension abutting slot trench C54.13 to the west while an east–west linear feature **C54.4** with sloping sides abuts C54.13 et the east. Hearth **C54.5** measures 0.86m in length and 0.76m wide and consists of a semi-circular area of oxidisation. **C54.4** measures 1.4m in length 0.23m wide and 0.06m deep and is filled with a compacted dark-brown clayey silt with pockets of black charcoal rich clayey silt **C54.4a** with frequent inclusions of angular pebbles, heat fractured stone and charcoal flecks. The terminus of a north–south orientated linear slot trench **C54.7** with steep sloping sides was recorded at the western extent of the extension. It measures 1.56m in length and 0.33m wide and 0.2m deep. It is filled by a light -brown clayey silt **C54.7a**. with frequent inclusions of natural angular pebbles. A linear feature **C54.6,** interpreted as a possible slot trench running northwest–southeast with steeply sloping sides was recoded directly to the east of C54.7. **C54.6** measures 2m in length 0.41m wide and 0.19m deep. It is filled with a loosely compacted dark-brown with occasional patches of black-brown clayey silt with frequent inclusions of heat shattered stone and charcoal flecks **C54.6a**. Frequent large and medium sized angular stone also present which may represent stone packing of a slot trench of a possible stone wall footing.. A northeast–southwest linear pit **C54.8** is recorded between slot trenches C54.6 and C54.13 at the west. It measures 2.5m in length and 1.3m wide with two fills visible on the surface. The upper fill **C54.8a** consists of a firm mid-brown clayey silt with occasional burnt stones. The lower fill consists of a black-brown charcoal rich clayey silt with frequent inclusions of heat shattered stone and charcoal flecks. Some larger chunks of charcoal visible main indicate charred timbers. There is also *in-situ* burning visible along the outer edge.

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					A curvilinear slot trench feature **C54.17** feature runs between **C54.3** and **C54.13** and measures 1.6m in length and 0.49m wide. It is filled by a soft dark-brown clayey silt **C54.17a** with frequent charcoal flecks and large stone. C54.17 delimits the northern edge of a cluster of possible postholes and stakeholes **C54.10, C54.11**, **C54.12** and **C54.14**. Possible stakehole **C54.10** measures 0.1m in length and 0.07m wide and is filled by a dark-brown clayey silt **C54.10a** with frequent charcoal inclusions. A possible posthole C54.11 measures 0.2m in diameter and is filled a dark-brown clayey silt **C54.11a** with frequent charcoal inclusions while a sub-circular possible posthole **C54.12** measures 0.38m in length and 0.27m wide and is filled with a dark-brown soft clayey silt with frequent charcoal flecks **C54.12a**. Possible posthole **C54.14** measures 0.24m in length and 0.21m wide. It is filled by a dark-brown soft clayey silt with frequent charcoal flecks **C54.14a**. It is possibly cut by **C54.12**. An east–west orientated linear pit **C54.9** measures 1.24m in length and 0.35m wide. It is filled by a mid-brown clayey silt **C54.9a** with frequent inclusions of small angular pebbles and occasional charcoal flecks. A curvilinear geophysical trend and circular anomalies were targeted with this trench. Plate 12, Figure 5
55	80	2	0.4	North-northwest–South-southeast	**AA3b:** A curvilinear slot trench with steep sides **C55.1** was recorded in the middle of trench 55. It measures 3.4m in length, 0.2m wide and 0.08m deep. It is filled by a dark grey-brown clayey silt with frequent charcoal and occasional stone **C55.1a**. An area of *in-situ* burning **C55.2** and a possible clay surface with charcoal throughout is enclosed by **C55.1**. A linear trend and circular anomalies were targeted in this trench. Plate 17, Figure 7
56	120	2	0.45	North-northwest–South-southeast	**AA3c:** A spread of burnt mound material **C56.1** with an irregular shape in plan was recorded at the north-western extent of trench 56. It measures 9.5m in length, 5.6m wide and 0.25m deep. A west–east aligned linear field drain **C56.2** cuts through the spread. It has gradually sloping sides and measures 9m in length, 1m wide and 0.2m deep. It is filled by a light brown sandy silt **C56.2a**. An irregular shaped anomaly and a linear trend were targeted by this trench. Plate 18, Figure 7
57	20	2	0.38	West–East	No archaeology found but a stone dump likely a result of land clearance was noted. A circular anomaly and a linear trend were targeted. Figure 4
58	100	2	0.4	Northwest–Southeast	**AA3e:** Two pits were recorded near the south-eastern end of trench 58. Sub-oval pit **C58.1** has gradually sloping sides and measures 1.15m in length, 0.75m wide. 0.15m deep. It is filled with a dark grey-black sandy silt **C58.1a** with frequent charcoal and heat affected stone. An oval shaped pit **C58.2** is located 9m to the southeast with gradually sloping sides and measures 0.8m in length, 0.6m wide and 0.08m deep. It is filled by a loose blackish-brown sandy silt **C58.2a**.

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					with moderate charcoal chunks, roots, occasional medium sized stone and very occasional heat affected stone A curvilinear trend was targeted. Plate 20, Figure 8
59	20	2	0.3	West–East	AA3d: A possible kiln C59.1 was recorded at the eastern end of trench 59. It is oval in plan and measures 2.4m in length and 0.7m wide. It has a top charcoal rich fill C59.1a with a concentration of stone or possible stone lining at the western half but no in-situ burning evident. An L-shaped feature C59.2 is located directly to the west and has near vertical sides. It measures 5m in length, 0.9m wide and 0.4m deep and is filled by a mottled brown sandy silt C59.2a with charcoal. A north–south aligned linear ditch with gradually sloping sides C59.3 measures 1.6m wide and 0.4m deep. It is filled by a greyish brown sandy silt C59.3a. with a charcoal lense recorded at 0.15m depth A number of circular anomalies were targeted with this trench. Plate 19, Figure 8
60	30	2	0.35	Northwest–Southeast	No archaeology found. No geophysical anomalies targeted. Figure 4
61	30	2	0.4	Northwest–Southeast	No archaeology found. A northeast–southwest aligned linear feature C61.1, interpreted as an agricultural ditch or drain was recorded at the north-western end of trench 61. It has steep sloping sides and measures 1.2m wide and 0.38m deep. It is filled with a soft sterile mid-brown silt C61.1a.. A curvilinear trend was targeted. Figure 4
62	120	2	0.5	North–South	No archaeology found. A linear trend and a circular anomaly were targeted. Figure 4
63	20	2	0.5	Northwest–Southeast	No archaeology found. A circular anomaly was targeted. Figure 4
64	50	2	0.4	NNW–SSE	No archaeology found. A ferrous anomaly was targeted. Figure 4
65	60	2	0.6	North–South	No archaeology found. No geophysical anomalies targeted. Figure 4
66	20	2	0.4	Northwest–Southeast	AA3a:An irregular shaped charcoal production pit or kiln C66.1 measures 1.7m in length and 1.4m wide. It is filled frequent charcoal and a concentration of stone C66.1a. Evidence for *in-situ* burning also present. Circular anomalies were targeted. Plate 16, Figure 7
67	10	2	0.4	Northwest–Southeast	No archaeology found but a concentration of shattered greenish yellow stone present. A burnt feature was targeted from the geophysical results. Figure 4
68	30	2	0.4	West–East	AA4a: An irregular shaped feature C68.1 was recorded at the western end of trench 68. It measures 4.4m in length and 1m wide and is filled by a loose stony mid-brown clayey silt C68.1a. At the southern end of the feature there is a concentration of charcoal and to the east of this there is *in-situ* burning evident. Directly north of the charcoal deposits mentioned above is a concentration of burnt bone

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					with occasional burnt bone inclusions spread out to the north of this. Burnt features and a possible archaeological linear trend was targeted in this trench. Plate 21, Figure 9
69	70	2	0.5	Northwest–Southeast	AA4b: A hearth or area of *in-situ* burning C69.1 was recorded at the north-western extent of trench 69. It measures 1.51m in length and 1.34m wide with a concentration of charcoal noted to the northwest. The charcoal rich area measures 0.31m long and 0.18m wide. A second area of in-situ burning C69.4 was recorded 1m to the south and measures 1.07m in length and 0.7m wide. A shallow sub-oval pit with steep sides C69.2 was recorded 3m to the southeast and measures 1.03m in length, 0.46m wide and 0.1m deep. It is filled by a soft blackish-brown sandy clay with charcoal throughout C69.3. Linear geophysical trends were targeted. Plate 22, Figure 9
70	120	2	0.54	Northwest–Southeast	No archaeology found but 10 parallel linear features (C70.1A–C) were identified within Trench 70, that have been interpreted as probable agricultural drainage features. They average 0.4–0.8m wide, 0.17–0.22m deep with steep to vertical sides and a flat base and are filled with brown silt with fibrous roots. Linear trends and a ferrous response which is the upstanding pipe of a borehole were targeted by this trench. Figure 4
71	30	2	0.7	West-northwest–East-southeast	No archaeology found but two modern field drains were noted to the west-northwest end of the trench. The first of these was a simple stone filled cut and the second contained an orange ceramic pipe. A ferrous response and a linear trend were targeted in this trench. Figure 4
72	20	2	0.52	Northeast–Southwest	No archaeology found, but the natural subsoil is variable here, so it is likely that the targeted geophysical trend was geological in nature. A curvilinear trend was targeted in this trench. Figure 4
73	60	2	0.6	Northwest–Southeast	No archaeology found but a west–east aligned linear field drain with steep sloping sides C73.1 measures 2m in length, 0.85m wide and 0.3m deep. It is filled by a mid-brown clayey silt, mottled grey with angular pebbles throughout C73.1a. Two other field drains were also noted here similar to those found in Trench 71. No geophysical anomalies targeted. Figure 4
74	20	2	0.47	West-northwest–East-southeast	No archaeology found but an area of natural subsoil had extra bedrock boulder showing through and a more compact natural than average near this. An area of increased magnetic response was targeted with this trench. Figure 4
75	120	2	0.7	North-northwest–South-southeast	No archaeology found, but two field drains were also noted here similar to those found in Trench 71. A linear trend was targeted with this trench. Figure 4
76	30	2	0.36	North–South	No archaeology found. A linear trend was targeted with this trench. Figure 4

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
77	120	2	0.4	North–South	No archaeology found but a dump of demolition material (stone, metal etc) was uncovered that is likely associated with the construction of the adjacent housing estate in recent times. A magnetic disturbance was targeted by this trench. Plate 36, Figure 4
78	100	2	0.36	West–East	AA6: A north–south running linear ditch feature C78.3 was recorded at the eastern end of trench 78. It has gradually sloping sides and measures 2.14m wide and 0.61 deep. It contains two fills; the upper fill C78.3a is a greyish brown clayey sand with some larger stone at the bottom of the layer while the lower fill C78.3b is a waterlogged compact plastic grey clay. Frequent charcoal and occasional butchered animal bone was noted in both the fills. A sub-circular pit C78.4 was recorded 16m to the east with concave sides that measures 1.2m in length, 0.34m in exposed width and 0.05m in depth. It is filled by a mid–dark brown sandy silt C78.4a with occasional small sub angular pebble. An adjacent steep sided north–south running field drain C78.5 measures 2m in length, 0.75m wide and 0.18m deep and is filled by a grey sandy clay C78.5a. with frequent large stones recorded. A north–south running linear ditch C78.6 was recorded 25m to the east of ditch C78.3 with steep to near vertical sides. It measures 1.83m wide and 0.44 deep and contains two fills. The upper fill C78.7 is a greyish brown clayey sand with some larger stone at the bottom of the layer while the lower fill C78.8 is a waterlogged compact plastic grey clay. Frequent charcoal and occasional butchered animal bone was noted in both the fills. The most easterly feature identified in the trench is a northeast–southwest linear ditch C78.10 located c.6m to the east of ditch C76.6. It has gradually sloping sides and measures 1.63m wide and was not bottomed at 0.54m. It is filled by a top greyish brown clay C78.10a and a basal waterlogged compact plastic grey clayC78.10b. Frequent charcoal, moderate amounts of butchered animal bone were recorded in both fills and an abraded flint core/pebble was recovered from the top fill. Three parallel linear features (C78.1, C78.2 and C78.9) were recorded within Trench 78 and have been interpreted as probable agricultural features. These furrows are orientated west–east, the longest is 14.4m in length and the shortest is 6.4m while the average width is 0.5m and depth ranges from 0.07m–0.09m. Fill consists of a light brown sandy silt. A possible gunflint was recovered from the topsoil. No geophysical anomalies targeted. Plate 27, Figure 11

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
79	100	2	0.3	West–East	No archaeology found but four field drains were noted in this trench. They are orientated northeast–southwest and average between 0.2–0.6m wide and 0.3m deep. No geophysical anomalies targeted. Figure 4
80	100	2	0.33	West–East	AA7: A washed out burnt spread C80.4 was recorded at the eastern extent of trench 80. It measures 8m long, 7m wide and 0.12m deep. A possible oval trough C80.2 abuts the spread at the west. It has vertical sides and measures 2.6m in length, 1.22m wide and 0.27m deep. It is filled by a waterlogged sandy silt C80.3 with frequent heat shattered stone. A large 20th century waste pit C80.1, was recorded at the southwestern end of the trench. It has gradually sloping sides and measures 2.14m wide and 0.5m deep. It is filled with loose brown topsoil mixed with abundant 19th century waste including medicine bottles, metal nails and animal bone. No geophysical anomalies targeted. Plate 28, Figure 11
81	130	2	0.38	West–East	No archaeology found. Circular anomalies and a ferrous response were targeted, possibly related to an area of bedrock boulders showing through the natural subsoil. Figure 4
82	30	2	0.38	West–East	No archaeology found. Circular anomalies were targeted, possibly related to a stony or gravelly portion of the natural subsoil. Figure 4
83	110	2	0.4	West–East	AA8: A linear feature C83.1 was recorded in the centre of trench 83. It is orientated north–south and measures 0.8m wide and 0.41m deep. It contains two fills; the upper fill C83.1a consists of a light grey sandy silt with moderate charcoal flecks and small pebbles and fibrous roots. The lower fill C83.1b consists of a light–mid brown sandy silt with rare charcoal flecks. A modern field drain with vertical sides C83.3 is orientated north–south and measures 0.26m wide. A linear trend and circular anomalies were targeted with this trench. Figure 12
84	100	2	0.5	West–East	AA8: A linear feature C84.1 was recorded in the centre of trench 84 and is likely the same as C83.1. It is orientated north–south and measures 1.1m wide and 0.52m deep. It has two fills; the upper fill consists of a light grey sandy silt C84.1a with moderate charcoal flecks, small pebbles and fibrous roots. The lower fill C84.1b consists of a light–mid brown sandy silt with rare sub-angular stones A sub-oval pit C84.2 was recorded 1m to the east measuring 1.4m in length, 0.75m wide and 0.24m deep with concave sides. It is filled with a mid-brown sandy silt C84.2 with occasional charcoal flecks and small angular pebbles.

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					A north–south orientated field drain with vertical sides C84.3 that measures 2m in length, 0.34m wide and 0.08 deep was also recorded here. Circular anomalies and a linear trend were targeted with this trench. A possible broken flint scraper was recovered from the topsoil. Plate 29, Figure 12

APPENDIX 2 LIST OF ARTEFACTS AND SAMPLES

CONTEXT NO.	TRENCH NO.	ARCHAEOLOGICAL AREA	DESCRIPTION	NO OF PIECES
C54.3	54	AA 1	Flint debitage	4
C54.13	54	AA 1	Possible hone stone	1
C54.13	54	AA 1	Possible manuport	1
Topsoil	84	AA 8	Broken flint scraper	1
C78.10	78	AA 6	Abraded flint core/pebble	1
Topsoil	78	AA 6	Possible gunflint	1

CONTEXT NO.	TRENCH NO.	ARCHAEOLOGICAL AREA	DESCRIPTION	SAMPLE NUMBER
C54.16	54	AA 1	Charred cereal grains	5

APPENDIX 3 RMP SITES WITHIN THE SURROUNDING AREA

SMR NO.:	WI008-073
RMP STATUS:	Yes
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728351/713576
CLASSIFICATION:	Ringfort-Rath
DIST. TO SITE:	c.220m northeast
DESCRIPTION:	This is the record for the possible ringfort revealed by geophysical survey and archaeological testing by Charles Mount (93E0187) and Eoin Halpin (94E0033). The feature was not subsequently excavated as it lay outside the area for development. (see Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-012001
RMP STATUS:	Yes
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728613/713597
CLASSIFICATION:	Church
DIST. TO SITE:	c.470m northeast
DESCRIPTION:	Situated on a gentle E-facing slope in gently undulating pasture overlooking a small stream 35m to S and the coastline of the Irish Sea 290m to E. Site of Rathdown Castle (WI008-011----) and deserted medieval settlement (WI008-011002-) 200m to NE. Known locally as St Crispin's Cell, present remains consist of a small single cell church (ext. dims. 5.43m N-S; 6.98m E -W; Wall T 0.7m) with square-shaped porch at W end. The well preserved walls are upstanding to the eaves and are built with rubble and granite with quarzitic quoins. The church is entered through the entrance porch (ext. dims. 3.2m E-W x 3.3m N-S; wall T 0.8m) via a doorway on the S wall. Off the porch a round-headed door in the centre of the W wall gives access to the interior of the church. The church was lit by flat-headed windows with timber lintels (removed) in the E and S walls. A small niche or aumbry (dims. H 0.4m x Wth 0.46m x D 0.25m) is visible in S wall located off centre to E. The church appears to be an 18th-century reconstruction using cut granite jambs, arches and threshold stones of a medieval church. Some tufa is used in the E window. At the NW angle substantial plinth stones projecting beyond the present church wall to the W suggests that the medieval church was partially beneath St. Crispin's Cell and was located to the NW of the cell. The 1985 the following earthworks to the N of the church were described as following; 'Surrounding the church on all sides except at S, are grass-covered mounds with some stone protruding. These may contain some stone from an older building of which there is no trace. The mounds are 4-5m wide and c. 0.5m H and extend 5-10m from St. Crispin's Cell' (ASI Field Report 06/06/1985).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-012002
RMP STATUS:	Yes

TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728612/713591
CLASSIFICATION:	Graveyard
DIST. TO SITE:	c.470m northeast
DESCRIPTION:	In the early seventeenth century this graveyard which was associated with St Crispin's Cell (WI008-012001-) was cleared and the disinterred bodies were 'buried in one pit at the east end' (O'Flanagan 1928, 33-5). In 1827 a local man of 97 years of age gave the following account about the graveyard; 'The small Chapel or cell of St. Crispin [WI008-012001-]. It is entered by a porch, placed at the west end and was lighted by one circular-headed window; it is now unroofed, and the walls clothed with ivy; the adjacent ground does not appear to have been used as a cemetery, although the body of a seaman, washed on shore near Rathdown Castle was interred here. The castle [WI008-011----], St. Crispin's Cell [WI008-012001-], and the parish church, were within short distances of each other and of the village [WI008-011002-]. Upon the final deletion of the village, Col. [Charles] Tarrant the proprietor, razed the tomb stones, disinterred the bones in the church yard and recommitted all the earth again in one large pit dug for the purpose, after which he erased the church itself' (Wright 1827, 19-20). In 1838 the Ordnance Survey Letters recorded that 'No one in the neighbourhood of Rathdown now remembers anything of the church thus razed, but they remember that the bones were all dug up from the graveyard of the little church [WI008-012001-] of St. Crispin and buried in one pit at the east end, by some bad man' (O'Flanagan 1928, 40).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-058
RMP STATUS:	No
TOWNLAND:	Templecarrig Lower
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728228/713724
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.426m northeast
DESCRIPTION:	A pit was uncovered here during archaeological testing in 2001 by Edmond O'Donovan (Excavation Licence 01E0616). The area was subsequently excavated in 2002 and the truncated remains of an isolated charcoal spread was uncovered (Excavation Licence 02E0227). (Hagen 2004, 541).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-068
RMP STATUS:	No
TOWNLAND:	Templecarrig Lower
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728253/713842
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.500m northeast

DESCRIPTION:	Four pits, one of which contained prehistoric pottery, were excavated here in 2003 (Excavation Licence 03E0886). Two other pits and a spread of charcoal rich material were excavated c. 7m to the N. (Baker 2006, 550-1)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-074
RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728443/713562
CLASSIFICATION:	Kiln – Corn-drying
DIST. TO SITE:	c.418m northeast
DESCRIPTION:	This is the record for the corn-drying kiln excavated by James Eogan and Richard O'Brien (97E0075). It consisted of an oval pit (3.5m long, 2m wide and 0.55m deep). The N part of the pit was deepest and the clay in its base had been oxidised. Two parallel lines of five stake-holes were found in the base of the kiln. Two shallow trenches, which probably functioned as flues, extended from the SE and SW corners of the pit. (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-071
RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728425/713632
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.435m northeast
DESCRIPTION:	This is the record for the pits, gullies, ditches etc. excavated by James Eogan and Richard N. O'Brien (97E0075). The occupation of this part of the site stretched from the late Neolithic/early Bronze Age with the presence of Beaker pottery, through to the late Bronze Age/early Iron Age as attested by radiocarbon dates and the artefact assemblage recovered from the various features. (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-070
RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728480/713657
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.460m northeast
DESCRIPTION:	This is the record for the platform (feature 125) and pits (features 128, 127 & 291) discovered during the excavation by James Eogan and Richard O'Brien (97E0075) which they dated from several diagnostic flint artefacts to the early Neolithic period. (Eogan and O'Brien 2005)

REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-072
RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728521/713645
CLASSIFICATION:	Road-Hollow-way
DIST. TO SITE:	c.460m northeast
DESCRIPTION:	In 1993 a geophysical survey was carried out by Geoquest Associates of Durham, England under licence No. 93E0187 in the field containing St. Crispin's Cell (WI008-012001-) and in the field to the W of the church. Magnetometer and selective resistivity survey of the west field indicated a relatively featureless geophysical terrain. Five small areas had positive magnetic lines which were interpreted as possible shallow ditches. Work in the east field revealed a series of features, possibly shallow ditches, most pronounced in a 40m x 40m area north-west of the church. Excavation was undertaken by Charles Mount in 1993 under licence No. 93E0187. The excavation examined the south-western corner of the east field and the "hollow way" (WI008-072----) which runs in a north–south direction across the western end of this field. Cutting 14 examined the hollow way. It measured 20m x 1m and was excavated to 1.03m in depth. The stratigraphy consisted of the sod layer which in the position of the hollow way was compressed to only 0.4m in thickness. This overlay a dark brown soil. In the area of the hollow this overlay a stone layer 0.3m in thickness and 3.2m in width. On the western side it abutted the lighter coloured subsoil but on the east it petered out. The surface hollow was not centred on this stone layer as the former's western edge was nearly in the base of the feature. Flint was most frequent and accounted for 85 finds. It occurred across the site but entirely in the sod and topsoil. Forty-six percent of the flints were unstruck pebbles, 25% were flakes, 16% were chipped cores and pebbles and 9% were scrapers. The high percentage of unchipped pebbles and chipped pebbles and cores, 62%, in comparison to the low percentage of scrapers, 9%, and their poor quality, suggests that this was a site at which flint pebbles were collected from the nearby shore and were made into artefacts. Pottery, at 29% of the finds, was mostly composed of 19th-century wares. Glazed red wares of possible medieval to 18th century date were scarce and unglazed red ware, of possible early medieval or prehistoric date, were scarcer again. Animal bone accounted for 11% of the finds and iron 7%. Excavation confirmed Halpin's interpretation that the earliest feature in this area was a ditch, subsequently filled in and used as a routeway. Two sherds of glazed medieval pottery and a sherd of medieval cooking ware were recovered from the upper fills of the ditch, but no diagnostic finds were made in the primary fills, so the date of the feature remains unknown (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-045
RMP STATUS:	No
TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728255/713137

CLASSIFICATION:	Redundant Record “Possible enclosure”
DIST. TO SITE:	c.95m south
DESCRIPTION:	A possible enclosure was noted here in 2003 (pers. comm. Chris Corlett), however archaeological testing of the area in 2005 did not produce anything of archaeological significance (Byrne 2008, 417).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-010
RMP STATUS:	No
TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	727223/713400
CLASSIFICATION:	Redundant Record “Potential site–aerial photograph”
DIST. TO SITE:	c.390m northwest
DESCRIPTION:	Listed in the SMR (1986) as a 'Potential site - aerial photograph' based on aerial photographs GSIAP O 62/63 (1973). On inspection in 1990 there was nothing of archaeological significance found. It was concluded that evidence on the aerial photograph was not sufficient to warrant accepting this as an archaeological monument and it was 'de-listed' on the 1995 RMP.
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-016
RMP STATUS:	No
TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	727130/712924
CLASSIFICATION:	Redundant Record “enclosure”
DIST. TO SITE:	c.416m west
DESCRIPTION:	Listed in the SMR (1986) as an 'enclosure' based on aerial photographs GSIAP O 62/63 (1973). However the evidence on the aerial photographs was not sufficient to warrant accepting this as an archaeological monument and it was 'de-listed' on the 1995 RMP.
REFERENCE:	www.archaeology.ie

APPENDIX 4 LEGISLATION PROTECTING THE ARCHAEOLOGICAL RESOURCE

PROTECTION OF CULTURAL HERITAGE

The cultural heritage in Ireland is safeguarded through national and international policy designed to secure the protection of the cultural heritage resource to the fullest possible extent (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), ratified by Ireland in 1997.

THE ARCHAEOLOGICAL RESOURCE

The *National Monuments Act 1930 to 2014* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which includes 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' (National Monuments Act 1930 Section 2). A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

OWNERSHIP AND GUARDIANSHIP OF NATIONAL MONUMENTS

The Minister may acquire national monuments 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.

REGISTER OF HISTORIC MONUMENTS

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the register is illegal without the permission of the Minister. Two months notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

PRESERVATION ORDERS AND TEMPORARY PRESERVATION ORDERS

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with 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 must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

RECORD OF MONUMENTS AND PLACES

Section 12(1) of the 1994 Act requires the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for Culture, Heritage and the Gaeltacht) to establish and maintain a record of monuments and places where the Minister believes that such monuments exist. The record comprises a list of monuments and relevant places and a map/s showing each monument and relevant place in respect of each county in the state. All sites recorded on the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994. All recorded monuments on the proposed development site are represented on the accompanying maps.

Section 12(3) of the 1994 Act provides that 'where the owner or occupier (other than the Minister for Arts, Heritage, Gaeltacht and the Islands) 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 of Arts, Heritage, Gaeltacht and the Islands to carry out work and shall not, except in case of urgent necessity and with the consent of the Minister, commence the work until two months after giving of notice'.

Under the National Monuments (Amendment) Act 2004, anyone who demolishes or in any way interferes with a recorded site is liable to a fine not exceeding €3,000 or imprisonment for up to 6 months. On summary conviction and on conviction of indictment, a fine not exceeding €10,000 or imprisonment for up to 5 years is the penalty. In addition they are liable for costs for the repair of the damage caused.

In addition to this, under the *European Communities (Environmental Impact Assessment) Regulations 1989,* Environmental Impact Statements (EIS) are required for various classes and sizes of development project to assess the impact the proposed development will have on the existing environment, which includes the cultural, archaeological and built heritage resources. These document's recommendations are typically incorporated into the conditions under which the proposed development must proceed, and thus offer an additional layer of protection for monuments which have not been listed on the RMP.

THE PLANNING AND DEVELOPMENT ACT 2000

Under planning legislation, each local authority is obliged to draw up a Development Plan setting out their aims and policies with regard to the growth of the area over a five-year period. They cover a range of issues including archaeology and built heritage, setting out their policies and objectives with regard to the protection and enhancement of both. These policies can vary from county to county. The Planning and Development Act 2000 recognises that proper planning and sustainable development includes the protection of the archaeological heritage. Conditions relating to archaeology may be attached to individual planning permissions.

Wicklow County Development Plan, 2016-2022
Archaeology Objectives

BH1 no development in the vicinity of a feature included in the Record of Monuments & Places (RMP) will be permitted which seriously detracts from the setting of the feature or which is seriously injurious to its cultural or educational value.

BH2 any development that may, due to its size, location or nature, have implications for archaeological heritage (including both sites and areas of archaeological potential/significance as identified in Schedule 10.01 & 10.02 and Maps 10.01 & 10.02 of this plan) shall be subject to an archaeological assessment. When dealing with proposals for development that would impact upon archaeological sites and/or features, there will be presumption in favour of the 'preservation in situ' of archaeological remains and settings, in accordance with Government policy. Where permission for such proposals is granted, the Planning Authority will require the developer to have the site works supervised by a competent archaeologist.

BH3 to protect previously unknown archaeological sites and features, including underwater sites, where they are discovered during development works.

BH4 to facilitate public access to National Monuments in State or Local Authority care, as identified in Schedule 10.02 of this plan.

BH5 to protect the Hillforts in west Wicklow and to engage with the relevant central Government department to seek to undertake a detailed study of their importance.

BH6 to facilitate the designation of the Glendalough Monastic Settlement as a UNESCO World Heritage Site.

APPENDIX 11 C RMP SITES WITHIN THE SURROUNDING AREA

Appendix 11.C RMP Sites within the Surrounding Area

SMR NO.:	WI008-073
RMP STATUS:	Yes
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728351/713576
CLASSIFICATION:	Ringfort-Rath
DIST. TO SITE:	c.260m northeast
DESCRIPTION:	This is the record for the possible ringfort revealed by geophysical survey and archaeological testing by Charles Mount (93E0187) and Eoin Halpin (94E0033). The feature was not subsequently excavated as it lay outside the area for development. (see Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-012001
RMP STATUS:	Yes
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728613/713597
CLASSIFICATION:	Church
DIST. TO SITE:	c.450m northeast
DESCRIPTION:	Situated on a gentle E-facing slope in gently undulating pasture overlooking a small stream 35m to S and the coastline of the Irish Sea 290m to E. Site of Rathdown Castle (WI008-011----) and deserted medieval settlement (WI008-011002-) 200m to NE. Known locally as St Crispin's Cell, present remains consist of a small single cell church (ext. dims. 5.43m N-S; 6.98m E -W; Wall T 0.7m) with square-shaped porch at W end. The well preserved walls are upstanding to the eaves and are built with rubble and granite with quarzitic quoins. The church is entered through the entrance porch (ext. dims. 3.2m E-W x 3.3m N-S; wall T 0.8m) via a doorway on the S wall. Off the porch a round-headed door in the centre of the W wall gives access to the interior of the

	church. The church was lit by flat-headed windows with timber lintels (removed) in the E and S walls. A small niche or aumbry (dims. H 0.4m x Wth 0.46m x D 0.25m) is visible in S wall located off centre to E. The church appears to be an 18th-century reconstruction using cut granite jambs, arches and threshold stones of a medieval church. Some tufa is used in the E window. At the NW angle substantial plinth stones projecting beyond the present church wall to the W suggests that the medieval church was partially beneath St. Crispin's Cell and was located to the NW of the cell. The 1985 the following earthworks to the N of the church were described as following; 'Surrounding the church on all sides except at S, are grass-covered mounds with some stone protruding. These may contain some stone from an older building of which there is no trace. The mounds are 4-5m wide and c. 0.5m H and extend 5-10m from St. Crispin's Cell' (ASI Field Report 06/06/1985).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-012002
RMP STATUS:	Yes
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728612/713591
CLASSIFICATION:	Graveyard
DIST. TO SITE:	c.450m northeast
DESCRIPTION:	In the early seventeenth century this graveyard which was associated with St Crispin's Cell (WI008-012001-) was cleared and the disinterred bodies were 'buried in one pit at the east end' (O'Flanagan 1928, 33-5). In 1827 a local man of 97 years of age gave the following account about the graveyard; 'The small Chapel or cell of St. Crispin [WI008-012001-]. It is entered by a porch, placed at the west end and was lighted by one circular-headed window; it is now unroofed, and the walls clothed with ivy; the adjacent ground does not appear to have been used as a cemetery, although the body of a seaman, washed on shore near Rathdown Castle was interred here. The castle [WI008-011----], St. Crispin's Cell [WI008-012001-], and the parish church, were within short distances of each other and of the village [WI008-011002-]. Upon the final deletion of the village, Col. [Charles] Tarrant the proprietor, razed the tomb stones, disinterred the bones in the church yard and recommitted all the earth again in one large pit dug for the purpose, after which he erased the church itself' (Wright 1827, 19-20).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-058
RMP STATUS:	No
TOWNLAND:	Templecarrig Lower
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728228/713724
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.383m northeast
DESCRIPTION:	A pit was uncovered here during archaeological testing in 2001 by Edmond O'Donovan (Excavation Licence 01E0616). The area was subsequently excavated in 2002 and the truncated remains of an isolated charcoal spread was uncovered (Excavation Licence 02E0227). (Hagen 2004, 541).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-074
RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728443/713562
CLASSIFICATION:	Kiln – Corn-drying
DIST. TO SITE:	c.300m northeast
DESCRIPTION:	This is the record for the corn-drying kiln excavated by James Eogan and Richard O'Brien (97E0075). It consisted of an oval pit (3.5m long, 2m wide and 0.55m deep). The N part of the pit was deepest and the clay in its base had been oxidised. Two parallel lines of five stake-holes were found in the base of the kiln. Two shallow trenches, which probably functioned as flues, extended from the SE and SW corners of the pit. (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-071

RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728425/713632
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.345m northeast
DESCRIPTION:	This is the record for the pits, gullies, ditches etc. excavated by James Eogan and Richard N. O'Brien (97E0075). The occupation of this part of the site stretched from the late Neolithic/early Bronze Age with the presence of Beaker pottery, through to the late Bronze Age/early Iron Age as attested by radiocarbon dates and the artefact assemblage recovered from the various features. (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-070
RMP STATUS:	No
TOWNLAND:	Rathdown Upper
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728480/713657
CLASSIFICATION:	Excavation-Miscellaneous
DIST. TO SITE:	c.396m northeast
DESCRIPTION:	This is the record for the platform (feature 125) and pits (features 128, 127 & 291) discovered during the excavation by James Eogan and Richard O'Brien (97E0075) which they dated from several diagnostic flint artefacts to the early Neolithic period. (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-072
RMP STATUS:	No
TOWNLAND:	Rathdown Upper

PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728521/713645
CLASSIFICATION:	Road-Hollow-way
DIST. TO SITE:	c.420m northeast
DESCRIPTION:	In 1993 a geophysical survey was carried out by Geoquest Associates of Durham, England under licence No. 93E0187 in the field containing St. Crispin's Cell (WI008-012001-) and in the field to the W of the church. Magnetometer and selective resistivity survey of the west field indicated a relatively featureless geophysical terrain. Five small areas had positive magnetic lines which were interpreted as possible shallow ditches. Work in the east field revealed a series of features, possibly shallow ditches, most pronounced in a 40m x 40m area north-west of the church. Excavation was undertaken by Charles Mount in 1993 under licence No. 93E0187. The excavation examined the south-western corner of the east field and the "hollow way" (WI008-072----) which runs in a north–south direction across the western end of this field. Cutting 14 examined the hollow way. It measured 20m x 1m and was excavated to 1.03m in depth. The stratigraphy consisted of the sod layer which in the position of the hollow way was compressed to only 0.4m in thickness. This overlay a dark brown soil. In the area of the hollow this overlay a stone layer 0.3m in thickness and 3.2m in width. On the western side it abutted the lighter coloured subsoil but on the east it petered out. The surface hollow was not centred on this stone layer as the former's western edge was nearly in the base of the feature. Flint was most frequent and accounted for 85 finds. It occurred across the site but entirely in the sod and topsoil. Forty-six percent of the flints were unstruck pebbles, 25% were flakes, 16% were chipped cores and pebbles and 9% were scrapers. The high percentage of unchipped pebbles and chipped pebbles and cores, 62%, in comparison to the low percentage of scrapers, 9%, and their poor quality, suggests that this was a site at which flint pebbles were collected from the nearby shore and were made into artefacts. Pottery, at 29% of the finds, was mostly composed of 19th-century wares. Glazed red wares of possible medieval to 18th century date were scarce and unglazed red ware, of possible early medieval or prehistoric date, were scarcer again. Animal bone accounted for 11% of the finds and iron 7%. Excavation confirmed Halpin's interpretation that the earliest feature in this area was a ditch, subsequently filled in and used as a routeway. Two sherds of glazed medieval pottery and a sherd of medieval cooking ware were recovered from the upper fills of the ditch, but no diagnostic finds were made in the primary fills, so the date of the feature remains unknown (Eogan and O'Brien 2005)
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-045
RMP STATUS:	No

TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	728255/713137
CLASSIFICATION:	Redundant Record “Possible enclosure”
DIST. TO SITE:	c.95m south
DESCRIPTION:	A possible enclosure was noted here in 2003 (pers. comm. Chris Corlett), however archaeological testing of the area in 2005 did not produce anything of archaeological significance (Byrne 2008, 417).
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-010
RMP STATUS:	No
TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	727223/713400
CLASSIFICATION:	Redundant Record “Potential site–aerial photograph”
DIST. TO SITE:	c.282m northwest
DESCRIPTION:	Listed in the SMR (1986) as a 'Potential site - aerial photograph' based on aerial photographs GSIAP O 62/63 (1973). On inspection in 1990 there was nothing of archaeological significance found. It was concluded that evidence on the aerial photograph was not sufficient to warrant accepting this as an archaeological monument and it was 'de-listed' on the 1995 RMP.
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-016
RMP STATUS:	No
TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown

I.T.M.:	727130/712924
CLASSIFICATION:	Redundant Record “enclosure”
DIST. TO SITE:	c.356m west
DESCRIPTION:	Listed in the SMR (1986) as an 'enclosure' based on aerial photographs GSIAP O 62/63 (1973). However the evidence on the aerial photographs was not sufficient to warrant accepting this as an archaeological monument and it was 'de-listed' on the 1995 RMP.
REFERENCE:	www.archaeology.ie

SMR NO.:	WI008-015
RMP STATUS:	No
TOWNLAND:	Coolagad
PARISH:	Delgany
BARONY:	Rathdown
I.T.M.:	727096, 712601
CLASSIFICATION:	Hillfort
DIST. TO SITE:	c.300m east
DESCRIPTION:	The summit of a steep hill (max. diams. 550m N-S; 650m E-W; area c. 28.2 hectares), now largely covered in forestry, is enclosed by an earth and stone bank (Wth 4m; max. H 1m), best preserved at the E (GSIAP O.62/63). The hillfort was recently described in the Atlas of Hillforts of Britain and Ireland as following; 'Partial contour fort surrounding the domed summit of steep hilltop. This prominent hilltop sits at the E edge of the Wicklow mountains overlooking Greystones town and the Wicklow coastline. Coolagad is positioned 2.8km to the NE of Downshill hillfort (Atlas No.0720). The univallate site forms a complete circuit and has a total footprint of 28.2ha. There are no recorded entrance features. No evidence for any internal features on the surface. Ramparts survive best at the E. The majority of the interior is under mature forestry. This hillfort is not depicted in any historic mapping. The enclosing elements follow the natural contours of the hill at the N and W. At the NE, the bank runs down slope and continues to the E across a gentle slope rather than utilizing the steeper slope uphill. The hilltop itself is prominent and sits at the E edge of the Wicklow mountains overlooking Greystones town and the Wicklow coastline. Boundary between Coolagad and Kindlestown Upper townland runs E-W through the center of the hillfort' (http://hillforts.arch.ox.ac.uk/records/IR0719.html). Described in 2019 (O'Driscoll et. al. 2019, 91) as a 'Class 1 Hillfort'.

REFERENCE:	www.archaeology.ie

APPENDIX 11 D LEGISLATION PROTECTING THE ARCHAEOLOGICAL RESOURCE

Appendix 11.D Legislation Protecting the archaeological Resource

PROTECTION OF CULTURAL HERITAGE

The cultural heritage in Ireland is safeguarded through national and international policy designed to secure the protection of the cultural heritage resource to the fullest possible extent (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), ratified by Ireland in 1997.

THE ARCHAEOLOGICAL RESOURCE

The *National Monuments Act 1930 to 2014* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which includes 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' (National Monuments Act 1930 Section 2). A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

OWNERSHIP AND GUARDIANSHIP OF NATIONAL MONUMENTS

The Minister may acquire national monuments 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.

REGISTER OF HISTORIC MONUMENTS

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the register is illegal without the permission of the Minister. Two months notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

PRESERVATION ORDERS AND TEMPORARY PRESERVATION ORDERS

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with 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 must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

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Section 12(3) of the 1994 Act provides that 'where the owner or occupier (other than the Minister for Arts, Heritage, Gaeltacht and the Islands) 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 of Arts, Heritage, Gaeltacht and the Islands to carry out work and shall not, except in case of urgent necessity and with the consent of the Minister, commence the work until two months after giving of notice'.

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In addition to this, under the *European Communities (Environmental Impact Assessment) Regulations 1989,* Environmental Impact Statements (EIS) are required for various classes and sizes of development project to assess the impact the proposed development will have on the existing environment, which includes the cultural, archaeological and built heritage resources. These document's recommendations are typically incorporated into the conditions under which the proposed development must proceed, and thus offer an additional layer of protection for monuments which have not been listed on the RMP.

THE PLANNING AND DEVELOPMENT ACT 2000

Under planning legislation, each local authority is obliged to draw up a Development Plan setting out their aims and policies with regard to the growth of the area over a five-year period. They cover a range of issues including archaeology and built heritage, setting out their policies and objectives with regard to the protection and enhancement of both. These policies can vary from county to county. The Planning and Development Act 2000 recognises that proper planning and sustainable development includes the protection of the archaeological heritage. Conditions relating to archaeology may be attached to individual planning permissions.

Wicklow County Development Plan, 2016-2022

Archaeology Objectives

BH1 no development in the vicinity of a feature included in the Record of Monuments & Places (RMP) will be permitted which seriously detracts from the setting of the feature or which is seriously injurious to its cultural or educational value.

BH2 any development that may, due to its size, location or nature, have implications for archaeological heritage (including both sites and areas of archaeological potential/significance as identified in Schedule 10.01 & 10.02 and Maps 10.01 & 10.02 of this plan) shall be subject to an archaeological assessment. When dealing with proposals for development that would impact upon archaeological sites and/or features, there will be presumption in favour of the 'preservation in situ' of archaeological remains and settings, in accordance with Government policy. Where permission for such proposals is granted, the Planning Authority will require the developer to have the site works supervised by a competent archaeologist.

BH3 to protect previously unknown archaeological sites and features, including underwater sites, where they are discovered during development works.

BH4 to facilitate public access to National Monuments in State or Local Authority care, as identified in Schedule 10.02 of this plan.

BH5 to protect the Hillforts in west Wicklow and to engage with the relevant central Government department to seek to undertake a detailed study of their importance.

BH6 to facilitate the designation of the Glendalough Monastic Settlement as a UNESCO World Heritage Site.

APPENDIX 11 E IMPACT ASSESSMENT & THE CULTURAL HERITAGE RESOURCE

Appendix 11.E Impact Assessment & the Cultural Heritage Resource

Potential Impacts On Archaeological And Historical Remains

Impacts are defined as 'the degree of change in an environment resulting from a development' (Environmental Protection Agency 2003: 31). They are described as profound, significant or slight impacts on archaeological remains. They may be negative, positive or neutral, direct, indirect or cumulative, temporary or permanent.

Impacts can be identified from detailed information about a project, the nature of the area affected and the range of archaeological and historical resources potentially affected. Development can affect the archaeological and historical resource of a given landscape in a number of ways.

- Permanent and temporary land-take, associated structures, landscape mounding, and their construction may result in damage to or loss of archaeological remains and deposits, or physical loss to the setting of historic monuments and to the physical coherence of the landscape.

- Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping and the passage of heavy machinery; disturbance by vehicles working in unsuitable conditions; or burial of sites, limiting accessibility for future archaeological investigation.

- Hydrological changes in groundwater or surface water levels can result from construction activities such as de-watering and spoil disposal, or longer-term changes in drainage patterns. These may desiccate archaeological remains and associated deposits.

- Visual impacts on the historic landscape sometimes arise from construction traffic and facilities, built earthworks and structures, landscape mounding and planting, noise, fences and associated works. These features can impinge directly on historic monuments and historic landscape elements as well as their visual amenity value.

- Landscape measures such as tree planting can damage sub-surface archaeological features, due to topsoil stripping and through the root action of trees and shrubs as they grow.

- Ground consolidation by construction activities or the weight of permanent embankments can cause damage to buried archaeological remains, especially in colluviums or peat deposits.

- Disruption due to construction also offers in general the potential for adversely affecting archaeological remains. This can include machinery, site offices, and service trenches.

Although not widely appreciated, positive impacts can accrue from developments. These can include positive resource management policies, improved maintenance and access to archaeological monuments, and the increased level of knowledge of a site or historic landscape as a result of archaeological assessment and fieldwork.

Predicted Impacts

The severity of a given level of land-take or visual intrusion varies with the type of monument, site or landscape features and its existing environment. Severity of impact can be judged taking the following into account:

- The proportion of the feature affected and how far physical characteristics fundamental to the understanding of the feature would be lost;

- Consideration of the type, date, survival/condition, fragility/vulnerability, rarity, potential and amenity value of the feature affected;

- Assessment of the levels of noise, visual and hydrological impacts, either in general or site-specific terms, as may be provided by other specialists.

APPENDIX 11.F MITIGATION MEASURES & THE CULTURAL HERITAGE RESOURCE

Appendix 11.F Mitigation Measures & the Cultural Heritage Resource

Potential Mitigation Strategies For Cultural Heritage Remains

Mitigation is defined as features of the design or other measures of the proposed development that can be adopted to avoid, prevent, reduce or offset negative effects.

The best opportunities for avoiding damage to archaeological remains or intrusion on their setting and amenity arise when the site options for the development are being considered. Damage to the archaeological resource immediately adjacent to developments may be prevented by the selection of appropriate construction methods. Reducing adverse effects can be achieved by good design, for example by screening historic buildings or upstanding archaeological monuments or by burying archaeological sites undisturbed rather than destroying them. Offsetting adverse effects is probably best illustrated by the full investigation and recording of archaeological sites that cannot be preserved *in situ*.

Definition Of Mitigation Strategies

Archaeological Resource

The ideal mitigation for all archaeological sites is preservation *in situ*. This is not always a practical solution, however. Therefore, a series of recommendations are offered to provide ameliorative measures where avoidance and preservation *in situ* are not possible.

Full Archaeological Excavation involves the scientific removal and recording of all archaeological features, deposits and objects to the level of geological strata or the base level of any given development. Full archaeological excavation is recommended where initial investigation has uncovered evidence of archaeologically significant material or structures and where avoidance of the site is not possible. (CIfA 2014b)

Archaeological Test Trenching can be defined as 'a limited programme... of intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site on land or underwater. If such archaeological remains are present test trenching defines their character and extent and relative quality.' (CIfA 2014a)

Archaeological Monitoring can be defined as a 'formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons within a specified area or site on land or underwater, where there is possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.' (CIfA 2014c)

APPENDIX 11 G LANDSCAPING PLAN AT ARCHAEOLOGICAL AREA 1

Plan | 1:500

0 5 10 15 20 m 30 40 50

SCALEBAR

Legend and Planting List:

SITE APPLICATION BOUNDARY

Existing Trees to be Retained
Refer to arborists drawings for details

Tree Planting
To be planted as 12-14cm g, 14-16cm g and 16-18cm g
To be of the following species:

Alnus glutinosa (Alder)
Betula pendula (Silver Birch)
Crataegus monogyna (Hawthorn)
Malus sylvestris (Crab Apple)
Prunus avium (Wild Cherry)
Prunus padus (Bird Cherry)
Quercus robur (Oak)
Sorbus aucuparia (Rowan)

Medium Sized Street Tree Planting
To be planted as 12-14cm g
To be of the following species:

Acer x freemanii 'Autumn Blaze' (Freeman Maple)
Alnus spaethii (Spaeth Alder)
Carpinus betulus 'Frans Fontaine' (Hornbeam)
Malus trilobata (Wild Apple)
Pyrus calleryana 'Chanticleer' (Ornamental Pear)
Sorbus aucuparia 'Sheerwater Seedling' (Rowan)
Tilia cordata 'Greenspire' (Lime)

Coniferous Tree Planting
Pinus sylvestris (Scots Pine)

Ornamental/Multi-stemmed Tree Planting
To be planted as 2.0-3.0m high, umbrella form
To be of the following species:

Amelanchier lamarkii (Snowy Mespilus)
Corylus avellana (Hazel)
Prunus avium 'Plena' (Wild Cherry)
Prunus serrulata 'Kanzan' (Kanzan Cherry)
Pyrus calleryana 'Chanticleer' (Ornamental Pear)

Existing Hedgerows
Retained and enhanced where necessary.

Proposed Hedgerows
Selectively maintained to enhance existing biodiversity.

Hedge Planting
To be planted at 900-1200mm high
To be of the following species:

Carpinus betulus (Hornbeam)
Fagus sylvatica (Beech)
Ligustrum ovalifolium (Privet)
Prunus lusitanica (Portugese Laurel)

Grass Seeding
Managed as an ornamental lawn.

Private Lawn
To rear gardens of dwellings.

Native Wildflower Meadow
Area to be managed as a wildflower meadow to improve the biodiversity of the local environment and reduce maintenance operations.

Bulb Planting

Bands of Ornamental Planting

Groundcover and Grass Planting
To be selected from following:

Groundcovers planted at 5 per m2 in single species groups. Herbaceous plants to be planted throughout in groups of 3, 5 and 7.

Groundcover + Grasses
Carex testacea
Hedera helix 'Hibernica' (Ivy)
Lavandula stoechas (Lavender)
Libertia formosa
Lonicera pileata (Honeysuckle)
Lonicera nitida 'Maigreen' (Honeysuckle)
Luzula nivea (Snowy Woodrush)
Molinia caerulea (Purple Moor Grass)
Persicaria affinis 'Superba'
Stipa calamagrostis
Stipa tenuissima
Vinca minor(Periwinkle)

Herbaceous Plants
Allium spp.
Anemone japonica 'Honorine Jobert' (Windflower)
Crocosmia 'Lucifer'
Ligularia 'Przewalskii'
Rudbeckia fulgida 'Goldsturm' (Black Eyed Susan)

Shrub Planting
To be selected from following:
Abelia x grandiflora
Buxus sempervirens (Box)
Cistus x hybridus (Rock Rose)
Cornus alba 'Sibirica' (Red Barked Dogwood)
Calamagrostis 'Karl Foerster'
Hypericum 'Hidcote' (St Johns Wort)
Ilex aquifolium (Holly)
Ligustrum japonicum (Japanise Privet)
Ligustrum vulgare (Common Privet)
Mahonia x media
Prunus lusitanica (Portugese Laurel)
Prunus laurocerasus (Common Laurel)
Salix brtizensis (Willow)
Stipa gigantea

Native Understorey Planting
Native planting mix beneath woodland copses

Native Wetland Planting
Wetland mix to banks of stream/ponds

Evo Geo
Retaining structure to edge of open spaces

Body of Water

Paving to gardens and access paths
Small unit concrete paving

Feature Paving to public spaces
Textured concrete paviors or flags

Informal Gravel Path

Informal Path

Root Barrier
Root barrier to rear or mounding

Existing / Proposed Levels
EL + 78.00
PL + 80.00

Retaining Wall Structure

Play Surface
To Play Area

Table and Chairs

Seating

Informal Play Equipment

Ringfort / Archaeological Site

Small Native Trees to Mounding

Species		
Betula pendula	6-8 cmg	2-2.5m tall
Corylus avellana	6-8 cmg	2-2.5m tall
Crataegus monogyna	6-8 cmg	2-2.5m tall
Malus sylvestris	6-8 cmg	2-2.5m tall
Sambucus nigra	6-8 cmg	2-2.5m tall
Sorbus aucuparia	6-8 cmg	2-2.5m tall

Native Understorey Planting Mix

Perennials, Grasses & Ferns		
Athyrium filix-femina	2L	40-60cm
Blechnum spicant	2L	40-60cm
Carex sylvatica	2L	40-60cm
Deschampsia cespitosa	2L	40-60cm
Dryopteris filix-mas	2L	40-60cm
Luzula sylvatica	2L	40-60cm
Polystichum setiferum	2L	40-60cm
Polypodium vulgare	2L	40-60cm
Stipa arundinacaea	2L	40-60cm

Native Wetland Planting Mix

Perennials & Grasses		
Apium nodiflorum	P9	30-40cm
Caltha paulustris	P9	30-40cm
Iris *pseudacorus*	P9	30-40cm
Myosotis scorpioides	P9	30-40cm
Phragmites australis	P9	30-40cm
Sparganium erectum	P9	30-40cm
Typha latifolia	P9	30-40cm
	P9	30-40cm

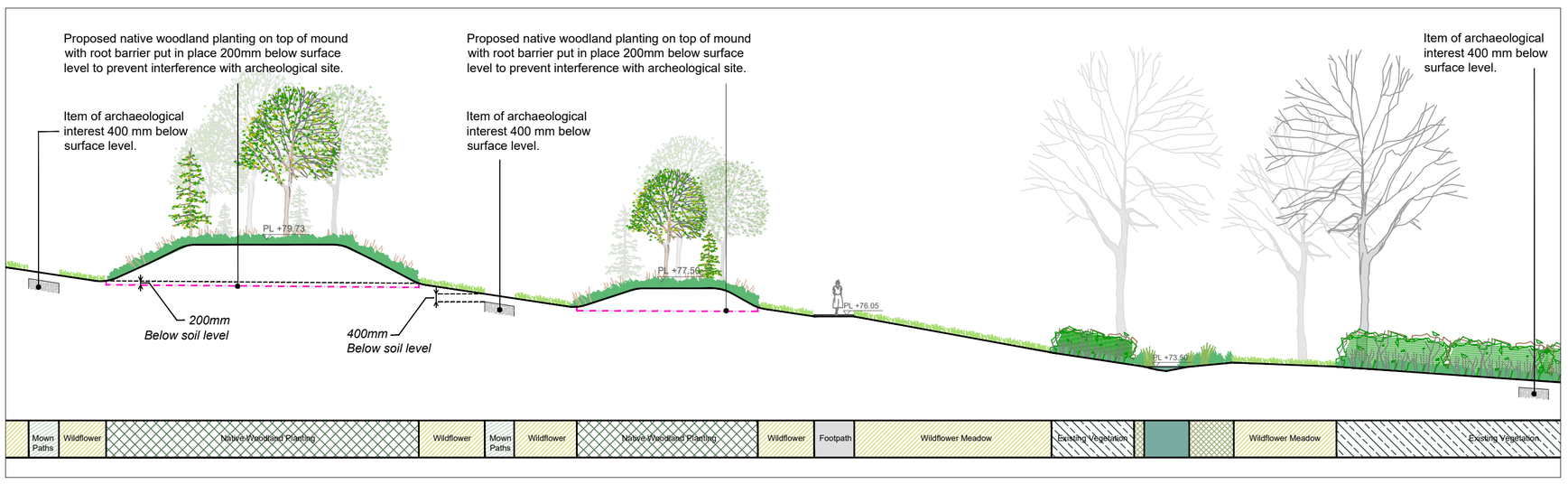
Native Wildflower Meadow Mix

Grass Species 85%	Perennials 15%		
Browntop Bent	*Birdsfoot Trefoil (Lotus Corniculatus)*	*Musk Mallow (Malva Moschata)*	*Small Scabious (Scabiosa columbaria)*
Crested Dogstail	*Common Cat's Ear (Hypochaeris Radicata)*	*Ox Eye Daisy (Leucanthemum Vulgare)*	*Common Sorrel (Rumex Acetosa)*
Sheeps Fescue	*Cowslip (Primula Veris)*	*Ragged Robin (Lychnis Flos Cuculi)*	*White Campion (Silene Alba)*
Chewings Fescue	*Field Scabious (Knautia Arvensis)*	*Red Campion (Silene Dioica)*	*Wild Carrot (Daucus carota)*
Creeping Red Fescue	*Lady's Bedstraw (Galium Verum)*	*Ribwort Plantain (Planatago Lanceolata)*	*Upright Hedge Parsley (Torilis Japonica)*
Yellow Oat Grass	*Lesser knapweed (Centaurea Nigra)*	*Rough Hawkbit (Leontodon hispidus)*	*Yarrow (Achillea millefolium)*
Sweet Vernal Grass	*Meadow Buttercup (Ranunculus Acris)*	*Salad Burnet (Sanguisorba Minor)*	*Yellow Rattle (Rhinanathus Minor)*
	Meadow Vetchling (Lathyrus pratensis)	*Self Heal (Prunella Vulgaris)*	*Wild Clary (Salvia Verbenaca)*

NOTE: Root barrier Specification

- Terram Rootguard Barrier - Water Permeable
- polypropylene/polypropylene fibres
- Non-woven geotextile
- 18.0 Tensile Strength, 30 elongation
- 3250 CBR puncture resistance

Planting Schedule



Section A-A | 1:200

notes DO NOT SCALE figured dimensions only to be taken from this drawing

rev	date	drawn	description

job Residential Development at Coolagad for Cairn Homes

drg. Archaeological Feature Treatment

Scales As Shown @ A1 | Status PLANNING

Date 08.02.22 | Drn. JMcC | Chd. KF | Passed

Job No. 0402 | Drawing No. 110 | Rev.

Kevin Fitzpatrick | Landscape Architecture
4 Main Street
Raheny
Dublin 5
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APPENDIX 11 H MONUMENT PROTECTION PLAN

IAC Archaeology

MONUMENT MANAGEMENT PLAN
FOR
ARCHAEOLOGICAL AREA 1,
COOLAGAD,
GREYSTONES,
CO. WICKLOW

APPLICANT: CAIRN HOMESPROPERTIES LTD.

I.T.M.: 727697/713014

AUTHOR: PAUL DUFFY

DATE: FEBRUARY 2022

IRISH ARCHAEOLOGICAL CONSULTANCY LTD
ARCHAEOLOGY & CONSERVATION CONSULTANTS

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CONTENTS

LIST OF FIGURES

1 INTRODUCTION

1.1 GENERAL

The following document details a proposed plan which includes the preservation by record and the preservation in-situ and ongoing management for elements of a large double ditched enclosure identified within lands intended for residential development in the townland of Coolagad, Greystones Co. Wicklow (Figure 1). This document will be submitted with an EIAR as part of an SHD planning application for the development.

A series of archaeological investigations have been undertaken on the site. Initially a geophysical survey of the site was carried out by Joanna Leigh in 2020 (Licence 20R0212). Gradiometer scanning identified responses indicative of a large enclosure (c. 95m diameter) with a further internal circular enclosure (Figure 2). The assessment was undertaken by Muireann Ni Cheallacháin of IAC Archaeology (IAC), under licence 21E0133 as issued by the National Monuments Service of the Department of Housing, Local Government and Heritage (DoHLGH). Testing revealed eight areas of archaeological significance, which have been designated as Archaeological Areas 1–8. It is proposed to preserve the archaeology of areas 2-8 b y record (excavation). It is proposed to preserve the southern 40% of the enclosure in AA1 by record (archaeological excavation under licence to the DoHLGH) and the northern 60% percent in-situ.

1.2 THE DEVELOPMENT

The proposed development will be residential in nature. The results of the geophysical survey and archaeological testing assessment have informed the proposed development layout which will include:

The proposed development consists of 586 residential units (351 houses; 203 apartments and 32 duplex units) at a site c. 26.03 ha at Coolagad, Greystones. The development will also include the provision of a community building (392 sqm), a creche, a sport field and a MUGA. A proposed new vehicular entrance with signalised junction from the R761 Rathdown Road to the north of Gate Lodge, Rathdown Road opposite Sea View and Redford Cemetery, providing a distributor road as part of the long-term objective to provide a northern access route from Greystones to the N11 is also proposed. The development also includes site development infrastructure, a hierarchy of internal streets including bridges, cycle paths & footpaths; new watermain connection and foul and surface water drainage; the development also provides for the upgrading of the public sewer within the wayleave of the R761/R762 (Rathdown Road) from the site entrance as far as the R762 in front of St. Kevin's National School, Rathdown Road, Greystones.

- 586 residential units,
- a community facility and creche,
- car, bike and motorcycle parking spaces,
- a new vehicular access onto the Regional Road R761, new roads, footpaths and cycle paths and connections within the site.

- un-landscaped zones of ecological conservation.
- The development also includes landscaped private and public open space, boundary treatment, lighting, play area, an ESB substation, site drainage works, and all ancillary site development works above and below ground.

FIGURE 1 Site location

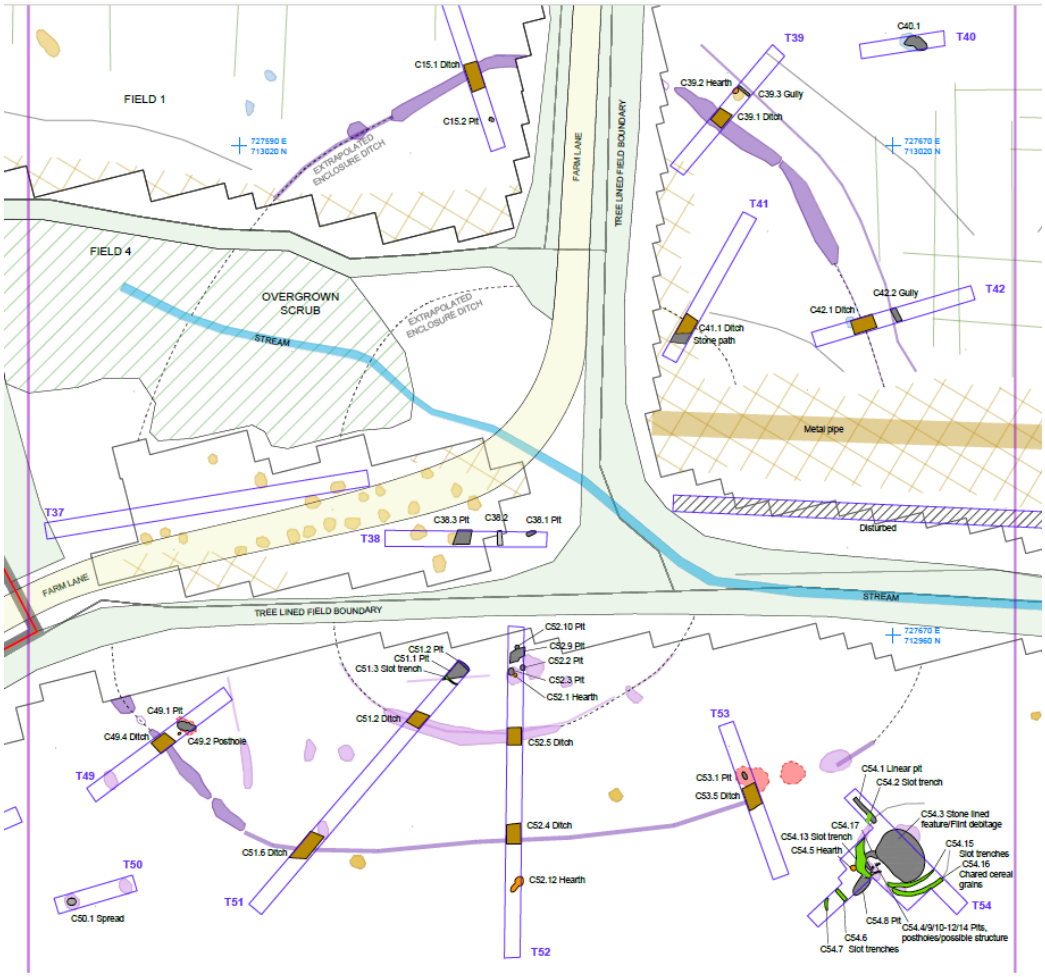

FIGURE 2 AA1 showing geophysical and test trenching results

2 SITE DESCRIPTION – AA1, ENCLOSURES

2.1 BACKGROUND TO DISCOVERY

The enclosures at Coolagad were identified during the geophysical survey, which was carried out by Joanna Leigh in 2020 (Licence 20R0212) in order to inform an SHD planning application. The survey identified responses indicative of a large enclosure (c. 95m diameter) with a further internal circular enclosure. The probable enclosure is truncated by multiple field boundaries, a farm laneway and is bisected by a small watercourse. In April 2021 archaeological testing at AA1 confirmed the presence of a partially disturbed, plectrum-shaped enclosure (possible original int. diameter: 95m x 90m). A smaller central, possibly oval enclosure (possible original int. diameter: 55m x 50m) was also identified. Testing also confirmed the presence of internal features including slot trenches, pits, postholes and hearths. External features including hearths, gullies and a concentration of industrial activity probably associated with cereal drying activity were also identified. No diagnostic artefacts were retrieved but the form of the bi-vallate enclosure suggests it is probably of early medieval date.

2.2 TOPOGRAPHY AND SETTING

The circuit of the enclosure at AA1 traverses 5 fields and is traversed by a number of field boundaries, which are lined with hedgerows. An active stream also traverses the site which is similarly lined with scrub. A farm laneway traverses the location of the enclosure. The lane is composed of hardcore material with dense gorse vegetation to one side.

2.3 ARCHAEOLOGICAL CONTEXT

There are no recorded monuments within the proposed development area, though there are a total of 12 sites are recorded within a 500m radius of the site. One of these is a Late Bronze Age or Iron Age hillfort (WI008-015). Given the identification of prehistoric features during testing it is possible that the large double-ditched enclosure could be of prehistoric date. However, the identification of a smaller, plectrum-shaped enclosure excavated at Farrankelly that has been dated to the beginning of the early medieval period may suggest that the double-ditched enclosure is of similar date.

During the medieval period, the area surrounding Greystones was located within the territories of the *Uí Dúnchada*, the ruling branch of which was the *Mac Gilla Mo Cholmóc*. At the time of the Anglo-Norman invasion, the family held much of what would become the half barony of Rathdown from a stronghold in the vicinity of Rathdown Castle, c. 1.5km to the northeast. The ruler *Domhnall Mac Gilla Mo Cholmóc* sided with the Anglo-Normans and as such managed to retain much of his land. If the enclosure dates to the medieval/early medieval period and represents a very large bivallate ringfort, it is likely to relate to the *Uí Dúnchada* lordship.

The ringfort, or rath, is considered to be the most common indicator of settlement during this time. The most recent study of the ringfort (Stout 1997) has suggested that there are over 45,000 potential ringforts or enclosure sites throughout Ireland. They are typically enclosed by an earthen bank and exterior ditch and range from 25m to

50m in diameter. The smaller sized and single banked type (univallate) were more likely to be home to the lower ranks of society while larger examples with more than one bank (bivallate/trivallate) housed the more powerful kings and lords. When the radiocarbon and dendro-chronological dates from ringfort excavations are compared (Stout 1997, 22-31), not only is the ringfort clearly an early medieval phenomenon, but a strong case emerges for dating the phase of ringfort construction to a period between the 7th and 9th centuries AD. The most common structures found within ringforts, usually through excavation, are the remains of buildings, generally houses, either circular or rectangular. A ringfort (WI008-073) is recorded c. 220m to the northeast.

It is interesting in this context that the name for the townland – Coolagad can be attested to at least as early as the 16th century and derives from the Irish Cúil a' ghaid, which can be read as 'corner or bend of the withy or rod.' This description could relate to the abrupt change in direction taken by the stream where it crosses AA1 with a reference to withies either suggesting that sally rods grew here or that it was a favourable spot for fishing with rods.

2.4 CONCLUSION OF ARCHAEOLOGICAL TESTING

> 'Testing at AA1 confirmed the presence of a partially disturbed, plectrum-shaped enclosure (possible original int. diameter: 95m x 90m). A smaller central, possibly oval enclosure (possible original int. diameter: 55m x 50m) was also identified. Testing also confirmed the presence of internal features including slot trenches, pits, postholes and hearths. External features including hearths, gullies and a concentration of industrial activity probably associated with cereal drying activity were also identified. No diagnostic artefacts were retrieved but the form of the bi-vallate enclosure suggests it is probably of early medieval date (Ní Cheallacháin, 2021).

2.5 DESIGN RATIONALE INFORMING EXTENT OF IMPACT ON ARCHAEOLOGICAL FEATURES

Before a full impact assessment could be carried out of the proposed development on the archaeology identified on the site, the layout of the proposed development needed to be finalised, taking into consideration all of the site constraints – including topographical, engineering, architectural, unit density, ecological and archaeological concerns. Extensive consultation at Design Team level was carried out and input was also sought from the National Monument Service via a number of meetings and pre-lodgement submission of documents including draft versions of the archaeological testing report and draft Monument Management Plan (see Appendices 11.2 and 11.8). The resulting layout for the proposed development provides for the preservation in-situ of c. 60% of the double-ditched enclosure at Archaeological Area 1 (northern portion and associated features) while all other Archaeological Areas identified during testing, as well as c. 40% (southern portion) of Archaeological Area 1, will be directly impacted by the proposed development layout.

This layout has been determined by the development strategy which aims to adapt to the dominant characteristics of the landscape while respecting planning imperatives and development objectives. Throughout this process, due regard was given to the archaeological resource of the site and how best to preserve and integrate this, where possible, in the context of the ensemble of (at times conflicting) constraints across the SHD application lands.

2.5.1 Topography and landscape characteristics:

The southern part of the SHD lands, which slope steeply west to east, present highly challenging topography for residential development. The development strategy addressees these site-specific challenges with a Cut-Fill – rebalancing of the profile which will involve the movement of some 427,000 cubic metres of soil within the site. The overall development lands have a strong natural division between the northern and southern sites demarcated by the Greystones Stream and east-west orientated hedgerows. The passage of the Greystones Stream and the line of the existing hedgerows cut across the enclosure at AA1. These hedgerows and the riparian zone along the stream will be retained in the proposed development from largely ecological reasons. The proposed housing development along the southern edge of the enclosure at AA1 are set back from this dominant east-west hedgerow (T and Y); the stream and field boundaries, allowing a large portion of the enclosure footprint (c. 60%) to be preserved in-situ, while the remainder of the enclosure is proposed to be archaeologically excavated under licence.

2.5.2 Visual amenity

The levelling up of ground level along the southeastern part of the site – along the boundary with the adjacent Waverly housing estate, increased the potential for negative impact on residential amenities, in terms of overlooking, overshadowing or overbearing impact, due to the topography of the site and the potential requirement for retaining features.

This sensitivity of boundaries with existing residential communities has had a strong influence on the proposed layout. To ensure that new development would not present an overbearing presence, the boundary zones comprise landscaped amenity areas. This necessitated the removal of some 30 houses due to site constraints, further constraining the amount of available internal space within the proposed development.

2.5.3 Road layout

The overall layout includes two parallel north-south roads, based on a strong urban design rationale to provide a coherent and legible street framework and facilitate permeable movement throughout the new residential area. Given the proximity of the western stream road crossing to the enclosure at AA1, the design team considered reducing the vehicular crossings of the Greystones Stream from two crossings to one crossing to further minimise impact upon the archaeology. However, it was found, due

to the following reasons, that a second vehicular stream crossing is required for the proposed development:

1. Health and Safety issues during the phasing of the development as construction traffic would need to travel through occupied residential phases. By providing two vehicular stream crossings, construction and residential traffic can be separated for the later stages of the development, for example by limiting construction traffic to Street 1 and Street 6, and using only the western stream crossing.

2. Health and Safety issues from an operational point of view as emergency vehicles would only have one access to the southern portion of the site.

    i. For example, in the event of an accident on the bridge, emergency services would only be able to access an incident from one side and residents in the southern portion would not have an alternative means of exiting the site via car.
    ii. The road levels have been designed to keep as close to existing levels as possible in the vicinity of the existing archaeological site. Please see below the cut and fill plan for the area in the vicinity of the site.

The siting of the road crossings is further dictated by the regulations governing the spatial requirements to be maintained between the houses. The space between the two road crossings needs to accommodate a residential layout maintaining a 22m distance between the back-to-back houses. The western road crossing is therefore as far east as it can be sited while respecting other constraints.

The road layout for the proposed development provides a legible series of housing cells linked along two north-south axis roads. This road network has been carefully designed and placed to address An Bord Pleanala's Opinion of March 2021 that inter alia:

Further consideration / amendment or justification of the design and layout of the proposed scheme having regard to the following:

- the linear approach to the scheme, in particular the internal road network and the central area of public open space.
- the dominance of the road network within the scheme and consideration of the provision of homezones and a reduction in the number of cul-de-sacs.
- the location of existing watercourses on the site which currently run off to a culvert with limited capacity.
- future connectivity to adjoining lands and the impact of the proposed scheme on the development potential of adjoining landholdings.

The development masterplan requires the construction of 2 north-south access roads to provide a satisfactory layout to address the Board's issues.

2.5.4 Planning

The application lands are located in an area designated as Action Area Plan 1 (AP1) in the Greystones and Delgany Local Area Plan 2013-2019 and consist of the majority of the AP1 area. The AP1 lands represent the north west boundary of the LAP area.

Accordingly, several zonings apply to the site. These are:

- R17: 'To provide for the development of sustainable residential communities up to a maximum density of 17 units per hectare and to preserve and protect residential amenity
- R22: To provide for the development of sustainable residential communities up to a maximum density of 22 units per hectare and to preserve and protect residential amenity.
- OS: To preserve, provide for and improve public and private open space for recreational amenity and passive open space.
- AOS: To provide for active recreational open space

The proposed development layout addresses several significant site constraints, but also must balance this with delivering open space and amenity areas in accordance with an acceptable level of density under the Sustainable Residential Development in Urban Areas (2009). As has been outlined above, the siting of the public amenity greenspace has been chosen to also allow for the preservation in-situ of a large portion of the double-ditched enclosure identified at AA1. The ongoing strategy for protection of this monument is outlined in the Monument Management Plan (Appendix 11.8).
The southern SHD land is aligned with the area indicated as R17 on the LAP Zoning map which use the hedgerow and stream system to demarcate a natural boundary (with R22) in the overall AAP expansion area.

3 PROPOSED LANDSCAPING WORKS AT AA1

3.1 EXCAVATION

It is proposed to preserve the southern portion of the enclosure by record (archaeological excavation) in advance of development (Figure 3). This will involve full archaeological excavation under licence to the National Monuments Service of the Department of Housing, Local Government and Heritage should a grant of planning be obtained and should the proposed archaeological mitigation strategies outlined in this document be deemed appropriate.

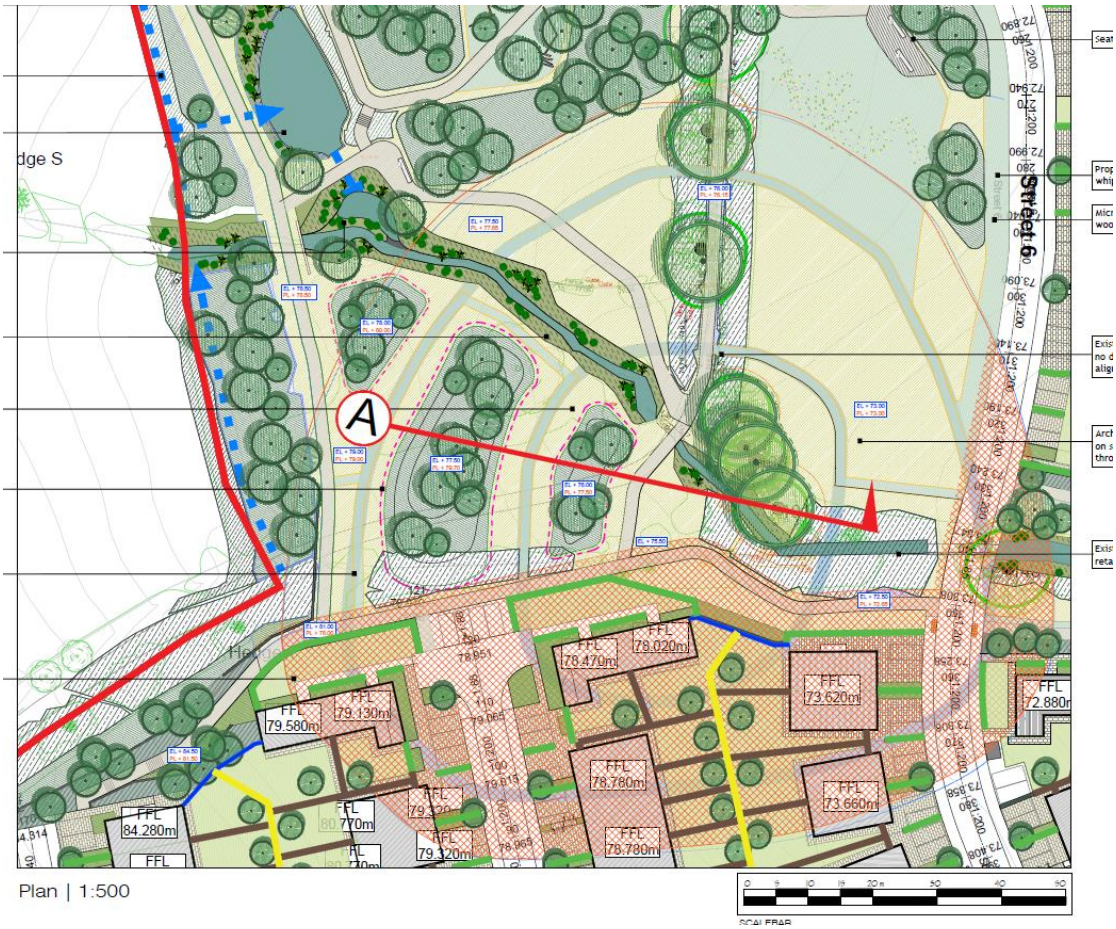

FIGURE 3 AA1 showing proposed excavation area hatched purple

3.2 WATERCOURSE

It is proposed to retain the watercourse and bring it into the landscaped area as a feature. While an attenuation pond will be excavated to the northwest of the enclosure, the run of the stream will remain largely unaltered. Gorse along the watercourse will be removed to improve stream as a habitat and to increase amenity value. The riverside banks will be retained and formed with imported soil (where absent) to encourage riparian vegetation (Figures 4 and 5).

3.3 PATHS

Two 'no-dig' paths are proposed within the area of preservation in-situ (Figure 4). The first will be constructed over the existing farm lane. The second will be constructed on

a formation of banked, imported soil (a similar approach has been recently employed successfully at Tully Church, Co. Dublin following consultation with the National Monuments Service of the DoHLGH).

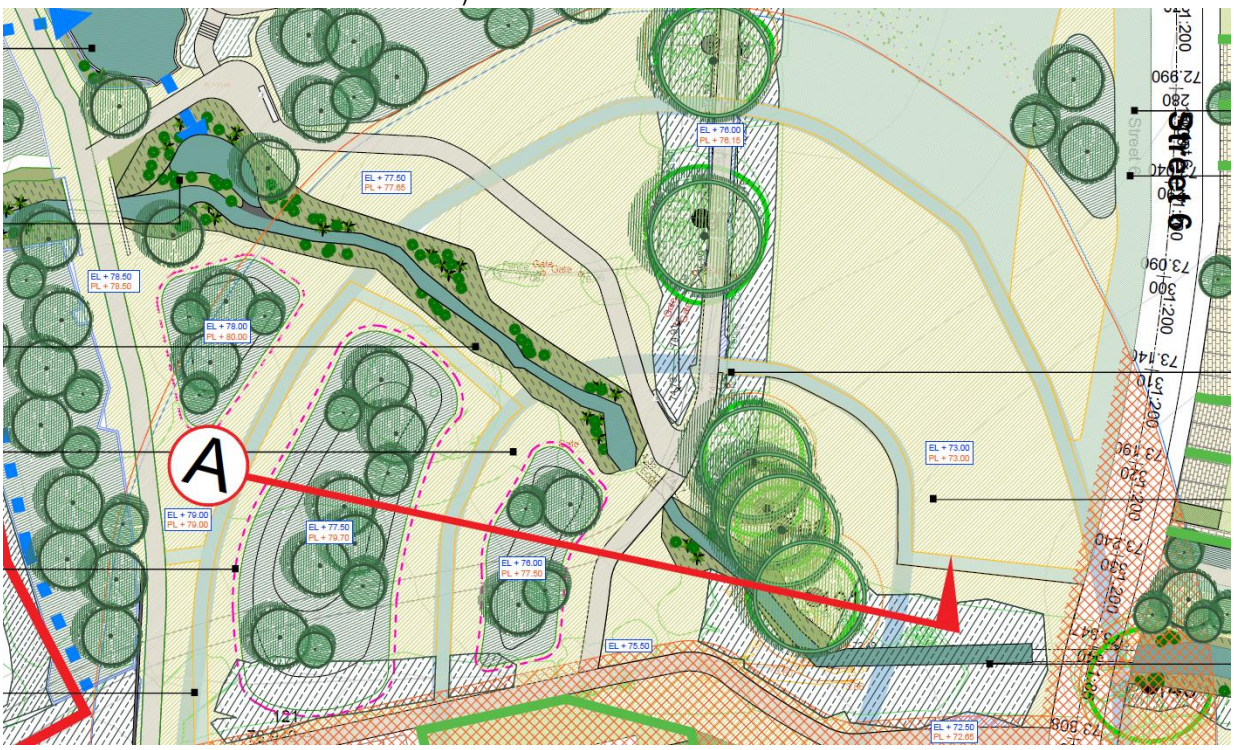

FIGURE 4 AA1 showing landscape proposal (Source: KFLA Landscape Architects)

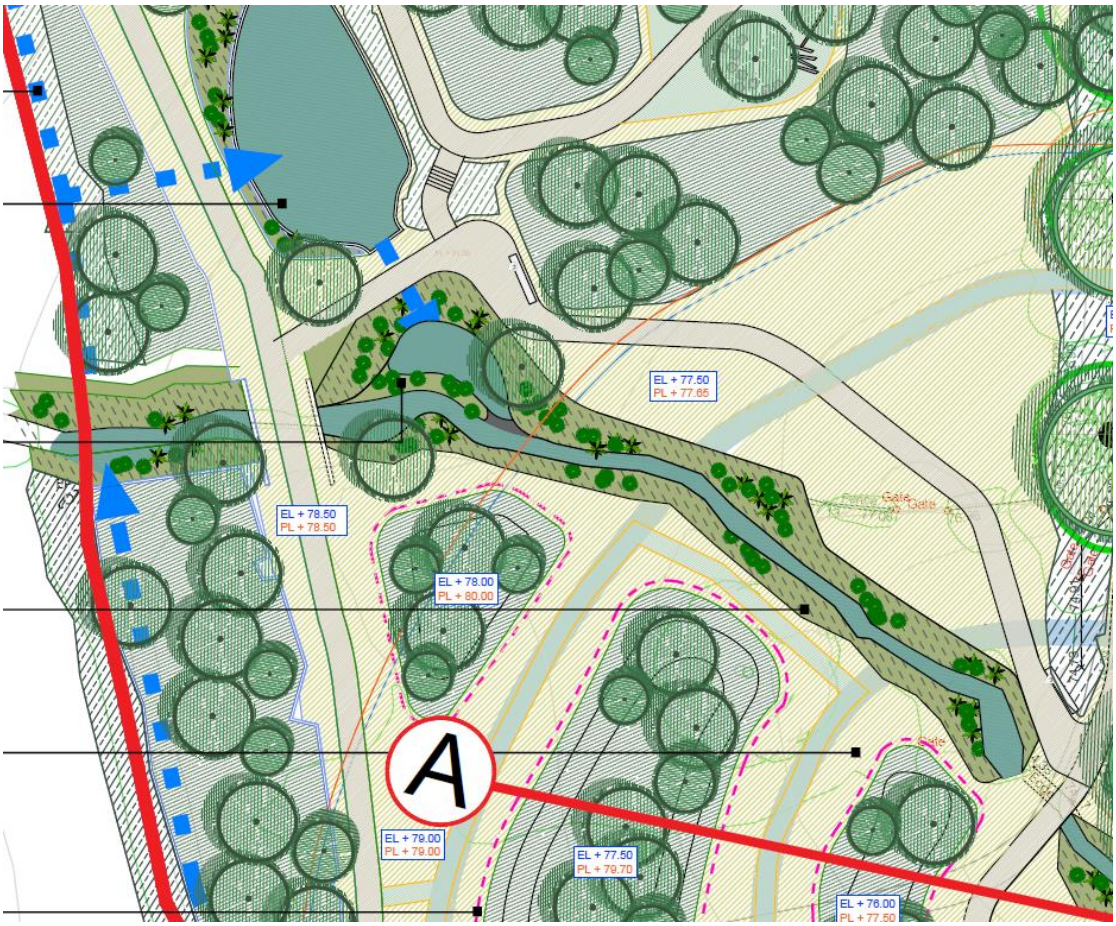

FIGURE 5 AA1 showing stream treatment and planting detail (Source: KFLA Landscape Architects)

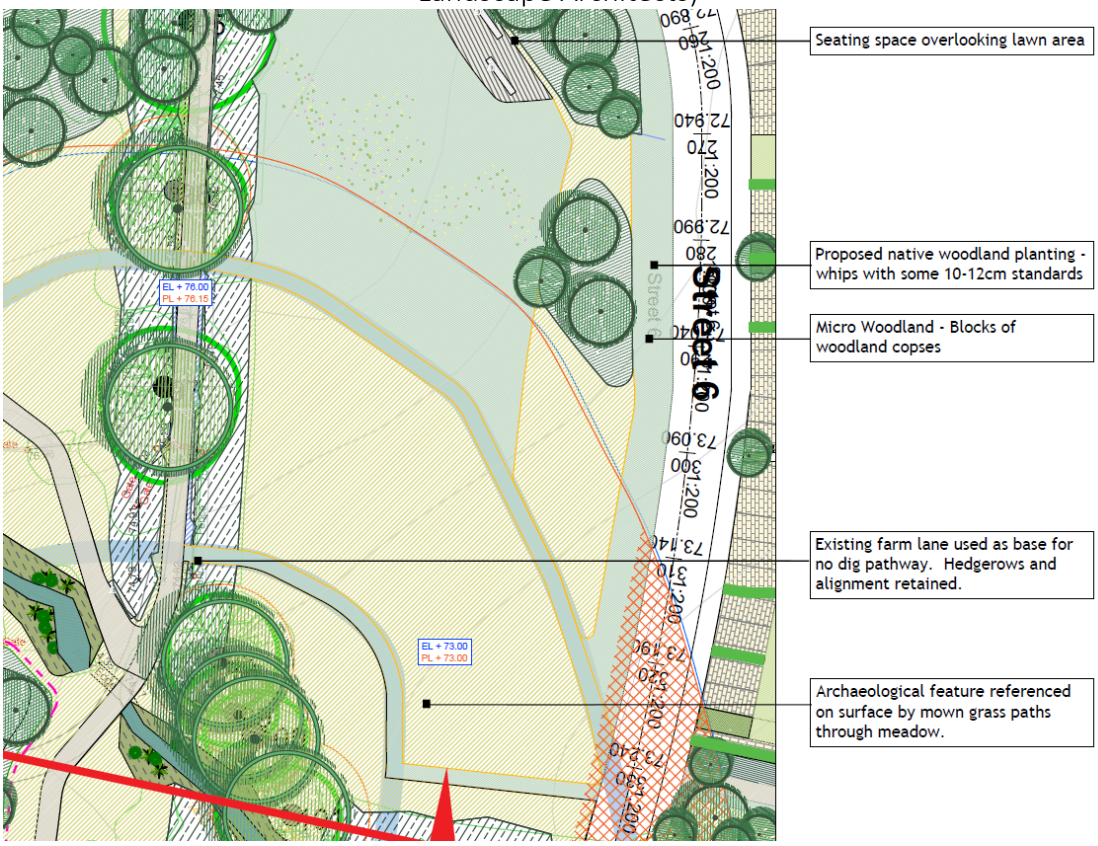

FIGURE 6 AA1 treatment of line of enclosure (Source: KFLA Landscape Architects)

3.4 PLANTING

Existing hedgerows along the farm lane will be retained. Gorse will be removed through cutting back and application of biocide to roots in order to facilitate establishment of blocks of native woodland copse. Within the area of archaeological preservation and within immediate proximity to the line of the enclosure ditches, it is proposed to import 2m of topsoil to allow for the root systems of native broadleaf trees to become established without damaging the subsurface archaeology. Meadow will be established across the remainder of the area. The line of the enclosure ditches will be referenced on the surface by mown grass paths through the meadow (Figure 6). Co-ordination between IAC and KFLA following planting will ensure the mown paths follow the correct lines.

3.5 INTERPRETATION OF MONUMENT

It is proposed to interpret the monument to the public through signage and wayfinding onsite with consideration given to a digital element accessible via a QR code or similar. The form and content of such should be agreed in advance with the NMS.

3.6 MAINTENANCE

Maintenance of the grassland, stream and woodland copses will be low interaction, and will be required to be covered within the contract of the management company that will be appointed to maintain the parks. It is envisaged that maintenance will comprise

hay cuts two or three times a year to prevent any large shrubs or trees taking root, pruning of the broadleaf copses and maintaining the stream free of rubbish or detritus.

4 RECOMMENDATIONS

4.1 PRESERVATION BY RECORD

- It is recommended that the southern 40% of site that will be impacted upon by the construction of housing units and road infrastructure be subject to preservation by record (archaeological excavation). This should be undertaken under licence to the National Monuments Service (NMS) and a comprehensive methodology developed for this work in consultation with the NMS archaeologist with responsibility for the area.

4.2 CONSTRUCTION PHASE

- It is recommended that a Construction Exclusion Zone be established around AA 1. This should be delineated by a 1m high post and sheepwire fence as shown. It is proposed to establish this fence a minimum of 5m distant from the recorded remains. The fence will be removed upon completion of the construction phase of the project.

- It is recommended that a Heritage Induction outlining the nature and significance of the archaeology in AA1 be a mandatory component of all contractors site inductions throughout the life of the project. The nature of the archaeology at AA1 and its location onsite should be addressed along with the details of the Construction Exclusion Zone.

- Signage should be erected in order to identify the Construction Exclusion Zone as having archaeological sensitivity and to notify any personnel that access to the exempt lands is strictly forbidden.

- It is recommended that the installation of topsoil imported from cut operations in adjacent areas of the site to build up the areas of copse woodland and the imported subsoil for the formation material for the no dig paths be carried out using lightweight dump truck (8 tonnes) and lightweight mechanical excavator (5-8 tonnes). It is recommended that this work be carried out during a period when the ground is dry. It is recommended that the use of displacement mats be considered should there be a requirement to track over any soft ground.

- It is recommended that no construction plant or heavy vehicles with the exception of those detailed above, be allowed to enter the exclusion zone nor may any materials or plant be stored in this area.

4.3 OPERATIONAL PHASE

- It is proposed to let the area surrounding AA 1 grow naturally as meadow. Some initial intervention may be required to seed the area, though this will be restricted to sod level. No cultivation or ground disturbances are required to create this environment.

- Maintenance of the grassland, stream and woodland copses will be low interaction, and will be covered within the contract of the management company that will be appointed to maintain the parks. It is envisaged that maintenance will comprise hay cuts two or three times a year to prevent any large shrubs or trees taking root, pruning of the broadleaf copses and maintaining the stream free of rubbish or detritus.

- Currently there are no plans for additional planting within AA 1. However, should this be planned in the future, planting within the green space containing the enclosures should be carefully considered to avoid directly impacting on archaeological remains, and consist of plants with shallow roots, which will not exceed the depth of topsoil. Trees should not be planted in the exempt area due to the potential impact their root systems will have on the archaeological remains. Furthermore, all proposed planting work should be subject to an archaeological assessment of the proposals and be carried out in full consultation with an archaeologist and approved by the National Monuments Service of the DoHLGH.

- It is recommended that an appropriate information signage and wayfinding be erected in order to inform the public of the significant nature of the enclosure site and the surrounding landscape. The form and content of such should be agreed in advance with the NMS.

- It is recommended that the area of archaeology to be preserved in-situ is assessed on a biennial basis, using the system of OPW monument inspection as a template for this process. This inspection should be undertaken by a suitably qualified archaeological consultant on behalf of the management company.

- Any potential future works involving ground disturbance in AA 1 will require an archaeological impact assessment prior to going ahead and may be subject to archaeological conditions.

Please note that all recommendations are subject to approval by the National Monuments Service of the Heritage and Planning Division, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

5 REFERENCES

Department of Arts, Heritage, Gaeltacht and the Islands. 1999a *Framework and Principles for the Protection of the Archaeological Heritage*. Dublin. Government Publications Office.

Department of Arts, Heritage, Gaeltacht and the Islands. 1999b *Policy and Guidelines on Archaeological Excavation*. Dublin. Government Publications Office.

Leigh, J.M, 2020 Geophysical Survey report for lands at Coolagad, greystones, Co. Wicklow

Murphy, M and Potterton, M. 2010 *The Dublin region in the Middle Ages, Settlement, land-use and economy,* Discovery Programme Monograph, Four Courts Press, Dublin 8

National Monument Section, Department of Arts, Heritage and The Gaeltacht. *Sites and Monuments Record*, County Wicklow.

Ní Cheallacháin, M. 2021 *Archaeological test excavations at Coolagad, Greystones, Co. Wicklow Licence Ref.: 21E0083* Unpublished report.

Stout, M. 1997 *The Irish Ringfort*, Four Courts Press, Dublin.

CARTOGRAPHIC SOURCES

Ordnance Survey 6-inch and 25-inch maps of County Wicklow (1843, 1863–7, 1909)

ELECTRONIC SOURCES

www.archaeology.ie – DoAHRRGA website listing all SMR sites with aerial photographs.

www.osiemaps.ie – Ordnance Survey aerial photographs dating to 1995, 2000 & 2005 and 6-inch/25-inch OS maps.

www.googleearth.com – Aerial photographs of the proposed development area

APPENDIX 1 LEGISLATION PROTECTING THE ARCHAEOLOGICAL RESOURCE

PROTECTION OF CULTURAL HERITAGE

The cultural heritage in Ireland is safeguarded through national and international policy designed to secure the protection of the cultural heritage resource to the fullest possible extent (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), ratified by Ireland in 1997.

THE ARCHAEOLOGICAL RESOURCE

The *National Monuments Act 1930 to 2014* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which includes 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' (National Monuments Act 1930 Section 2). A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

OWNERSHIP AND GUARDIANSHIP OF NATIONAL MONUMENTS

The Minister may acquire national monuments 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.

REGISTER OF HISTORIC MONUMENTS

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the register is illegal without the permission of the Minister. Two months notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

PRESERVATION ORDERS AND TEMPORARY PRESERVATION ORDERS

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with 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 must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

RECORD OF MONUMENTS AND PLACES

Section 12(1) of the 1994 Act requires the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for Culture, Heritage and the Gaeltacht) to establish and maintain a record of monuments and places where the Minister believes that such monuments exist. The record comprises a list of monuments and relevant places and a map/s showing each monument and relevant place in respect of each county in the state. All sites recorded on the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994. All recorded monuments on the proposed development site are represented on the accompanying maps.

Section 12(3) of the 1994 Act provides that 'where the owner or occupier (other than the Minister for Arts, Heritage, Gaeltacht and the Islands) 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 of Arts, Heritage, Gaeltacht and the Islands to carry out work and shall not, except in case of urgent necessity and with the consent of the Minister, commence the work until two months after giving of notice'.

Under the National Monuments (Amendment) Act 2004, anyone who demolishes or in any way interferes with a recorded site is liable to a fine not exceeding €3,000 or imprisonment for up to 6 months. On summary conviction and on conviction of indictment, a fine not exceeding €10,000 or imprisonment for up to 5 years is the penalty. In addition they are liable for costs for the repair of the damage caused.

In addition to this, under the *European Communities (Environmental Impact Assessment) Regulations 1989,* Environmental Impact Statements (EIS) are required for various classes and sizes of development project to assess the impact the proposed development will have on the existing environment, which includes the cultural, archaeological and built heritage resources. These document's recommendations are typically incorporated into the conditions under which the proposed development must proceed, and thus offer an additional layer of protection for monuments which have not been listed on the RMP.

THE PLANNING AND DEVELOPMENT ACT 2000

Under planning legislation, each local authority is obliged to draw up a Development Plan setting out their aims and policies with regard to the growth of the area over a five-year period. They cover a range of issues including archaeology and built heritage, setting out their policies and objectives with regard to the protection and enhancement of both. These policies can vary from county to county. The Planning and Development Act 2000 recognises that proper planning and sustainable development includes the protection of the archaeological heritage. Conditions relating to archaeology may be attached to individual planning permissions.

Wicklow County Development Plan, 2016-2022

Archaeology Objectives

BH1 no development in the vicinity of a feature included in the Record of Monuments & Places (RMP) will be permitted which seriously detracts from the setting of the feature or which is seriously injurious to its cultural or educational value.

BH2 any development that may, due to its size, location or nature, have implications for archaeological heritage (including both sites and areas of archaeological potential/significance as identified in Schedule 10.01 & 10.02 and Maps 10.01 & 10.02 of this plan) shall be subject to an archaeological assessment. When dealing with proposals for development that would impact upon archaeological sites and/or features, there will be presumption in favour of the 'preservation in situ' of archaeological remains and settings, in accordance with Government policy. Where permission for such proposals is granted, the Planning Authority will require the developer to have the site works supervised by a competent archaeologist.

BH3 to protect previously unknown archaeological sites and features, including underwater sites, where they are discovered during development works.

BH4 to facilitate public access to National Monuments in State or Local Authority care, as identified in Schedule 10.02 of this plan.

BH5 to protect the Hillforts in west Wicklow and to engage with the relevant central Government department to seek to undertake a detailed study of their importance.

BH6 to facilitate the designation of the Glendalough Monastic Settlement as a UNESCO World Heritage Site.

APPENDIX 11 I RECORD OF CONSULTATION WITH NATIONAL MONUMENT SERVICE

Appendix 11.I – Record of Consultation with National Monument Service

From: Paul Duffy
Sent: Tuesday 9 November 2021 17:25
To: manager.DAU@housing.gov.ie
Cc: Maeve O'Callaghan <Maeve.O'Callaghan@housing.gov.ie>
Subject: Coolagad, Greystones Co. Wicklow

A Chara,

Please find attached a draft Monument Protection Plan and figure outlining a strategy of partial preservation by record and partial preservation in-situ of a recently discovered bivallate enclosure at Coolagad, Greystone, Co. Wicklow.

This document will form part of an EIAR relating to a future SHD submission.

This document is being submitted as part of ongoing consultation with the NMS with regard to archaeological discoveries on the site. We would welcome your comment on the proposed strategy in advance of lodgement.

Kind regards,

Paul Duffy

Associate Director/Project Manager

IAC Archaeology

PROUDLY CELEBRATING 20 YEARS IN BUSINESS

An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

Your Ref: Pre SHD Coolagad
Our Ref: G G Pre00281/2021 (Please quote in all related correspondence)

2 December 2021

IAC
Unit G1
Network Enterprise Park
Kilcoole
Co. Wicklow
A63 KT32

Via email: PDuffy@iac.ie

Proposed Pre SHD Planning Development: CAIRN HOMES PLC.: Pre-SHD draft Monument Protection Plan and figure outlining a strategy of partial preservation by record and partial preservation in-situ of a recently discovered bivallate enclosure atCoolagad, Greystones, Co. Wicklow

A chara

I refer to correspondence received in connection with the above. Outlined below are heritage-related observations/recommendations co-ordinated by the Development Applications Unit under the stated headings.

Archaeology

Geophysical survey (20R0212 J. Leigh) and archaeological testing (21E0083 M. Ní Cheallacháin) was carried out at this proposed development site and a preliminary testing report was submitted to the National Monuments Service on 01/07/2021.

A meeting was subsequently held on 16/07/2021 to discuss the archaeological findings and consult in relation to the protection of the archaeological heritage potentially impacted by the proposed Strategic Housing Development. The meeting was attended by Rob Lynch (IAC), Muireann Ní Cheallacháin (IAC), Jerry Barnes (MacCabe Durney Barnes), Clíona Eogan (Cairn Homes Ltd.), Seán Kirwan (NMS) and Maeve O'Callaghan (NMS). Details to be addressed in the archaeological impact assessment to accompany any future SHD application were discussed.

Having reviewed the Draft Monument Protection Plan recently submitted to the National Monuments Service, we wish to make the following observations. The recent submission relates only to the newly discovered double-ditched enclosure identified within the proposed development site. It is important that the archaeological impact assessment documentation

submitted to An Bord Pleanála with any future SHD application includes a full and detailed archaeological impact assessment report (including mitigation proposals) relating to the archaeological heritage impacted within the overall development site.

The proposed short term and long term measures to ensure the preservation in-situ of archaeological remains identified in Areas AA4b and AA7 shall also be detailed in any AIA documentation submitted with the SHD application. Accompanying annotated plans and drawings shall be included as necessary. Details of all additional proposed archaeological excavation and mitigation measures (including excavation of all other identified archaeological areas as identified in the preliminary testing report and monitoring of topsoil stripping and groundworks) shall also be included.

Observations on Draft Monument Protection Plan

The Department was previously informed that 30% of the identified double ditched enclosure was proposed for excavation while 70% would be preserved in-situ. However, this approach has since been reviewed and now 40% (southern portion) is proposed for full excavation and 60% to be preserved in-situ (northern portion). As recommended at our meeting, it will be necessary to explain how this decision was reached by the design team and the evidential basis for this conclusion needs to be presented and justified. The developer needs to explain why 100% preservation cannot be achieved, the arguments to justify preservation by record have to be presented and the rationale in reaching this conclusion should be included in the SHD application.

Section 3 entitled 'Proposed Landscaping Works at AA1' should include an annotated existing site plan showing features within the area (such as the farm lane, stream, etc.) and the confirmed location of the double ditched enclosure within the existing landscape as well as an annotated proposed landscape plan and development layout (at appropriate scale). Details relating to proposed landscaping including type and depth of materials to be imported, location and extent of proposed importation of material, temporary measures to ensure protection of sub-surface archaeological features during construction period, section drawings and plans to clearly illustrate proposed preservation in-situ measures etc. should all be provided.

It is noted in section 3.4 that it is proposed to import 2m of topsoil to allow for the root systems of native broadleaf trees to become established without damaging the subsurface archaeology. However, no detailed information is provided to ensure that this approach will ensure the long-term protection and preservation in-situ of the sub-surface archaeological remains. The proposed location and extent of the area of imported material is not shown on plan. No details of proposed planting are provided other than reference to the possible future planting of unspecified native broadleaf trees within the 'exclusion area'. The potential damage caused by the root systems associated with the planting of unspecified native broadleaf trees to the buried archaeological remains has not been adequately assessed.

The above information will be required in any AIA submitted with the SHD application to demonstrate that the proposed preservation in-situ measures will result in the long-term protection of the monument.

It is also noted that the line of the enclosure ditches will be referenced on the surface by mown grass paths through the meadow. This 'soft' approach to representing the monument on the surface is certainly worth considering but it should be acknowledged that this will only be a seasonal approach to presenting the monument as presumably the grass paths cannot be maintained year round. Other methods of interpreting and presenting the monument as an integral part of the overall development should also be considered and included in the AIA accompanying the SHD application. The ongoing maintenance of the grassland following the completion of the development will be a critical matter to be taken into consideration. Reference is made to a 'Taking Charge Strategy' that will be required to ensure ongoing maintenance. However, more details in this regard should be provided and assurance given that any such proposals will be fully implemented in the long-term.

Section 3.5 which makes reference to proposed interpretation of the monument to the public should be expanded upon and more detail provided in the SHD application.

In Section 4.1 it is recommended that the southern 40% of the monument be archaeologically excavated. However, the location, extent and area of the proposed full archaeological excavation in advance of construction works should be shown clearly on plan (appropriate scale). Figure 3 is not to scale.

Details of the developer's obligations relating to the funding of full archaeological excavation, post-excavation and submission of a final archaeological report should be included. Details of the proposed method statement for archaeological excavation shall be agreed with the relevant authorities following submission of any future excavation licence application to DoHLGH.

As noted at our meeting on 16/07/2021, the National Monuments Service is concerned about some of the conclusions reached in the preliminary testing report (21E0083) regarding the nature and extent of the archaeological remains surviving in Area AA1. The developer should be made fully aware of the full implications of carrying out full archaeological excavation of this monument which could prove to be a more complex excavation than anticipated in the preliminary report. It has been suggested in the preliminary report that the double-ditched enclosure *"is probably of early medieval date."* However, no diagnostic artefacts were retrieved, confirmed pre-historic features were identified to the north-east and possible prehistoric features were identified elsewhere within the development site and these may be

contemporary with the double-ditched enclosure and/or possibly the hillfort at Coolagad (RMP WI008-015) which is located approximately 500m to the south-west.

Furthermore only a very limited number of test trenches excavated across the ditches of the double-ditched enclosure were 'bottomed' and yet it is concluded in the preliminary report that the outer ditch measures 0.84m in depth and the inner ditch 0.76m. It is possible that the ditches are more extensive than anticipated in the report. The archaeological excavation of 40% of the monument could prove more complex than anticipated in the preliminary report and this should be acknowledged in the SHD application.

The developer should be made fully aware of all requirements and costs associated with the full archaeological excavation of such an extensive portion of the monument including the on-site archaeological excavation, provision of sufficient team of archaeologists for duration of excavation, specialists as required, post-excavation analysis, preparation and submission of final report, etc. All resulting and associated archaeological costs shall be borne by the developer.

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

You are requested to send further communications to the Development Applications Unit (DAU) at **manager.dau@housing.gov.ie**.

Is mise le meas**,**

Diarmuid Buttimer
Development Applications Unit
Administration

IAC Archaeology

Diarmuid Buttimer
Development Applications Unit
Department of Housing,
Local Government and Heritage
Custom House,
Dublin,
D01 W6X00
18/01/2022

RE: G G Pre00281/2021

A Chara,

Many thanks for your comments relating to the draft Monument Management Plan (MPP) that is to accompany an SHD planning application for Coolagad, Co. Wicklow. The majority of these will be fully addressed in the EIAR chapter that will accompany the application. The EIAR document will include a full and detailed Archaeological Impact Assessment (AIA) - including recommended mitigation measures - which will outline the proposed approach to all archaeological areas across the development. Proposals for monitoring of topsoil stripping and groundworks will also be provided for. These recommendations will also take into account all discussions held to date with the NMS on this project. Annotated plans and drawings will be included to illustrate the report.

With regard to the specific observations on the content of the draft MPP, the EIAR will include the archaeological testing report and MMP as appendices and full justification with regard to engineering, design and density constraints will be supplied in order to explain the level of preservation in-situ and preservation by record that is proposed. Please find attached revised scaled drawings which take into account the items raised in your communication. We would welcome further comment on these if deemed necessary. Particular attention has been paid – as per NMS observation – to the proposed level and extent of topsoil importation along with a detailed inventory of proposed broadleaf species and their rooting parameters.

In addition to the 'soft' options for referencing the double-ditched monument in the development, additional options for interpretation and presentation will be presented, as requested, in the AIA accompanying the final submission. The final submission will include a full Taken in Charge strategy which will be described in detail in relation to the ongoing management of the monument.

We acknowledge the points made with regard to the provisional dating of the monument in our draft testing report and these conclusions will be balanced by other potential interpretations as suggested.

Unit G1,
Network Enterprise Park,
Kilcoole, Co. Wicklow
A63 KT32, Ireland
T: +353 (0)1 2018380
E: archaeology@iac.ie

9 Stranmillis Road,
Belfast,
BT9 5AF

T: +44 (0)28 906 83136
E: archaeologybelfast@iac.ie

Directors:
Rob Lynch, Pat Gormley
Company Reg. No. 288812
VAT Reg. No. IE 8288812U

We also acknowledge your comment to the effect that the developer:

> needs to be made aware of all requirements and costs associated with the full archaeological excavation of such an extensive portion of the monument including the on-site archaeological excavation, provision of sufficient team of archaeologists for duration of excavation, specialists as required, post-excavation analysis, preparation and submission of final report, etc – and that all resulting and associated archaeological costs shall be borne by the developer.

From the outset, this has formed part of the discussion around the mitigation measures available to the client. Having navigated similar-sized excavation projects through planning, excavation and post-excavation stages with this client in the past, IAC are confident that there is an evolved understanding among the project team of the processes required and of associated costs involved in this level of archaeological excavation.

Yours sincerely,

Paul Duffy
Associate Director/Project Manager

An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

Your Ref: Pre SHD Coolagad
Our Ref: G Pre00281/2021 (Please quote in all related correspondence)

28 January 2022

IAC
Unit G1
Network Enterprise Park
Kilcoole
Co. Wicklow
A63 KT32

Via email: PDuffy@iac.ie

Proposed Pre SHD Planning Development: CAIRN HOMES PLC.: Pre-SHD draft Monument Protection Plan and figure outlining a strategy of partial preservation by record and partial preservation in-situ of a recently discovered bivallate enclosure atCoolagad, Greystones, Co. Wicklow

A chara

I refer to correspondence received in connection with the above. Outlined below are heritage-related observations/recommendations co-ordinated by the Development Applications Unit under the stated headings.

Archaeology

The Department previously issued a detailed response on 02/12/2021 to the draft Monument Management Plan submitted by IAC Archaeology relating to the above pre-SHD consultation. The Department is now in receipt of a revised landscaping drawing and your letter dated 18/01/2022 which commits to preparing a detailed Archaeological Impact Assessment report and monument management plan for inclusion in the EIAR to accompany the Strategic Housing Development application. You note that the AIA will take into consideration the recommendations outlined in our previous correspondence and at our meeting held on 16/07/2021.

With regard to the proposed landscape plan and section provided (drawing no. 110, Kevin Fitzpatrick, Landscape Architecture), it will be important to provide specifications and details relating to the proposed 'root barrier' to be installed, the depth/extent of root systems associated with the proposed planting within the archaeologically sensitive areas,

identification of any related potential archaeological impact and suggested mitigation as part of the overall Archaeological Impact Assessment.

The Department will comment further when the archaeological impact assessment and monument management plan have been prepared and submitted with any future SHD application

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

You are requested to send further communications to the Development Applications Unit (DAU) at **manager.dau@housing.gov.ie**.

Is mise le meas**,**

Diarmuid Buttimer
Development Applications Unit
Administration

From: Paul Duffy
Sent: Tuesday 15 February 2022 13:31
To: Housing Manager DAU <Manager.DAU@housing.gov.ie>
Cc: Maeve O'Callaghan <Maeve.O'Callaghan@housing.gov.ie>
Subject: RE: G Pre00281/2021 - Pre SHD Coolagad

Diarmuid,

Many thanks for your letter dated 28th January. As per your further observations, we have updated the final landscaping figure and specified the root barrier and rooting system of the trees proposed for planting. We have also, following numerous design team workshops, finalised a detailed justification piece with regards to the preservation in situ vs by record of the known archaeology onsite.

While I acknowledge that you letter states you will review further iterations via the SHD application, we would be more than happy for you to review both documents prior to submission.

Let me know if this is possible.

Kind regards,

Paul Duffy
Associate Director/Project Manager

IAC Archaeology

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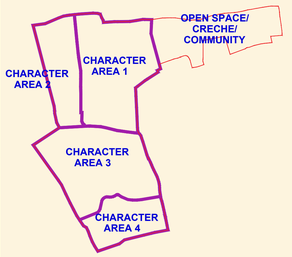
APPENDIX 12 A SITE LAYOUT

GENERAL NOTES



KEY TO DWELLING REFERENCES

DWELLING TYPE A
STREET NUMBER 31|18 DWELLING NUMBER

##m² AREA OF INDIVIDUAL PRIVATE REAR GARDENS TO HOUSES

EXTENT OF PLANNING APPLICATION
CHARACTER AREA OUTLINE

THIS DRAWING TO BE READ IN CONJUNCTION WITH-
ARCHITECT'S DRAWINGS
CONSULTANT ENGINEER'S DRAWINGS AND SPECIFICATIONS
LANDSCAPE ARCHITECT'S DRAWINGS AND SPECIFICATIONS

O.S.I. MAP REFS:
1:1,000 | 3674-06
1:1,000 | 3674-11
1:2,500 | 3673-B

NOTES:

DO NOT SCALE FROM DRAWINGS. WORK TO FIGURED DIMENSIONS ONLY. ARCHITECT TO BE NOTIFIED OF ALL DISCREPANCIES.

REVISIONS

DATE	DESCRIPTION	No.

MCORM
M°CROSSAN O'ROURKE MANNING **ARCHITECTS**
1 Grantham Street, Dublin 8, D08 A4PY Ireland.
Tel: 01-4788700 Fax: 01-4788711 E-Mail: arch@mcorm.com

PROJECT TITLE:	Coolagad, Greystones
DRAWING TITLE:	Site Layout Plan - Overall
DATE:	MAR '22
DRAWN BY:	PMCN
SCALE:	1:1000@A0
REVISION:	-
JOB NO:	20005
DRAWING NO:	PL03

APPENDIX 12 B BUS CAPACITY ASSESSMENT REPORT

COOLAGAD SITE - BUS CAPACITY ASSESSMENT REPORT

Table of Contents

COOLAGAD SITE - BUS CAPACITY ASSESSMENT REPORT

1. Introduction.

Cairn Homes Properties Limited intend to apply to An Bord Pleanala for planning permission for a strategic housing development (SHD) at Coolagad, Greystones, Co Wicklow. This report, by Derry O'Leary, Transport Consultant, has been commissioned by Cairn to estimate the available spare capacity in the current bus network. The author, a Civil Engineer, qualified as a Traffic Engineer and has over 40 years experience. He has spent nearly 30 years in both planning and operations in Dublin Bus. This report work will supplements the Traffic and Transport Assessment, and in particular Appendix E, undertaken by Aecom on the subject site.

2. Background to Dublin's Public Transport Network

2.1 While the customer-facing bus network serving the Greater Dublin Area has been relatively stable in recent years, the organisation of these operations has undergone significant structural change in the last decade or so. The National Transport Authority (NTA), established in 2009, is now the public transport Regulator. The planning of bus and rail services nationwide has moved from the CIE Group of companies to the NTA. Responsibility for the network and individual route designs, fares and timetable details, etc. now lies solely with the Regulator. Under this new regime even the smallest modification to any bus route or timetable must be agreed with the NTA in advance of implementation. The Authority also allocates State funding to meet the Public Service Obligation (PSO) benefits provided by the public transport network. The NTA also approves and allocates licences to commercial bus operators, subject to agreed routes, timetables and conditions.

2.2 In 2015, the Authority commenced a root and branch review of the efficiency and effectiveness of the Dublin Bus Network, branded as Bus Connects. In parallel, it also began a Bus Market Opening (BMO) process to open the Irish bus market to competition. These are now briefly outlined below.

3. Bus Market Opening (BMO)

3.1 In order to open the bus market to competition to more than the incumbent State-owned operators (Dublin Bus and Bus Eireann) the NTA first tendered a package of orbital bus routes operated by Dublin Bus in 2016. The group of 24 routes, and total fleet of 125 buses, represented 10% of the bus market in the Greater Dublin Area. Following the competitive tendering process, the Go-Ahead Group (a largely UK-based bus and rail operator with significant overseas businesses) was selected to operate these routes. The seamless transfer of routes, in stages, from Dublin Bus to Go-Ahead Ireland (GAI) took place over a 12-month period in 2018/2019. The switch was barely noticed by the general public and passengers alike, as the new operations were introduced under the NTA's Transport for Ireland (TFI) brand. Route 184 which operates between Newtownmountkennedy and Bray DART Station, past the Coolagad site, is operated by Go-Ahead Ireland on behalf of the NTA.

3.2 All PSO operators, whether commercially or State-owned, operate bus services under contract to the NTA and must meet a set of key performance indicators (KPIs) covering reliability, timekeeping and vehicle maintenance. The same standards are expected of all contracted operators and failure to meet the targets will result in fines or contract cessation. Both the performance standards expected of contractors and the level of fines exacted for not meeting those standards are in the public domain.

3.3 The NTA owns the fleet deployused by GAI to operate its routes in the GDA. It appears that, over time, the entire public transport fleet will be owned by the NTA as the fleet is renewed and the Authority obtains the capital funding to buy and replace buses for use in the PSO networks across Ireland. The next batch of buses ordered by the NTA for the Dublin urban market are fully-electric traction. The delivery of the first of these EV buses is expected in 2024.

4. Bus Connects Project Overview

4.1 This fundamental root and branch re-design of the urban bus network in the Greater Dublin Area (GDA), including the North Wicklow services, was commenced by the NTA in 2015. In tandem with the service re-designs, the bus route alignments will be upgraded to radically enhance bus priority measures. This investment is required to protect the enhanced operation from the adverse impacts on reliability caused by traffic congestion. These Core Bus Corridors (CBCs) along which the high-frequent Spine routes will run and the revised routes themselves have been through a series of extensive consultation phases with the general public and key stakeholders. Local Authorities have been directly involved in both the bus route and CBC design process. The final route network, modified following the review of thousands of submissions by members of the public and key stakeholders, has now been agreed.

4.2 Phased implementation of new Spine routes has started. To date, only two of the phases required to modify the bus network in the Greater Dublin Area, which also encompasses north Wicklow, have been introduced. The C-Spine and H-Spine changes have been introduced in parts of the west and north suburbs of Dublin. Further phases have been designed and planned but will take a number of years to implement. The whole network of services is expected to be implemented by 2024. No changes to the North Wicklow Network have yet taken place, and the specific bus route changes planned for the Greystones area in 2023 are outlined later.

5 Existing Public Transport Network Serving the Coolagad Site

5.1 The Coolagad site is well-located on the main bus routes serving the North Wicklow area between Greystones and Bray. It is c. 2km from Greystones DART Station. The public service obligation (PSO) routes operated under contract to the NTA that serve the site are as follows

Route	Origin	Destination	Frequency (Peak) Mins
84	Newcastle	Blackrock	30
84X	Newcastle/Kilcoole	City Centre	10
184	Newtownmountkennedy	Bray DART Station	30

5.2 There are two northbound bus stops and a corresponding southbound pair that serve the site. All four stops are well within standard walking distance of the site. Stop 4297, the closest to the development, is only 80m from the site entrance and it is served by Routes 84 and 184. The second, stop 4296, is 260m to the south of the development entrance. This second northbound stop, while further away, has additional routes stopping there. The stop is served by scheduled routes 84 and 184, by the route 84X (which operates to Dublin City at peak times only) and the Route 702 Aircoach service to Dublin Airport.

5.3 Routes 84 (to Blackrock) and 184 (to Bray DART Station) are operated under contract to the NTA by Dublin Bus and Go-Ahead Ireland, respectively. They operate the typical 18–hour day, 7 days / week, with reduced frequencies in the off-peak and weekends. By contrast, route 84X, popular with commuters because of the limited number of stops, consists of a series on peak-only Monday-Friday services that operate to/from Dublin City Centre. This express, or limited-stop route, is also run by Dublin Bus. It quickly accesses UCD and Dublin via the N11 QBC and the Southern Cross Routes and avoids deviating to serve Bray which improves significantly end improves the end too end journey times for passengers. The Aircoach Airport Express Route 702 provides good, direct linkage between the area and Dublin Airport.

5.4 The DART station in Greystones is circa 2 kilometres from the site. DART offers an attractive 30-minute frequency across the entire week from Geystones into Dublin City Centre and beyond to Malahide and Howth. The potential to increase the frequency of the DART

service is constrained by the limitations imposed by the one-way line south of Bray. Routes 84 and 184 also serve the DART station in Greystones in the southern direction on their way to Newcastle/Kilcoole and Newtownmountkennedy, respectively from the Redford stops 4214 or 4215. Passengers of route 184 have the option to transfer to the DART at Bray Station, where the route terminates.

5.5 The transport fares and ticketing products are designed by the NTA to encourage bus/rail/LUAS transfers, e.g. via the LEAP card and other ticketing products. The current DART frequency northwards from Bray, is now, post-pandemic, operating at 10 minute headways and is a very attractive for bus passengers wishing to interchange on their way towards Dublin.

5.6 The nature of the bus fleet operating on any given route can gives a useful insight into the scale of demand anticipated by the NTA and the operator of that route, all other things being equal. If the service is operated by single deck buses this indicates that demand on the route is relatively low and that the level of peak patronage rarely, if ever, exceeded the capacity of that bus type. Many orbital routes serving local areas have single deck operation. Route 84 and 84X are double-deck routes, reflecting the strong peak nature of their loadings. Route 84X is a limited stop service that is quite tidal in nature, in that the demand for transport is almost exclusively in the northbound direction towards UCD, Donnybrook and Dublin City Centre in the morning, and the opposite in the evening. The service offers 12 northbound morning trips but only 7 return services in the afternoon/evening peak. The parent route 84, also a double-deck operation, only operates as far as Blackrock village. On the other hand, route 184 forms the backbone of the North Wicklow bus network in that it links Bray with Greystones (past the subject site), before serving Delgany and Newtownmountkennedy. It interchanges with the DART network at two locations, Bray and Greystones. While predominantly a single-deck operation (as specified in the NTA contract), a small number of scheduled trips have double-deckers allocated to them to meet the demands of schoolchildren for transport, arising from the many schools in the Vevay Road area of Bray.

5.7 There is a new NTA-funded Bus Interchange proposed for Bray DART Station. This proposal has been put through the Part 8 planning process by Wicklow County Council and is scheduled for construction in 2022. The new layout to the front of the station will radically improve the public domain, enhance public safety and increase the operational efficiency of the Interchange in time for the route upgrades and alterations anticipated with the Bus Connects project.

6. Public Transport Capacity Assessment

6.1 The purpose of this analysis is to determine whether or not the demand for public transport, here primarily bus services, generated by developing the Coolagad site will not put the existing bus (or rail) services under undue pressure. A series of surveys have been undertaken at nearby bus stops to demonstrate that the additional demand will not overload the existing levels of public transport services.

6.2 The demand profile for public transport services, like road traffic, is quite seasonal in nature.

- Demand for bus services, in general, is materially lower in the Summer and school holiday periods.

- Demand tends to be somewhat higher in the late Autumn and in the run up to the busy Christmas holiday. Surveying in the none-holiday weeks in the opening four months of the year, and early Autumn, represent a reliable indication of base-level pre-development expressed demand for transport.

- Demand also varies by day of the week, with traffic demand generally lower on Mondays and Fridays, with some exceptions. Public transport usage on Saturdays and Sundays (in particular) are materially lower than mid-week demand.

- Demand for bus travel varies throughout the standard weekday but morning peak- hour levels are shorter but higher than the corresponding evening peak flows.

6.3 In determining whether spare capacity is available to meet increasing demand from any development site it is best to undertake surveys and test the mid-week morning peaks prior to the Summer period when schools are open. The, perhaps, temporary negative implications for public transport demand due to the reduced commuter travel caused by Covid-19 related restrictions is addressed later in section 6.7.

6.4 Surveys of public transport usage were undertaken by Aecom on Wednesday, 9th February, 2022 to establish the current level of bus patronage at the Coolagad site. These have been undertaken at a suitably representative time of the year, as identified in 6.2 above. The relevant data have been reproduced here. The northbound buses were surveyed at stop 4297, the bus stop closest to the site entrance. Bus capacity for the purposes of this analysis is taken, conservatively, as the seated capacity only, which understates the true capacity of buses.

Table 1. Northbound Buses (Stop 4297) in the AM Peak (towards Bray/Dublin)

Time	Route	Bus Type	Passengers	Bus capacity	% Spare Capacity
6.54	184	Single	2	40	95
7.16	84	Double	10	67	85
7.24	184	Single	2	40	95
7.48	84	Double	10	67	85
7.52	184	Double	15	67	78
Average			8		88

The corresponding surveys taken at southbound stop 4214 show similar low levels of passengers loading on these key commuter and local bus routes:

Table 2. Southbound Buses in the AM Peak (towards Greystones/Newtownmountkennedy)

Time	Route	Bus Type	Passengers	Seated Bus Capacity	% Spare Capacity
7.10	184	Single	10	40	75
7.23	84	Double	10	67	85
7.39	184	Single	5	40	88

8.09	184	Single	15	40	63
Average			10		78

6.5 In order to get a more complete picture of the demand for buses in this area it was decided to undertake a second survey at bus stop 4296, which, as indicated above, is only 260m from the site entrance. Under the “generalised cost” concept it is widely recognised in traffic engineering that potential bus users at this more distant stop from the Coolagad site would trade-off the slightly longer walk in order to access the benefits of the more frequent and faster commuter route 84X. This second survey of passenger usage, on Tuesday March 8, 2022 yielded the following data

Time	Route	Bus Type	Passengers	Bus capacity	% Spare Capacity
7.09	84X	Double	15	67	78
7.13	84	Double	12	67	82
7.20	84X	Double	10	67	85
7.22	184	Single	7	40	85
7.29	84X	Double	21	67	78
7.37	84X	Double	10	67	85
7.47	84	Double	10	67	85
7.49	184	Double	13	67	81
7.52	84X	Double	31	67	54
8.06	84X	Double	32	67	52
8.09	84X	Double	13	67	81
8.13	702	Coach	N/A	N/A	-
8.21	184	Single	28	40	30
8.22	84	Double	47	67	30

TOTAL			249		70

Table 3. Northbound Buses (Stop 4296) in the AM Peak (towards Bray/Dublin)

Passenger loadings of the buses stopping at this second stop (4296) are materially higher than those at the next stop, 4297. Nevertheless, there is more than adequate spare capacity on all the routes.

6.6 It was clear from observing passengers arrive at this stop that they were targeting specific buses, particularly route 84X. This was by far the busier route, accounting for 53% of passengers surveyed. This service is tailored for commuters to Dublin city centre and UCD-bound students. The departures are designed to reach these key destinations in time for 09.00 (or earlier) starts. The departures on route 84X either side of 08.00 were noticeably busier as can be seen in Table 3 above. The passenger loadings on the shoulder of this peak are lower. Future residents in Coolagad would favour walking to stop 4296 to avail of this express service. The current footpath infrastructure also favours this stop. It has both a good shelter and re-assuring Real Time Passenger Information (RTPI) unit. The local 184 service was used by many schoolchildren, many of whom alighted at this stop for the local schools. Like route 84, it also carried commuters towards Bray.

6.7 The surveys and analysis clearly show that there is a significant level of spare capacity in the current bus service in the peak hour in both directions at the point in the network adjacent to the Coolagad site. In addition, survey data of this nature suggests that there is more than adequate spare capacity on buses in both directions to meet the increased demand arising from the public transport trips generated from the TRICS analysis, as determined in the Aecom TTA. This same bus capacity analysis, post planned construction, with the generated public transport trips is now assessed in 6.6.

6.8 The output of the TRICS analysis undertaken by Aecom (in their sister report as part of the Coolagad TTA) was an additional 24 public transport generated trips leaving the site in the am peak. This was assumed to be distributed roughly 80/20 northbound/southbound, broadly in line with Dublin-bound commuter patterns. This resulted in each of the surveyed five northbound bus trips allocated an additional four passengers. The balance of four generated passengers were allocated, one each, to the four southbound bus trips.

Table 4. Northbound Buses (Stop 4297), with generated trips, in the AM Peak (towards Bray/Dublin)

Time	Route	Bus Type	Passengers	Bus capacity	% Spare Capacity
6.54	184	Single	6	40	85
7.16	84	Double	14	67	79
7.24	184	Single	6	40	85
7.48	84	Double	14	67	79
7.52	184	Double	19	67	72
Average			12		80

Table 5. Southbound Buses, with generated trips, in the AM Peak (towards Greystones/Newtownmountkennedy)

Time	Route	Bus Type	Passengers	Seated Bus Capacity	% Spare Capacity
7.10	184	Single	11	40	72
7.23	84	Double	11	67	84
7.39	184	Single	6	40	85
8.09	184	Single	16	40	60
Average			11		75

Repeating the analysis completed in Tables 1 and 2 in 6.4 above, the spare capacity, including TRICS generated passengers, northbound and southbound, is shown in Table 4 and Table 5

respectively. As can be seen from the summary Table 6 spare bus capacity, with generated passengers included, remains high at 80% and 75% respectively.

Table 6. Spare Capacity (Stop 4297), post development, remains high.

Direction	Average passengers	TRICS increase/bus	Existing Spare Bus Capacity	Future Spare Bus Capacity
Northbound	8	4	88	80
Southbound	10	1	78	75

The output of the second survey at stop 4296 suggests a lower level of spare capacity, especially on route 84X, but it remains high by industry standards. The effects of the distribution of the generated trips are marginal when spread over the higher number of buses from stop 4296. The negative impacts of Covid-19 are clear to see. The extent to which this suppressed demand might return is discussed in 6.10 below.

Sensitivity Test

6.9 The assumptions about modal split inherent in the TRICS data in the Aecom TTA (Appendix E, Table 3), and outlined in 6.8 above, were subjected to a sensitivity test. This was undertaken to further test the resilience of the bus network. For this test it was assumed that

- 15% of the trips leaving the site in the AM peak hour are made by bus, a marked increase on the TRICS output.

- The bus trips are again split 80:20 into northbound:southbound direction, as above.

- 60% of these trips are assigned to buses in the busiest 30 minutes, as determined in the survey (part of the peak hour for bus travel), recognising a “peak within a peak”.
- The trips are then spread evenly over the buses in this busy 30 minute time-band.
- The base data is from the busiest northbound stop (4296)

The generated TRICS data from the Aecom TTA totalled 576 leaving the site in the peak hour. Under the test 15%, or 86 person trips, were assumed to travel by bus. This reduces to 69 passengers travelling northbound following the 80/20 split. Allocating these trips using the above assumptions increases passengers on all five scheduled buses between 07.52 and 08.22, the busiest 30-minute time-band. Each bus is allocated an additional fourteen passengers.

The sensitivity test, shown in Table 7 below, takes the form of the heaviest loaded buses, at the busiest bus stop, each being allocated an extra fourteen passengers.

Time	Route	Bus Type	(Revised) Passengers	Seated Bus Capacity	% Spare Capacity
7.52	84X	Double	45	67	33
8.06	84X	Double	46	67	31
8.09	84X	Double	27	67	60
8.21	184	Single	42	40	(5)
8.21	84	Double	61	67	9

Table 7. Sensitivity Test Results. Higher allocation of generated trips to buses.

These quite onerous modal share assumptions, involving a materially higher allocation to the bus mode, in this sensitivity test indicates more than adequate spare capacity passing the subject site. While the single decker bus on route 184 in table 7 requires two passengers to

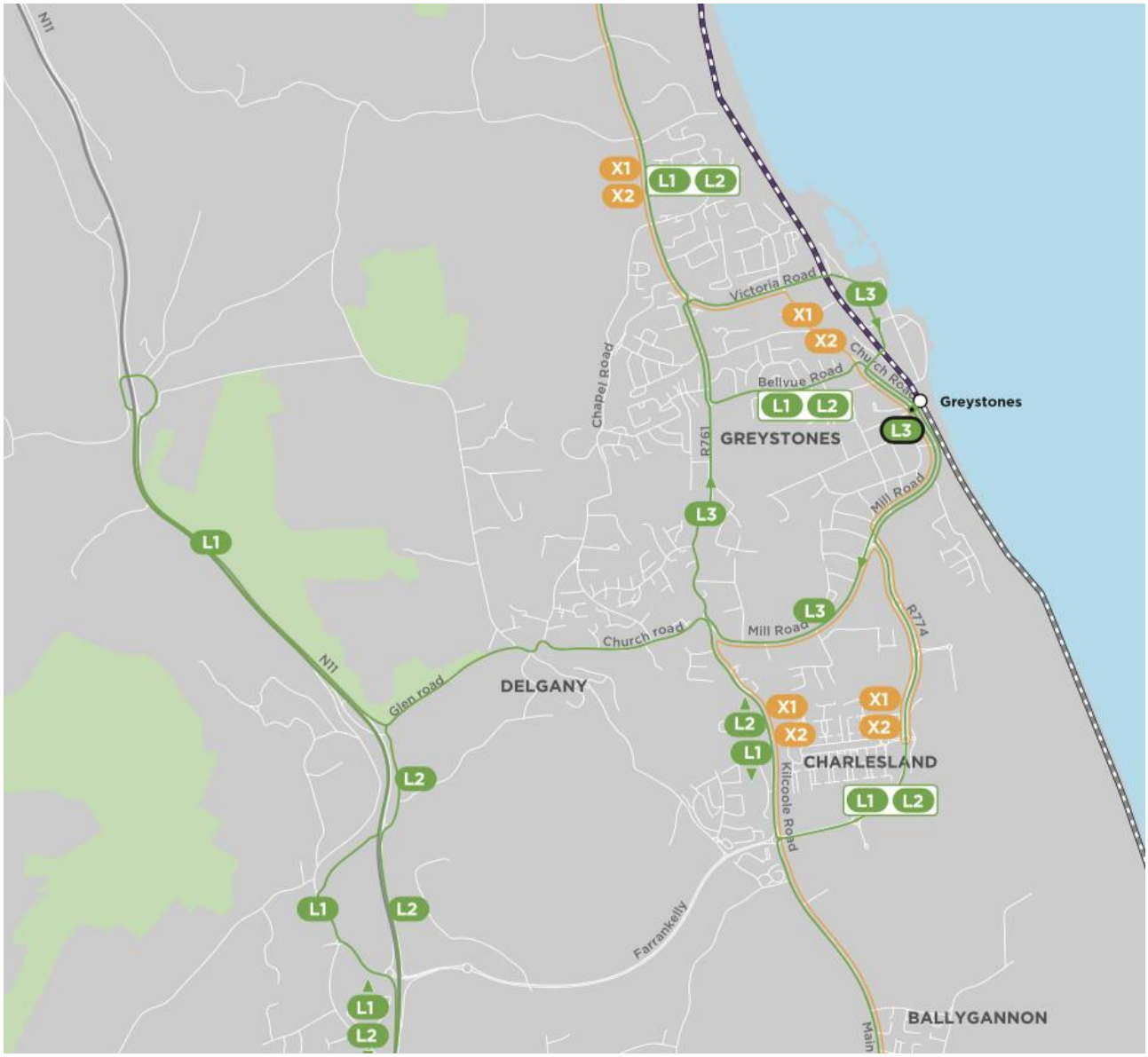
stand under this scenario, this is still well within the overall design capacity of 68 passengers (40 seated, 28 standing) for this bus type. Under the Bus Connects proposals for this area, expected to be implemented in 2023, frequency on the equivalent route(s) will significantly increase in any case. This is detailed in section 7 below.

6.10 The artificially low volumes of commuters due to the impacts of Covid-19 are partly reflected in the survey data. The extent to which they will recover back to “normal” levels is unclear. Bus patronage generally in Ireland is at approximately 70 - 75% of pre-Covid levels. This is similar to the trend in the Uk also. Factoring up the surveyIncreasing numbers by 33%, to get them to approximate “normal” levels, does not suggest any capacity impact of any consequence. There is, of course, no guarantee that commuter levels will ever fully recover with increased levels of WFH becoming more established, and being legislated for. The data from the surveys show that capacity utilisation is quite low at this peripheral point in the network. In addition, should the need arise, the first service alteration would likely be the full conversion of single deck buses on route 184 to double-deckers, leaving aside any Bus Connects changes. This fleet change increases seated capacity from 40 to 67 passengers, or by 68% and total capacity, including standees still further. There is no suggestion from our survey data that this capacity upgrade is required any time soon. The Bus Connects proposals will likely be the next material change to services in the North Wicklow area. These are now discussed.

7. Bus Connects in Greystones and North Wicklow.

7.1 While the Bus Connects project largely covers the built up area of Dublin it does extend as far south as Greystones and beyond to take in the operational areas of the routes under consideration here. The network of services arising from the major review in North Wicklow is shown in Figure 1 below.

Figure 1. Bus Connects Map for North Wicklow.



The output from figure 1 is best illustrated in Table 8 below.

Existing Route	Bus Connects Replacement	Frequency

84	None	N/A
84X	X1 and X2	Reduced in am peak
184	L1 and L2 combined	Increased Mon/Fri
None	L3	Every 30 minutes

Table 8. Comparison of Current and Proposed Bus Connects Network.

7.2 In the proposed Bus Connects network, expected to be introduced ahead of the planned Coolagad development, the most significant alterations to the network are as follows

- The removal of route 84 which currently operates towards Blackrock Village.

- The existing route 184 is replicated by a combination of L1 and L2 (which operate clockwise and anti-clockwise loops between Greystones and Newcastle, via Newtownmountkennedy). This revised design, in effect, results in two material changes. Firstly, it extends the current 184 route to Newcastle and secondly, critically, increases its frequency from every 30 to every 20 minutes past the Applicant's site during each weekday. While the resultant increased frequency between Newcastle and Bray may account for the removal of route 84, it also means that nearly all buses interchange with both Greystones and Bray DART Station, in both directions.

- Direct connections to Dublin in the peaks only are maintained with the X1 and X2 services. There is no direct link to Dublin in the off-peak periods, or at weekends. These express routes are designated by the NTA as direct replacements for the 84X. Both services are nearly identical but route X1 operates to/from Kilcoole, while X2 extends further south to Newcastle. The Bus Connects "frequency table", when compared with the existing Dublin Bus website, suggests that the number of AM peak buses will reduce from 12 to 9 while the evening peak service increases from 7 to 9 buses. The current imbalance between am and pm peak services is eliminated.

- The novel element of the Bus Connects plan for North Wicklow is the proposed introduction of the clockwise only internal loop service around Greystones. It starts and finishes at Greystones DART Station. One of the “Public Transport Objective” of the current Wicklow County Development Plan requires that

“developers of large-scale new employment and residential developments in the designated key towns in the County that are distant (more than 2km) from train/Luas stations to fund/provide feeder bus services for an initial period of at least three years”.

- This strongly suggests that the NTA (and Wicklow County County) wish to actively encourage more bus/rail interchange at Greystones DART Station. The proposed L3 frequency, every 30 minutes, matches the current DART frequency and one would anticipate that the timetable will be designed accordingly. This planned route, in my view, is likely to be extended to better serve the newer residential areas, including Coolagad. In this case the frequency is likely to be improved to enhance connectivity throughout the Greystones hinterland.

7.3 The above analysis strongly suggests that the revised bus network will strengthen internal linkage within North Wicklow with both improved frequencies on the L1/L2 routes past the subject site and the new L3 service. The proposed X1 and X2 peak services can easily be expanded, if required, with the additional of extra buses. While the new circular route, as can be seen from the graphic in Figure 1 above, does not currently serve the Coolagad site, it opens up the possibility of it being extended close to the site (possible along the Blacklion Manor Road) when implemented in 2023. The proposed pedestrian linkages eastwards towards Blacklion Manor Road will facilitate access to this extended L3, were it to happen. The net effect of three existing routes (84, 84X, 184) being replaced by the two combinations of L1/L2 and X1/X2 and an entirely new local Greystones feeder route is extremely positive for potential residents of Coolagad.

8 Conclusions

8.1 The likely impact of the planned development of the Coolagad site in Greystones on the capacity of the existing bus network has been assessed. There are two key conclusions. Firstly, surveys undertaken by Aecom and the report writer, and the subsequent analysis of bus capacity above, strongly suggest that there is more than adequate existing spare capacity in the local North Wicklow bus network. A further sensitivity test, allocating more trips to public transport, confirms this position. Secondly, the Bus Connects future network proposals, planned by the NTA to commence in 2023 will serve to enhance bus capacity by increased frequency past the site and increase buses' attractiveness to residents in the Coolagad site. Any proposal to extend the planned local, circular route close to the site will enhance connectivity with the DART Station in Greystones and further facilitate the important modal split objectives of the NTA. Good access from the subject site to the two existing sheltered bus stops, together with the range of services, will encourage more use of the bus network.

APPENDIX 12 C AECOM PUBLIC TRANSPORT OCCUPANCY SURVEY

Project:	**Coolagad**	Job No:	**60641912**
Subject:	**Bus Service Occupancy**		
Prepared by:	**Hilary Herlihy**	Date:	**10 February 2022**
Checked by:	**Patrick McGeough**	Date:	**14 February 2022**
Approved by:	**Tim Robinson**	Date:	**23 February 2022**

Introduction

Cairn Homes Properties Limited, intend to apply to An Bord Pleanála for planning permission for a strategic housing development at this site of c.26.03ha at 'Coolagad', Greystones, Co. Wicklow. As part of this proposed planning application, AECOM has been commissioned by Cairn Homes Properties Limited to undertake a Traffic and Transport Assessment for the subject site.

As part of the Traffic and Transport Assessment, this note has been compiled in order to assess the existing public transport routes available and the associated carrying capacity for expected peak times for public transport use, in order to assess if the existing public transport network may adequately support the proposed development's public transport requirements.

Figure 1 – Proposed Site Location

Proposed Development

The proposed development consists of:

- 586 residential units including:
  - 351 two storey houses (207 no. 3 bed, 140 no. 4 bed, 4 no. 5 bed) comprising detached, semi detached and terrace units
  - no. apartments (65 no. 1 bed, 123 no. 2 bed, 15 no. 3 bed) provided within 6 no. blocks ranging from three to four-storey (over basement) with residential amenity facilities.
  - 32 no. duplex units (16 no. 2 bed and 16 no. 3 bed units) c. 5,192 sqm of communal open space is provided to serve the proposed apartment/duplex units;
- Community building (single storey) of 393 sq.m. with 29 car parking spaces, which includes changing rooms and multipurpose room and ancillary facilities.
- Creche building of 734 sq.m. with 21 car parking spaces
- Provision of a new vehicular entrance with signalised junction from the R761 (Rathdown Road), to the north of Gate Lodge, Rathdown Road opposite Sea View and Redford Cemetery, providing a distributor road (and future vehicular connection to lands to the west) as part of the long-term objective to provide a northern access route from Greystones to the N11 and provision for future vehicular connection to lands to the south
- Provision of pedestrian and cycle connections to the site boundary with land to the east and south.
- Car parking spaces is provided in a mix of basement level for the apartments and off-street for the houses and duplexes. This includes:
  - 702 on curtilage car parking spaces for the houses;
  - 206 car parking spaces at basement level and 5 at surface level for the apartments;
  - 32 spaces for the duplex unit and 10 visitor spaces at surface level
  - 22 motorbike parking spaces and 422 cycle spaces (310 secure spaces and 112 visitor spaces) are also provided.
  - The development also includes site development infrastructure, a hierarchy of internal streets including bridges, cycle paths & footpaths; new watermain connection and foul and surface water drainage; the development also provides for the construction of a new public sewer along the R761/R762 from the site entrance as far as the R762 in front of St. Kevin's National School, Rathdown Road, Greystones.
  - c.10.43ha open space to include a sport field, a MUGA, private, communal and public open spaces (including enhancement of an existing stream), formal and informal play areas, and new boundary treatments.
  - ESB substations/switchrooms, lighting, site drainage works and all ancillary site development works above and below ground.

The proposed development schedule of residential accommodation is shown in Table 1:

Table 1 – Schedule of Residential Accommodation

Land Use	Type	Quantum
Apartments	Standard – 1 Bed	65
	Standard – 2 Bed	123
	Standard – 3 Bed	15
	2 Bedroom Duplex	16
	3 Bedroom Duplex	16
Houses	3 Bedroom	207
	4 Bedroom	140
	5 Bedroom	4
Total		**586**

In addition to residential dwellings and creche / community space the development proposals also include for related internal road network, landscaping, open space and connection to the Coolagad Link Road.

Proposed Trip Generation

In order to compare the potential vehicle trip generation for the subject site, trip rates were taken from the industry standard TRICS (Trip Rate Information Computer System) for the proposed land uses using the latest version of the software (version 7.7.3). A multi-modal assessment was undertaken to determine the potential trip generation associated with various modes of travel such as pedestrian, cyclists, public transport and vehicles. Table 2 indicates the proposed trip rates for a mixed residential development comprising (private) houses and apartments with Table 3 showing the predicted trip generations for the various modes of travel to / from the proposed development during the AM (08:00 – 09:00) and PM (15:00 – 16:00) peak hour periods.

It is assumed that trips associated by the creche / community facility would originate from within the residential element of the site and are therefore also accounted for in Table 2.

Table 2 Proposed Trip Rates

Mode of Travel	AM (08:00 - 09:00)		PM (15:00 - 16:00)	
	Arrivals	Departures	Arrivals	Departures
Vehicle	0.158	0.534	0.351	0.262
Vehicle Passenger	0.033	0.281	0.185	0.107
Cyclist	0.002	0.012	0.007	0.004
Pedestrian	0.018	0.065	0.067	0.051
Public Transport	0	0.039	0.032	0.002

It can be determined that the trip rates in Table 3 are generally more robust and therefore considered most applicable.

When the above trip rates are used in conjunction with the schedule of accommodation of the proposed development (619 units), the resulting trip generations are shown in Table 3.

Table 3 – Proposed Trip Generation

Mode of Travel	AM (08:00 - 09:00)		PM (17:00 - 18:00)	
	Arrivals	Departures	Arrivals	Departures
Vehicle	98	331	217	162
Vehicle Passenger	20	174	115	66
Cyclist	1	7	4	2
Pedestrian	11	40	41	32
Public Transport	0	24	20	1

Table 3 outlines that the estimated total vehicular movements by the proposed development during the morning and evening peak hours is **428** and **379** two-way flows, respectively. Given the good level of walking, cycling and public transport availability in proximity to the site, it is considered that these figures are particularly robust and through adoption of a Mobility Management Plan it would be anticipated that the level of active travel and sustainable trips could be much higher than those calculated using TRICS. This would also result in a lower level of vehicle trips.

Sustainable Transport – Bus Services

As graphically illustrated in Figure 2, the site benefits from good bus transport connections shown by the bus stops along Rathdown Road, allowing residents to travel by this sustainable mode.

The closest bus stops are located along the R761 Rathdown Road approximately 100m north of the proposed edge of site and approximately 800 m walk (6min) from the centre of the site. Two stops are located to the south of the R761 / Black Lion Manor Road / Redford Park junction adjacent to the Lidl store. These bus stops are operated by Dublin Bus, Go Ahead and Aircoach, who provide services to Dublin Airport. A further two bus stops are located approximately 70m north of the proposed R761 / Coolagad Link Road junction, although these are not serviced by the Aircoach service to Dublin Airport. Figure 2 illustrates the location of the bus stops in relation to the development with Table 4 to Table 7 detailing the number of services per day and the routes.

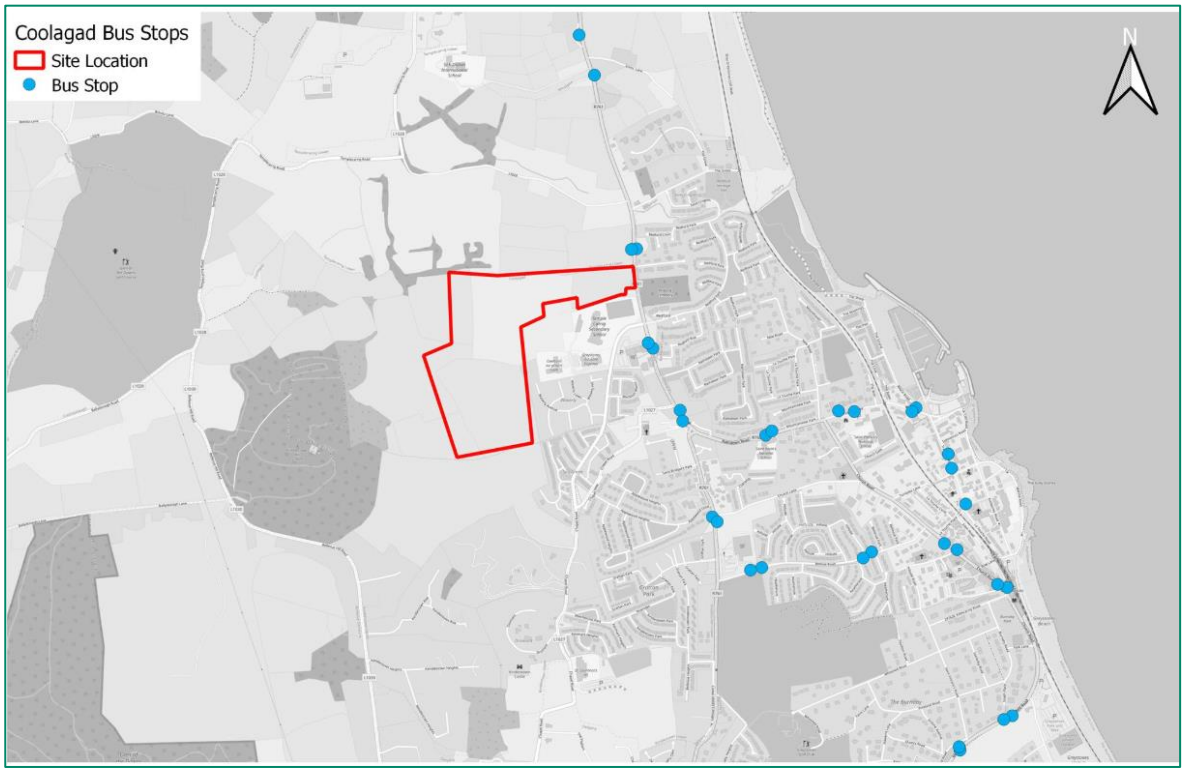


Figure 2 – Bus Stops in Vicinity of the Site

Table 4 – Bus Services Timetabling Summary at Greystones Redford Park

Service Number	Service Provider	Route	Monday - Friday	Saturday	Sunday
84	Dublin Bus	Temple Road – Newcastle Road (Sea Road)	Hourly Service (0520-2308)	Hourly Service (0535-2349)	Hourly Service (0919-2347)
184	Go-Ahead Ireland	Newtownmountkennedy - Bray Station	Half Hourly Service (0652-2321)	Half Hourly Service (0701-2321)	Half Hourly Service (0910-2340)
702	Aircoach	Dublin Airport - Greystones	8 Services (0419-1809)	8 Services (0419-1809)	8 Services (0419-1809)

Source: https://bustimes.org/map#16/53.1541/-6.082

Table 5 – Bus Services Timetabling Summary at Greystones Opposite Redford Park

Service Number	Service Provider	Route	Monday - Friday	Saturday	Sunday
84	Dublin Bus	Temple Road – Newcastle Road (Sea Road)	Hourly Service (0439-0019)	Hourly Service (0740-0031)	Hourly Service (1127-0020)
84N	Nitelink, Dublin Bus	Dublin – Delgany	No Service	2 Hourly Service (0054-0454)	2 Hourly Service (0054-0454)
84X	Dublin Bus	Trinity College - Beechdale Estate	5 Services (1657-1840)	No Service	No Service
184	Go-Ahead Ireland	Newtownmountkennedy - Bray Station	Half Hourly Service (0638-0003)	Half Hourly Service (0628-2336)	Half Hourly Service (0836-2336)
702	Aircoach	Dublin Airport - Greystones	8 Services (0419-1809)	8 Services (0419-1809)	8 Services (0419-1809)

Source: https://bustimes.org/map#16/53.1541/-6.082

Table 6 – Bus Services Timetabling Summary north of Sea View (northbound)

Service Number	Service Provider	Route	Monday - Friday	Saturday	Sunday
84	Dublin Bus	Temple Road – Newcastle Road (Sea Road)	Hourly Service (0520-2308)	Hourly Service (0535-2349)	Hourly Service (0919-2347)
184	Go-Ahead Ireland	Newtownmountkennedy - Bray Station	Half Hourly Service (0652-2321)	Half Hourly Service (0701-2321)	Half Hourly Service (0910-2340)

Source: https://bustimes.org/map#16/53.1541/-6.082

Table 7 – Bus Services Timetabling Summary north of Sea View (southbound)

Service Number	Service Provider	Route	Monday - Friday	Saturday	Sunday
84	Dublin Bus	Temple Road – Newcastle Road (Sea Road)	Hourly Service (0520-2308)	Hourly Service (0535-2349)	Hourly Service (0919-2347)
84N	Nitelink, Dublin Bus	Dublin – Delgany	No Service	2 Hourly Service (0054-0454)	2 Hourly Service (0054-0454)
184	Go-Ahead Ireland	Newtownmountkennedy - Bray Station	Half Hourly Service (0652-2321)	Half Hourly Service (0701-2321)	Half Hourly Service (0910-2340)

Source: https://bustimes.org/map#16/53.1541/-6.082

Site Observations - AM and PM Peaks

On February 9th 2022, AECOM went on site to the R761 to bus stops number 4297 (city bound) and 4214 (Greystones Bound). Observations were taken from 06:50 to 08:10 as this was estimated to be the time that would take commuters to travel from the proposed subject site towards key employment destinations via public transport such as Dublin city centre, Greystones and Bray and various stops along public transport services. With travel time to Dublin by bus being 1 hour and 20 mins, commuters would therefore need to be on the bus at Redford (R761) for 07:00 to 07:30 to reach their place of work or education by 08:30 – 09:00.

The subject site's nearest bus stop is located along the R761, near Redford. There is pedestrian footway on the southbound side of the road only. On the northbound side of the road (proposed site side) there is no pedestrian footway and public street lighting.

Figure 3 below illustrates the bus stop and location in relation to the subject site that was monitored during the morning peak hour of February 9th 2022.

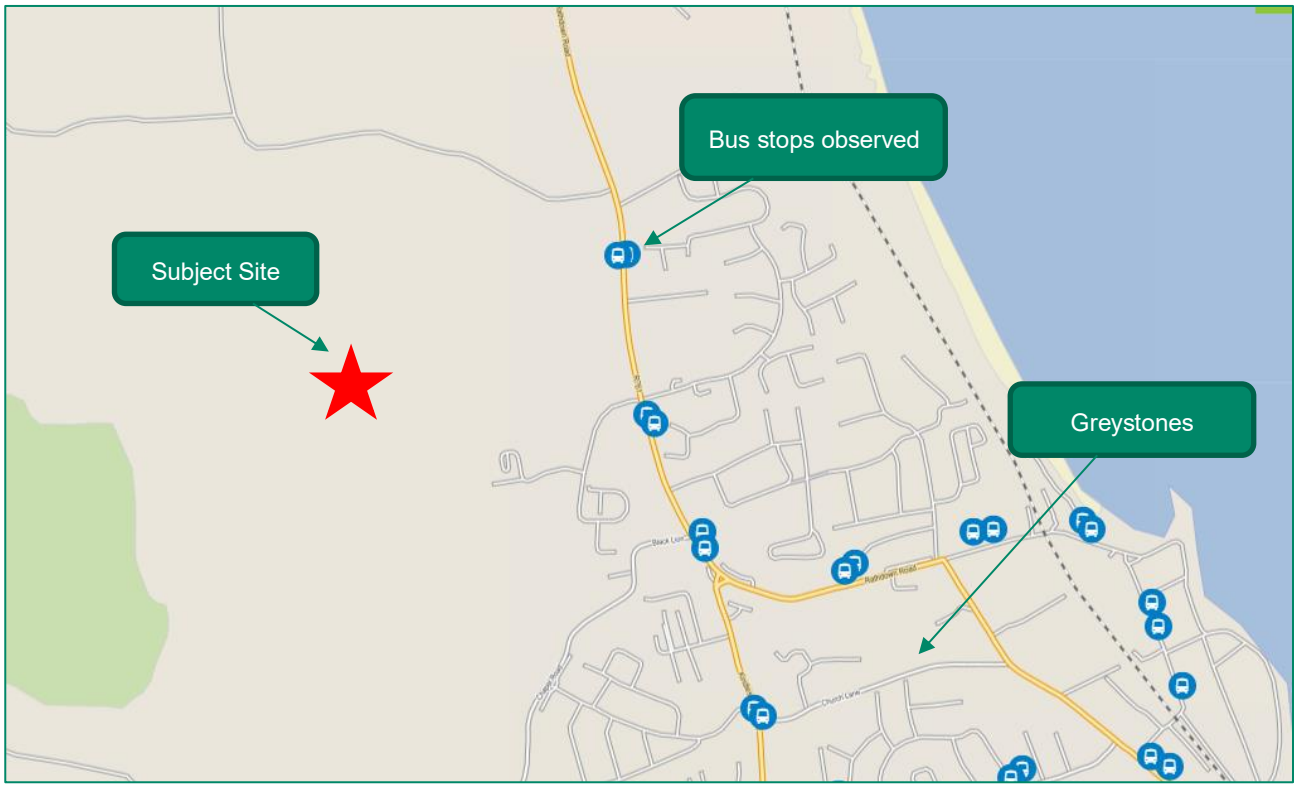


Figure 3 Bus stop locations in the relation to the subject site.

Greystones AM Peak

During the site visit, the bus occupancy and services were recorded, as per Table 6 below. As seen in the tables below, the peak period there is reserve capacity within the bus services operating at the subject site along the R761.

Table 8 North Bound Bus Service Observations Redford

North Bound (to Dublin City and Bray)					
Time	Service Number	Scheduled to stop	Deck	No. of Passengers aboard service	Reserve Capacity available?
06:54	184	yes	Single	2	Yes
07:16	84	Yes	Double	10	Yes
07:24	184	Yes	Single	2	Yes
07:48	84	Yes	Double	10	Yes
07:52	184	Yes	Double	15	Yes

Table 9 South Bound AM Observations Redford

South Bound (to Greystones)					
Time	Service Number	Scheduled to stop	Deck	No. of Passengers aboard service	Reserve Capacity available?
07:10	184	yes	Single	10	Yes
07:23	84	yes	Double	10	Yes
07:39	184	yes	Single	5	Yes
08:09	184	yes	Single	15	Yes

It is noted that whilst services were scheduled to stop at the Redford Bus Stop, services did stop, as there were no boarding or alighting passengers across the AM peak period. It is also noted that there is adequate capacity for all buses which were scheduled to stop at the site in the AM peak period, meaning the existing public transport network should be able to support the proposed development's public transport trips in the AM Peak period.

Bray DART Station PM Peak

On February 9th 2022, AECOM attended at Bray Train Station to observe the bus services and the capacity levels of specific routes that would go to the proposed development location for a return journey for Dublin or Bray in the PM peak when commuters are returning home from, work. The site visit began at 5:15pm and Finished at 7pm. The rationale for the site visit timing was based off an assumed peak period for commuters, workers and students leaving Dublin city at 5:30pm or earlier to catch a DART to Bray train station and further to proceed onto the bus system to get to their desired location. It was observed that although many arrived at the train station by way of DART that a large percentage went on foot for the next portion of their journey, or they were being collected outside the train station by vehicles. Of those that did use the bus system the table below outlines the bus service number, the time it departed the train station and the number of passengers aboard the service

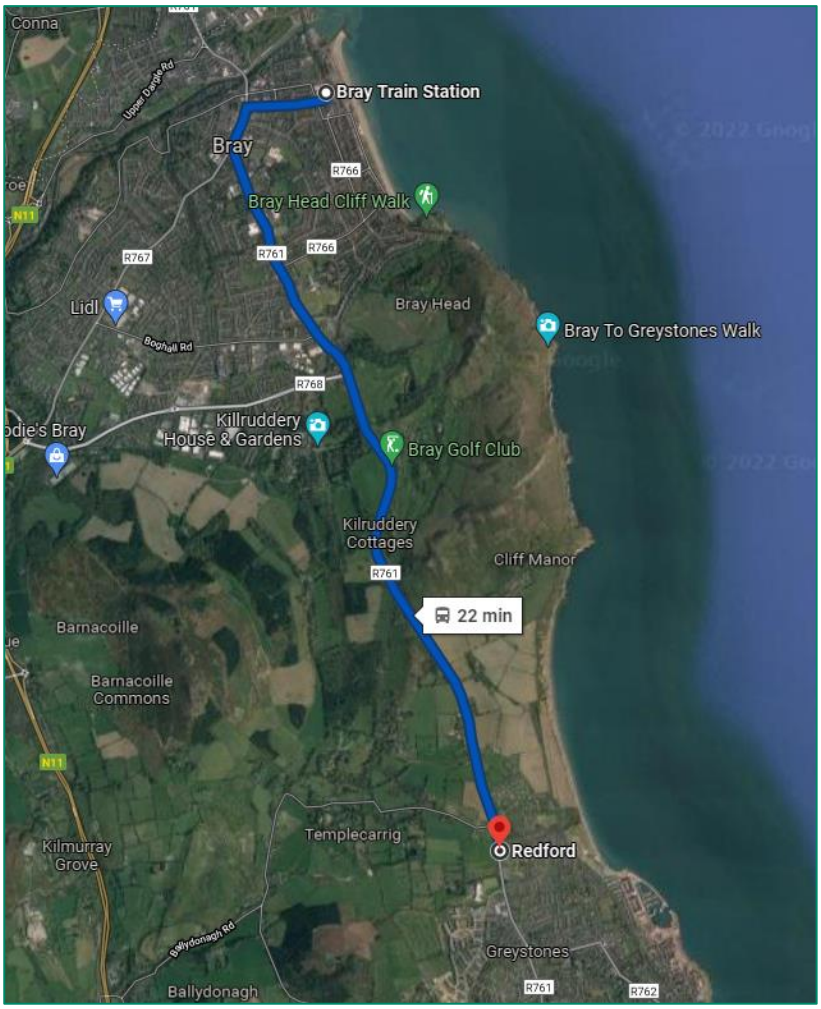


Figure 4 Route From Bray Train Station to the proposed site via the bus service no. 184.

Table 10 Bray DART Station PM peak observations

Bray Dart Station stop number 4168 PM					
Time	Service Number	Destination	Deck	No. of Passengers	Reserve capacity
17:24	84	Newcastle	Single	3	yes
17:38	84	Blackrock	Double	1	yes
17:40	184	Newtown Mountkennedy	Single	8	yes
17:49	84	Blackrock	Double	3	yes
17:50	84	Blackrock	Double	8	yes
18:06	184	Newtown Mountkennedy	Double	3	yes
18:40	84	Blackrock	Double	2	yes
18:47	84	Newcastle	Double	8	yes

The above services show that the bus services running between Bray Dart Station and the Subject site to the south operate with reserve capacity, even with additional trips departing from the DART and alighting for southbound journeys towards the proposed development site where DART journeys terminate at Bray and do not continue on towards Greystones.

It is also noted that there is adequate passenger capacity on all buses which were scheduled to stop at the site in the PM peak period, meaning the existing public transport network should be able to support the proposed development's public transport trips in the PM Peak period.

Summary and Conclusions

AECOM undertook an on-site survey on 9th February 2022 to assess the existing public transport services, their existing occupancy and reserve capacity as part of the Traffic and Transport Assessment for the proposed development site at Coolagad, Greystones, Co. Wicklow. As presented in the note above, there are adequate services and capacity to support the proposed development and to suggest that commuters travelling via public transport from the proposed development site should not have significant effects on the existing public transport network available to the proposed development site.

A part of the TTA AECOM have identified 3 no. of developments that have planning permission and are developed and operational or partially developed within the area. The additional trip generation impact on public transport from these developments is considered to be negligible.

It was observed that commuting trips via public transport were being undertaken at the time of surveys being carried out. However, it was observed and assumed that passenger levels had not quite returned to pre covid levels, and therefore it would be assumed that whilst the number of commuters may rise, however there would still be expected to be reserve capacity for commuters availing of public transport services for the proposed development site based on surveys carried out.

APPENDIX 12D GO CAR LETTER

Cairn Homes
7 Grand Canal
Grand Canal Street Lower
Dublin 2

28/03/2022

To Whom It May Concern,

This is a letter to confirm that GoCar intends to provide a car sharing service in the "Coolagad" residential development located at Greystones, Wicklow. GoCar representatives have discussed the project with representatives of Cairn Homes and are excited to provide a car sharing service at this location. The development consists of approximately 586 dwellings within the Coolagad area of Wicklow. The developer proposes to have available 1 vehicle for public service at surface level within the development.

GoCar is Ireland's leading car sharing service with over 60,000 members and over 850 cars and vans on fleet. Each GoCar which is placed in a community has the potential to replace the journeys of up to 15 private cars. The Department of Housing's Design Standards for New Apartments - Guidelines for Planning Authorities 2018 outline: "For all types of location, where it is sought to eliminate or reduce car parking provision, it is necessary to ensure... provision is also to be made for alternative mobility solutions including facilities for car sharing club vehicles."

Carsharing is a sustainable service. By allowing multiple people to use the same vehicle at different times, car sharing reduces car ownership, car dependency, congestion, noise, and air pollution. It frees up land which would otherwise be used for additional parking spaces. Most GoCar users only use a car when necessary and walk and use public transport more often than car owners.

By having GoCar car sharing vehicles in a development such as this, the residents therein will have access to pay-as-you-go driving, in close proximity to their homes, which will increase usership of the service.

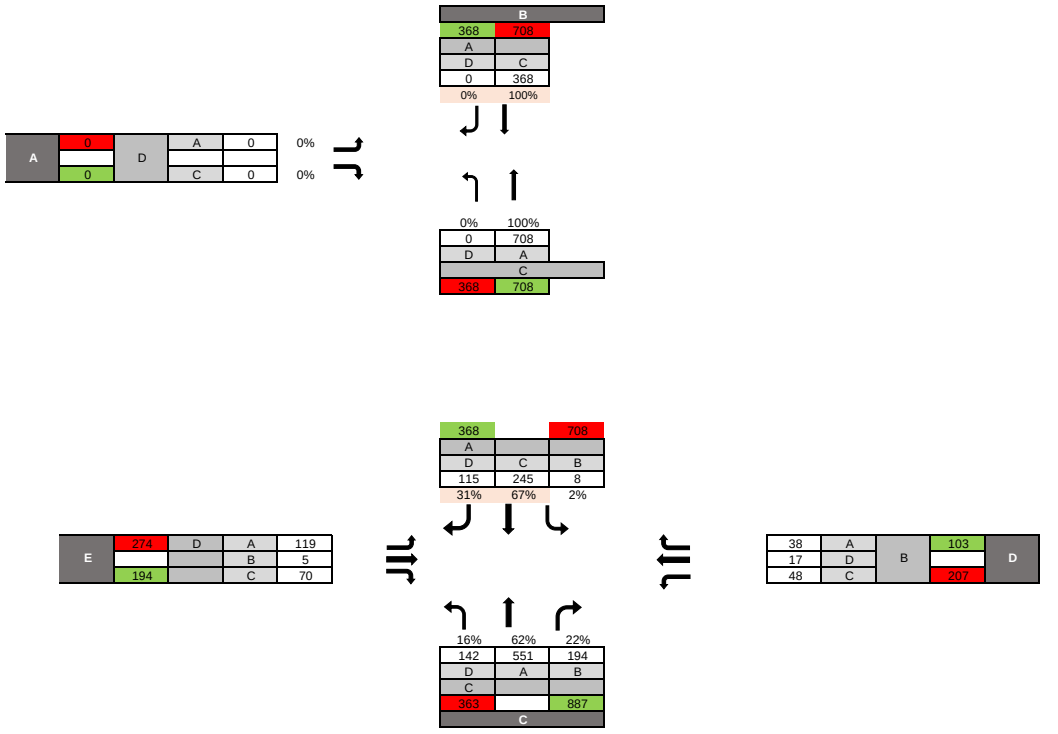
I trust that this information is satisfactory. For any queries, please do not hesitate to contact me.

D Ralston

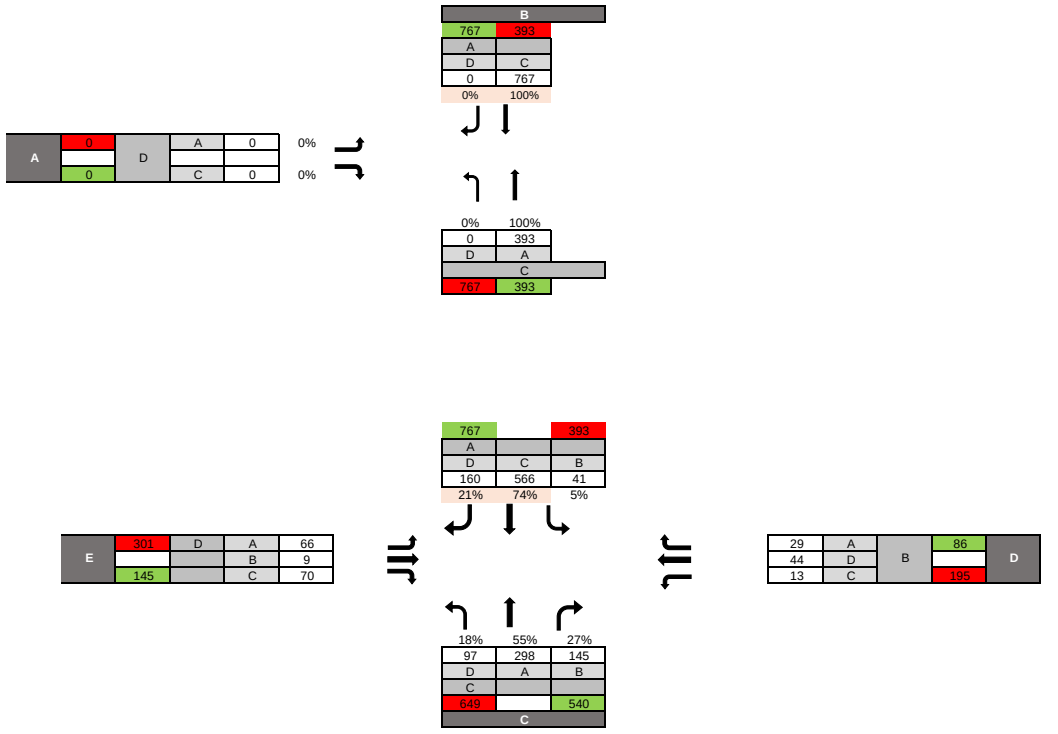
Daniel Ralston
Business Manager
GoCar Carsharing Ltd
Mobile: 086 0414 991
E: daniel.ralston@gocar.ie

APPENDIX 12E TRAFFIC MODELLING

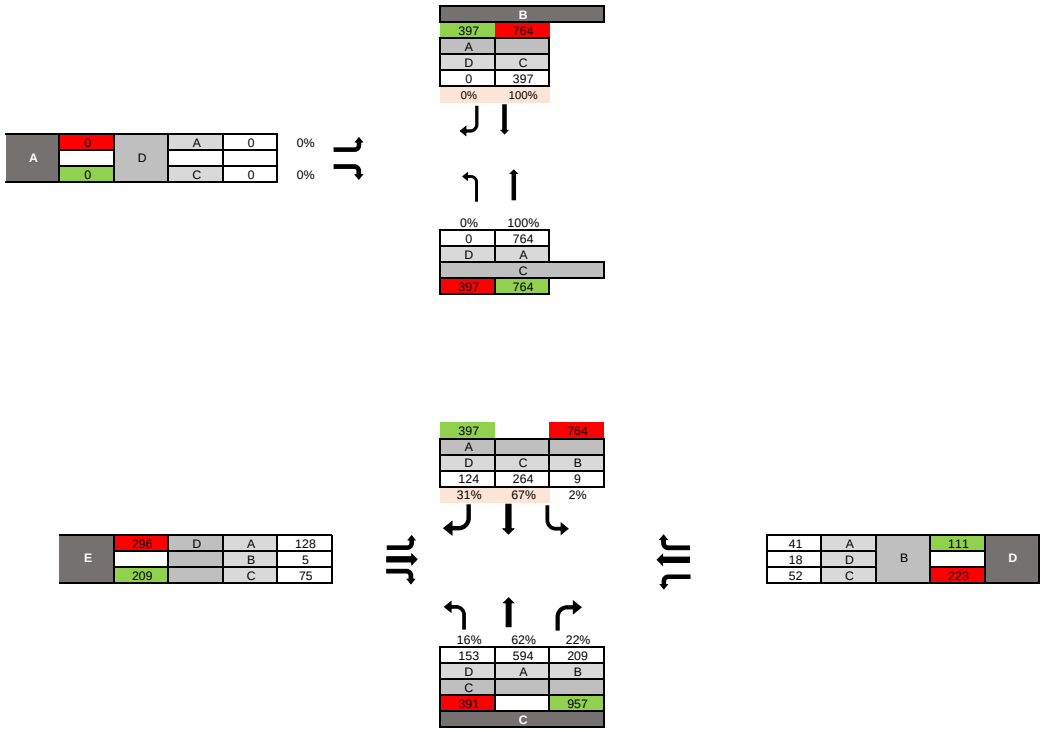
AM BASE



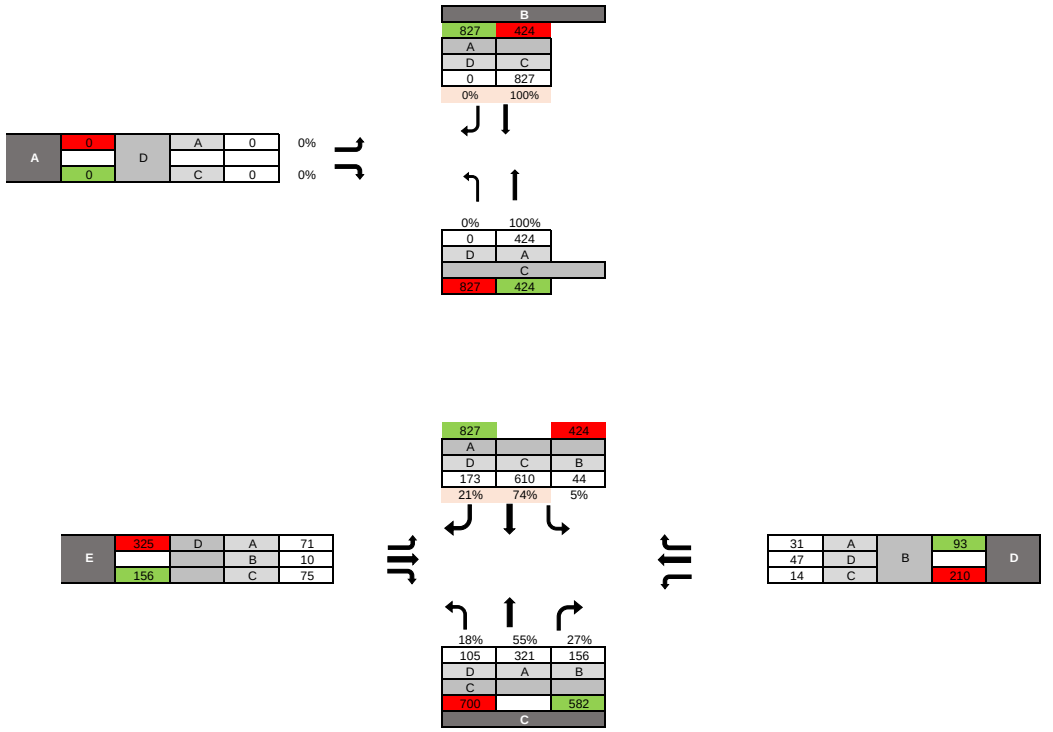
PM BASE



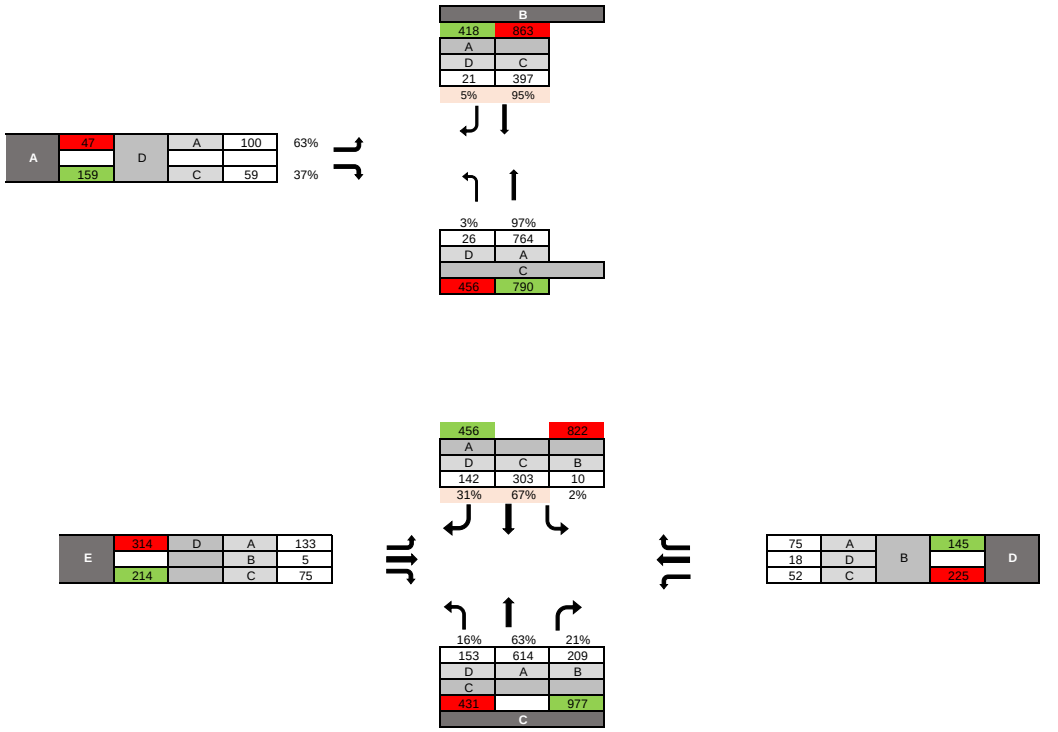
2023 AM BASE



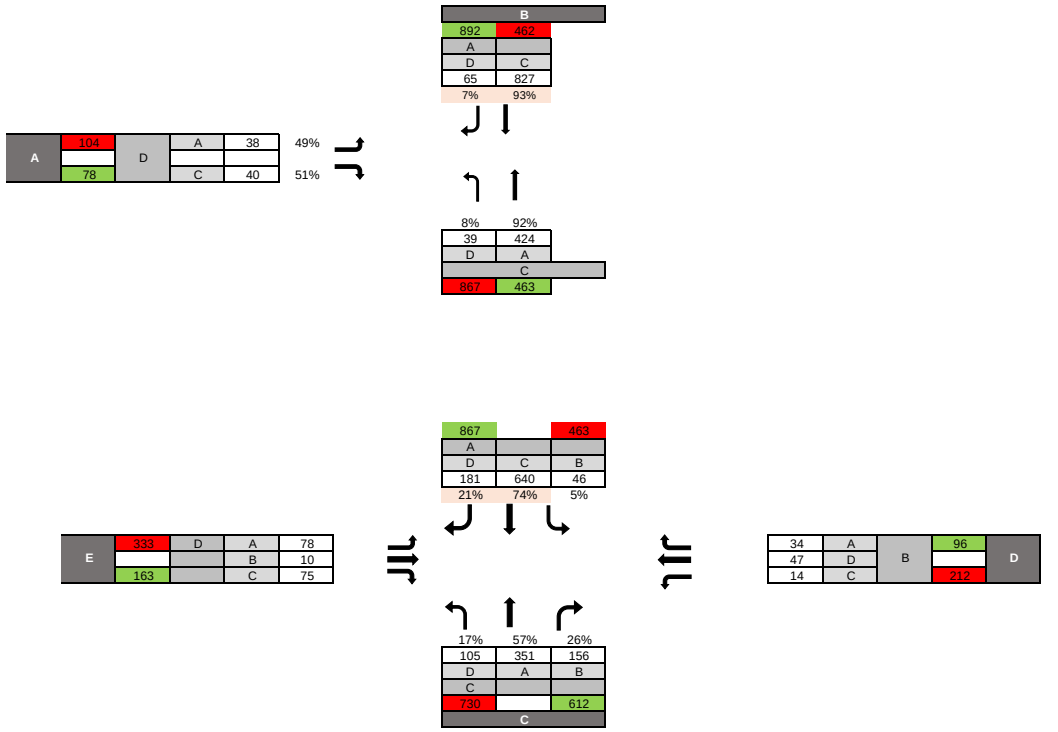
2023 PM BASE



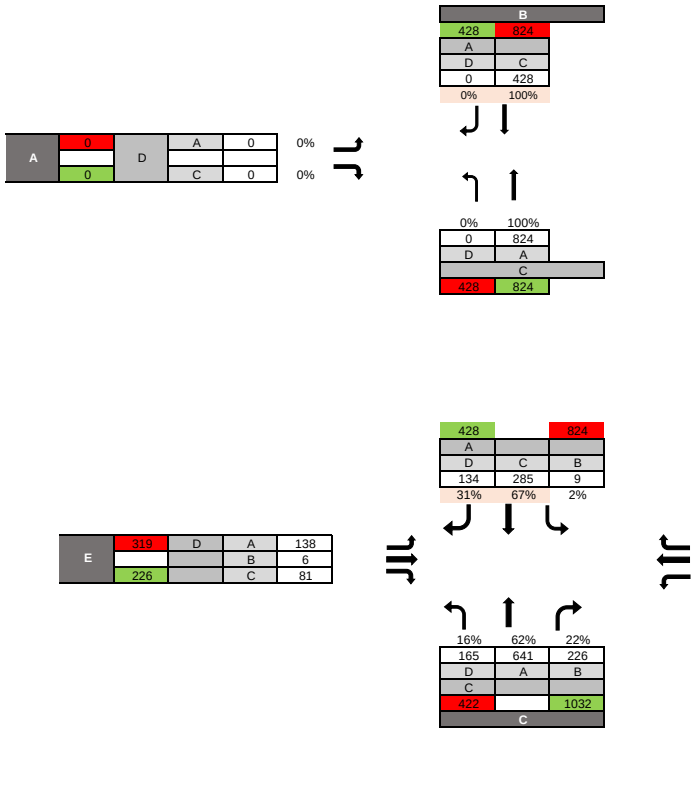
2023 AM BASE + Dev



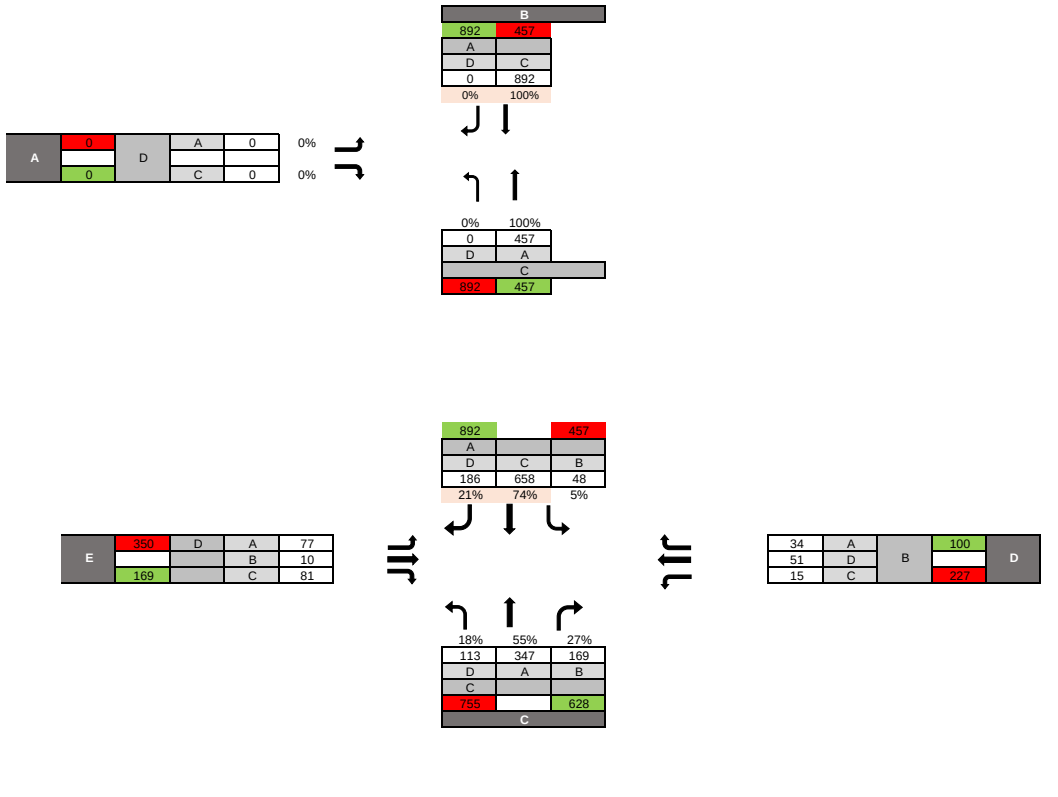
2023 PM BASE + dev



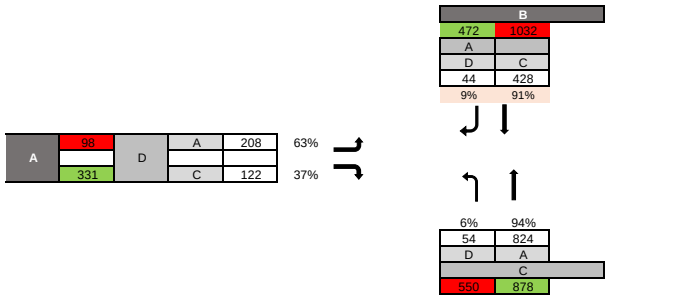
2028 AM BASE

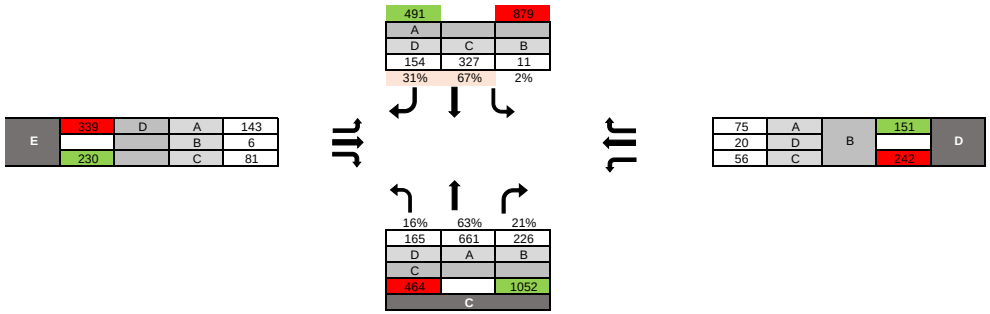


2028 PM BASE



2028 AM BASE + DEV





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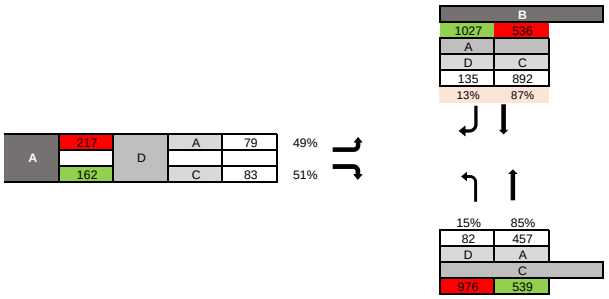
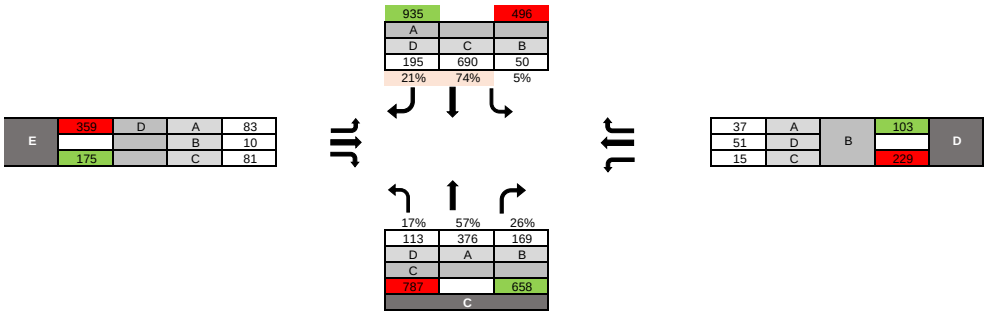
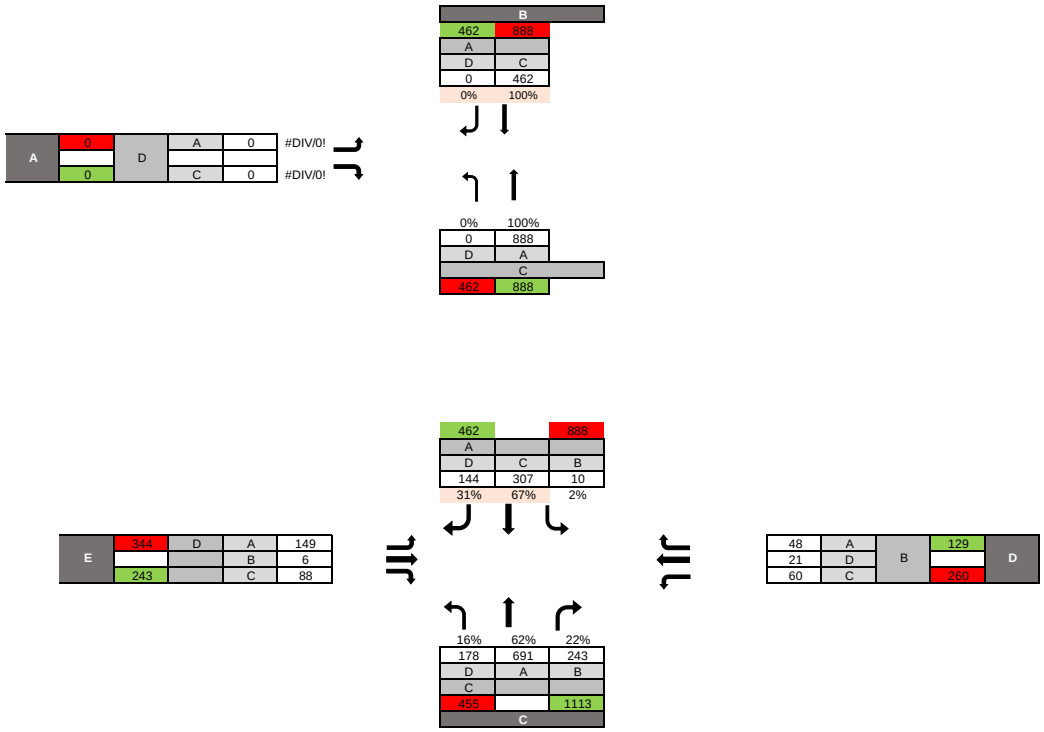
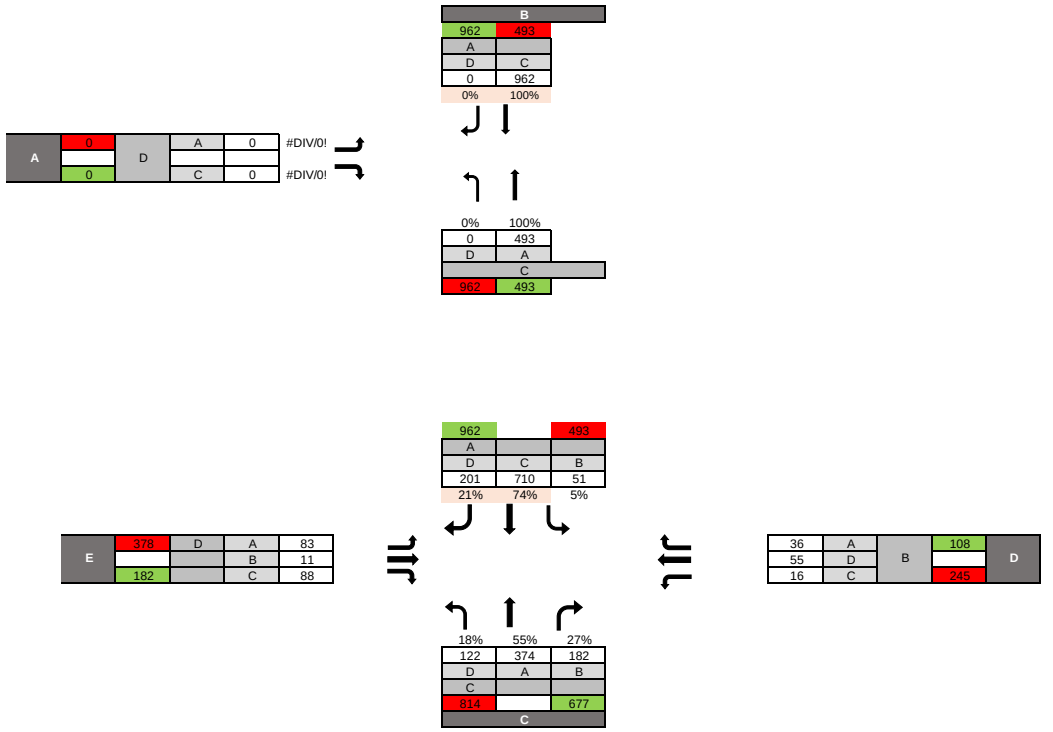




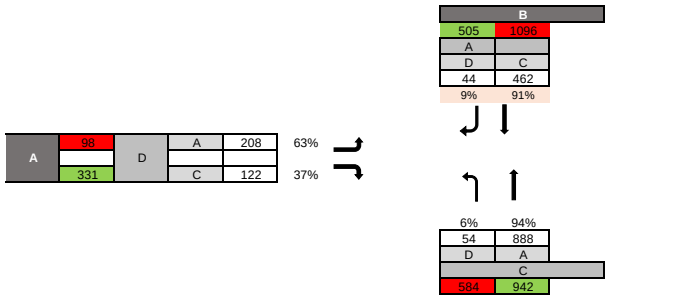
2038 AM BASE

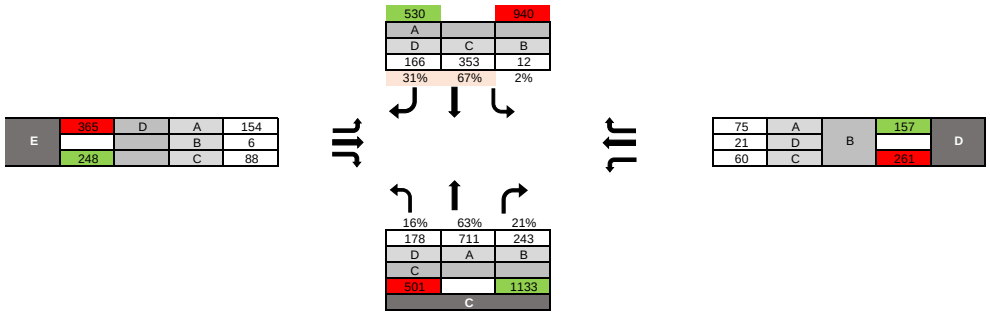


2038 PM BASE



2038 AM BASE + Dev





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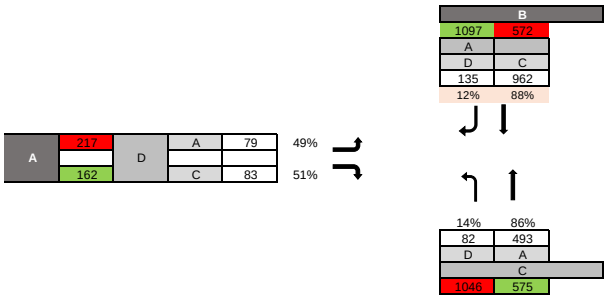
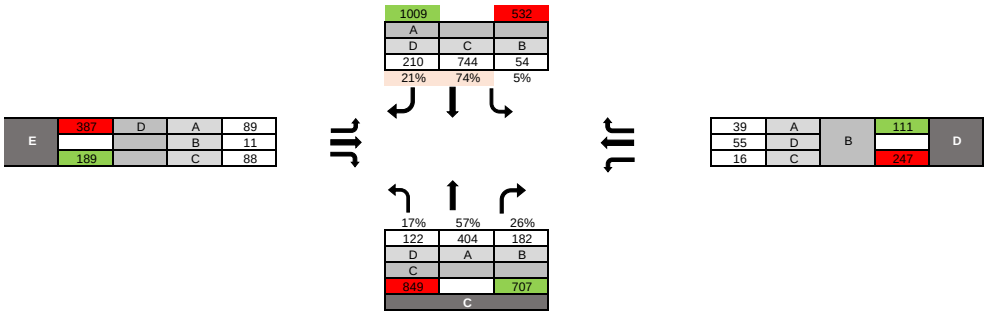




APPENDIX 12 F TRICS OUTPUTS

Calculation Reference: AUDIT-204601-201209-1253

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : A - HOUSES PRIVATELY OWNED
MULTI-MODAL TOTAL VEHICLES

Selected regions and areas:

12	CONNAUGHT		
	CS	SLIGO	1 days
	LT	LEITRIM	1 days
13	MUNSTER		
	WA	WATERFORD	1 days
14	LEINSTER		
	WC	WICKLOW	1 days
15	GREATER DUBLIN		
	DL	DUBLIN	1 days
16	ULSTER (REPUBLIC OF IRELAND)		
	CV	CAVAN	1 days
	DN	DONEGAL	3 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: No of Dwellings
Actual Range: 50 to 280 (units:)
Range Selected by User: 50 to 437 (units:)

Parking Spaces Range: All Surveys Included

Parking Spaces per Dwelling Range: All Surveys Included

Bedrooms per Dwelling Range: All Surveys Included

Percentage of dwellings privately owned: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/12 to 20/06/18

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	3 days
Tuesday	1 days
Wednesday	2 days
Thursday	1 days
Friday	2 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	9 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	2
Edge of Town	6
Neighbourhood Centre (PPS6 Local Centre)	1

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Residential Zone	6
Village	1
No Sub Category	2

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village,

Secondary Filtering selection:

Use Class:

C3	9 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:

All Surveys Included

Population within 1 mile:

1,000 or Less	1 days
1,001 to 5,000	2 days
5,001 to 10,000	1 days
10,001 to 15,000	5 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,000 or Less	1 days
5,001 to 25,000	6 days
25,001 to 50,000	1 days
50,001 to 75,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	2 days
1.1 to 1.5	6 days
1.6 to 2.0	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	9 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	9 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 CS-03-A-04 DETACHED & SEMI-DETACHED SLIGO
R292
STRANDHILL

Neighbourhood Centre (PPS6 Local Centre)
Village
Total No of Dwellings: 63
Survey date: THURSDAY *27/10/16* *Survey Type: MANUAL*

2 CV-03-A-02 DETACHED & SEMI DETACHED CAVAN
R212 DUBLIN ROAD
CAVAN
KILLYNEBBER
Edge of Town
No Sub Category
Total No of Dwellings: 80
Survey date: MONDAY *22/05/17* *Survey Type: MANUAL*

3 DL-03-A-10 SEMI DETACHED & DETACHED DUBLIN
R124
MALAHIDE
SAINT HELENS
Edge of Town
Residential Zone
Total No of Dwellings: 65
Survey date: WEDNESDAY *20/06/18* *Survey Type: MANUAL*

4 DN-03-A-03 DETACHED/SEMI-DETACHED DONEGAL
THE GRANGE
LETTERKENNY
GLENCAR IRISH
Edge of Town
Residential Zone
Total No of Dwellings: 50
Survey date: MONDAY *01/09/14* *Survey Type: MANUAL*

5 DN-03-A-04 SEMI-DETACHED DONEGAL
GORTLEE ROAD
LETTERKENNY
GORTLEE
Edge of Town
Residential Zone
Total No of Dwellings: 83
Survey date: FRIDAY *26/09/14* *Survey Type: MANUAL*

6 DN-03-A-05 DETACHED/SEMI-DETACHED DONEGAL
GORTLEE ROAD
LETTERKENNY
GORTLEE
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 146
Survey date: WEDNESDAY *03/09/14* *Survey Type: MANUAL*

7 LT-03-A-01 SEMI-DETACHED & DETACHED LEITRIM
ARD NA SI
CARRICK-ON-SHANNON
ATTIRORY
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 90
Survey date: FRIDAY *24/04/15* *Survey Type: MANUAL*

8 WA-03-A-04 DETACHED WATERFORD
MAYPARK LANE
WATERFORD

Edge of Town
Residential Zone
Total No of Dwellings: 280
Survey date: TUESDAY *24/06/14* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

9	WC-03-A-01	DETACHED HOUSES	WICKLOW
	STATION ROAD		
	WICKLOW		
	CORPORATION MURRAGH		
	Edge of Town		
	No Sub Category		
	Total No of Dwellings:	50	
	Survey date: MONDAY	*28/05/18*	*Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
MULTI-MODAL TOTAL VEHICLES
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	101	0.045	9	101	0.175	9	101	0.220
08:00 - 09:00	9	101	0.158	9	101	0.534	9	101	0.692
09:00 - 10:00	9	101	0.227	9	101	0.258	9	101	0.485
10:00 - 11:00	9	101	0.161	9	101	0.176	9	101	0.337
11:00 - 12:00	9	101	0.159	9	101	0.215	9	101	0.374
12:00 - 13:00	9	101	0.264	9	101	0.269	9	101	0.533
13:00 - 14:00	9	101	0.254	9	101	0.238	9	101	0.492
14:00 - 15:00	9	101	0.311	9	101	0.299	9	101	0.610
15:00 - 16:00	9	101	0.351	9	101	0.262	9	101	0.613
16:00 - 17:00	9	101	0.334	9	101	0.230	9	101	0.564
17:00 - 18:00	9	101	0.442	9	101	0.271	9	101	0.713
18:00 - 19:00	9	101	0.366	9	101	0.272	9	101	0.638
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			3.072			3.199			6.271

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	50 - 280 (units:)
Survey date date range:	01/01/12 - 20/06/18
Number of weekdays (Monday-Friday):	9
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
MULTI-MODAL CYCLISTS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	101	0.002	9	101	0.003	9	101	0.005
08:00 - 09:00	9	101	0.002	9	101	0.012	9	101	0.014
09:00 - 10:00	9	101	0.003	9	101	0.004	9	101	0.007
10:00 - 11:00	9	101	0.002	9	101	0.004	9	101	0.006
11:00 - 12:00	9	101	0.006	9	101	0.001	9	101	0.007
12:00 - 13:00	9	101	0.000	9	101	0.002	9	101	0.002
13:00 - 14:00	9	101	0.002	9	101	0.004	9	101	0.006
14:00 - 15:00	9	101	0.001	9	101	0.002	9	101	0.003
15:00 - 16:00	9	101	0.007	9	101	0.004	9	101	0.011
16:00 - 17:00	9	101	0.009	9	101	0.002	9	101	0.011
17:00 - 18:00	9	101	0.004	9	101	0.003	9	101	0.007
18:00 - 19:00	9	101	0.004	9	101	0.002	9	101	0.006
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.042			0.043			0.085

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
MULTI-MODAL VEHICLE OCCUPANTS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	101	0.053	9	101	0.207	9	101	0.260
08:00 - 09:00	9	101	0.191	9	101	0.815	9	101	1.006
09:00 - 10:00	9	101	0.266	9	101	0.372	9	101	0.638
10:00 - 11:00	9	101	0.186	9	101	0.223	9	101	0.409
11:00 - 12:00	9	101	0.190	9	101	0.265	9	101	0.455
12:00 - 13:00	9	101	0.319	9	101	0.336	9	101	0.655
13:00 - 14:00	9	101	0.305	9	101	0.310	9	101	0.615
14:00 - 15:00	9	101	0.447	9	101	0.379	9	101	0.826
15:00 - 16:00	9	101	0.536	9	101	0.369	9	101	0.905
16:00 - 17:00	9	101	0.498	9	101	0.300	9	101	0.798
17:00 - 18:00	9	101	0.620	9	101	0.396	9	101	1.016
18:00 - 19:00	9	101	0.514	9	101	0.378	9	101	0.892
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			4.125			4.350			8.475

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
MULTI-MODAL PEDESTRIANS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	101	0.012	9	101	0.028	9	101	0.040
08:00 - 09:00	9	101	0.018	9	101	0.065	9	101	0.083
09:00 - 10:00	9	101	0.023	9	101	0.064	9	101	0.087
10:00 - 11:00	9	101	0.047	9	101	0.050	9	101	0.097
11:00 - 12:00	9	101	0.042	9	101	0.037	9	101	0.079
12:00 - 13:00	9	101	0.033	9	101	0.033	9	101	0.066
13:00 - 14:00	9	101	0.071	9	101	0.063	9	101	0.134
14:00 - 15:00	9	101	0.075	9	101	0.039	9	101	0.114
15:00 - 16:00	9	101	0.067	9	101	0.051	9	101	0.118
16:00 - 17:00	9	101	0.077	9	101	0.039	9	101	0.116
17:00 - 18:00	9	101	0.054	9	101	0.028	9	101	0.082
18:00 - 19:00	9	101	0.045	9	101	0.057	9	101	0.102
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.564			0.554			1.118

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
MULTI-MODAL PUBLIC TRANSPORT USERS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	101	0.000	9	101	0.004	9	101	0.004
08:00 - 09:00	9	101	0.000	9	101	0.039	9	101	0.039
09:00 - 10:00	9	101	0.001	9	101	0.004	9	101	0.005
10:00 - 11:00	9	101	0.000	9	101	0.002	9	101	0.002
11:00 - 12:00	9	101	0.001	9	101	0.002	9	101	0.003
12:00 - 13:00	9	101	0.000	9	101	0.000	9	101	0.000
13:00 - 14:00	9	101	0.003	9	101	0.001	9	101	0.004
14:00 - 15:00	9	101	0.006	9	101	0.001	9	101	0.007
15:00 - 16:00	9	101	0.032	9	101	0.002	9	101	0.034
16:00 - 17:00	9	101	0.006	9	101	0.001	9	101	0.007
17:00 - 18:00	9	101	0.002	9	101	0.000	9	101	0.002
18:00 - 19:00	9	101	0.000	9	101	0.001	9	101	0.001
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.051			0.057			0.108

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
MULTI-MODAL TOTAL PEOPLE
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	101	0.067	9	101	0.243	9	101	0.310
08:00 - 09:00	9	101	0.211	9	101	0.931	9	101	1.142
09:00 - 10:00	9	101	0.293	9	101	0.444	9	101	0.737
10:00 - 11:00	9	101	0.236	9	101	0.279	9	101	0.515
11:00 - 12:00	9	101	0.238	9	101	0.305	9	101	0.543
12:00 - 13:00	9	101	0.352	9	101	0.372	9	101	0.724
13:00 - 14:00	9	101	0.381	9	101	0.378	9	101	0.759
14:00 - 15:00	9	101	0.528	9	101	0.421	9	101	0.949
15:00 - 16:00	9	101	0.642	9	101	0.427	9	101	1.069
16:00 - 17:00	9	101	0.590	9	101	0.342	9	101	0.932
17:00 - 18:00	9	101	0.680	9	101	0.427	9	101	1.107
18:00 - 19:00	9	101	0.563	9	101	0.439	9	101	1.002
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			4.781			5.008			9.789

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

APPENDIX 12 G LINSIG OUTPUTS

Basic Results Summary

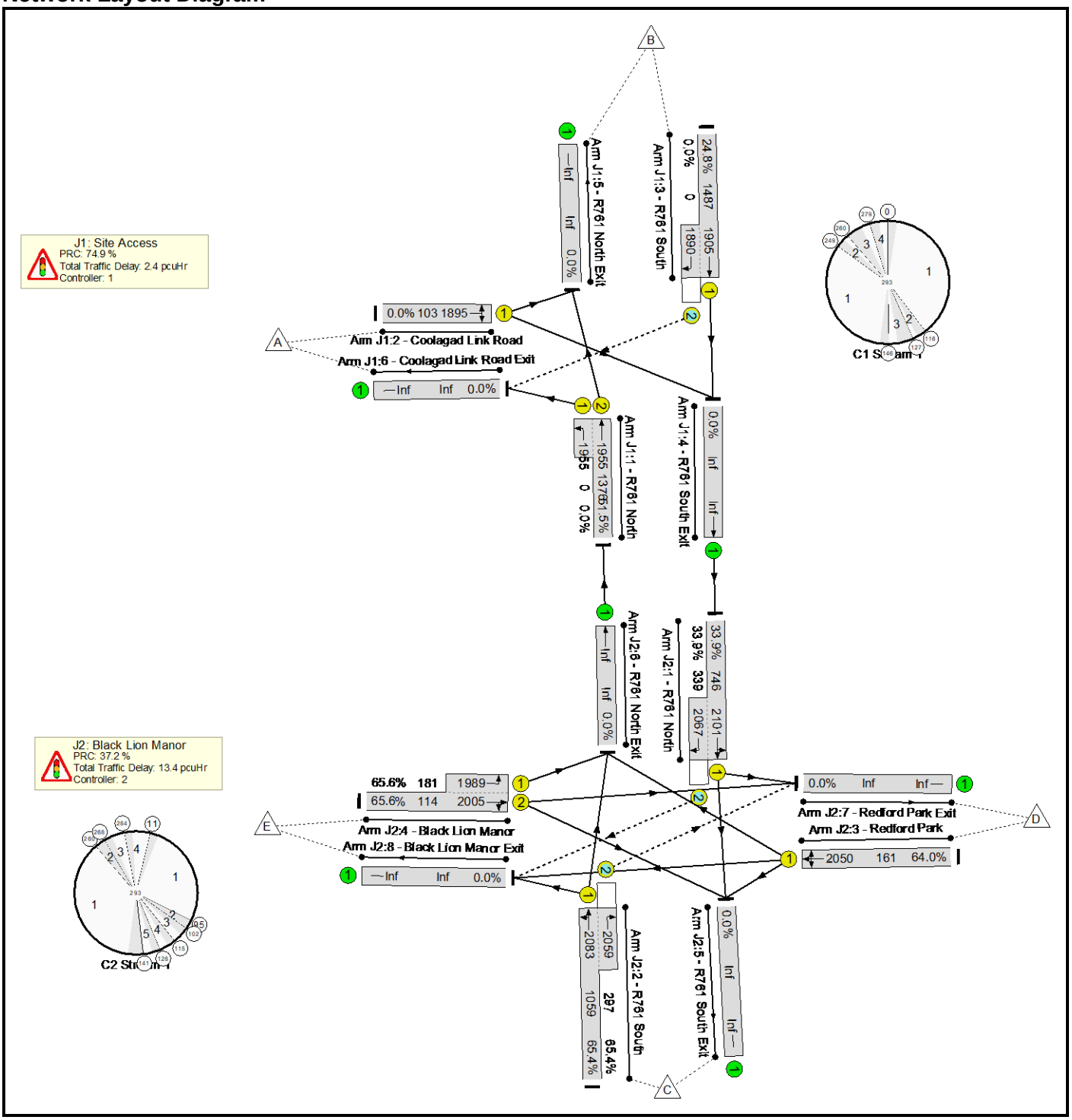
User and Project Details

Project:	
Title:	
Location:	
Additional detail:	
File name:	Linsig Network Black Lion Manor and Site Access Rev 4c Base.lsg3x
Author:	
Company:	
Address:	

Basic Results Summary

Scenario 1: 'AM Base' (FG1: 'AM Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

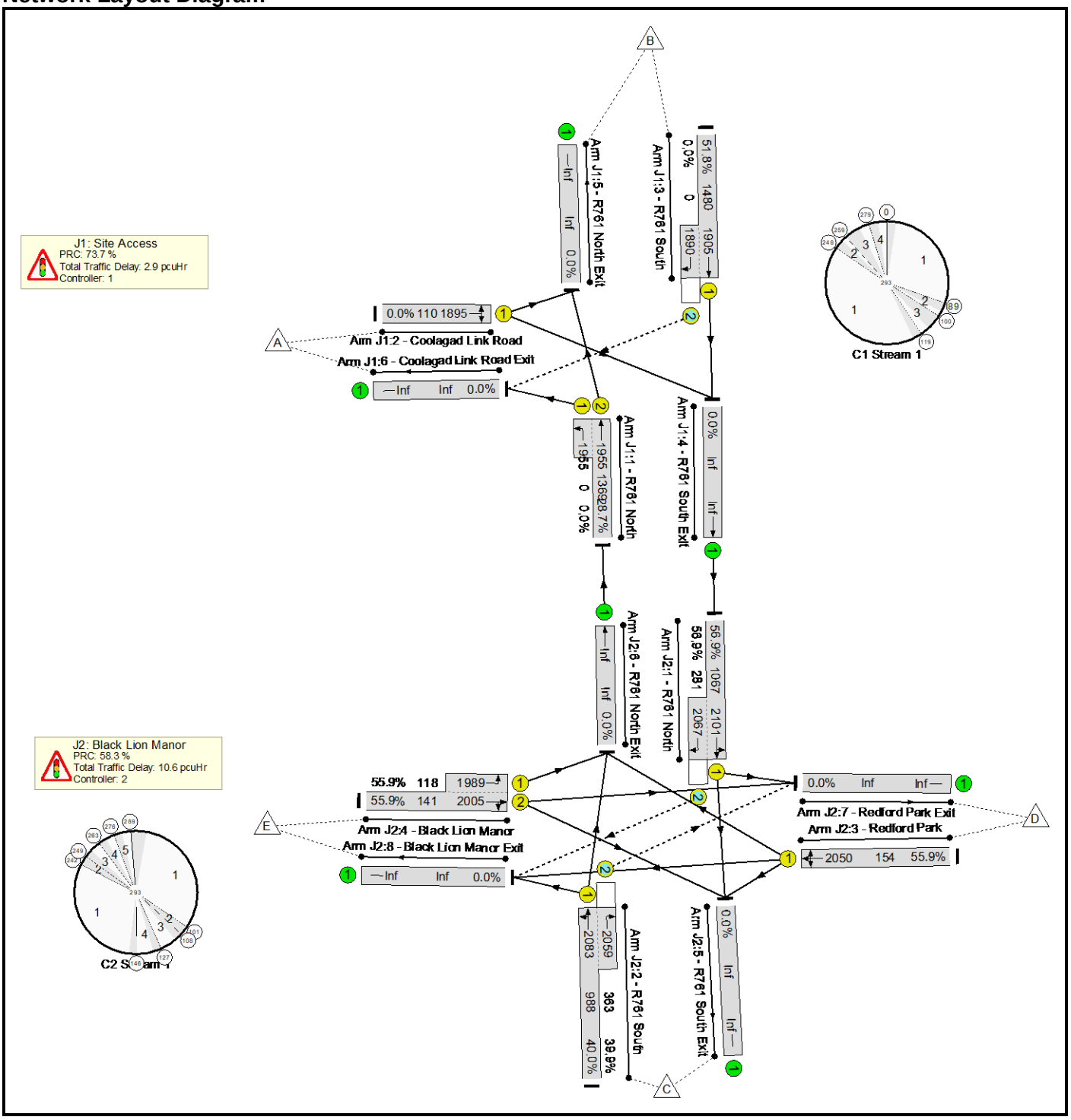
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**65.6%**	**309**	**0**	**0**	**15.9**	**-**	**-**
J1: Site Access	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**51.5%**	**0**	**0**	**0**	**2.4**	**-**	**-**
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	708	1955:1955	1376+0	51.5 : 0.0%	-	-	-	1.8	9.1	15.7
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	368	1905:1890	1487+0	24.8 : 0.0%	0	0	0	0.6	6.2	5.1
J2: Black Lion Manor	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**65.6%**	**309**	**0**	**0**	**13.4**	**-**	**-**
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:200	-	368	2101:2067	746+339	33.9 : 33.9%	115	0	0	1.5	14.6	3.4
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:200	-	887	2083:2059	1059+297	65.4 : 65.4%	194	0	0	4.7	19.0	22.9
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	103	2050	161	64.0%	-	-	-	2.8	98.1	5.7
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	17:30	-	194	2005:1989	114+181	65.6 : 65.6%	-	-	-	4.5	82.6	6.4

C1	Stream: 1 PRC for Signalled Lanes (%):	74.9	Total Delay for Signalled Lanes (pcuHr):	2.43	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	37.2	Total Delay for Signalled Lanes (pcuHr):	13.44	Cycle Time (s): 293
	PRC Over All Lanes (%):	37.2	Total Delay Over All Lanes(pcuHr):	15.86	

Basic Results Summary

Scenario 2: 'PM Base' (FG2: 'PM Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

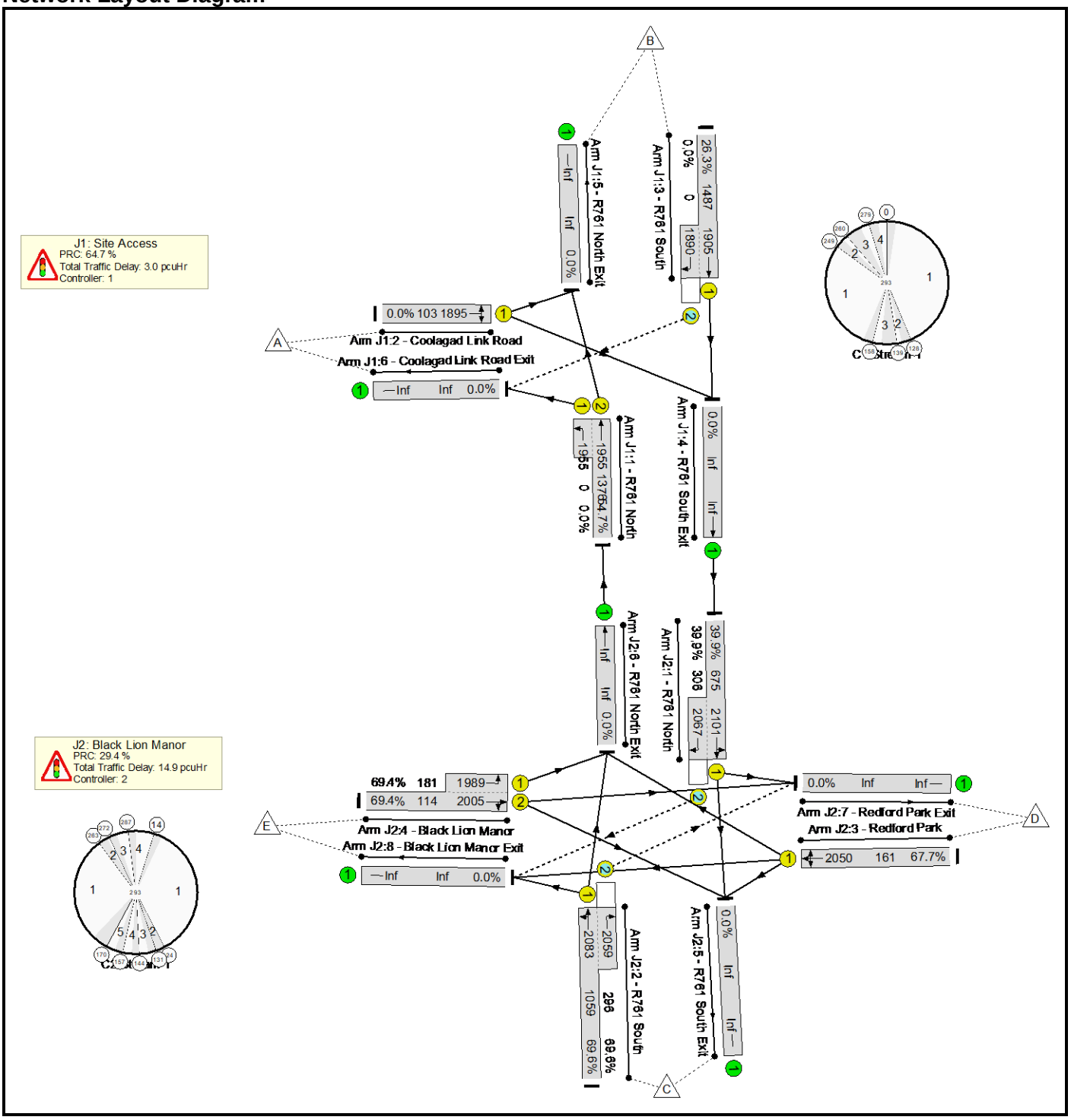
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**56.9%**	**305**	**0**	**0**	**13.5**	**-**	**-**
J1: Site Access	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**51.8%**	**0**	**0**	**0**	**2.9**	**-**	**-**
1/2+1/1	R761 North Ahead Left	U	C1:A		2	204	-	393	1955:1955	1369+0	28.7 : 0.0%	-	-	-	1.0	8.9	4.5
2/1	Coolagad Link Road Right Left	U	C1:B		2	15	-	0	1895	110	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	226	8	767	1905:1890	1480+0	51.8 : 0.0%	0	0	0	1.9	8.9	14.8
J2: Black Lion Manor	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**56.9%**	**305**	**0**	**0**	**10.6**	**-**	**-**
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	767	2101:2067	1067+281	56.9 : 56.9%	160	0	0	2.5	11.8	15.3
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	540	2083:2059	988+363	40.0 : 39.9%	145	0	0	2.8	18.7	9.6
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	86	2050	154	55.9%	-	-	-	2.2	92.1	4.3
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	145	2005:1989	141+118	55.9 : 55.9%	-	-	-	3.1	77.8	3.9

C1	Stream: 1 PRC for Signalled Lanes (%):	73.7	Total Delay for Signalled Lanes (pcuHr):	2.87	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	58.3	Total Delay for Signalled Lanes (pcuHr):	10.65	Cycle Time (s): 293
	PRC Over All Lanes (%):	58.3	Total Delay Over All Lanes(pcuHr):	13.52	

Basic Results Summary

Scenario 3: 'AM 2023 Base' (FG3: 'AM 2023 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

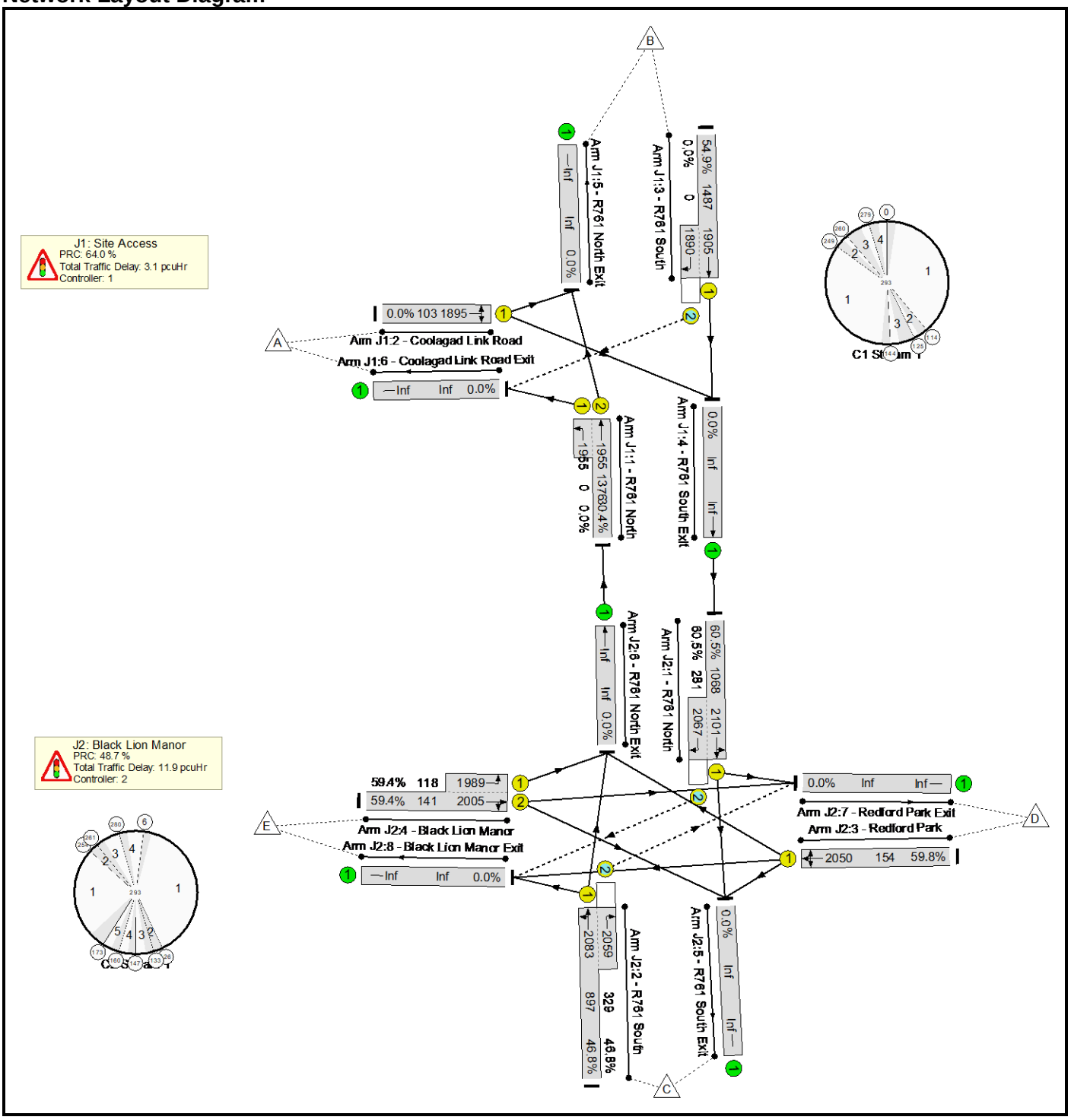
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**69.6%**	**328**	**0**	**0**	**17.9**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**54.7%**	**0**	**0**	**0**	**3.0**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	752	1955:1955	1376+0	54.7 : 0.0%	-	-	-	2.3	11.1	10.8
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	391	1905:1890	1487+0	26.3 : 0.0%	0	0	0	0.7	6.3	5.5
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**69.6%**	**328**	**0**	**0**	**14.9**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:201	-	391	2101:2067	675+306	39.9 : 39.9%	122	0	0	1.8	16.3	5.2
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:201	-	943	2083:2059	1059+296	69.6 : 69.6%	206	0	0	5.3	20.3	25.9
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	109	2050	161	67.7%	-	-	-	3.0	99.1	5.3
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	16:30	-	205	2005:1989	114+181	69.4 : 69.4%	-	-	-	4.8	83.6	6.3

C1	Stream: 1 PRC for Signalled Lanes (%):	64.7	Total Delay for Signalled Lanes (pcuHr):	3.00	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	29.4	Total Delay for Signalled Lanes (pcuHr):	14.85	Cycle Time (s): 293
	PRC Over All Lanes (%):	29.4	Total Delay Over All Lanes(pcuHr):	17.85	

Basic Results Summary

Scenario 4: 'PM 2023 Base' (FG4: 'PM 2023 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

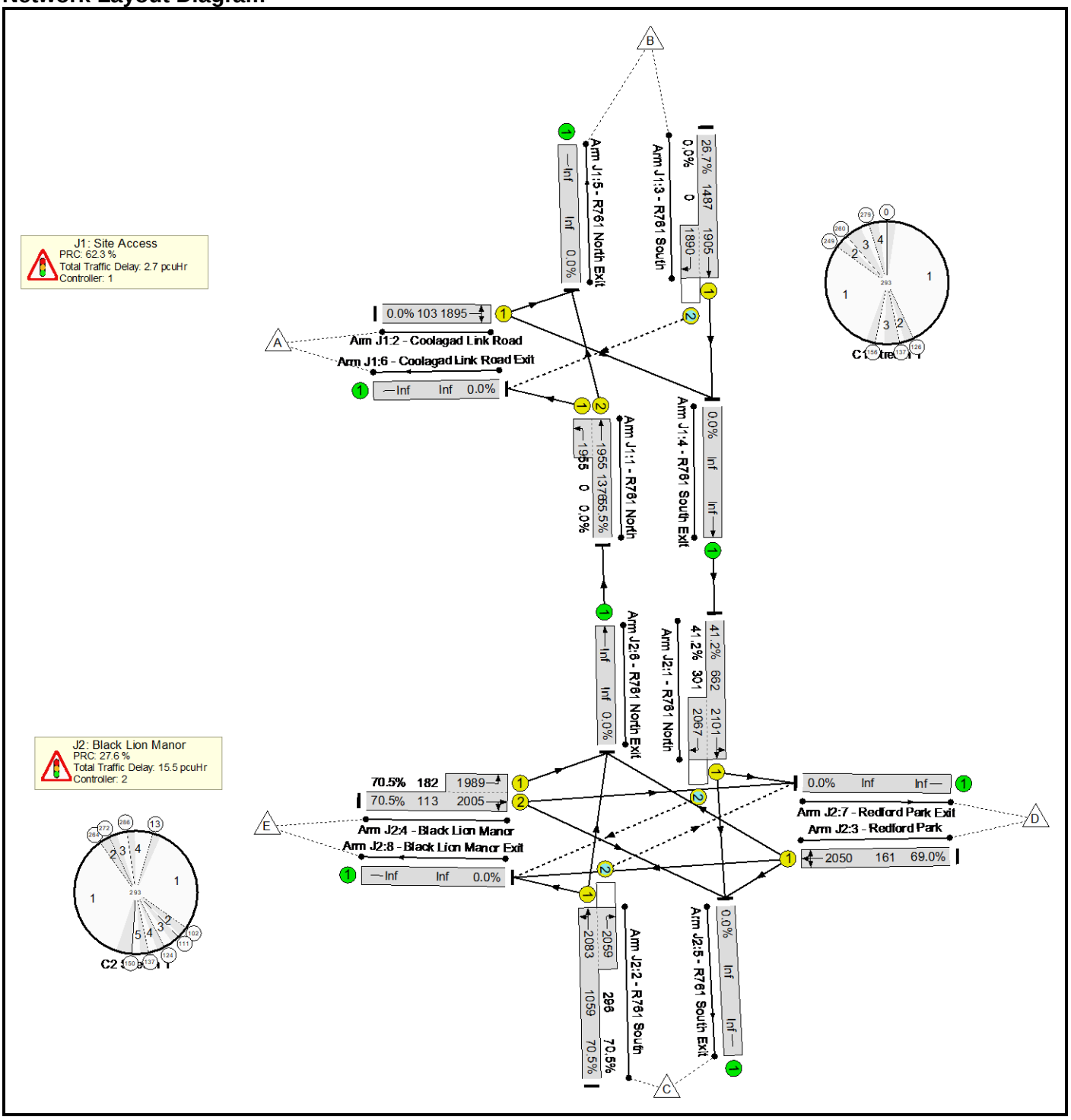
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**60.5%**	**324**	**0**	**0**	**15.0**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**54.9%**	**0**	**0**	**0**	**3.1**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	418	1955:1955	1376+0	30.4 : 0.0%	-	-	-	1.0	8.9	5.2
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	816	1905:1890	1487+0	54.9 : 0.0%	0	0	0	2.1	9.1	16.0
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**60.5%**	**324**	**0**	**0**	**11.9**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	816	2101:2067	1068+281	60.5 : 60.5%	170	0	0	2.9	12.6	20.1
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	574	2083:2059	897+329	46.8 : 46.8%	154	0	0	3.2	20.3	10.7
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	92	2050	154	59.8%	-	-	-	2.4	94.4	4.6
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	154	2005:1989	141+118	59.4 : 59.4%	-	-	-	3.4	79.9	4.4

C1	Stream: 1 PRC for Signalled Lanes (%):	64.0	Total Delay for Signalled Lanes (pcuHr):	3.10	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	48.7	Total Delay for Signalled Lanes (pcuHr):	11.93	Cycle Time (s): 293
	PRC Over All Lanes (%):	48.7	Total Delay Over All Lanes(pcuHr):	15.03	

Basic Results Summary

Scenario 5: 'AM 2024 Base' (FG5: 'AM 2024 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

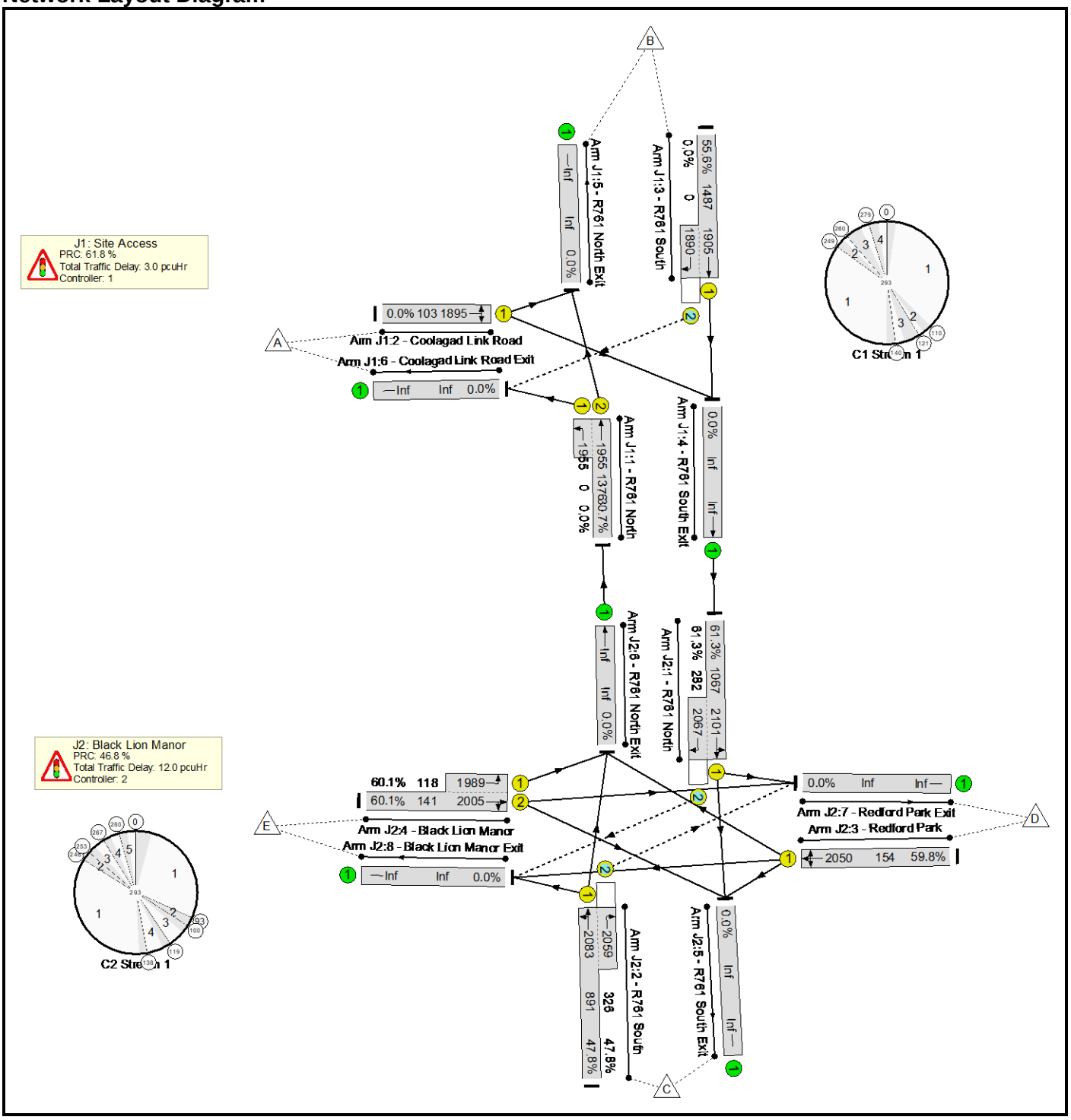
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**70.5%**	**333**	**0**	**0**	**18.1**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**55.5%**	**0**	**0**	**0**	**2.7**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	763	1955:1955	1376+0	55.5 : 0.0%	-	-	-	2.0	9.4	16.9
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	397	1905:1890	1487+0	26.7 : 0.0%	0	0	0	0.7	6.3	5.6
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**70.5%**	**333**	**0**	**0**	**15.5**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:202	-	397	2101:2067	662+301	41.2 : 41.2%	124	0	0	1.9	17.2	4.2
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:202	-	956	2083:2059	1059+296	70.5 : 70.5%	209	0	0	5.5	20.7	27.7
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	111	2050	161	69.0%	-	-	-	3.1	101.7	6.1
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	15:30	-	208	2005:1989	113+182	70.5 : 70.5%	-	-	-	4.9	85.3	7.1

C1	Stream: 1 PRC for Signalled Lanes (%):	62.3	Total Delay for Signalled Lanes (pcuHr):	2.69	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	27.6	Total Delay for Signalled Lanes (pcuHr):	15.45	Cycle Time (s): 293
	PRC Over All Lanes (%):	27.6	Total Delay Over All Lanes(pcuHr):	18.14	

Basic Results Summary

Scenario 6: 'PM 2024 Base' (FG6: 'PM 2024 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

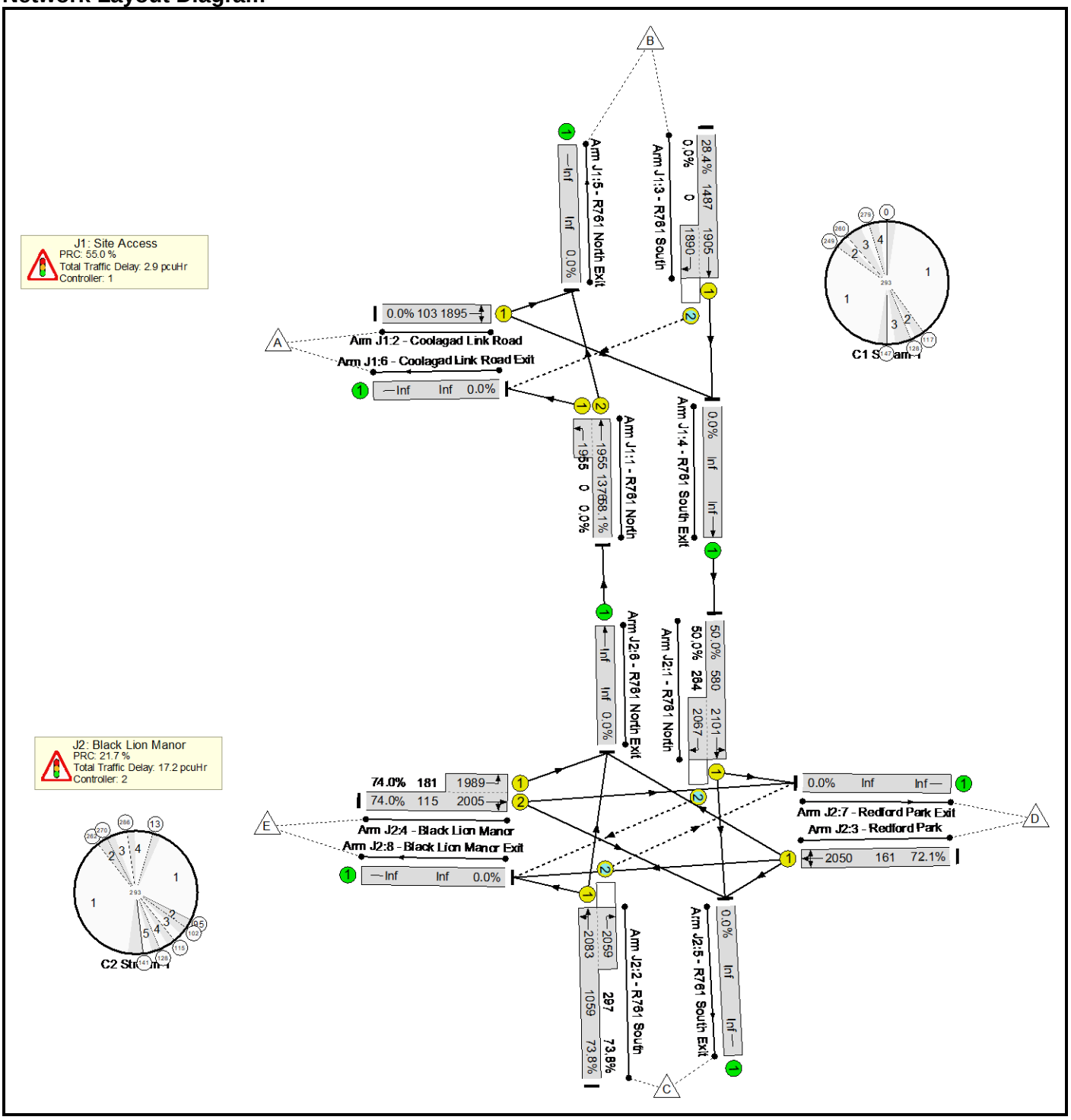
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**61.3%**	**329**	**0**	**0**	**15.0**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**55.6%**	**0**	**0**	**0**	**3.0**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	423	1955:1955	1376+0	30.7 : 0.0%	-	-	-	0.9	7.6	4.6
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	827	1905:1890	1487+0	55.6 : 0.0%	0	0	0	2.1	9.2	16.5
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**61.3%**	**329**	**0**	**0**	**12.0**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	827	2101:2067	1067+282	61.3 : 61.3%	173	0	0	2.9	12.6	20.7
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	582	2083:2059	891+326	47.8 : 47.8%	156	0	0	3.3	20.3	10.9
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	92	2050	154	59.8%	-	-	-	2.4	94.0	4.4
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	156	2005:1989	141+118	60.1 : 60.1%	-	-	-	3.4	79.4	4.2

C1	Stream: 1 PRC for Signalled Lanes (%):	61.8	Total Delay for Signalled Lanes (pcuHr):	3.01	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	46.8	Total Delay for Signalled Lanes (pcuHr):	12.02	Cycle Time (s): 293
	PRC Over All Lanes (%):	46.8	Total Delay Over All Lanes(pcuHr):	15.03	

Basic Results Summary

Scenario 7: 'AM 2028 Base' (FG7: 'AM 2028 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

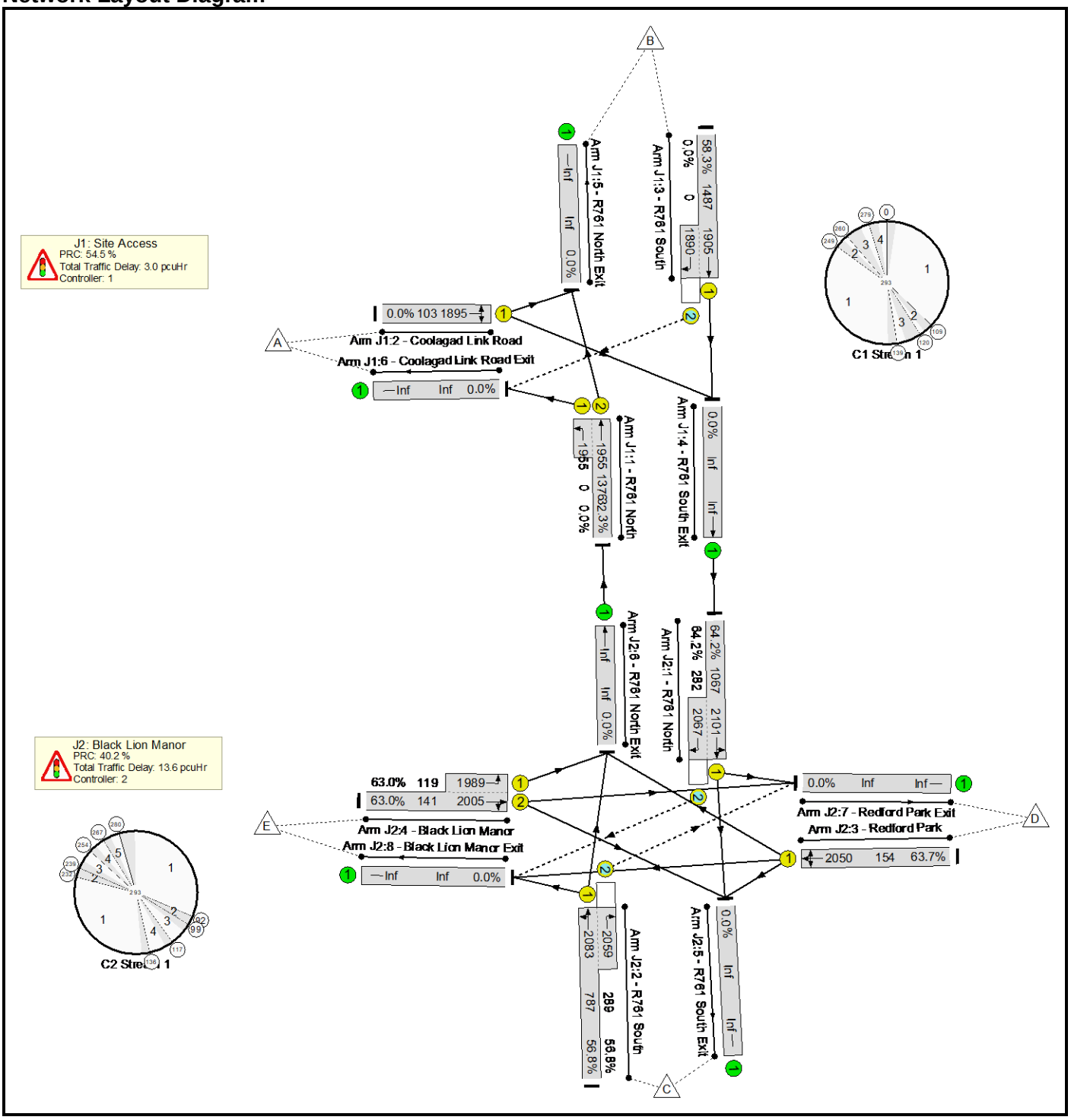
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**74.0%**	**351**	**0**	**0**	**20.2**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**58.1%**	**0**	**0**	**0**	**2.9**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	799	1955:1955	1376+0	58.1 : 0.0%	-	-	-	2.2	9.8	19.0
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	422	1905:1890	1487+0	28.4 : 0.0%	0	0	0	0.8	6.4	6.1
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**74.0%**	**351**	**0**	**0**	**17.2**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:200	-	422	2101:2067	580+264	50.0 : 50.0%	132	0	0	2.3	19.7	4.8
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:200	-	1001	2083:2059	1059+297	73.8 : 73.8%	219	0	0	6.1	21.9	29.2
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	116	2050	161	72.1%	-	-	-	3.4	106.8	6.8
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	17:30	-	219	2005:1989	115+181	74.0 : 74.0%	-	-	-	5.4	88.5	8.2

C1	Stream: 1 PRC for Signalled Lanes (%):	55.0	Total Delay for Signalled Lanes (pcuHr):	2.93	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	21.7	Total Delay for Signalled Lanes (pcuHr):	17.22	Cycle Time (s): 293
	PRC Over All Lanes (%):	21.7	Total Delay Over All Lanes(pcuHr):	20.15	

Basic Results Summary

Scenario 8: 'PM 2028 Base' (FG8: 'PM 2028 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

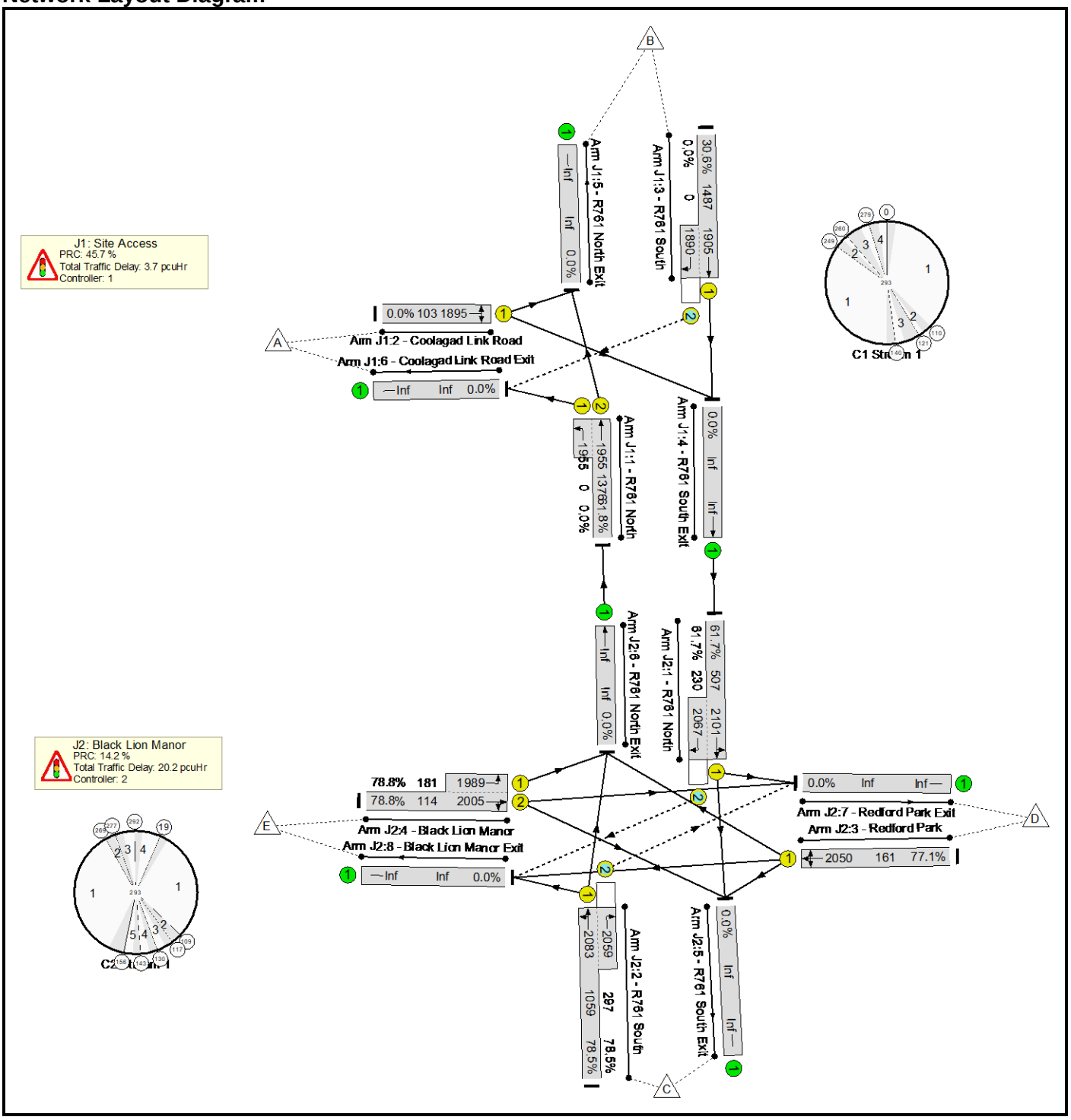
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**64.2%**	**345**	**0**	**0**	**16.6**	**-**	**-**
J1: Site Access	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**58.3%**	**0**	**0**	**0**	**3.0**	**-**	**-**
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	445	1955:1955	1376+0	32.3 : 0.0%	-	-	-	0.7	5.3	8.2
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	866	1905:1890	1487+0	58.3 : 0.0%	0	0	0	2.3	9.7	17.8
J2: Black Lion Manor	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**64.2%**	**345**	**0**	**0**	**13.6**	**-**	**-**
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	866	2101:2067	1067+282	64.2 : 64.2%	181	0	0	3.4	14.2	12.9
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	611	2083:2059	787+289	56.8 : 56.8%	164	0	0	3.9	22.7	12.2
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	98	2050	154	63.7%	-	-	-	2.7	97.6	5.1
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	164	2005:1989	141+119	63.0 : 63.0%	-	-	-	3.7	80.9	4.5

C1	Stream: 1 PRC for Signalled Lanes (%):	54.5	Total Delay for Signalled Lanes (pcuHr):	2.98	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	40.2	Total Delay for Signalled Lanes (pcuHr):	13.61	Cycle Time (s): 293
	PRC Over All Lanes (%):	40.2	Total Delay Over All Lanes(pcuHr):	16.59	

Basic Results Summary

Scenario 9: 'AM 2038 Base' (FG9: 'AM 2038 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

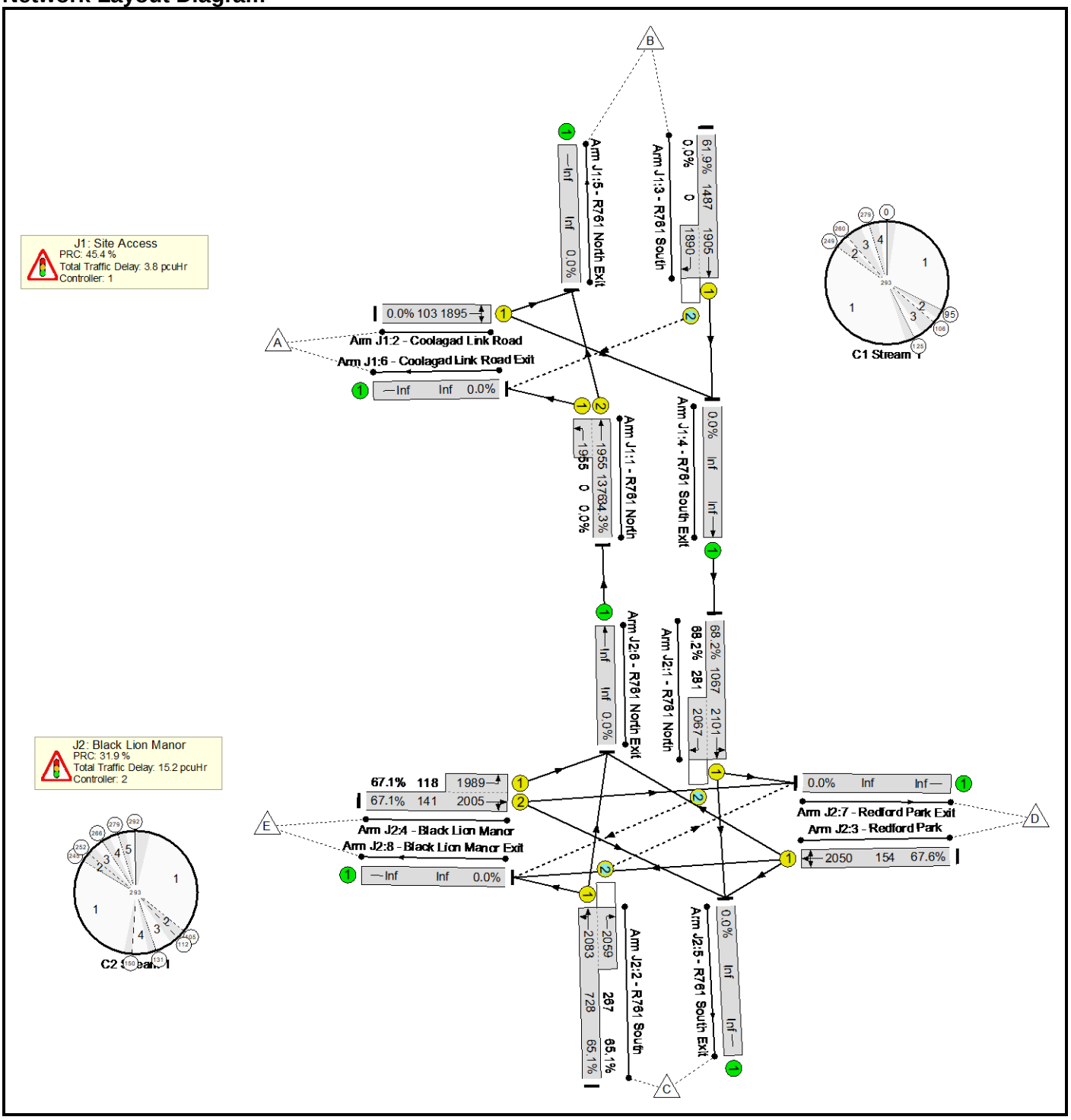
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**78.8%**	**375**	**0**	**0**	**23.8**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**61.8%**	**0**	**0**	**0**	**3.7**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	850	1955:1955	1376+0	61.8 : 0.0%	-	-	-	2.8	12.1	17.5
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	455	1905:1890	1487+0	30.6 : 0.0%	0	0	0	0.8	6.6	6.7
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**78.8%**	**375**	**0**	**0**	**20.2**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:201	-	455	2101:2067	507+230	61.7 : 61.7%	142	0	0	3.2	25.0	7.3
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:201	-	1064	2083:2059	1059+297	78.5 : 78.5%	233	0	0	7.1	24.1	34.1
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	124	2050	161	77.1%	-	-	-	3.9	112.5	7.2
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	16:30	-	233	2005:1989	114+181	78.8 : 78.8%	-	-	-	6.0	92.6	8.8

C1	Stream: 1 PRC for Signalled Lanes (%):	45.7	Total Delay for Signalled Lanes (pcuHr):	3.68	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	14.2	Total Delay for Signalled Lanes (pcuHr):	20.15	Cycle Time (s): 293
	PRC Over All Lanes (%):	14.2	Total Delay Over All Lanes(pcuHr):	23.83	

Basic Results Summary

Scenario 10: 'PM 2038 Base' (FG10: 'PM 2038 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**68.2%**	**366**	**0**	**0**	**19.0**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**61.9%**	**0**	**0**	**0**	**3.8**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	472	1955:1955	1376+0	34.3 : 0.0%	-	-	-	1.2	9.0	5.3
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	920	1905:1890	1487+0	61.9 : 0.0%	0	0	0	2.6	10.3	20.0
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**68.2%**	**366**	**0**	**0**	**15.2**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	920	2101:2067	1067+281	68.2 : 68.2%	192	0	0	3.6	14.0	25.1
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	648	2083:2059	728+267	65.1 : 65.1%	174	0	0	4.6	25.7	13.5
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	104	2050	154	67.6%	-	-	-	2.9	101.4	5.6
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	174	2005:1989	141+118	67.1 : 67.1%	-	-	-	4.0	83.5	5.0

C1	Stream: 1 PRC for Signalled Lanes (%):	45.4	Total Delay for Signalled Lanes (pcuHr):	3.82	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	31.9	Total Delay for Signalled Lanes (pcuHr):	15.16	Cycle Time (s): 293
	PRC Over All Lanes (%):	31.9	Total Delay Over All Lanes(pcuHr):	18.98	

Basic Results Summary

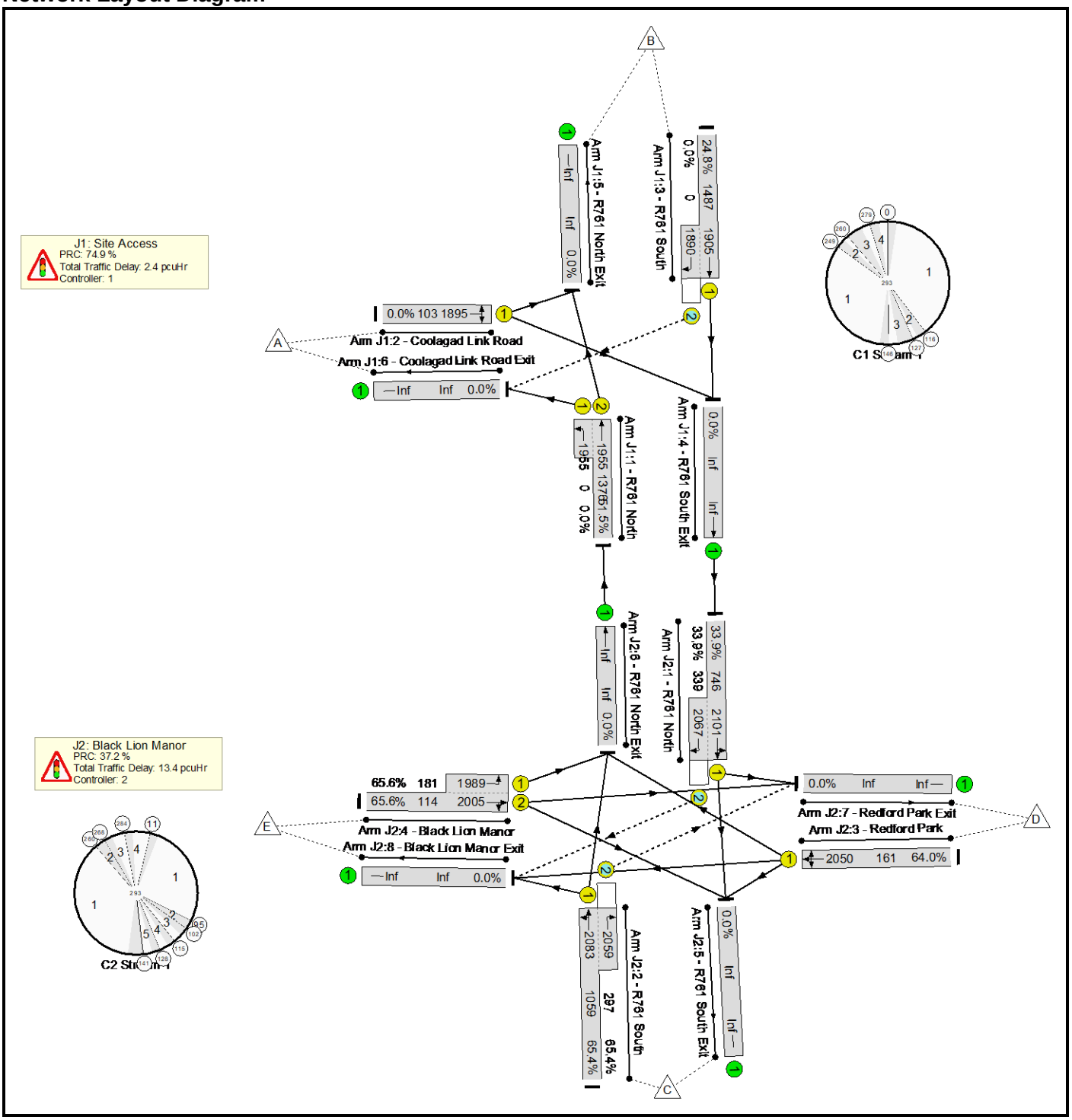
User and Project Details

Project:	
Title: **Location:** **Additional detail:** **File name:** **Author:**	Linsig Network Black Lion Manor and Site Access Rev 4D Full Dev.lsg3x
Company: **Address:**	

Basic Results Summary

Scenario 1: 'AM Base' (FG1: 'AM Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

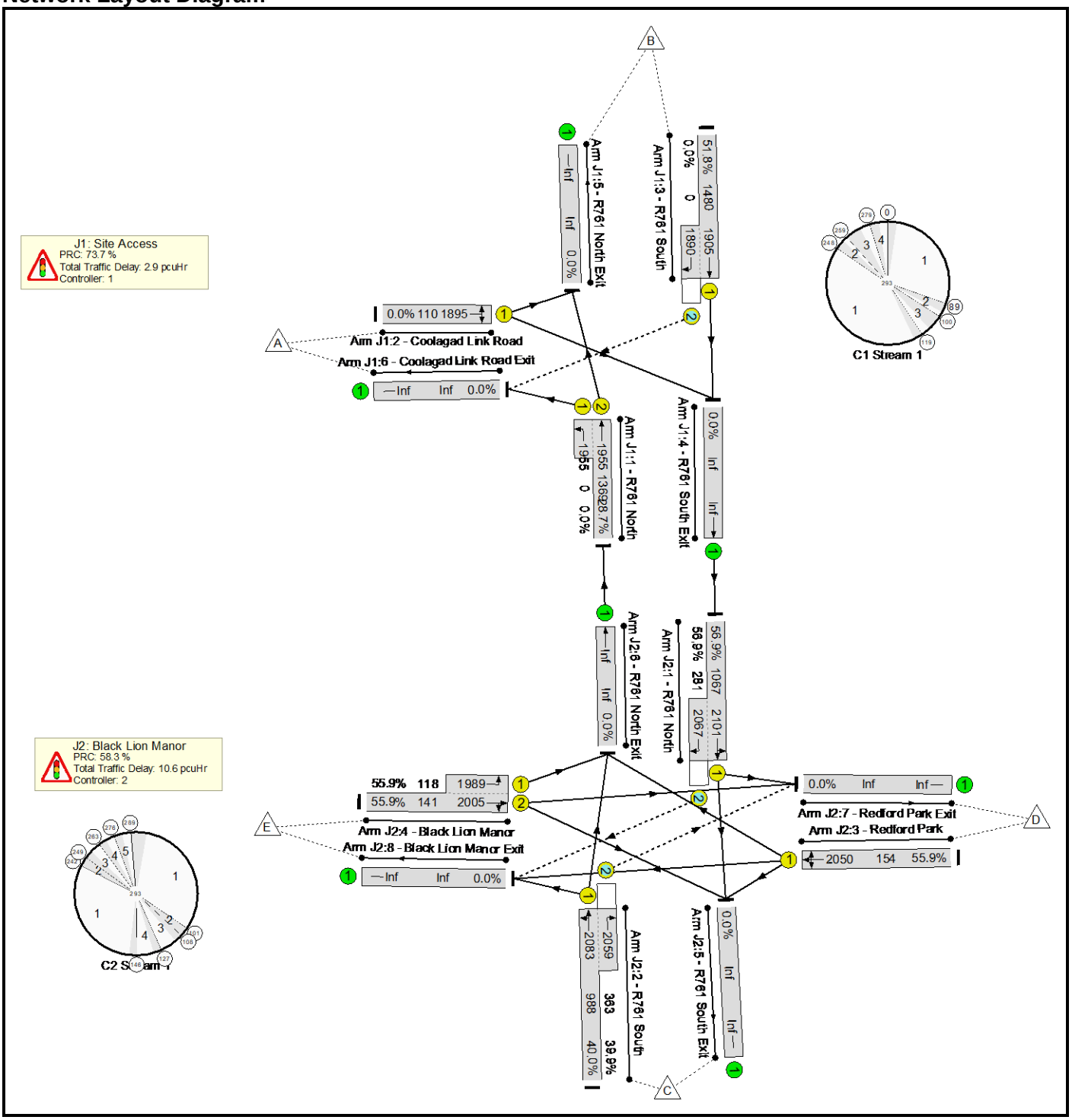
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**65.6%**	**309**	**0**	**0**	**15.9**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**51.5%**	**0**	**0**	**0**	**2.4**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	708	1955:1955	1376+0	51.5 : 0.0%	-	-	-	1.8	9.1	15.7
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	368	1905:1890	1487+0	24.8 : 0.0%	0	0	0	0.6	6.2	5.1
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**65.6%**	**309**	**0**	**0**	**13.4**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:200	-	368	2101:2067	746+339	33.9 : 33.9%	115	0	0	1.5	14.6	3.4
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:200	-	887	2083:2059	1059+297	65.4 : 65.4%	194	0	0	4.7	19.0	22.9
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	103	2050	161	64.0%	-	-	-	2.8	98.1	5.7
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	17:30	-	194	2005:1989	114+181	65.6 : 65.6%	-	-	-	4.5	82.6	6.4

C1	Stream: 1 PRC for Signalled Lanes (%):	74.9	Total Delay for Signalled Lanes (pcuHr):	2.43	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	37.2	Total Delay for Signalled Lanes (pcuHr):	13.44	Cycle Time (s): 293
	PRC Over All Lanes (%):	37.2	Total Delay Over All Lanes(pcuHr):	15.86	

Basic Results Summary

Scenario 2: 'PM Base' (FG2: 'PM Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

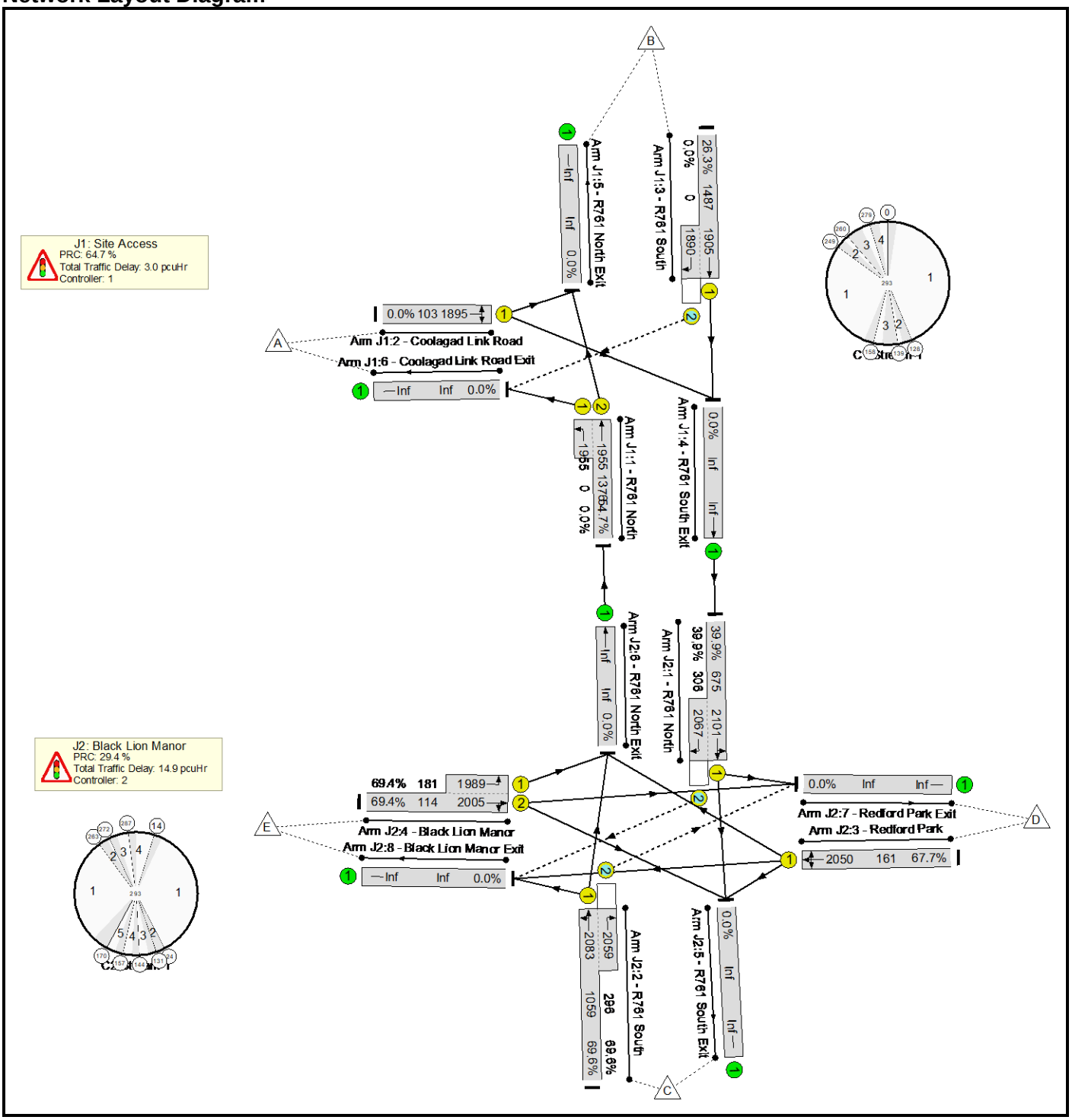
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**56.9%**	**305**	**0**	**0**	**13.5**	**-**	**-**
J1: Site Access	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**51.8%**	**0**	**0**	**0**	**2.9**	**-**	**-**
1/2+1/1	R761 North Ahead Left	U	C1:A		2	204	-	393	1955:1955	1369+0	28.7 : 0.0%	-	-	-	1.0	8.9	4.5
2/1	Coolagad Link Road Right Left	U	C1:B		2	15	-	0	1895	110	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	226	8	767	1905:1890	1480+0	51.8 : 0.0%	0	0	0	1.9	8.9	14.8
J2: Black Lion Manor	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**56.9%**	**305**	**0**	**0**	**10.6**	**-**	**-**
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	767	2101:2067	1067+281	56.9 : 56.9%	160	0	0	2.5	11.8	15.3
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	540	2083:2059	988+363	40.0 : 39.9%	145	0	0	2.8	18.7	9.6
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	86	2050	154	55.9%	-	-	-	2.2	92.1	4.3
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	145	2005:1989	141+118	55.9 : 55.9%	-	-	-	3.1	77.8	3.9

C1	Stream: 1 PRC for Signalled Lanes (%):	73.7	Total Delay for Signalled Lanes (pcuHr):	2.87	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	58.3	Total Delay for Signalled Lanes (pcuHr):	10.65	Cycle Time (s): 293
	PRC Over All Lanes (%):	58.3	Total Delay Over All Lanes(pcuHr):	13.52	

Basic Results Summary

Scenario 3: 'AM 2023 Base' (FG3: 'AM 2023 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

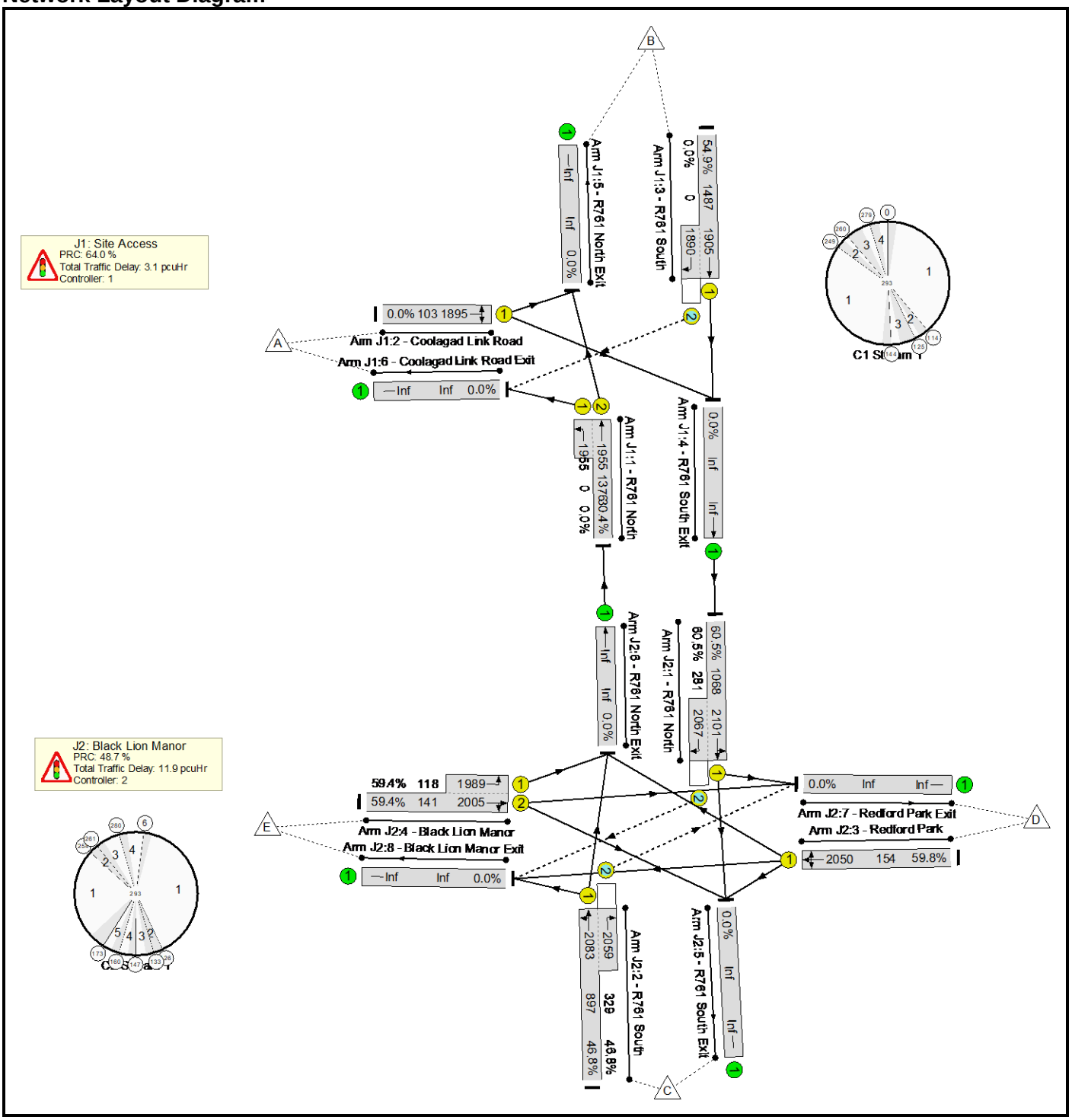
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**69.6%**	**328**	**0**	**0**	**17.9**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**54.7%**	**0**	**0**	**0**	**3.0**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	752	1955:1955	1376+0	54.7 : 0.0%	-	-	-	2.3	11.1	10.8
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	391	1905:1890	1487+0	26.3 : 0.0%	0	0	0	0.7	6.3	5.5
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**69.6%**	**328**	**0**	**0**	**14.9**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	185:201	-	391	2101:2067	675+306	39.9 : 39.9%	122	0	0	1.8	16.3	5.2
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	185:201	-	943	2083:2059	1059+296	69.6 : 69.6%	206	0	0	5.3	20.3	25.9
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	109	2050	161	67.7%	-	-	-	3.0	99.1	5.3
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	16:30	-	205	2005:1989	114+181	69.4 : 69.4%	-	-	-	4.8	83.6	6.3

C1	Stream: 1 PRC for Signalled Lanes (%):	64.7	Total Delay for Signalled Lanes (pcuHr):	3.00	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	29.4	Total Delay for Signalled Lanes (pcuHr):	14.85	Cycle Time (s): 293
	PRC Over All Lanes (%):	29.4	Total Delay Over All Lanes(pcuHr):	17.85	

Basic Results Summary

Scenario 4: 'PM 2023 Base' (FG4: 'PM 2023 Base', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

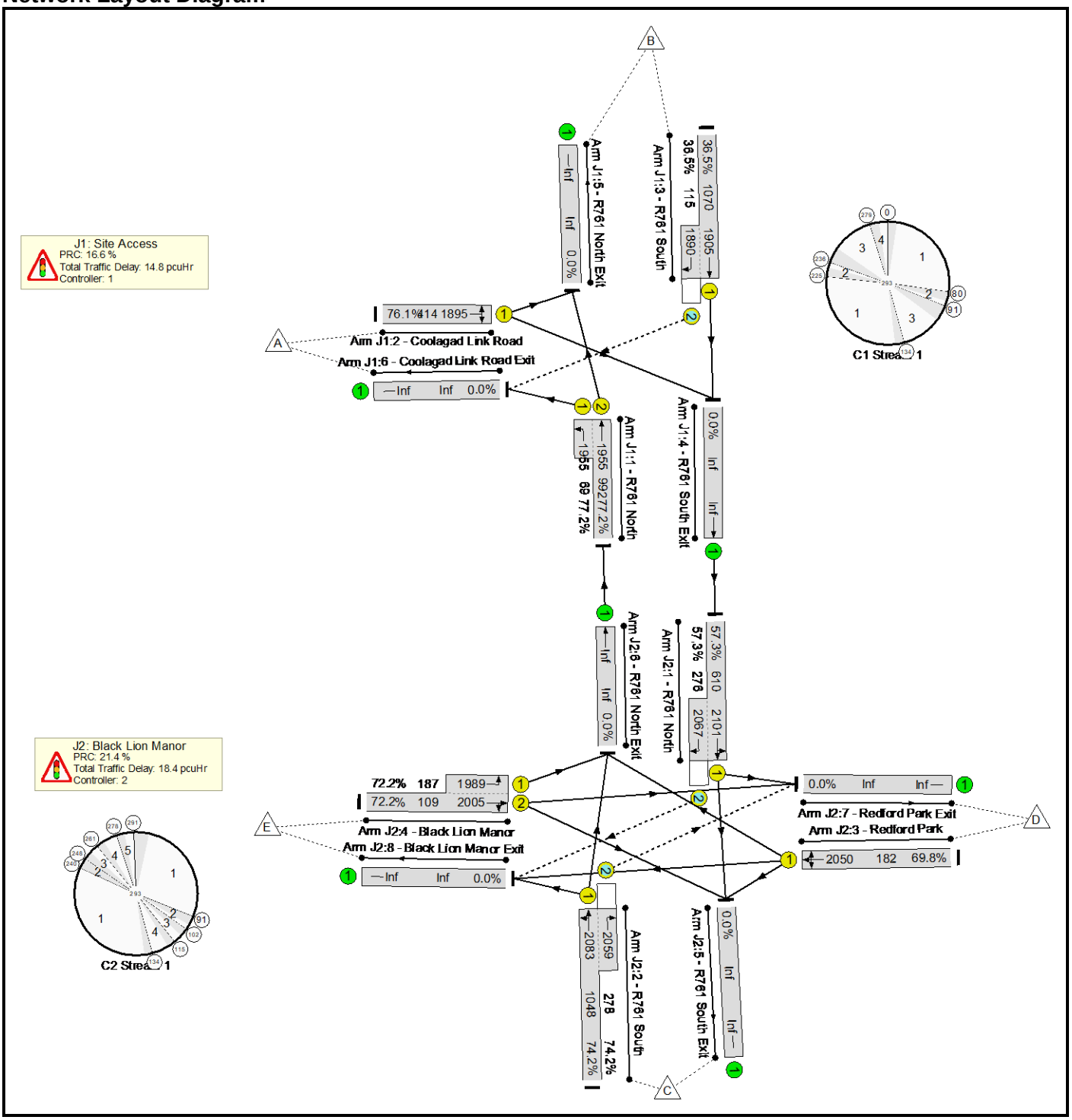
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**60.5%**	**324**	**0**	**0**	**15.0**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**54.9%**	**0**	**0**	**0**	**3.1**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	205	-	418	1955:1955	1376+0	30.4 : 0.0%	-	-	-	1.0	8.9	5.2
2/1	Coolagad Link Road Right Left	U	C1:B		2	14	-	0	1895	103	0.0%	-	-	-	0.0	0.0	0.0
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	227	8	816	1905:1890	1487+0	54.9 : 0.0%	0	0	0	2.1	9.1	16.0
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**60.5%**	**324**	**0**	**0**	**11.9**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	183:197	-	816	2101:2067	1068+281	60.5 : 60.5%	170	0	0	2.9	12.6	20.1
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	183:197	-	574	2083:2059	897+329	46.8 : 46.8%	154	0	0	3.2	20.3	10.7
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	92	2050	154	59.8%	-	-	-	2.4	94.4	4.6
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	21:33	-	154	2005:1989	141+118	59.4 : 59.4%	-	-	-	3.4	79.9	4.4

C1	Stream: 1 PRC for Signalled Lanes (%):	64.0	Total Delay for Signalled Lanes (pcuHr):	3.10	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	48.7	Total Delay for Signalled Lanes (pcuHr):	11.93	Cycle Time (s): 293
	PRC Over All Lanes (%):	48.7	Total Delay Over All Lanes(pcuHr):	15.03	

Basic Results Summary

Scenario 5: 'AM 2023 + Dev' (FG5: 'AM 2023 + Dev', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

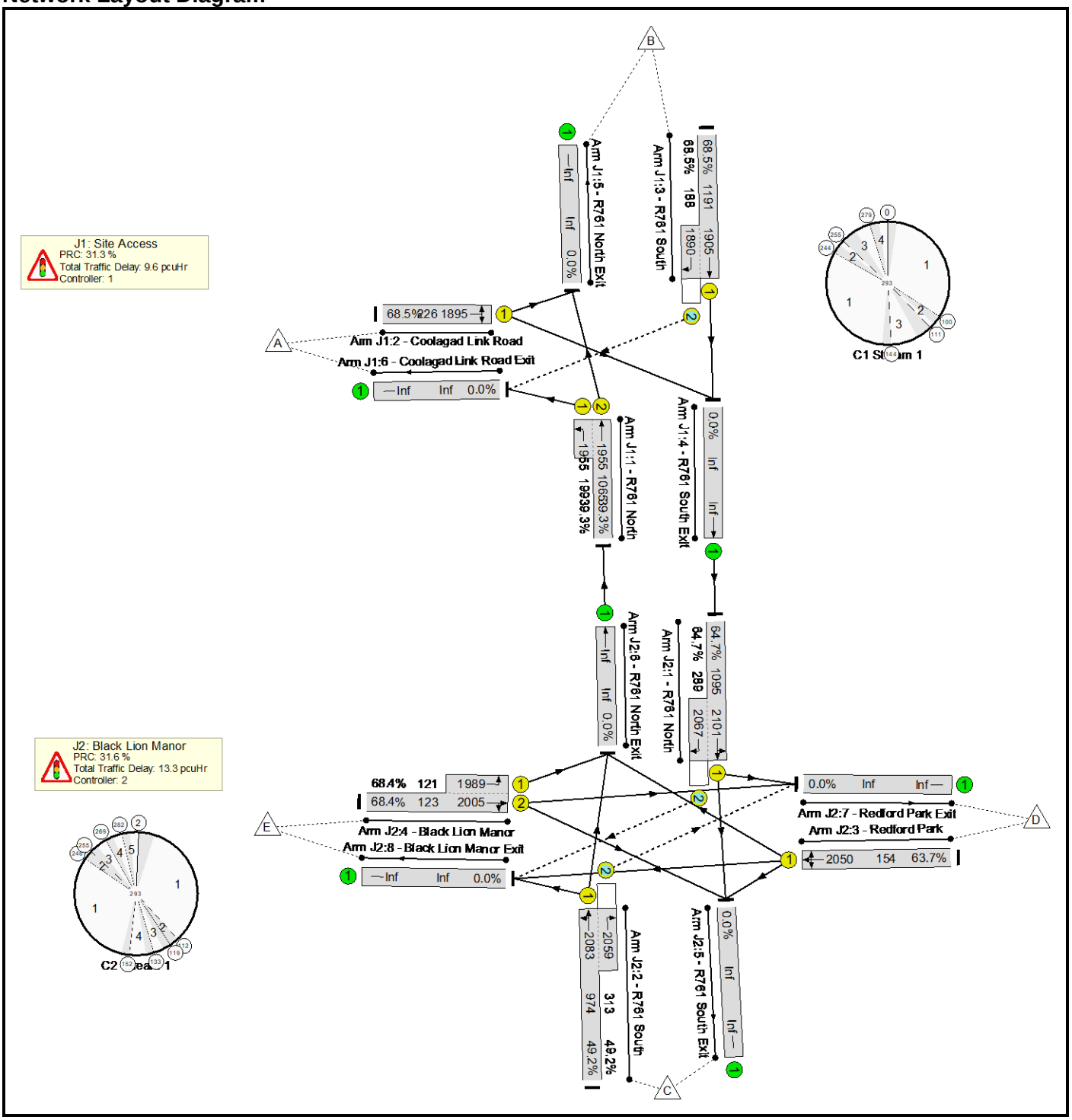
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**77.2%**	**403**	**3**	**1**	**33.3**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**77.2%**	**39**	**3**	**1**	**14.8**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	157	-	819	1955:1955	992+69	77.2 : 77.2%	-	-	-	6.3	27.7	28.8
2/1	Coolagad Link Road Right Left	U	C1:B		2	62	-	315	1895	414	76.1%	-	-	-	6.2	71.3	13.7
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	179	8	433	1905:1890	1070+115	36.5 : 36.5%	39	3	1	2.3	19.2	9.4
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**74.2%**	**364**	**0**	**0**	**18.4**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	181:200	-	508	2101:2067	610+276	57.3 : 57.3%	158	0	0	3.5	24.6	5.0
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	181:200	-	983	2083:2059	1048+278	74.2 : 74.2%	206	0	0	6.5	23.7	31.0
3/1	Redford Park Left Right Ahead	U	C2:G		2	24	-	127	2050	182	69.8%	-	-	-	3.4	96.4	6.2
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	14:31	-	214	2005:1989	109+187	72.2 : 72.2%	-	-	-	5.1	85.4	6.7

C1	Stream: 1 PRC for Signalled Lanes (%):	16.6	Total Delay for Signalled Lanes (pcuHr):	14.85	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	21.4	Total Delay for Signalled Lanes (pcuHr):	18.42	Cycle Time (s): 293
	PRC Over All Lanes (%):	16.6	Total Delay Over All Lanes(pcuHr):	33.27	

Basic Results Summary

Scenario 6: 'PM 2023 + Dev' (FG6: 'PM 2023 + Dev', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

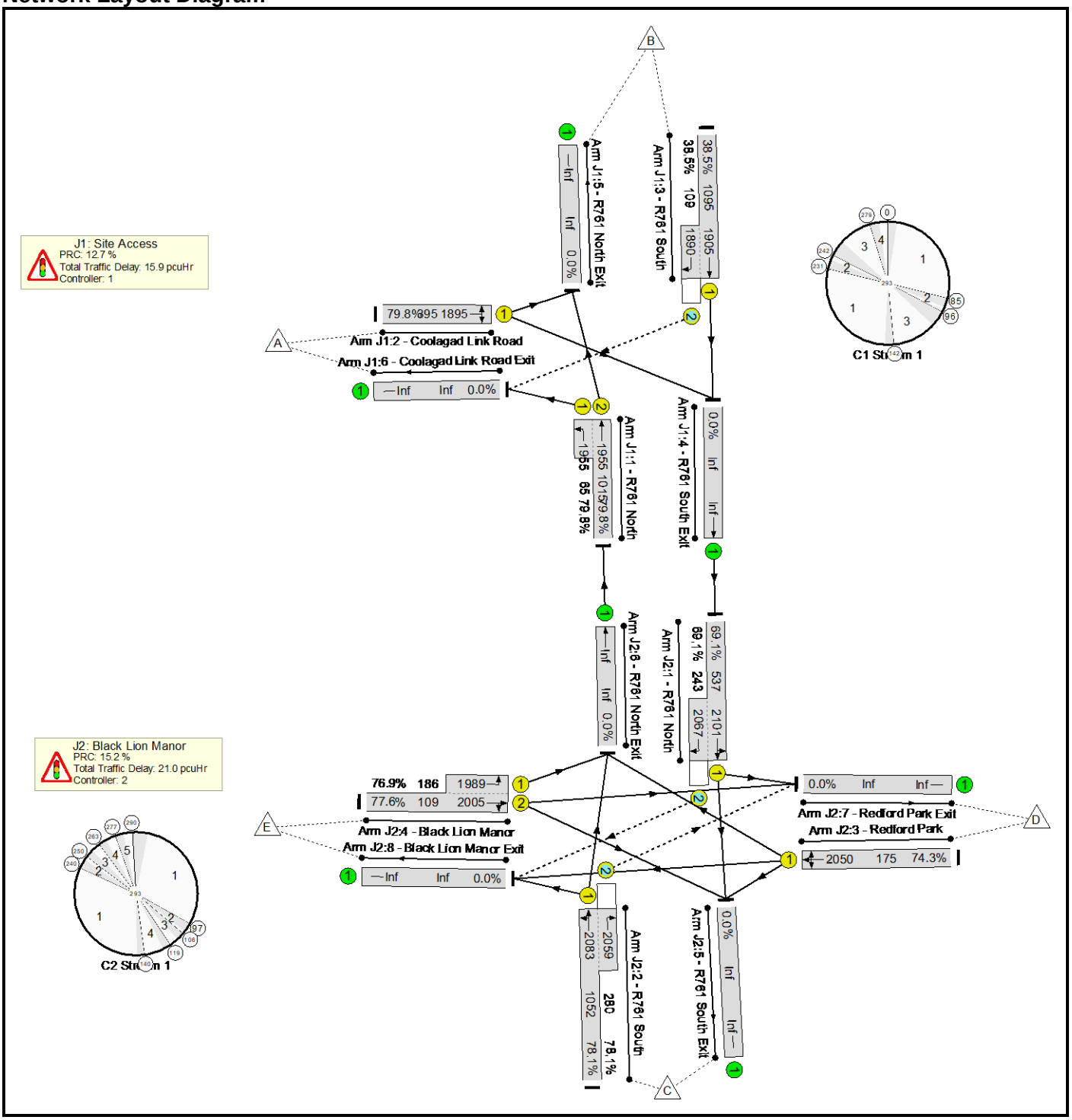
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**68.5%**	**460**	**8**	**2**	**22.9**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**68.5%**	**119**	**8**	**2**	**9.6**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	186	-	496	1955:1955	1065+199	39.3 : 39.3%	-	-	-	1.7	12.6	6.9
2/1	Coolagad Link Road Right Left	U	C1:B		2	33	-	155	1895	226	68.5%	-	-	-	3.7	86.5	7.4
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	208	8	945	1905:1890	1191+188	68.5 : 68.5%	119	8	2	4.2	15.8	22.7
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**68.4%**	**341**	**0**	**0**	**13.3**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	188:202	-	896	2101:2067	1095+289	64.7 : 64.7%	187	0	0	3.0	12.0	25.1
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	188:202	-	633	2083:2059	974+313	49.2 : 49.2%	154	0	0	3.5	20.2	12.8
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	98	2050	154	63.7%	-	-	-	2.7	97.7	5.1
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	16:28	-	167	2005:1989	123+121	68.4 : 68.4%	-	-	-	4.1	87.6	4.6

C1	Stream: 1 PRC for Signalled Lanes (%):	31.3	Total Delay for Signalled Lanes (pcuHr):	9.61	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	31.6	Total Delay for Signalled Lanes (pcuHr):	13.27	Cycle Time (s): 293
	PRC Over All Lanes (%):	31.3	Total Delay Over All Lanes(pcuHr):	22.88	

Basic Results Summary

Scenario 7: 'AM 2028 + Dev' (FG7: 'AM 2028 + Dev', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

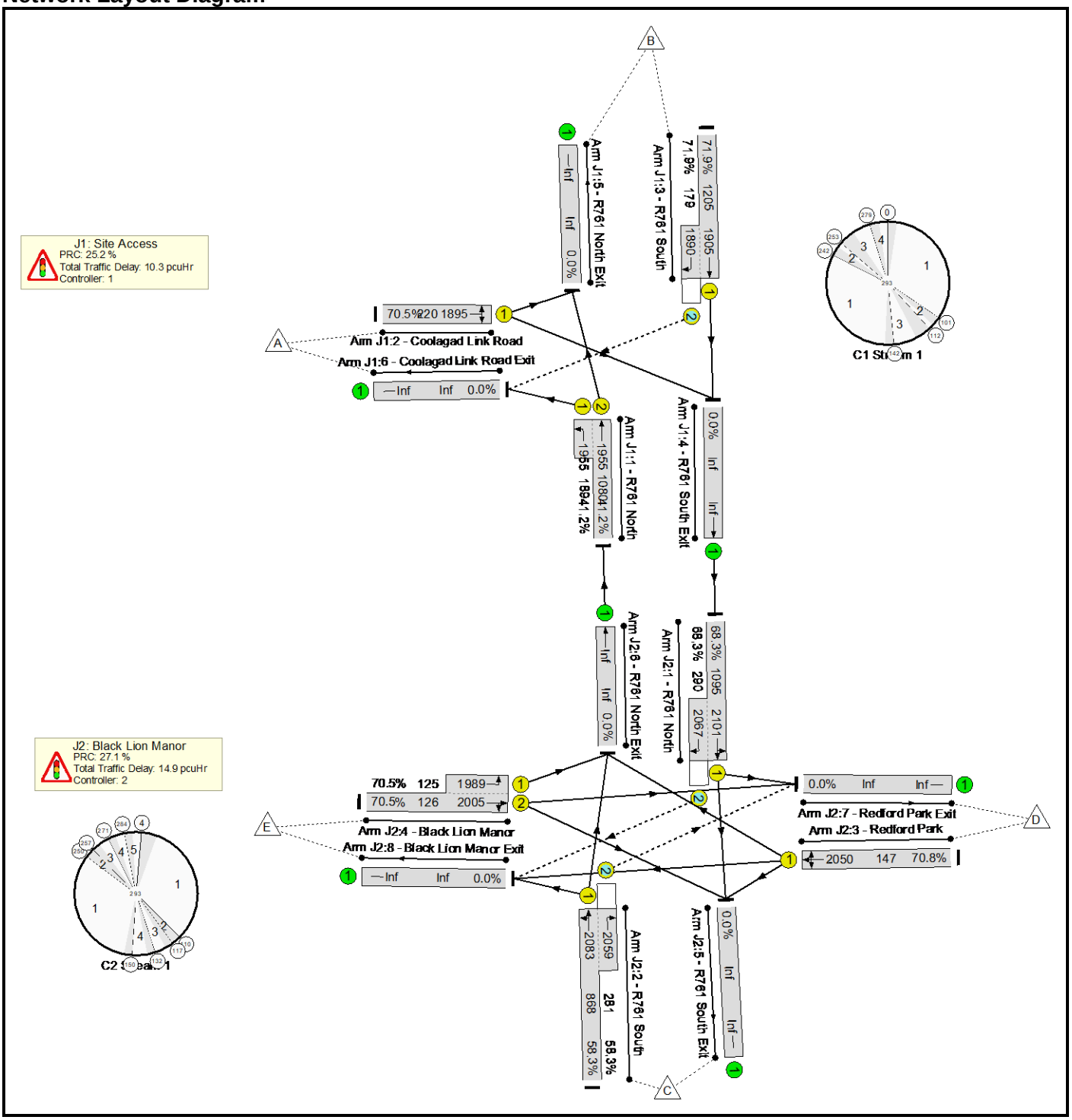
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**79.8%**	**424**	**3**	**3**	**36.9**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**79.8%**	**39**	**3**	**1**	**15.9**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	160	-	862	1955:1955	1015+65	79.8 : 79.8%	-	-	-	6.8	28.3	31.8
2/1	Coolagad Link Road Right Left	U	C1:B		2	59	-	315	1895	395	79.8%	-	-	-	6.7	76.8	14.6
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	182	8	464	1905:1890	1095+109	38.5 : 38.5%	39	3	1	2.4	18.6	9.4
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**78.1%**	**385**	**0**	**2**	**21.0**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	182:201	-	539	2101:2067	537+243	69.1 : 69.1%	168	0	0	4.3	28.5	5.9
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	182:201	-	1041	2083:2059	1052+280	78.1 : 78.1%	217	0	2	7.3	25.2	34.6
3/1	Redford Park Left Right Ahead	U	C2:G		2	23	-	130	2050	175	74.3%	-	-	-	3.7	103.4	6.7
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	14:31	-	228	2005:1989	109+186	77.6 : 76.9%	-	-	-	5.7	90.0	7.8

C1	Stream: 1 PRC for Signalled Lanes (%):	12.7	Total Delay for Signalled Lanes (pcuHr):	15.88	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	15.2	Total Delay for Signalled Lanes (pcuHr):	20.98	Cycle Time (s): 293
	PRC Over All Lanes (%):	12.7	Total Delay Over All Lanes(pcuHr):	36.86	

Basic Results Summary

Scenario 8: 'PM 2028 + Dev' (FG8: 'PM 2028 + Dev', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

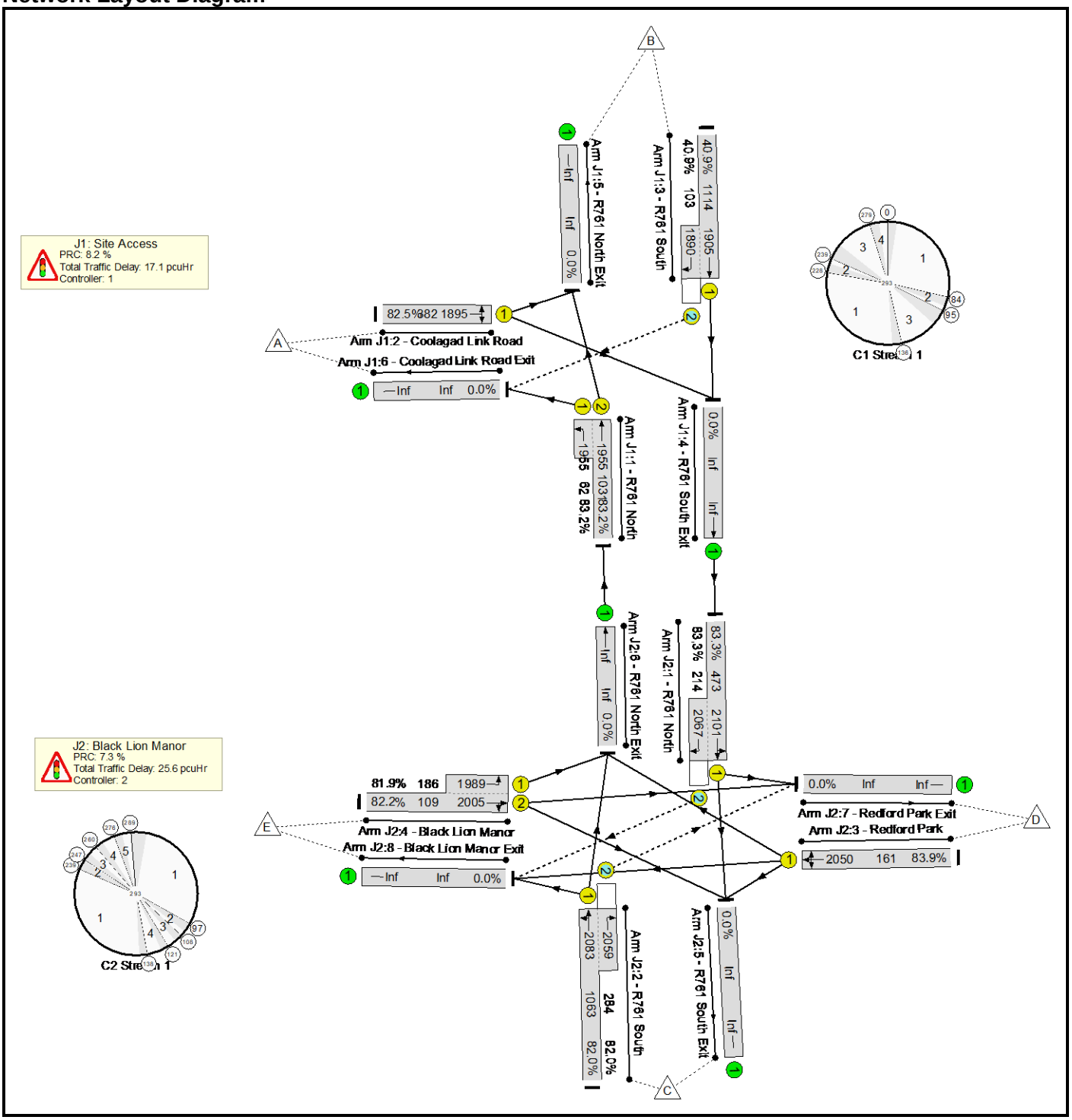
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**71.9%**	**481**	**8**	**2**	**25.3**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**71.9%**	**119**	**8**	**2**	**10.3**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	187	-	523	1955:1955	1080+189	41.2 : 41.2%	-	-	-	1.8	12.6	6.9
2/1	Coolagad Link Road Right Left	U	C1:B		2	32	-	155	1895	220	70.5%	-	-	-	3.8	89.3	7.6
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	209	8	995	1905:1890	1205+179	71.9 : 71.9%	119	8	2	4.6	16.8	26.6
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**70.8%**	**362**	**0**	**0**	**14.9**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	188:202	-	946	2101:2067	1095+290	68.3 : 68.3%	198	0	0	3.3	12.6	27.1
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	188:202	-	670	2083:2059	868+281	58.3 : 58.3%	164	0	0	4.2	22.6	14.2
3/1	Redford Park Left Right Ahead	U	C2:G		2	19	-	104	2050	147	70.8%	-	-	-	3.1	106.7	5.6
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	17:29	-	177	2005:1989	126+125	70.5 : 70.5%	-	-	-	4.3	87.9	4.9

C1	Stream: 1 PRC for Signalled Lanes (%):	25.2	Total Delay for Signalled Lanes (pcuHr):	10.32	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	27.1	Total Delay for Signalled Lanes (pcuHr):	14.94	Cycle Time (s): 293
	PRC Over All Lanes (%):	25.2	Total Delay Over All Lanes(pcuHr):	25.26	

Basic Results Summary

Scenario 9: 'AM 2038 + Dev' (FG9: 'AM 2038 + Dev', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

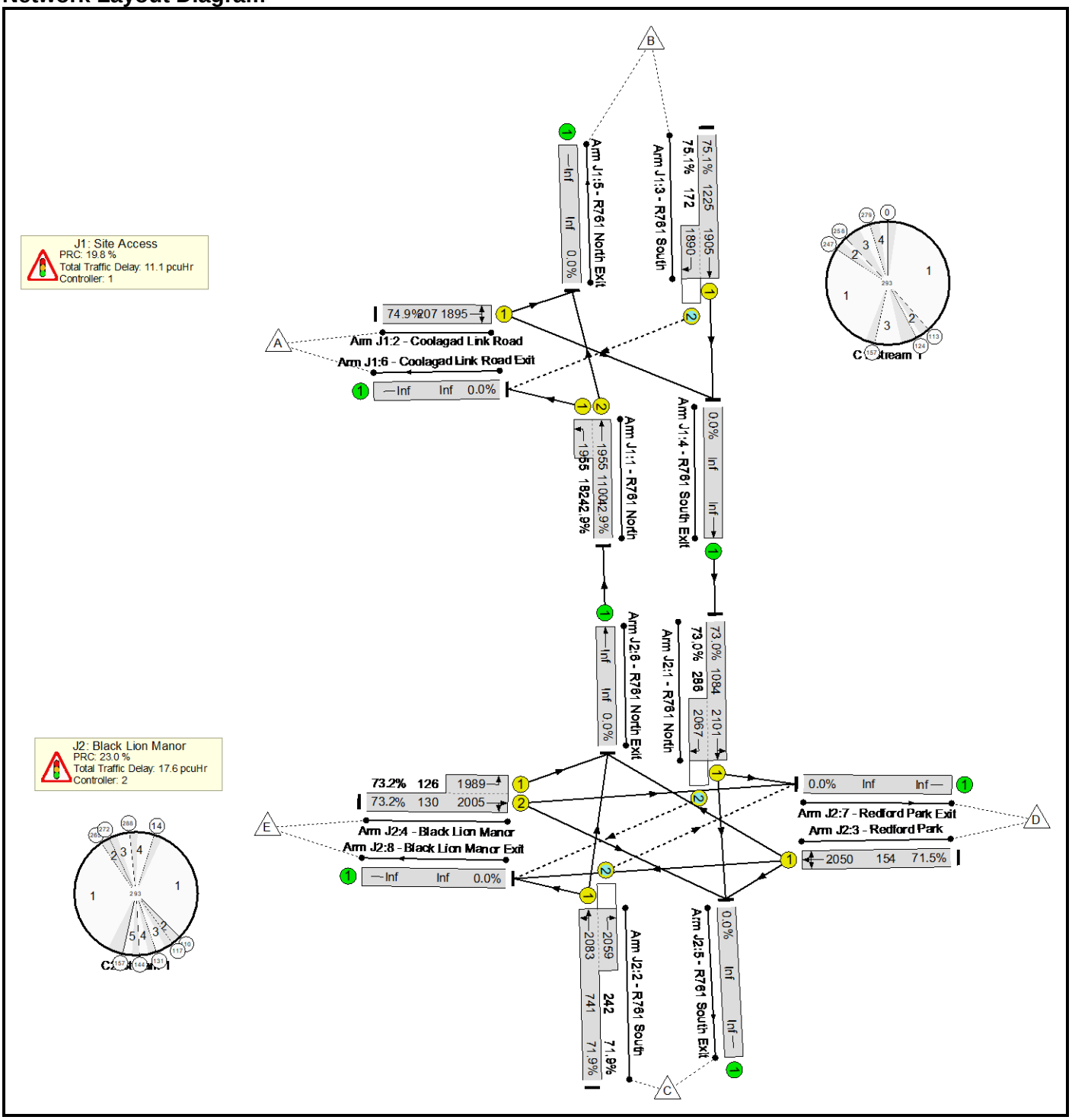
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**83.9%**	**437**	**3**	**13**	**42.7**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**83.2%**	**39**	**3**	**1**	**17.1**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	162	-	910	1955:1955	1031+62	83.2 : 83.2%	-	-	-	7.4	29.4	33.8
2/1	Coolagad Link Road Right Left	U	C1:B		2	57	-	315	1895	382	82.5%	-	-	-	7.1	81.4	14.7
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	184	8	497	1905:1890	1114+103	40.9 : 40.9%	39	3	1	2.6	18.8	11.0
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**83.9%**	**398**	**0**	**13**	**25.6**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	184:203	-	572	2101:2067	473+214	83.3 : 83.3%	168	0	10	6.0	38.0	7.8
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	184:203	-	1104	2083:2059	1063+284	82.0 : 82.0%	230	0	3	8.3	27.2	39.2
3/1	Redford Park Left Right Ahead	U	C2:G		2	21	-	135	2050	161	83.9%	-	-	-	4.7	126.1	8.0
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	14:31	-	242	2005:1989	109+186	82.2 : 81.9%	-	-	-	6.5	96.3	9.1

C1	Stream: 1 PRC for Signalled Lanes (%):	8.2	Total Delay for Signalled Lanes (pcuHr):	17.14	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	7.3	Total Delay for Signalled Lanes (pcuHr):	25.58	Cycle Time (s): 293
	PRC Over All Lanes (%):	7.3	Total Delay Over All Lanes(pcuHr):	42.71	

Basic Results Summary

Scenario 10: 'PM 2038 + Dev' (FG10: 'PM 2038 + Dev', Plan 1: 'Network Control Plan 1')

Network Layout Diagram



Basic Results Summary

Network Results

Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network	-	-	-		-	-	-	-	-	-	**75.1%**	**502**	**8**	**2**	**28.7**	-	-
J1: Site Access	-	-	-		-	-	-	-	-	-	**75.1%**	**119**	**8**	**2**	**11.1**	-	-
1/2+1/1	R761 North Ahead Left	U	C1:A		2	189	-	550	1955:1955	1100+182	42.9 : 42.9%	-	-	-	1.9	12.1	8.5
2/1	Coolagad Link Road Right Left	U	C1:B		2	30	-	155	1895	207	74.9%	-	-	-	4.2	97.4	8.4
3/1+3/2	R761 South Ahead Right	U+O	C1:C	C1:E	2	211	8	1049	1905:1890	1225+172	75.1 : 75.1%	119	8	2	5.0	17.2	26.8
J2: Black Lion Manor	-	-	-		-	-	-	-	-	-	**73.2%**	**383**	**0**	**0**	**17.6**	-	-
1/1+1/2	R761 North Ahead Left Right	U+O	C2:C C2:D		2	186:200	-	1000	2101:2067	1084+286	73.0 : 73.0%	209	0	0	4.2	15.1	32.2
2/1+2/2	R761 South Ahead Right Left	U+O	C2:A C2:B		2	186:200	-	707	2083:2059	741+242	71.9 : 71.9%	174	0	0	5.5	28.1	16.1
3/1	Redford Park Left Right Ahead	U	C2:G		2	20	-	110	2050	154	71.5%	-	-	-	3.2	105.8	6.0
4/2+4/1	Black Lion Manor Right Left Ahead	U	C2:F C2:E		2	18:30	-	187	2005:1989	130+126	73.2 : 73.2%	-	-	-	4.7	89.5	5.4

C1	Stream: 1 PRC for Signalled Lanes (%):	19.8	Total Delay for Signalled Lanes (pcuHr):	11.06	Cycle Time (s): 293
C2	Stream: 1 PRC for Signalled Lanes (%):	23.0	Total Delay for Signalled Lanes (pcuHr):	17.60	Cycle Time (s): 293
	PRC Over All Lanes (%):	19.8	Total Delay Over All Lanes(pcuHr):	28.66	

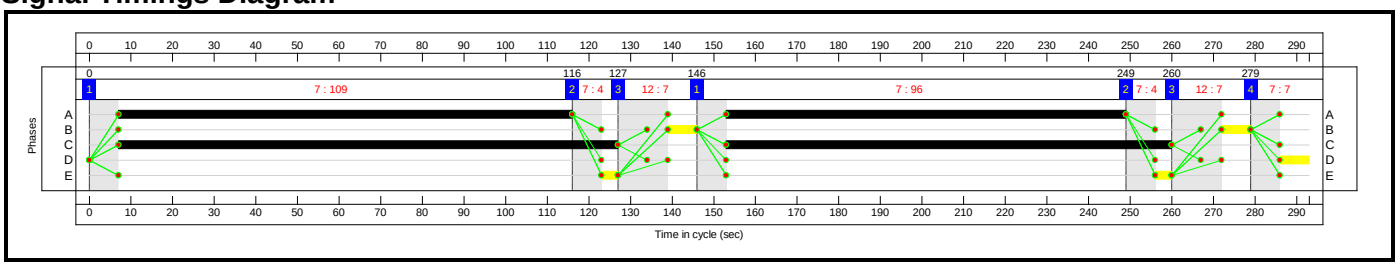
Basic Results Summary

User and Project Details

Project:	
Title:	
Location:	
Additional detail:	
File name:	Linsig Network Black Lion Manor and Site Access Rev 4D Full Dev.lsg3x
Author:	
Company:	
Address:	

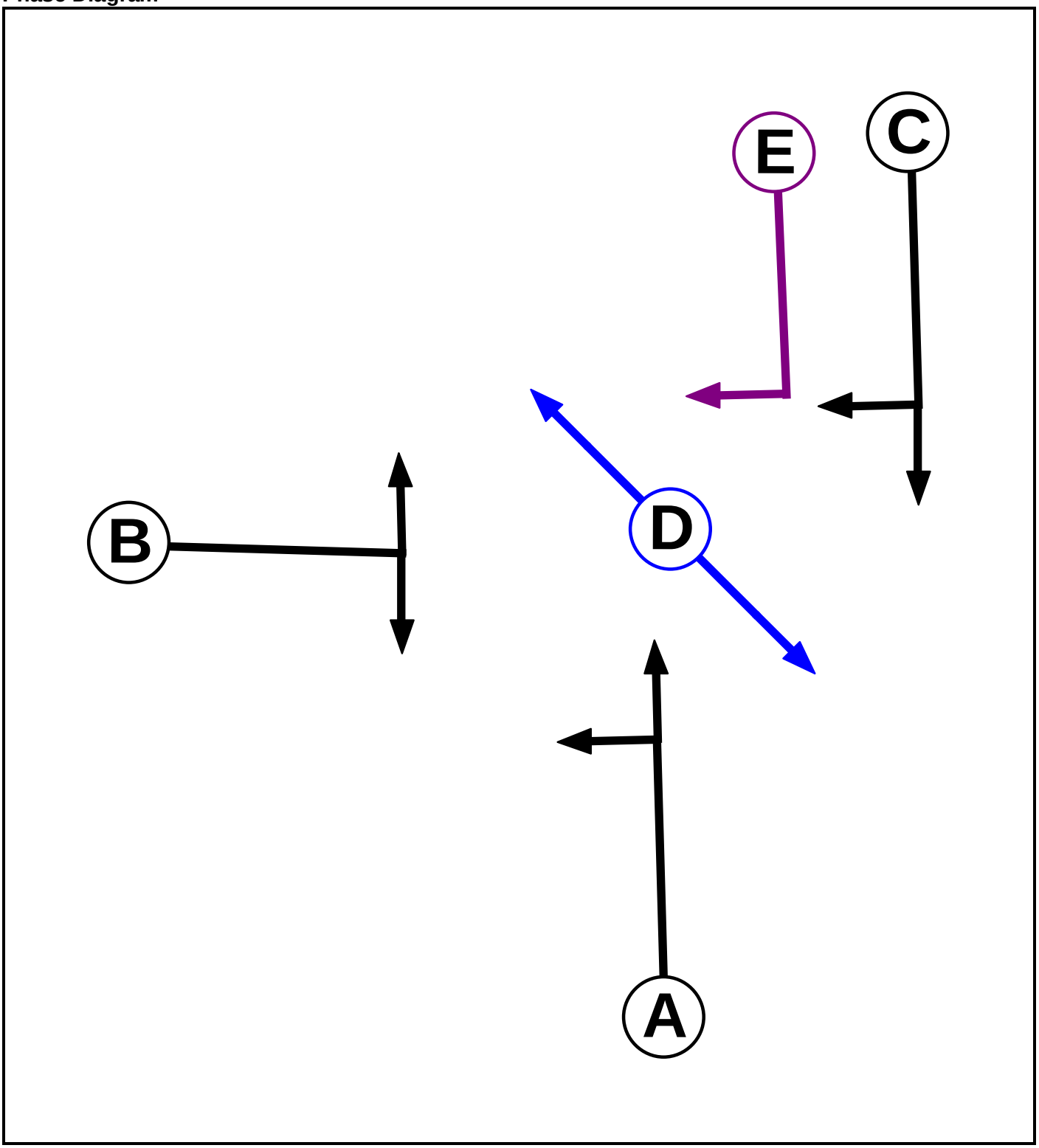
Scenario 1: 'AM Base' (FG1: 'AM Base', Plan 1: 'Network Control Plan 1')
C1

Signal Timings Diagram



Basic Results Summary

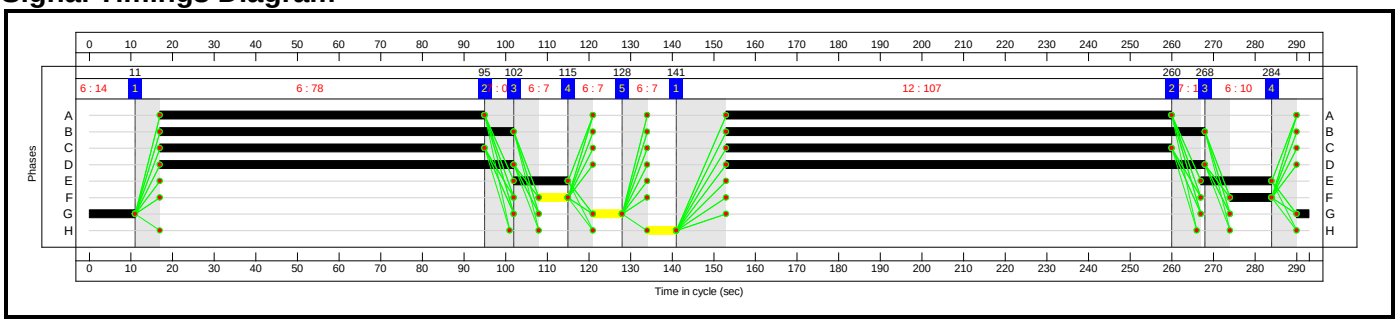
Phase Diagram



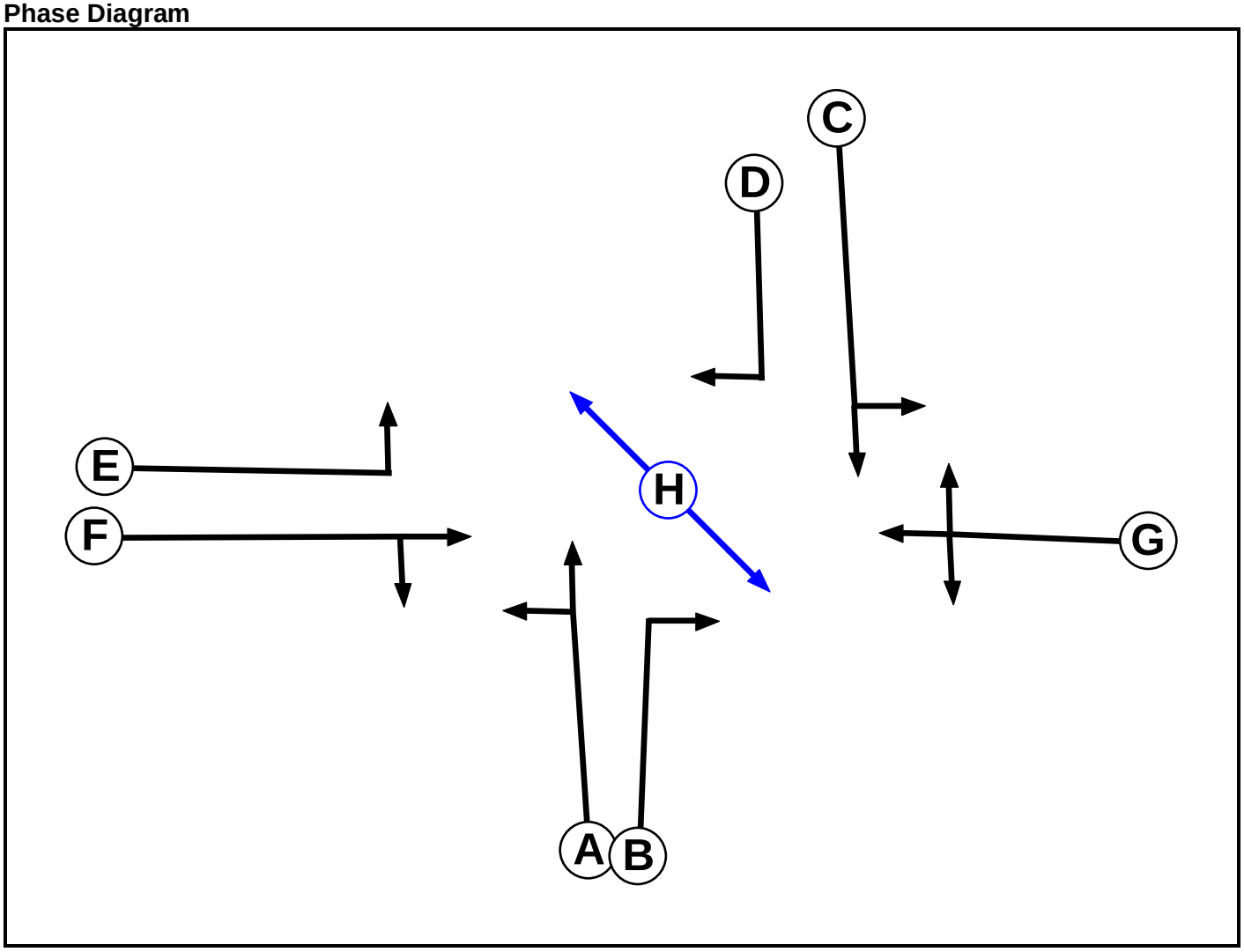
Basic Results Summary

C2

Signal Timings Diagram



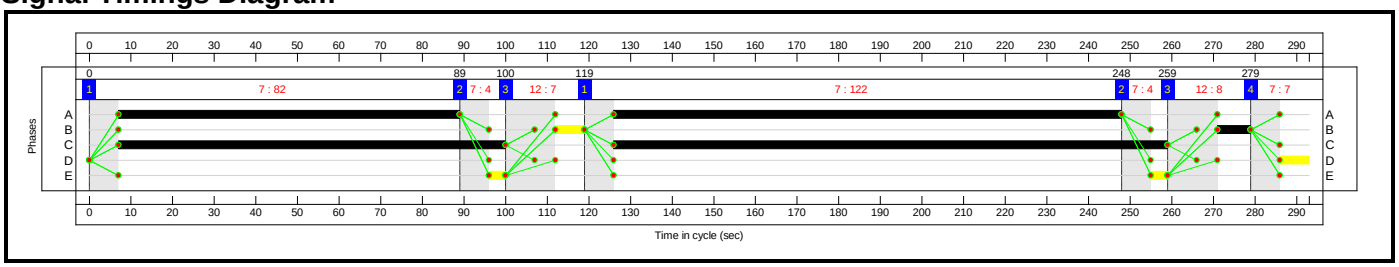
Phase Diagram



Scenario 2: 'PM Base' (FG2: 'PM Base', Plan 1: 'Network Control Plan 1')

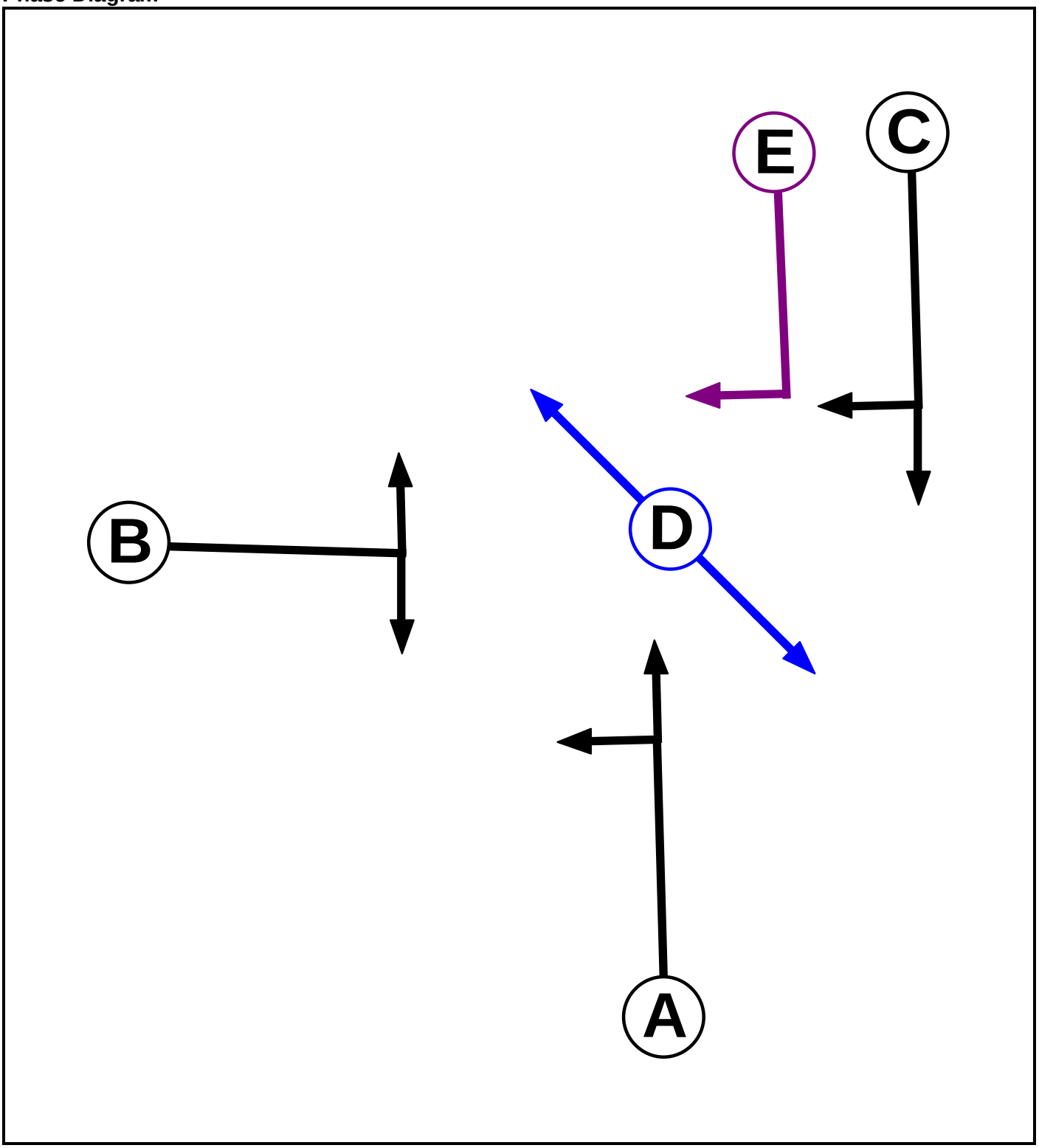
C1

Signal Timings Diagram



Basic Results Summary

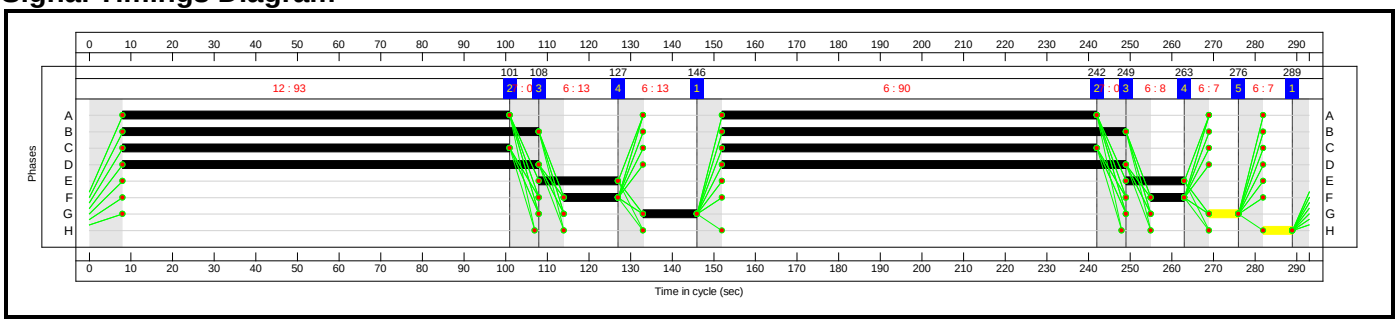
Phase Diagram



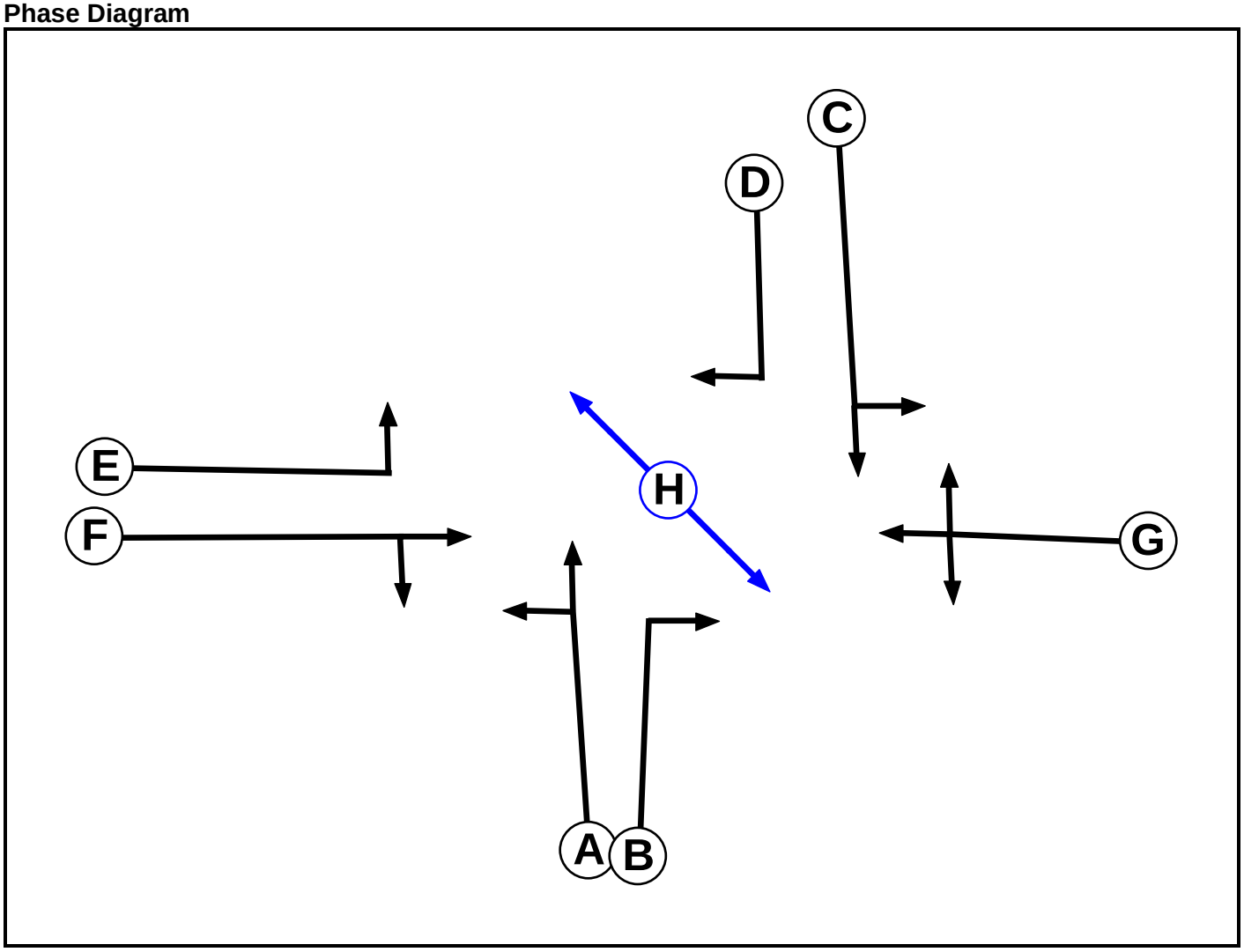
Basic Results Summary

C2

Signal Timings Diagram



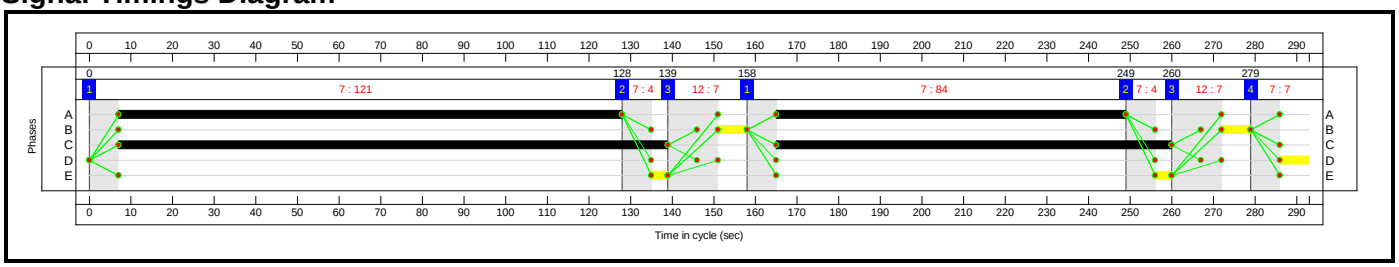
Phase Diagram



Scenario 3: 'AM 2023 Base' (FG3: 'AM 2023 Base', Plan 1: 'Network Control Plan 1')

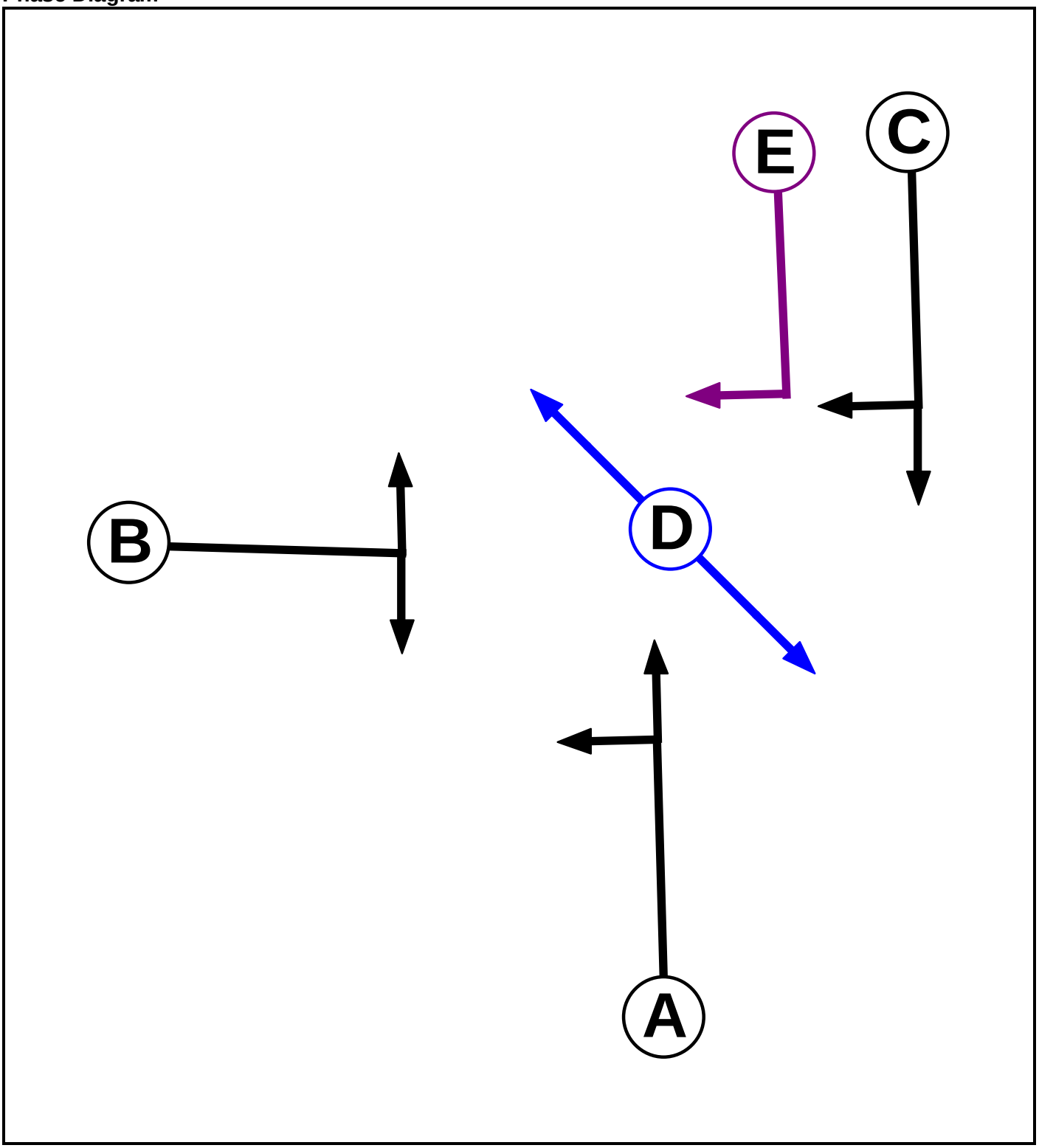
C1

Signal Timings Diagram



Basic Results Summary

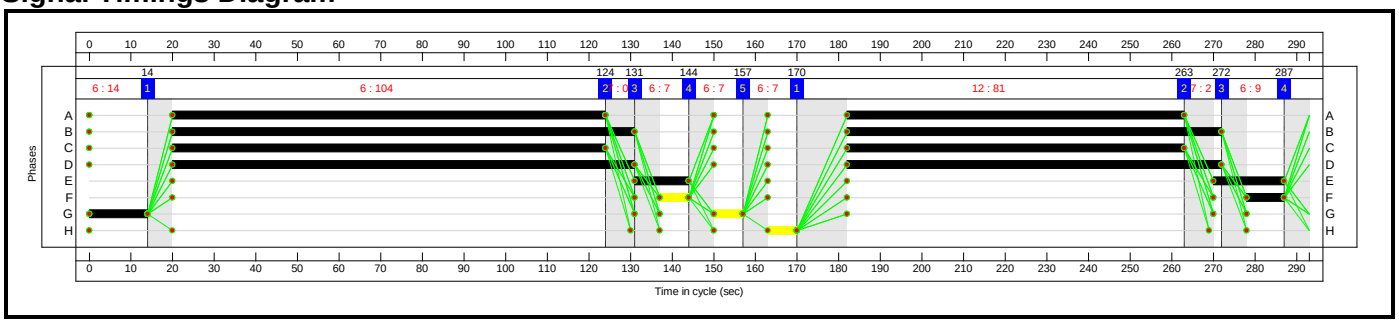
Phase Diagram



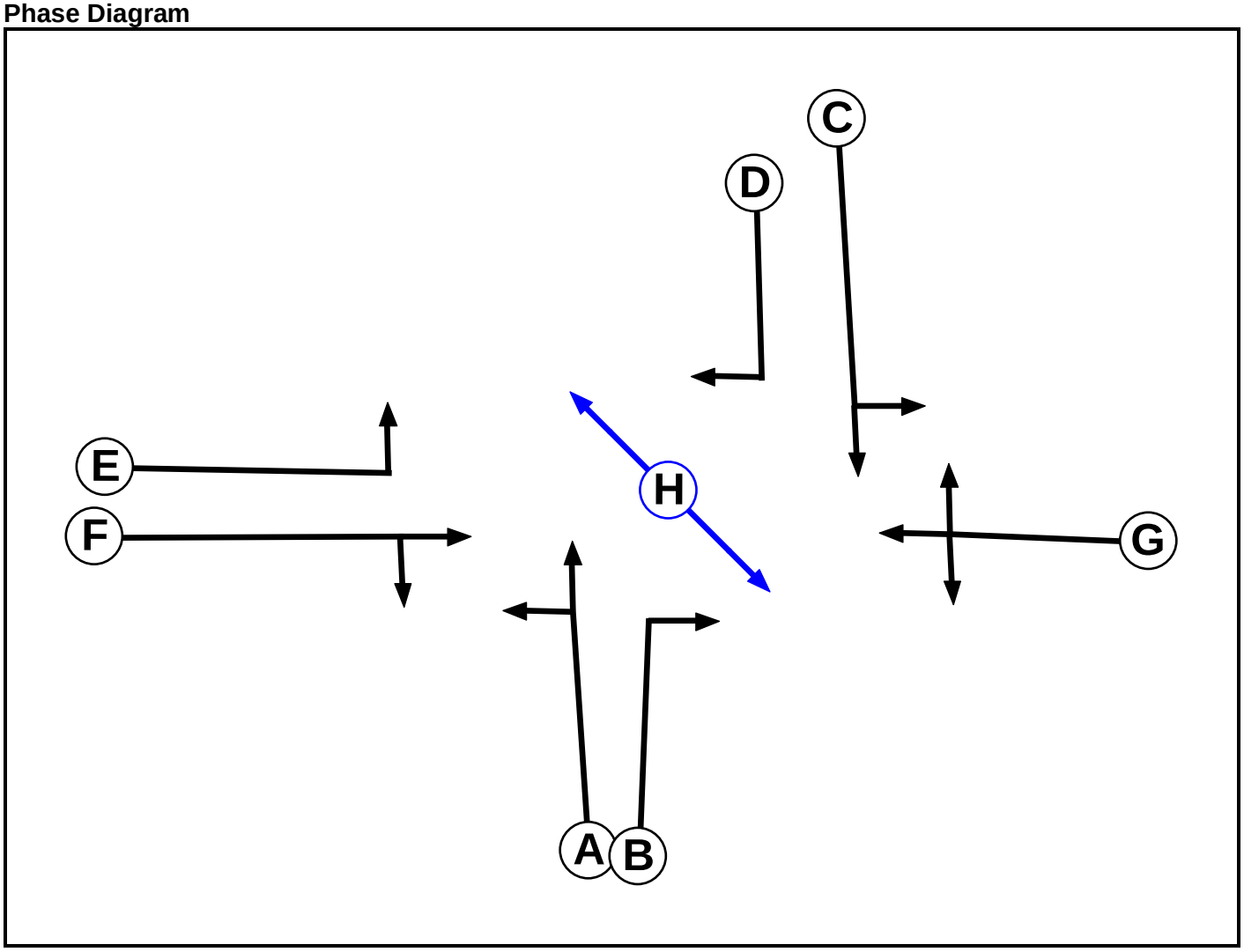
Basic Results Summary

C2

Signal Timings Diagram



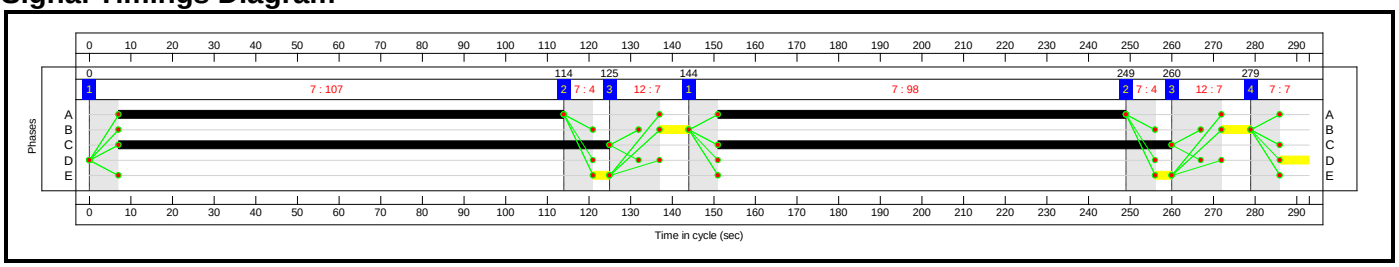
Phase Diagram



Scenario 4: 'PM 2023 Base' (FG4: 'PM 2023 Base', Plan 1: 'Network Control Plan 1')

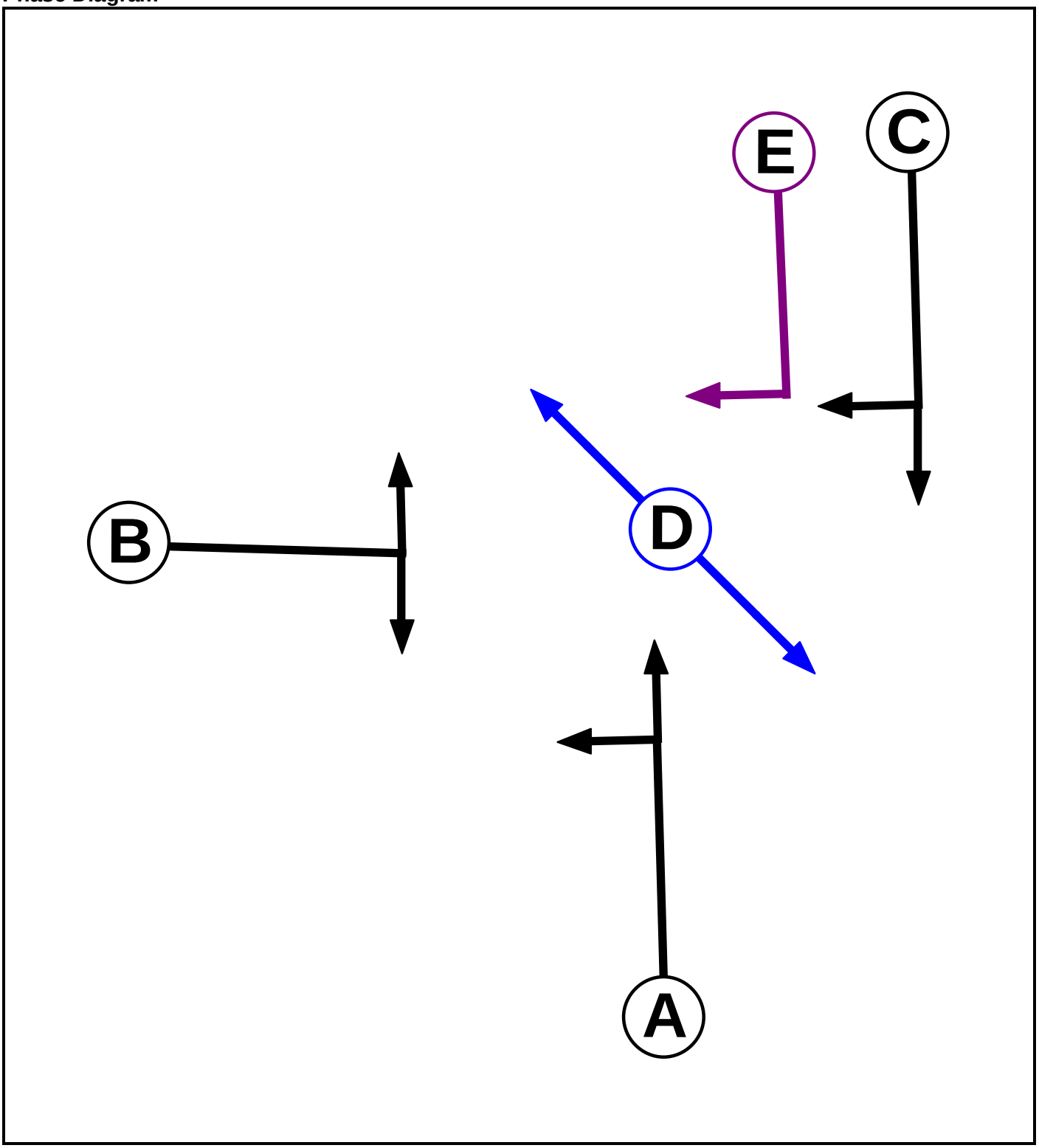
C1

Signal Timings Diagram



Basic Results Summary

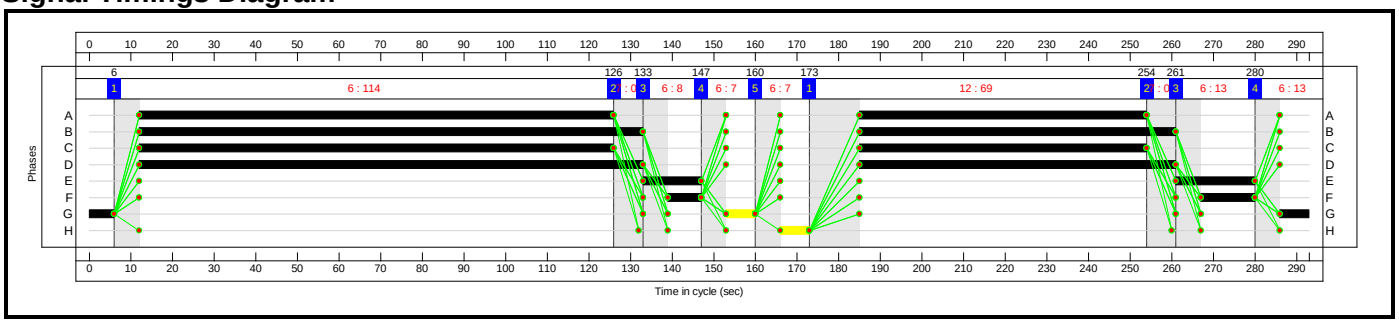
Phase Diagram



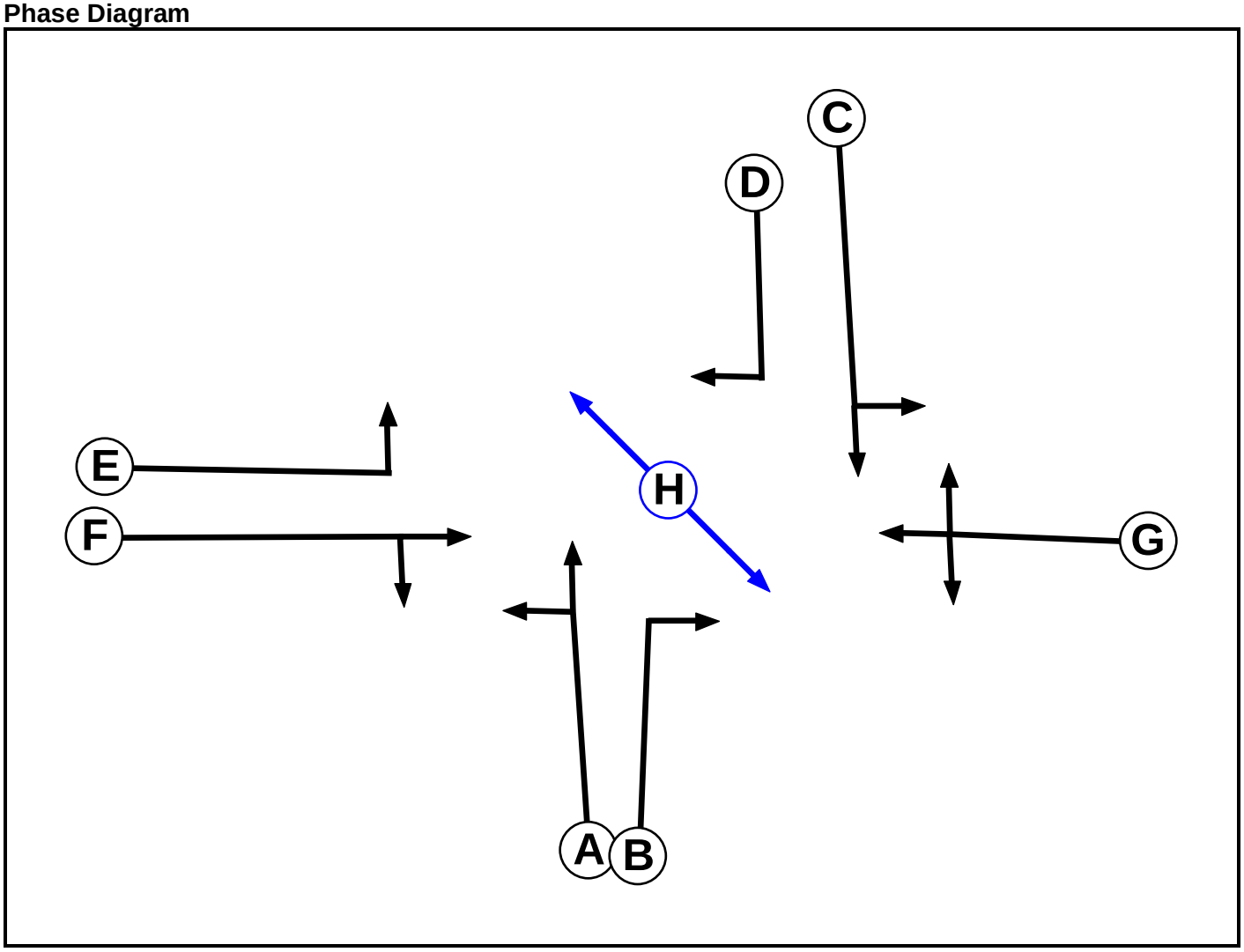
Basic Results Summary

C2

Signal Timings Diagram



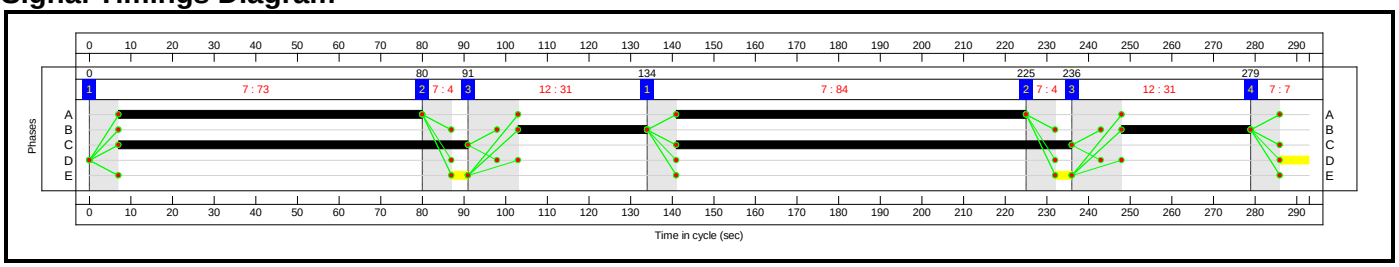
Phase Diagram



Scenario 5: 'AM 2023 + Dev' (FG5: 'AM 2023 + Dev', Plan 1: 'Network Control Plan 1')

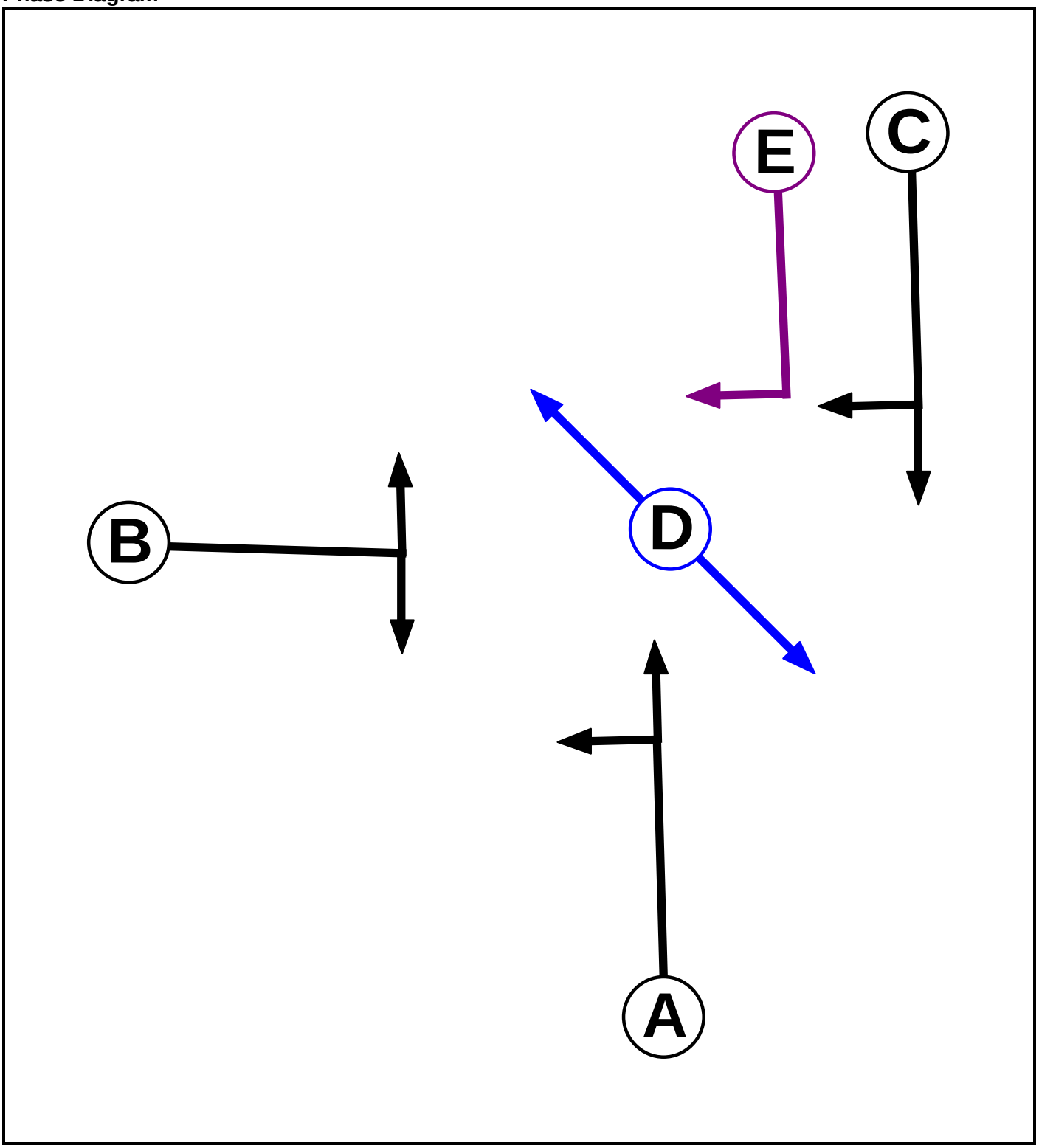
C1

Signal Timings Diagram



Basic Results Summary

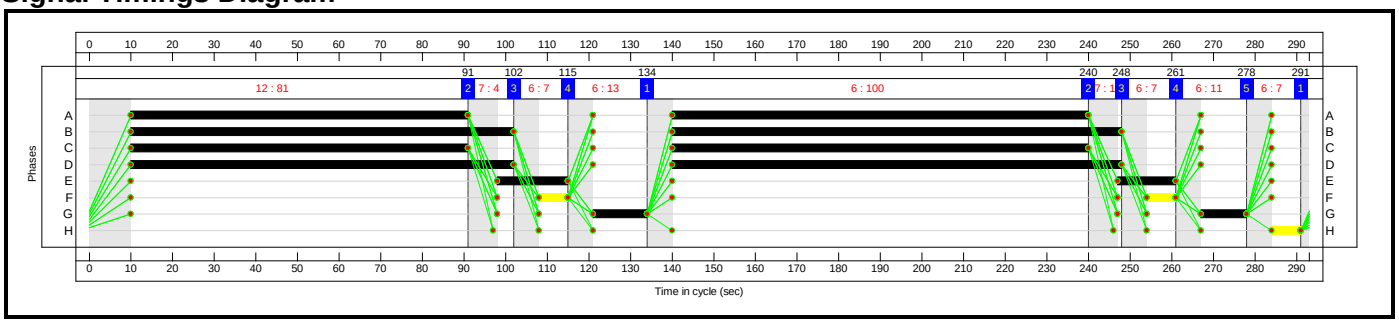
Phase Diagram



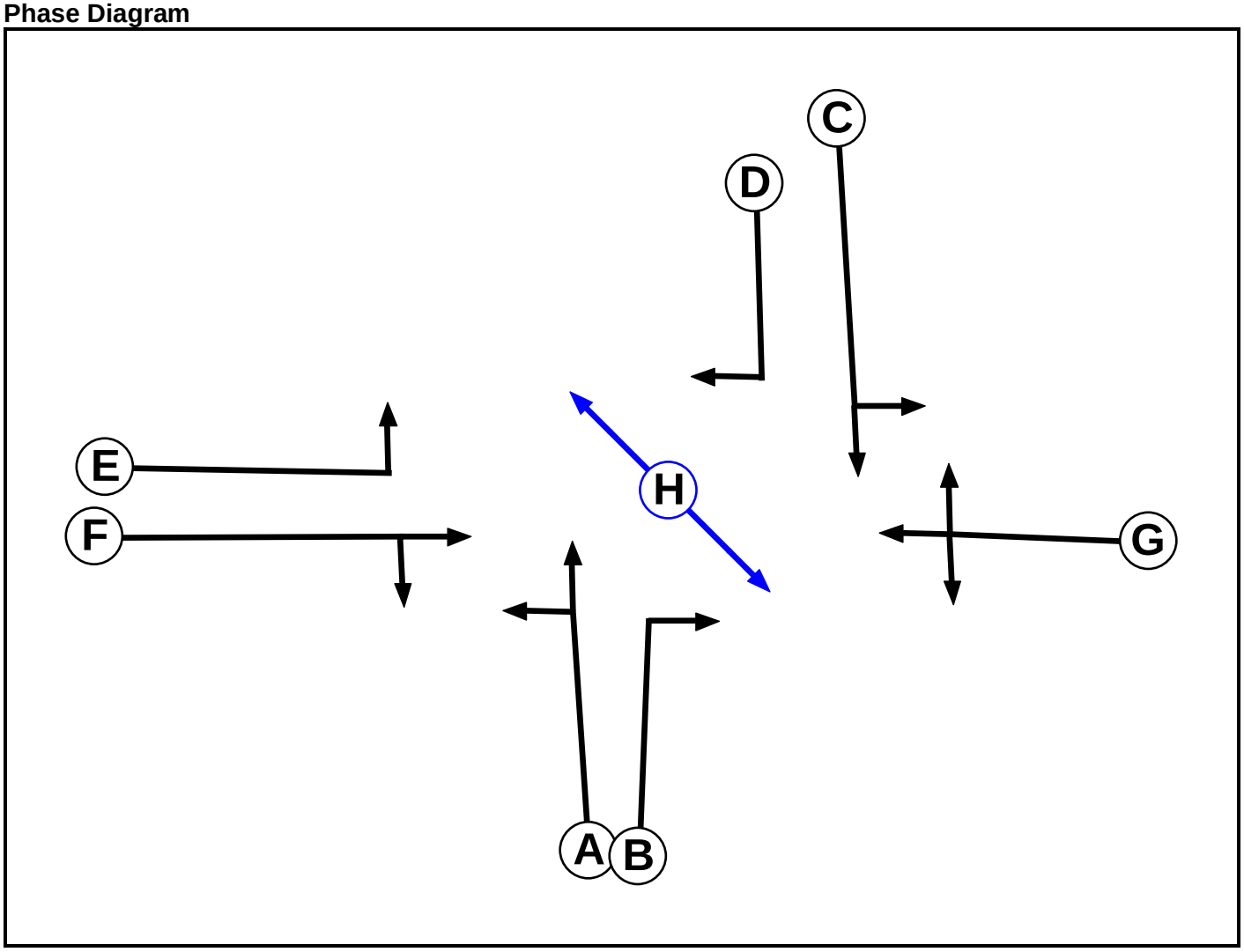
Basic Results Summary

C2

Signal Timings Diagram



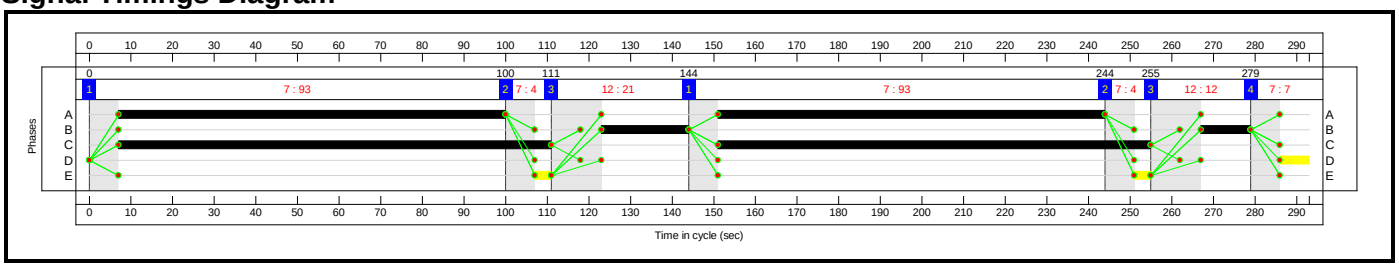
Phase Diagram



Scenario 6: 'PM 2023 + Dev' (FG6: 'PM 2023 + Dev', Plan 1: 'Network Control Plan 1')

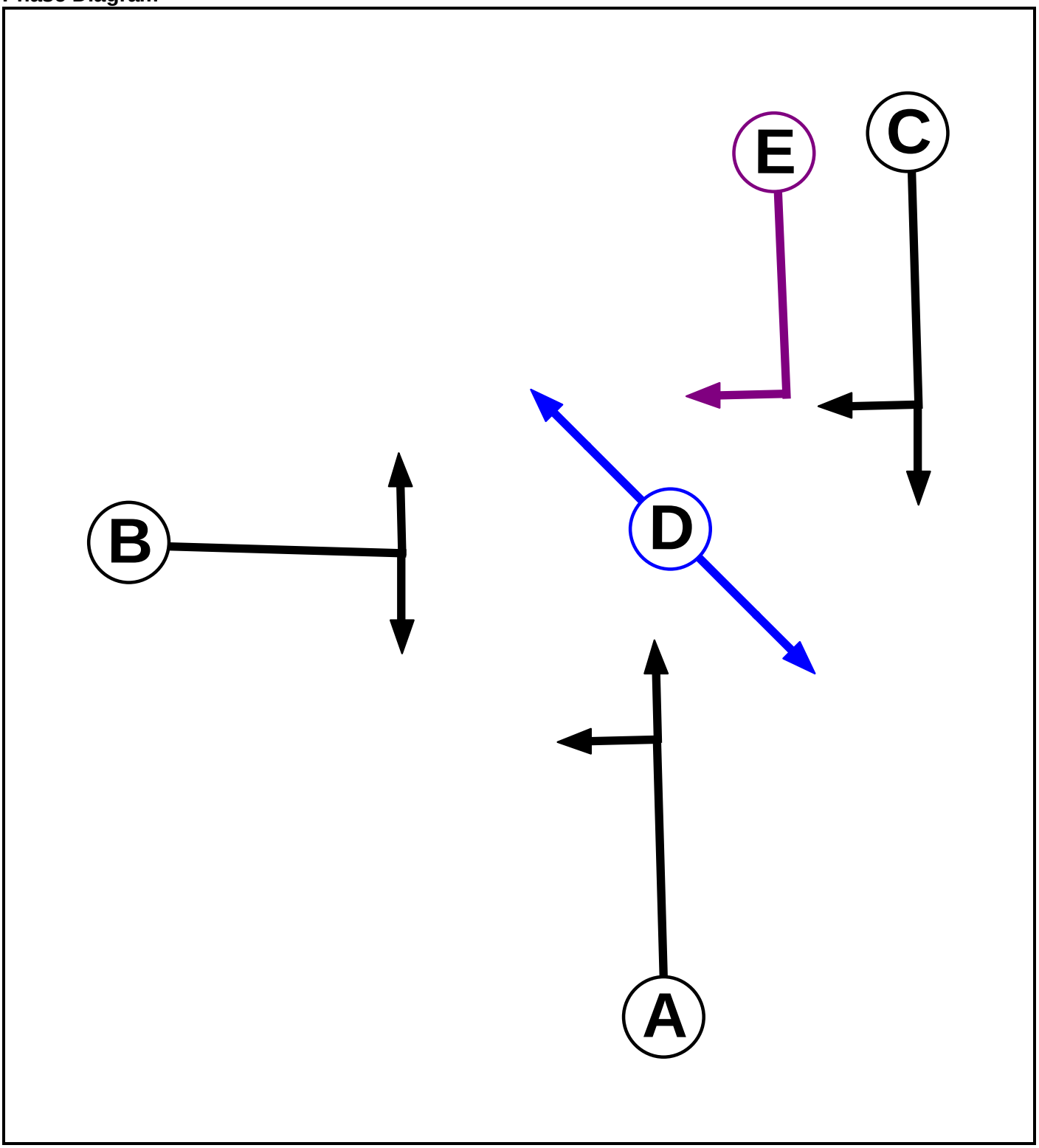
C1

Signal Timings Diagram



Basic Results Summary

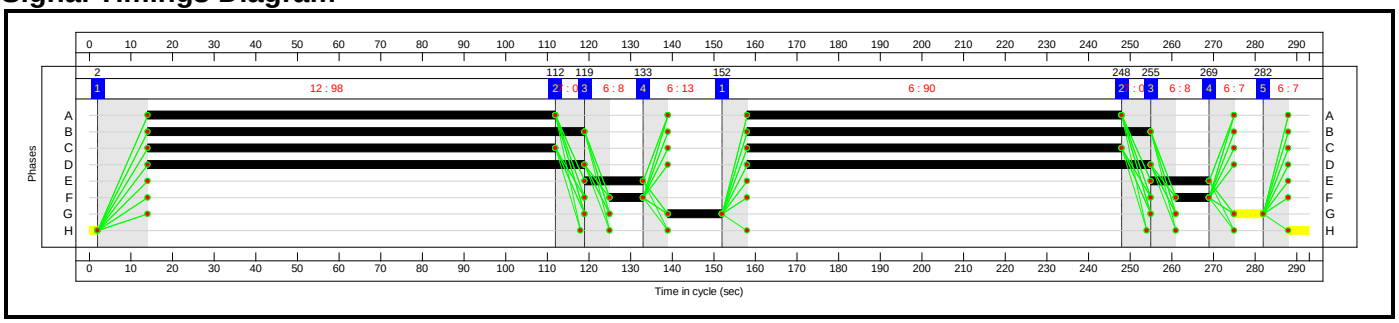
Phase Diagram



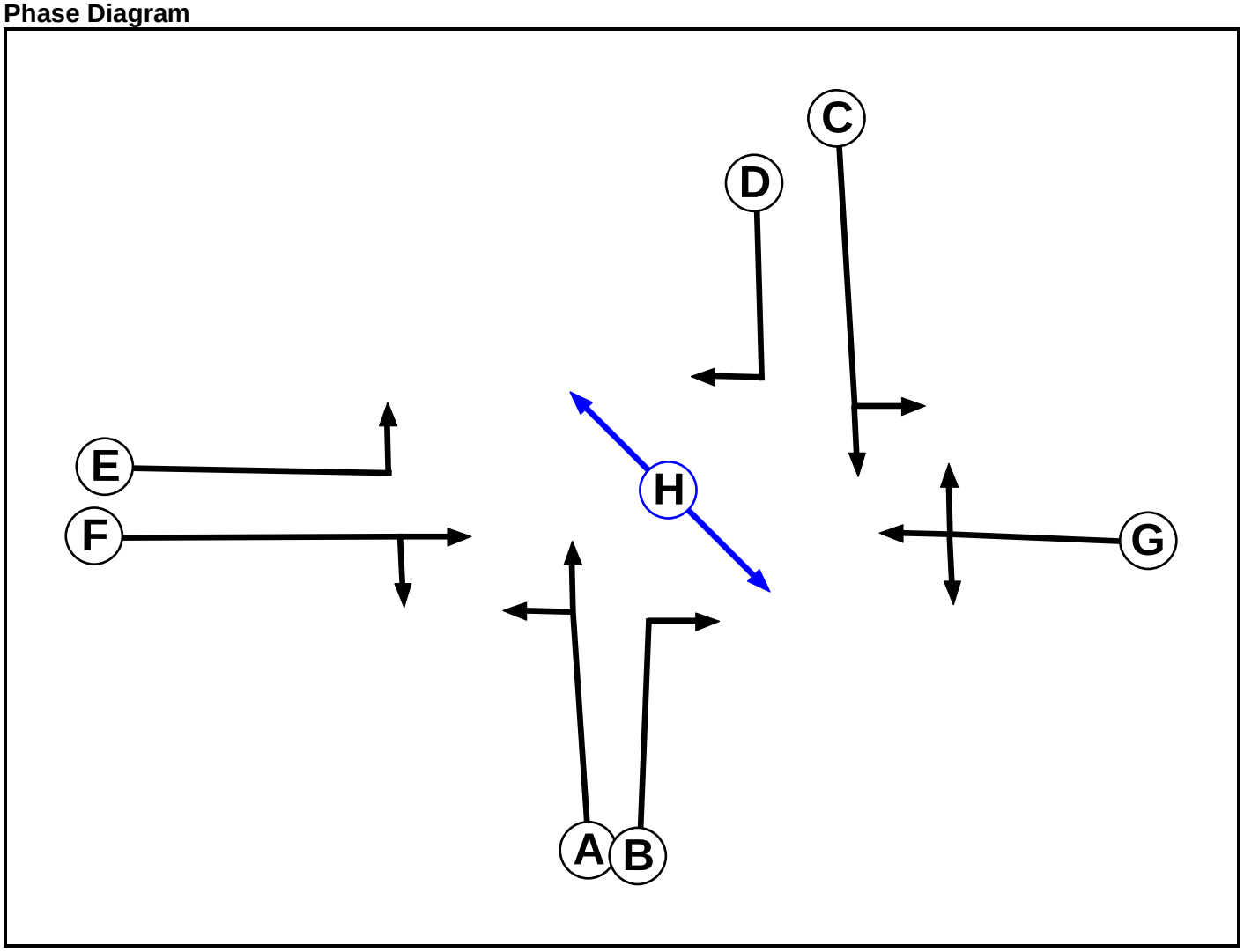
Basic Results Summary

C2

Signal Timings Diagram



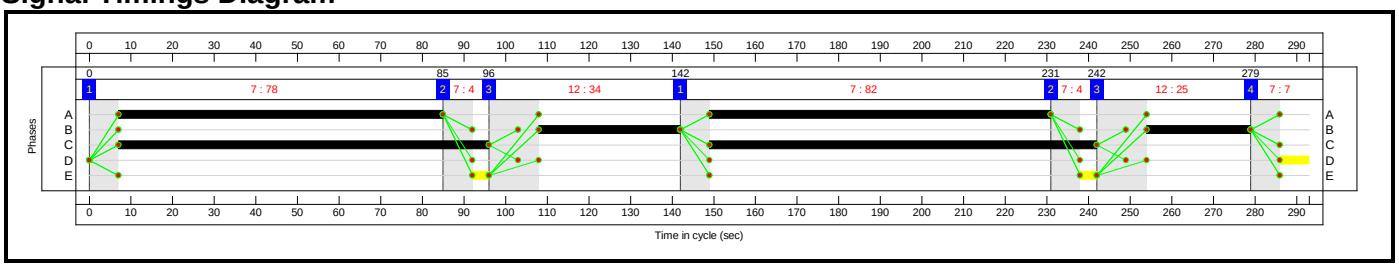
Phase Diagram



Scenario 7: 'AM 2028 + Dev' (FG7: 'AM 2028 + Dev', Plan 1: 'Network Control Plan 1')

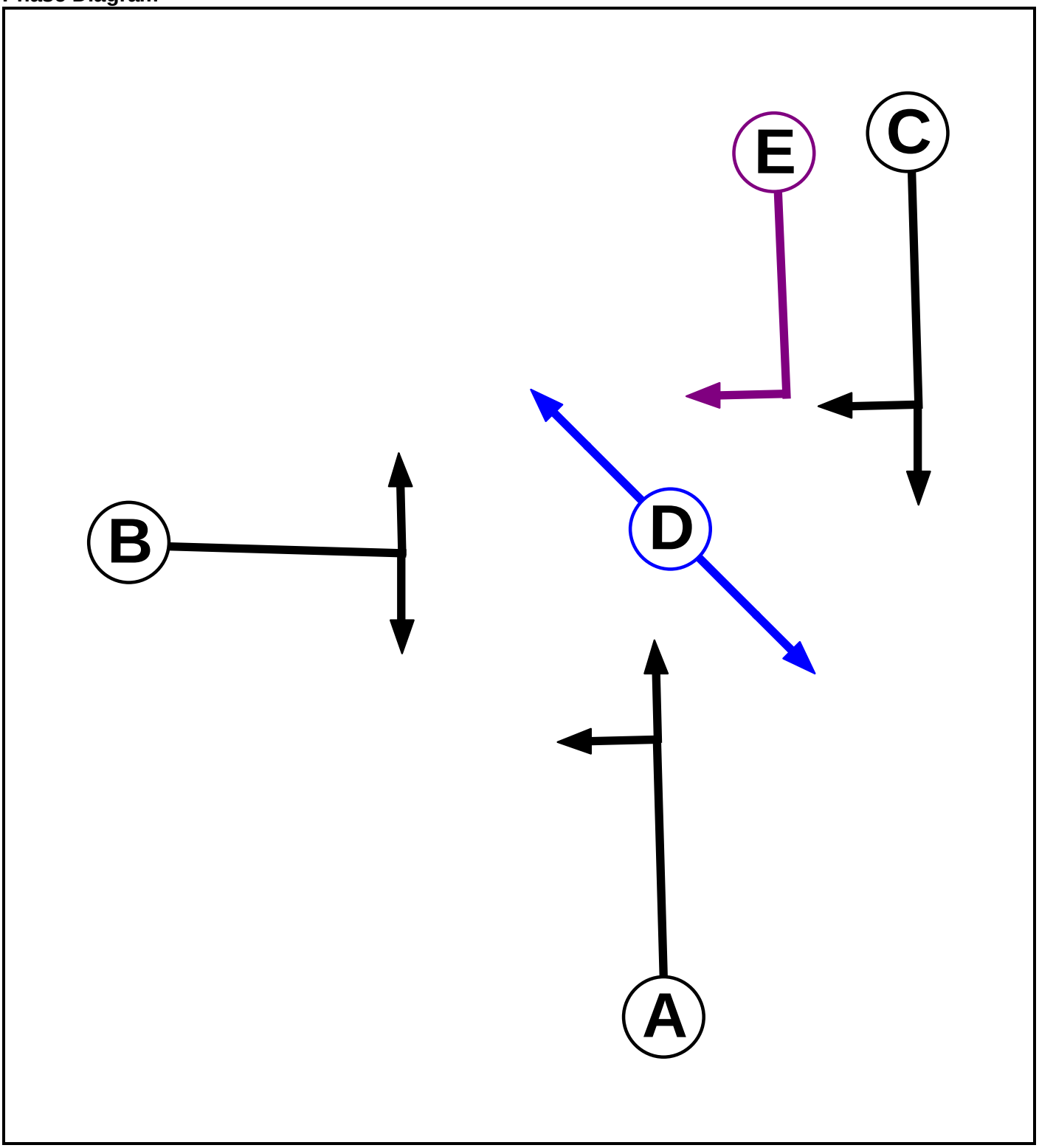
C1

Signal Timings Diagram



Basic Results Summary

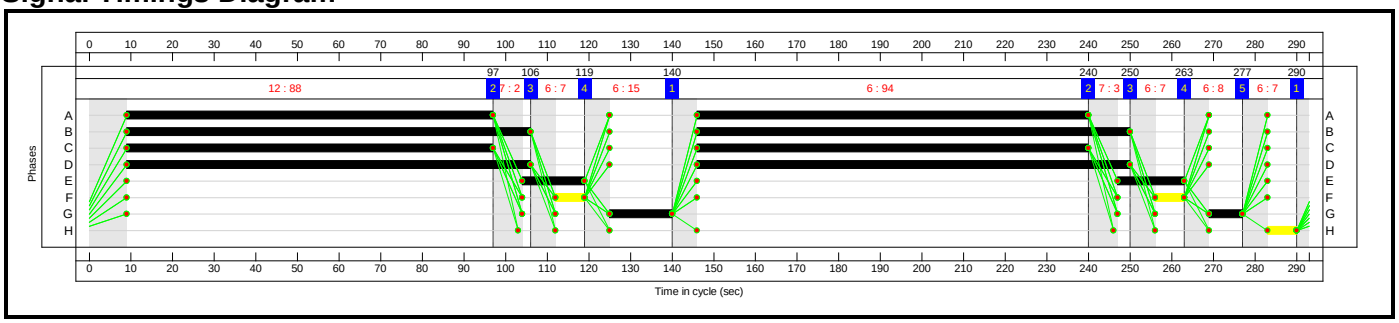
Phase Diagram



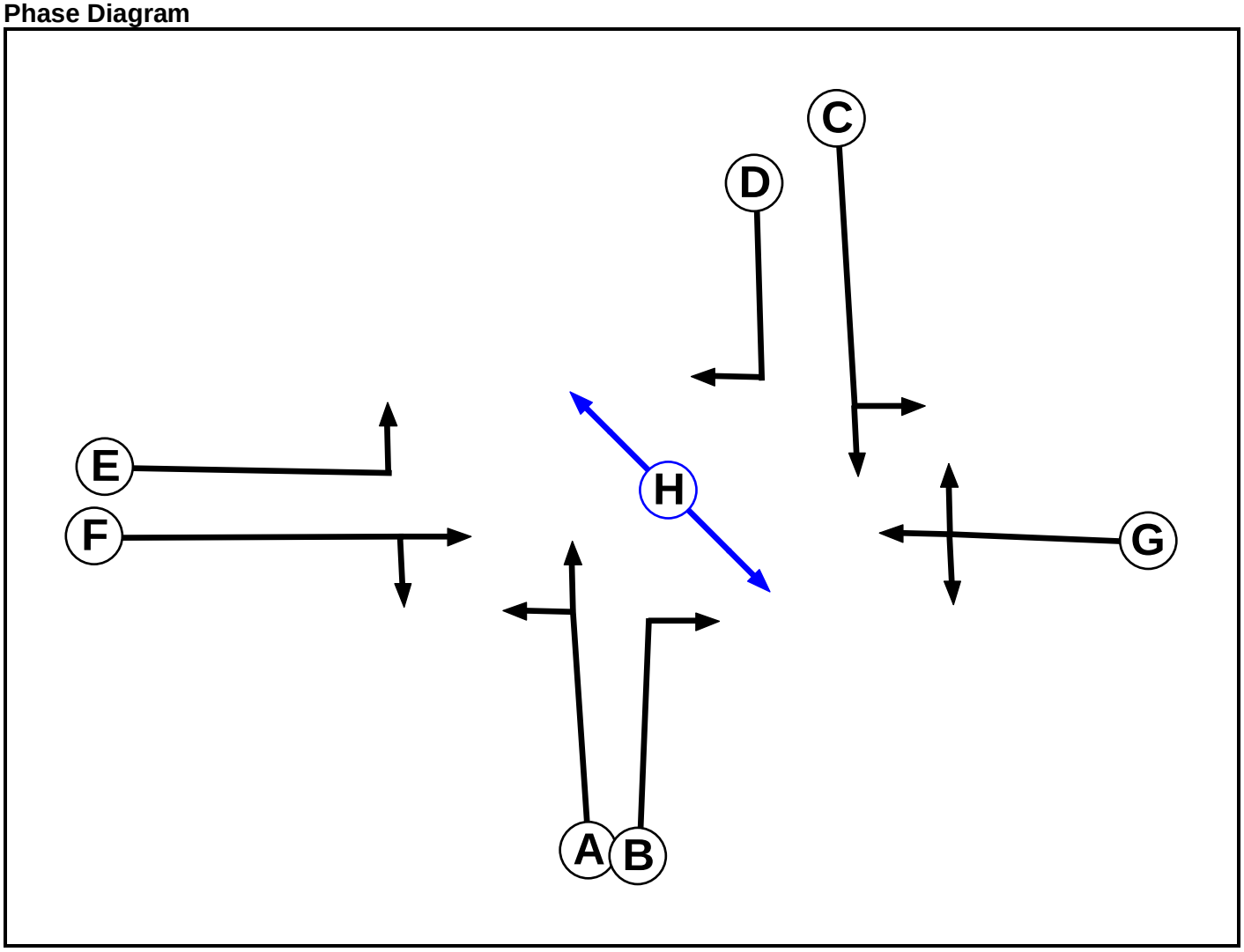
Basic Results Summary

C2

Signal Timings Diagram



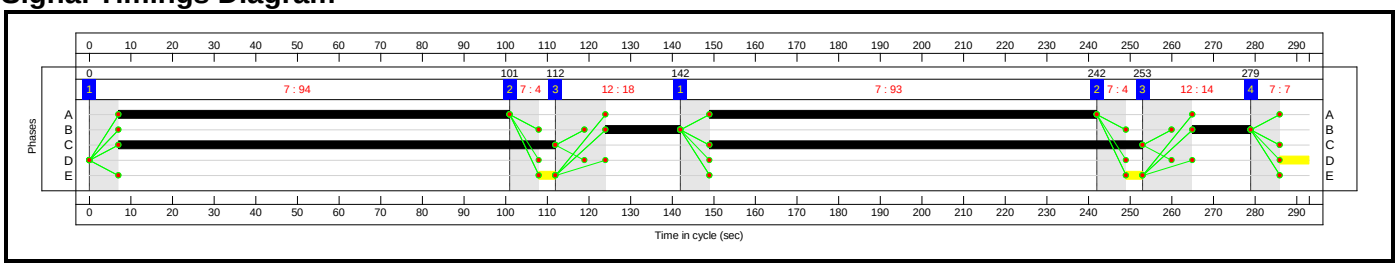
Phase Diagram



Scenario 8: 'PM 2028 + Dev' (FG8: 'PM 2028 + Dev', Plan 1: 'Network Control Plan 1')

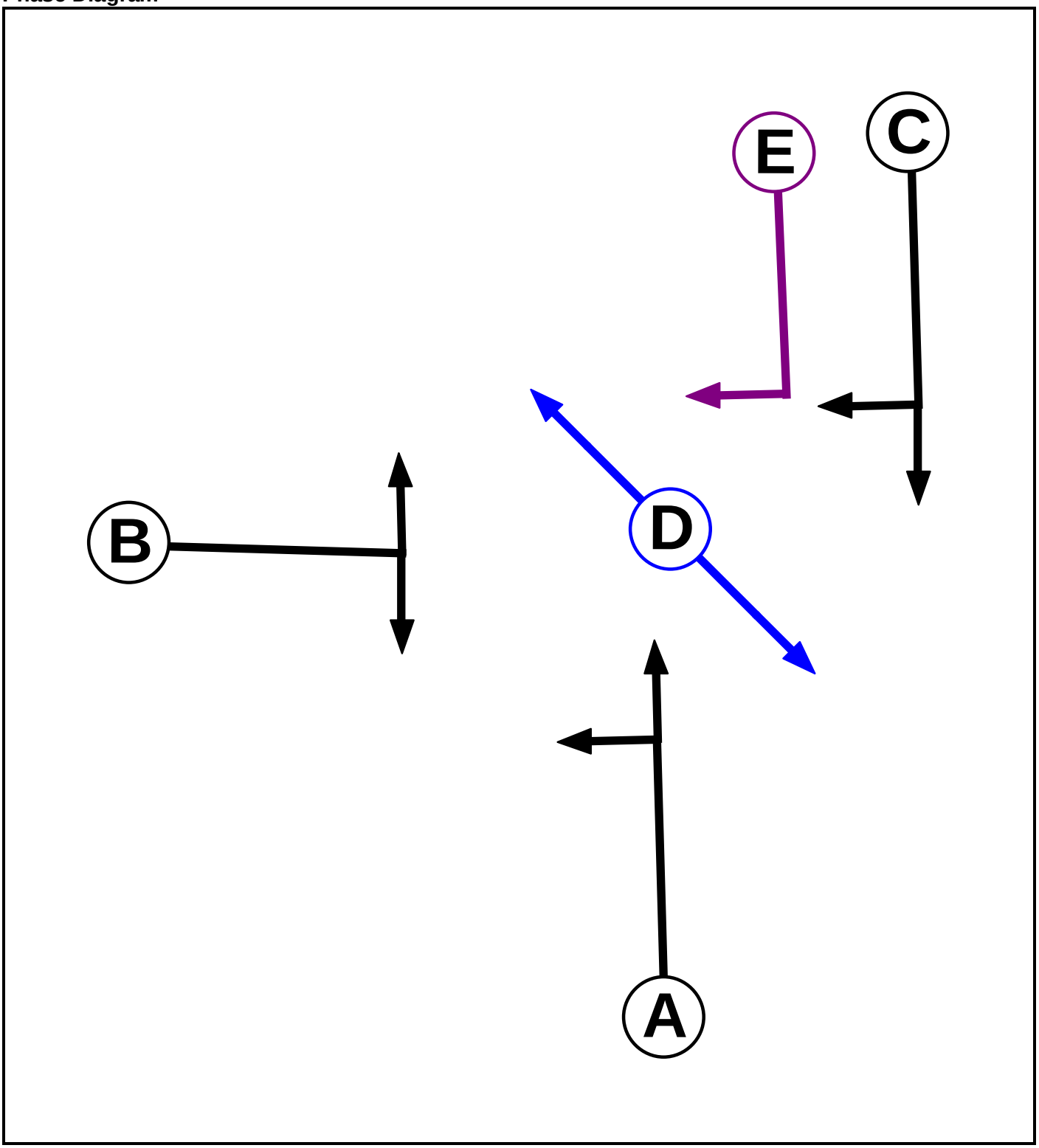
C1

Signal Timings Diagram



Basic Results Summary

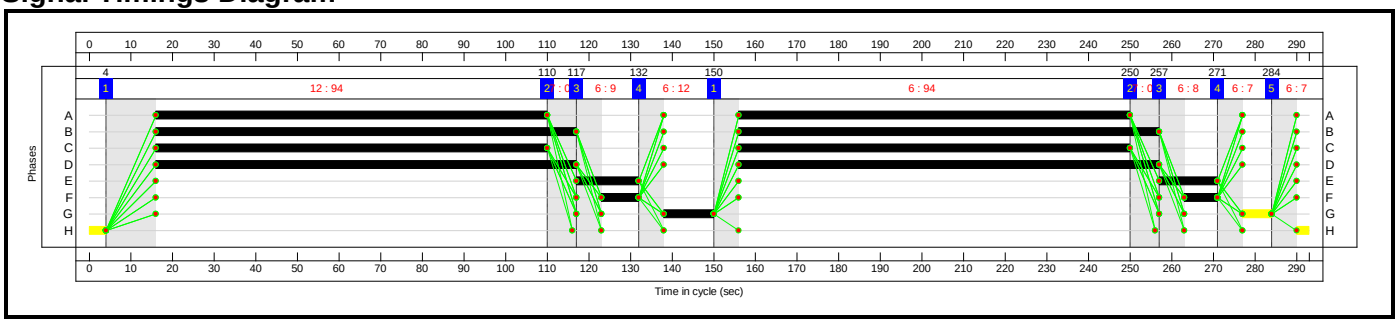
Phase Diagram



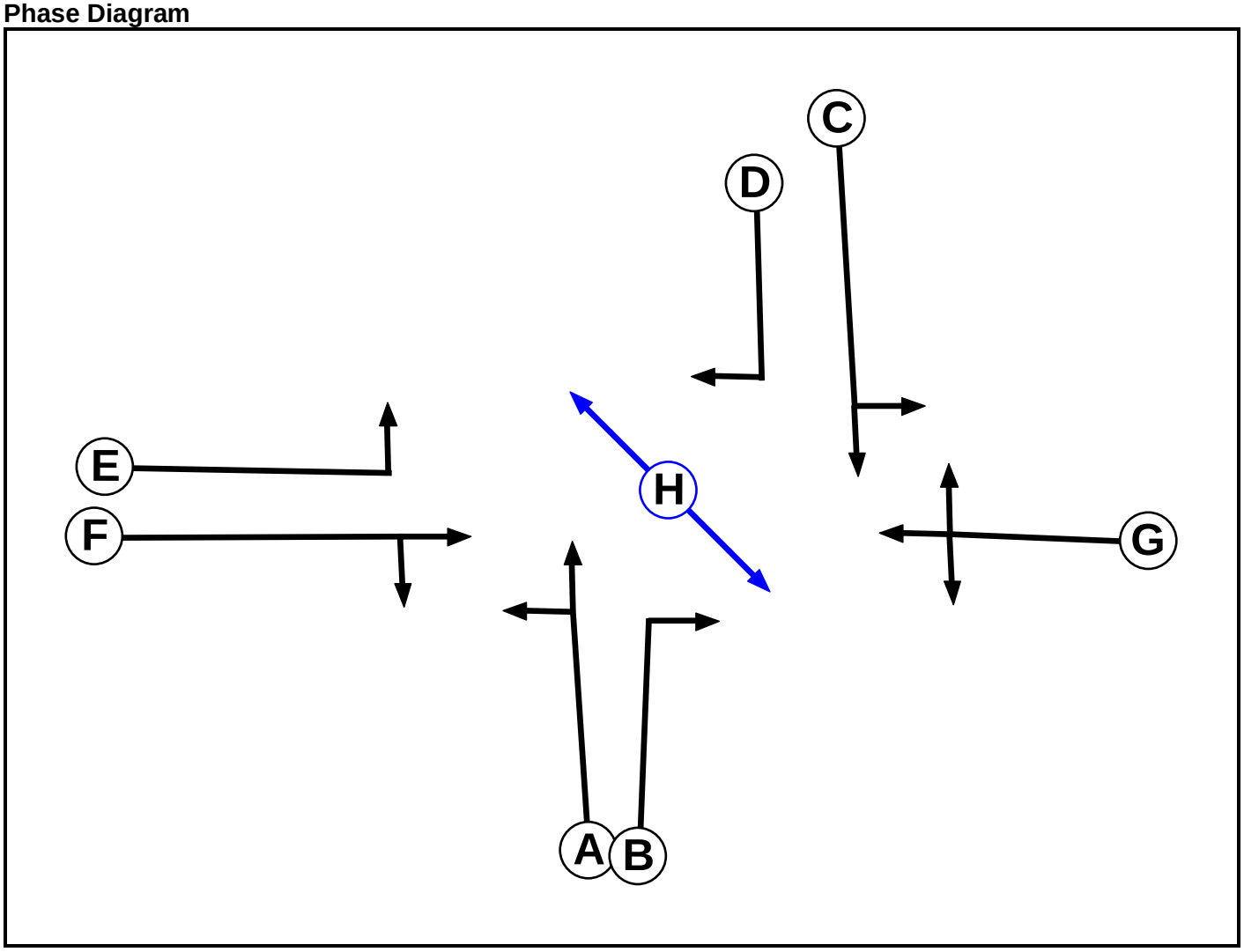
Basic Results Summary

C2

Signal Timings Diagram



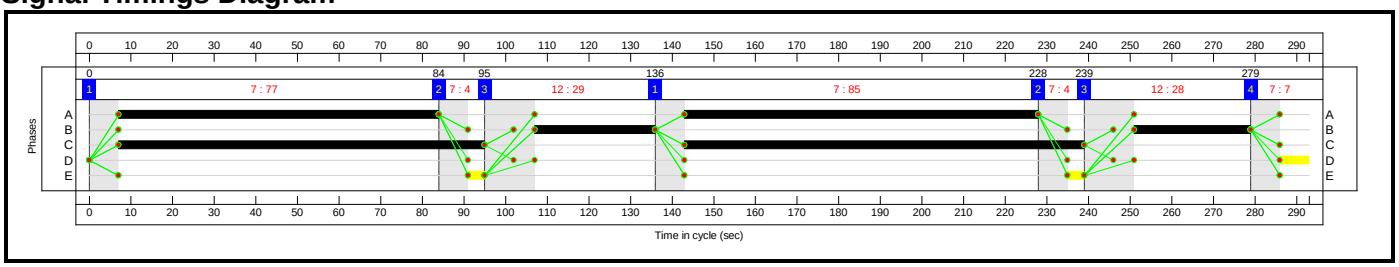
Phase Diagram



Scenario 9: 'AM 2038 + Dev' (FG9: 'AM 2038 + Dev', Plan 1: 'Network Control Plan 1')

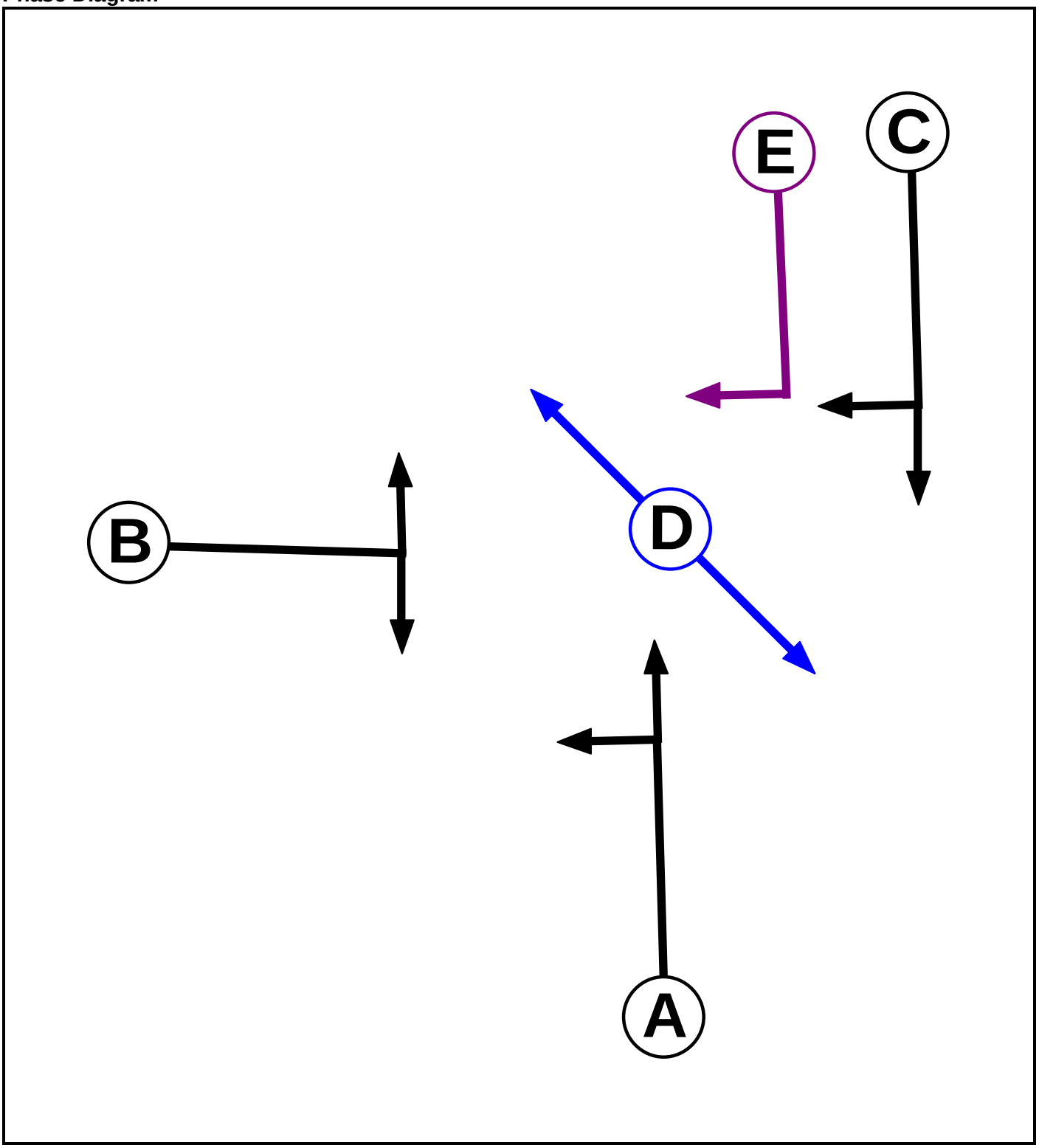
C1

Signal Timings Diagram



Basic Results Summary

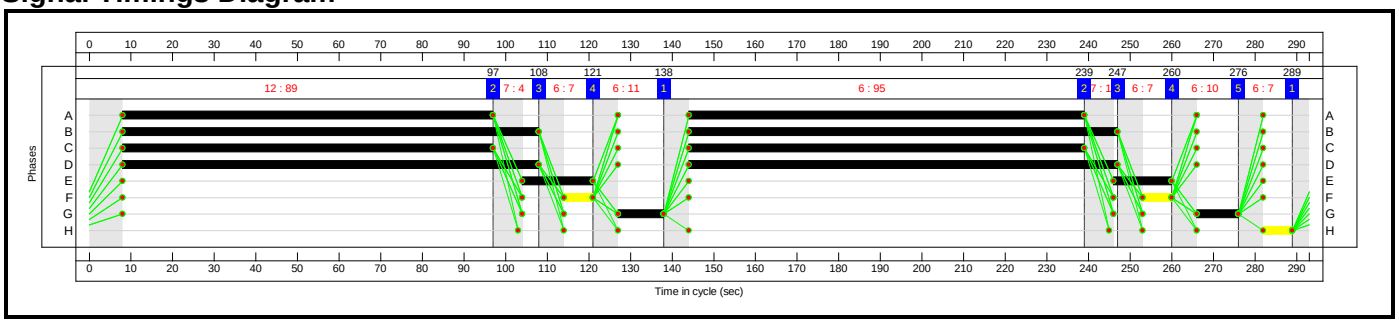
Phase Diagram



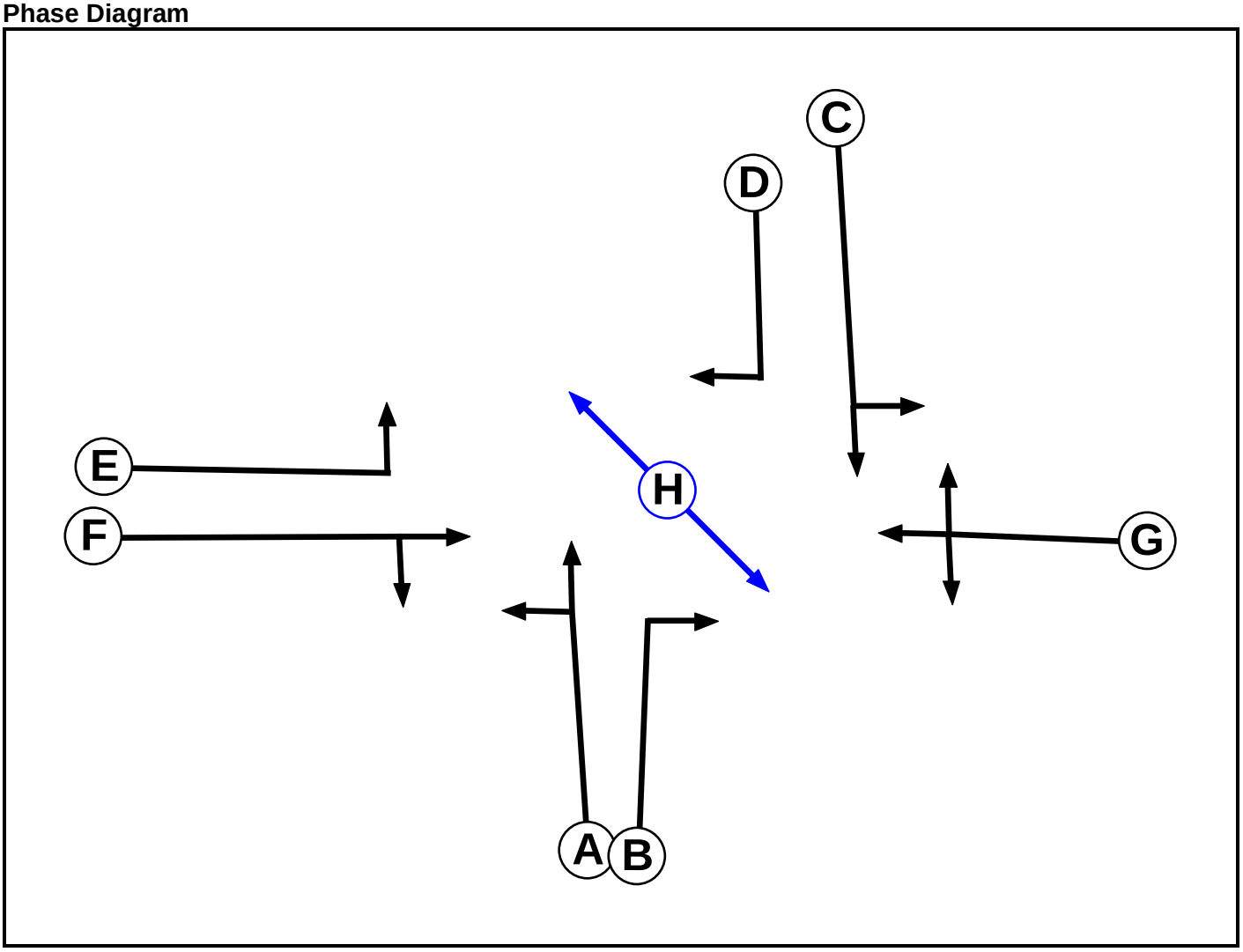
Basic Results Summary

C2

Signal Timings Diagram



Phase Diagram



Scenario 10: 'PM 2038 + Dev' (FG10: 'PM 2038 + Dev', Plan 1: 'Network Control Plan 1')

C1

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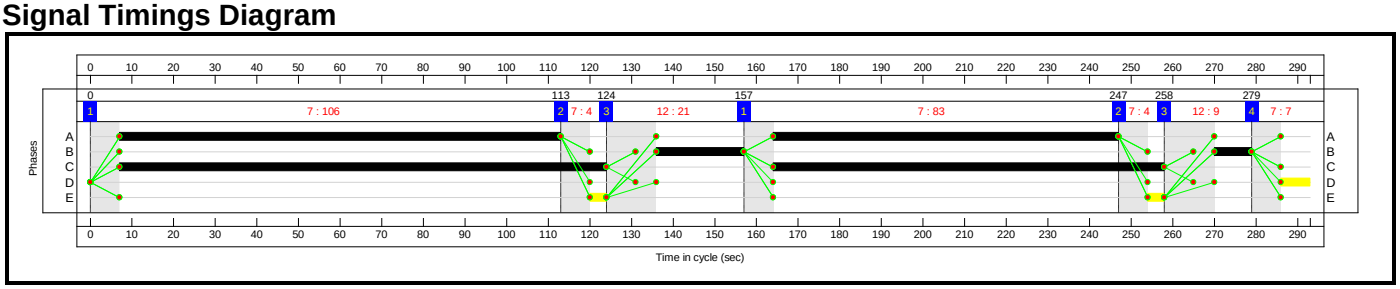
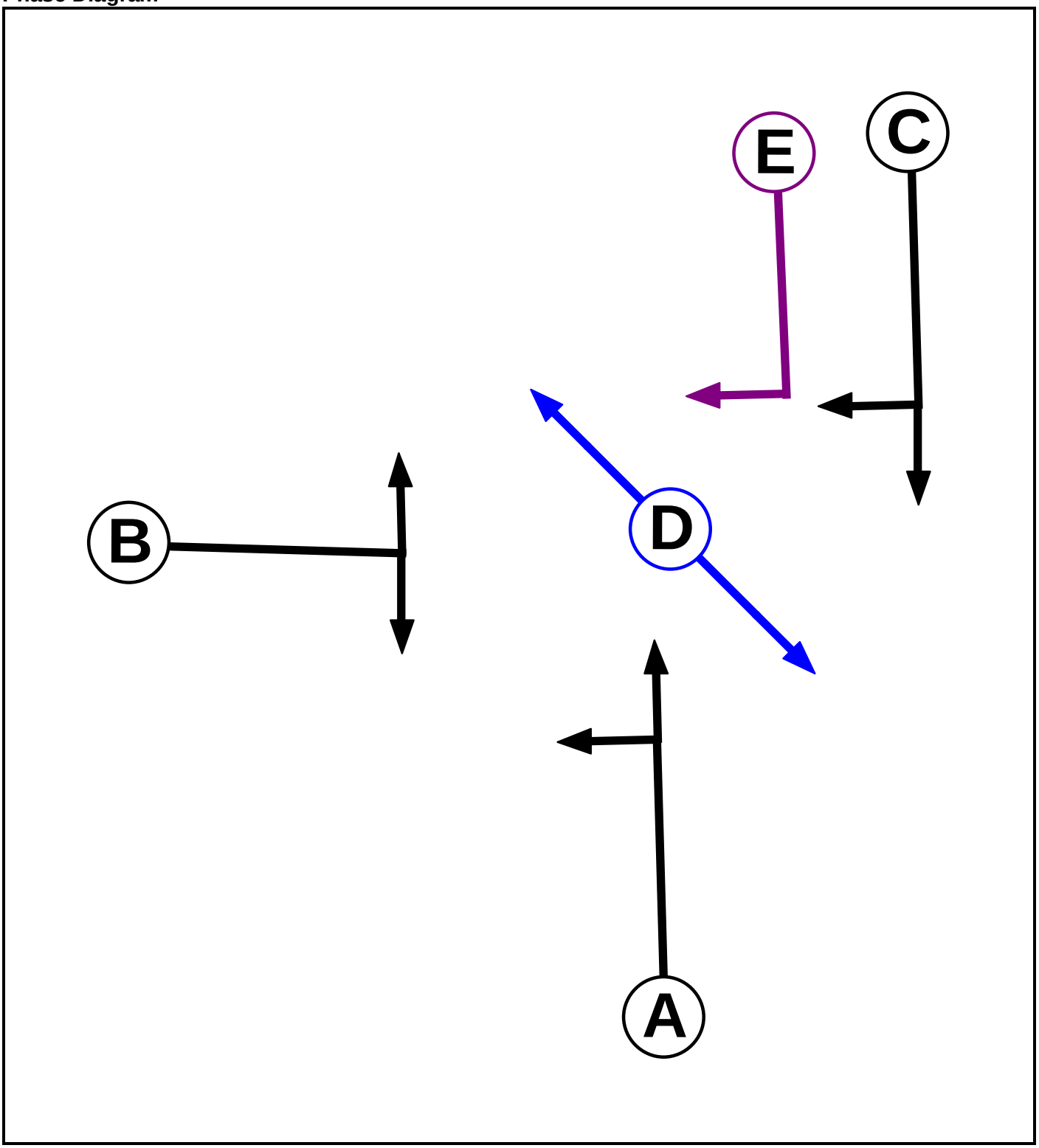


Basic Results Summary

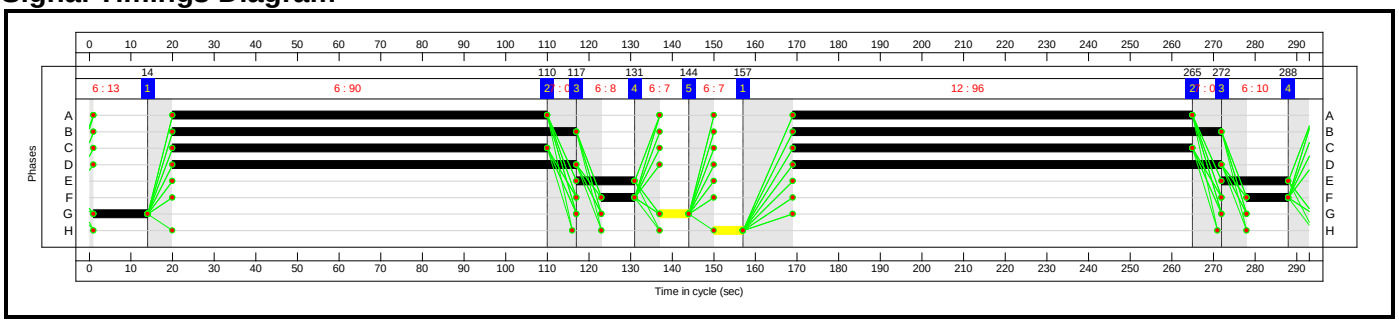
Phase Diagram



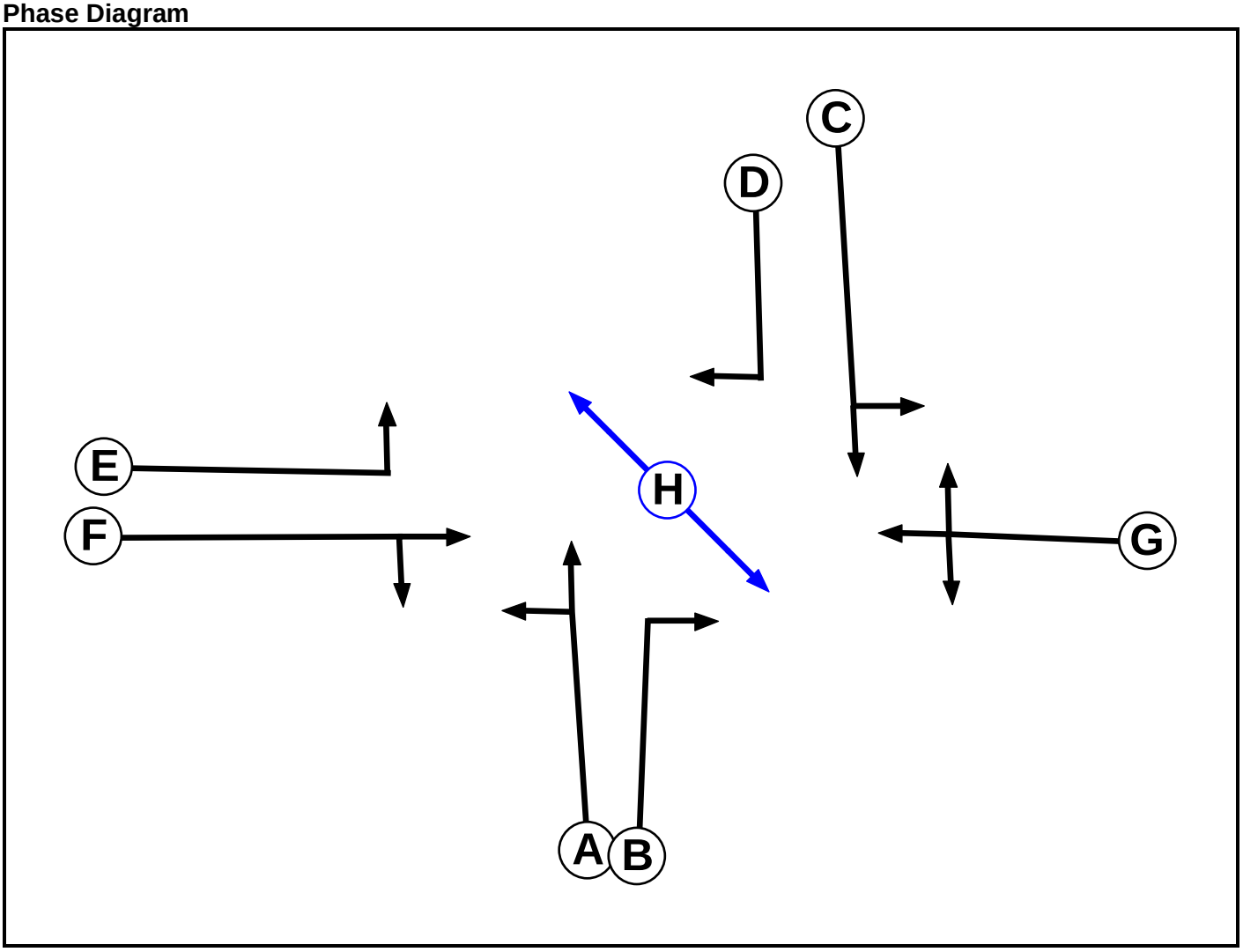
Basic Results Summary

C2

Signal Timings Diagram



Phase Diagram



APPENDIX 13 A OPERATIONAL WASTE MANAGEMENT PLAN

OPERATIONAL WASTE MANAGEMENT PLAN

FOR

PROPOSED RESIDENTIAL DEVELOPMENT

AT

COOLAGAD, GREYSTONES, CO. WICKLOW

March 2022

ON BEHALF OF

Cairn Homes Properties Ltd.

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DOCUMENT CONTROL SHEET

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Document Title	Operational Waste Management Plan

Rev.	Status	Author(s)	Reviewed by	Approved by	Issue Date
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01	Draft for Client Review	SFI Environmental Consultant	GF Director	GF Director	30/11/2021
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03	Updated Draft for Client Review	SFI Environmental Consultant	GF Director	GF Director	20/01/2022
04	Final	SFI Environmental Consultant	GF Director	GF Director	23/03/2022

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Enviroguide Consulting has produced this Operational Waste Management Plan (OWMP) at the request of Cairn Homes Properties Ltd. for a Proposed Residential Development located on lands at Coolagad, Greystones, Co. Wicklow.

A full project description is in included in Section 3 of this report. The development consists of a mix of apartments, houses, duplexes, a crèche facility and a community centre.

This OWMP has been prepared to ensure that the management of waste during the operational phase of the proposed development is undertaken in accordance with current legal and industry standards including the Waste Management Act 1996, as amended and associated Regulations, Protection of the Environment Act 2003 as amended, Litter Pollution Act 1997 as amended, the 'Eastern-Midlands Waste Region Waste Management Plan, 2015-2021' and County of Wicklow (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-laws, 2018 (hereinafter referred to as 'the bye-laws').

At present, there are no specific guidelines issued by Wicklow County Council for the preparation of OWMPs. Therefore, in preparing this document, consideration has been given to the requirements of national and regional waste policy, legislation and other guidelines.

The plan will be subject to review if a planning permission is forthcoming and any material-changes in the proposed operational strategy will be subject to agreement with Wicklow County Council at project construction and operational stages.

In particular, this OWMP aims to provide a detailed plan for the storage, handling, collection, and transport of the wastes generated at the development in a manner that does not present a risk to human health or the environment, or a risk of common waste related nuisance such as litter or odour.

The OWMP is designed to ensure that waste arising from the operational phase of the project is managed to incentivise waste prevention and to encourage the segregation of waste so that it can be managed in accordance with the Waste Hierarchy. Diversion of waste from landfill and waste prevention will be the overarching philosophy adopted. The plan estimates the type and quantity of waste to be generated from the proposed development during the operational phase and provides a strategy for managing the different waste streams.

This OWMP takes into account the requirements of national and regional waste policy, legislation, and other guidelines such as guidance published by Dun Laoghaire-Rathdown County Council (DLRCC) for the preparation of OWMPs, '*Guidance Notes, Waste Management Planning'*, which is the only Local Authority Guidance available to date in relation to OWMPs. In addition, it takes account of the following guidance:

- *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities* and
- *BS 5906:2005 Waste management in buildings — Code of practice*

2 OVERVIEW OF WASTE MANAGEMENT IN IRELAND

Operational Waste Management Plans are often required through the planning process in Ireland. The purpose of this Operational Waste Management Plan is to detail and plan how waste generated during the operational phase of a proposed development will be managed. This will include requirements for waste storage provisions, access to authorised waste collection and proximity to additional recycling facilities.

This proposed development is located in the Wicklow County Council (WCC) planning district. In preparing this document, consideration has been given to the requirements of WCC's Environment Department and to national and regional waste policy, legislation, and other Local Authority Guidelines.

2.1 European and Irish Legal Context

Waste Legislation in Europe and Ireland is extensive and often complex. Waste framework legislation establishes the legal structure for the prevention and management of waste in Ireland. This legislation also governs the reporting on waste generation, waste treatment and capacity. It also sets down mandatory targets for waste diversion, collection, and treatment.

The Waste Framework Directive (Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste) is a core component of waste regulations across Europe. The Waste Framework Directive (WFD) (which was transposed into Irish law in 2011 (S.I. No. 126/2011 - European Communities (Waste Directive) Regulations 2011), encourages the prevention, recycling, and processing of waste. It sets out a Waste Hierarchy which priorities waste prevention, preparation for re-use, recycling, and energy recovery. Waste disposal is the last resort and least favourable option. The Directive requires Member States to adopt waste management plans and waste prevention programmes.

The new WFD (Directive (EU) 2018/851 of the European Parliament, amending Directive 2008/98/EC on waste) was approved by the EU in July 2018 and was transposed into Irish Law in July 2020. The new WFD forms part of the circular Economy Package adopted by the EU; it requires EU Member States to improve their waste management systems, to improve the efficiency of resource use, and to ensure that waste is valued as a resource.

In Ireland, the primary platform for waste legislation is the Waste Management Act 1996, as amended and the Protection of the Environment Act 2003 as amended. The Waste Management Act as amended, has been brought into effect by making a series of subordinate regulations, covering a range of specific 'priority' waste types such as food waste, waste electrical and electronic equipment, batteries etc. The Act has been further amended by enacting regulations, mainly the Waste Directive Regulations which address new EU environmental initiatives and strengthen areas where problems have arisen.

One of the guiding principles of European waste legislation, which has in turn been incorporated into the Waste Management Act as amended, and subsequent Irish legislation, is the principle of "Duty of Care". This implies that the waste producer is responsible for waste from the time it is generated until its legal disposal (including its method of disposal).

As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final waste treatment destination, waste contractors will be employed to physically transport waste to the final waste destination. It is therefore imperative that residential development management companies undertake on-site management of waste in accordance with all legal requirements and employ appropriately authorised waste contractors to undertake off-site management of their waste in accordance with all legal requirements. This includes the requirement that a waste contractor handle, transport, and reuse/recover/recycle/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

Each appointed Waste Contractor must hold a valid waste collection permit to transport waste which is issued by the National Waste Collection Permit Office (NWCPO). Waste treatment facilities must also be appropriately proposed or licensed by the Local Authority or Environmental Protection Agency to accept the waste. The Management Company appointed will be responsible for ensuring that all Waste Contractors hold the appropriate authorisations.

2.2 Waste Policy in Ireland

In addition to waste regulations, Ireland has adopted waste management policies. Waste management policy is adopted by the government and is detailed in a set of policy documents which have been produced since 1998:

- Waste Management: Changing Our Ways (1998)
- Preventing and Recycling Waste: Delivering Change (2002)
- Taking Stock & Moving Forward (2004)
- National Strategy on Biodegradable Waste Management (2006)
- A Resource Opportunity – Waste Management Policy in Ireland (2012)
- A Waste Action Plan for a Circular Economy (2020)

A Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025 was published by the Department of Communications, Climate Action and Environment in September 2020. This policy sets out a number of important policy actions with the aim of transforming the current economic and waste system from linear to circular. These include the following actions:

- A shift towards a policy framework which rewards circularity and moves away from the waste of resources.
- Increased accountability of products that producers place on the market through levies on non-recyclable waste and the overuse of packaging.
- Targets for recycling (65% by 2035), food waste (reduced by 50% by 2030) and waste to landfill (no more than 10% by 2035).
- To support households, awareness and education measures will be strengthened; the waste collection industry will be encouraged to play a role in such measures.
- All Regional Waste Management Plans will be replaced with a National Waste Management Plan for a Circular Economy.
- A standardising of the colour coding of bins (general waste bin to be designated as a 'recovery' bin: colour black; mixed dry recycling bin: colour green; organic waste bin to be designated as 'organic waste recycling bin': colour brown).

2.3 Regional Waste Management Plans & Local Bye-laws

Wicklow County Council is located within the Eastern-Midlands Waste Region (EMWR) which is one of Ireland's three waste management regions. The framework for the prevention and management of waste for this regional is set out in the Eastern-Midlands Waste Region Waste Management Plan 2015-2021, a statutory document underpinned by national and EU waste legislation. The strategic vision of the regional waste management plan (WMP) is to rethink the approach to managing wastes. In order to achieve this vision, the WMP has set out three specific and measurable performance targets:

- 1% reduction per annum in the quality of household waste generated per capita over the period of the Eastern Midlands Region Waste Management Plan.
- Reduce to 0% the direct disposal of unprocessed municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.
- Achieve a recycling rate of 50% of managed municipal waste by 2020.

Wicklow County Council Segregation, Storage and Presentation of Household and Commercial Waste Bye-Laws 2018, place some additional obligations in how waste is stored and managed at the development.

The bye-laws state that "household kerbside waste shall only be presented for collection in an appropriate waste container. The container shall not be over-loaded, and the lid shall be securely closed. No waste shall be presented on the top of the lid or adjacent to the waste container." And that the waste container "shall be maintained in such condition and state of repair that the waste placed therein will not be a source of nuisance or litter."

A management company of an apartment complex shall ensure that "separate receptacles of adequate size and number are provided for the proper segregation, storage and collection of recyclable household kerbside waste and residual household kerbside waste" and "additional receptacles are provided for the segregation, storage and collection of food waste where this practice is a requirement of the national legislation on food waste" The number of bins to be provided at this development are further detailed in Section 4 of this report.

Section 10 (h) of the bye-laws state "adequate access and egress onto and from the premises by waste collection vehicles is maintained" for the collection of waste. This requirement has been taken into account when designing the development. Sufficient access and egress for waste collection vehicles will be provided.

This OWMP also takes into account the objectives of Chapter 9, WE2, of the Wicklow County Development Plan 2016 – 2022:

> *"To require all new developments, whether residential, community, agricultural or commercial to make provision for storage and recycling facilities (in accordance with the standards set out in Development & Design Standards of this plan)."*

3 DESCRIPTION OF THE PROJECT

3.1 Description of the Development

The development site is located on Coolagad, Greystones, Co. Wicklow.

The proposed development consists of 586 residential units (351 houses; 203 apartments and 32 duplex units) at a site c. 26.03 ha at Coolagad, Greystones. The development will also include the provision of a community building, a creche, a sport field and a MUGA. A proposed new vehicular entrance with signalised junction from the R761 Rathdown Road to the north of Gate Lodge, Rathdown Road opposite Sea View and Redford Cemetery, providing a distributor road as part of the long-term objective to provide a northern access route from Greystones to the N11 is also proposed. The development also includes site development infrastructure, a hierarchy of internal streets including bridges, cycle paths & footpaths; new watermain connection and foul and surface water drainage; the development also provides for the upgrading of the public sewer within the wayleave of the R761/R762 (Rathdown Road) from the site entrance as far as the R762 in front of St. Kevin's National School, Rathdown Road, Greystones.

The Operational Waste Management Plan addresses waste management for the development once it is operational i.e., post the construction phase.

3.2 Proximity of the Development to Recycling Facilities

The development site is located at Coolagad, Greystones, Co. Wicklow. Figure 3-1 presents the proximity of the development site to local bring bank facilities. There is a large civic amenity centres in Bray servicing the Wicklow area, with numerous bring banks throughout the region for glass bottle collection.

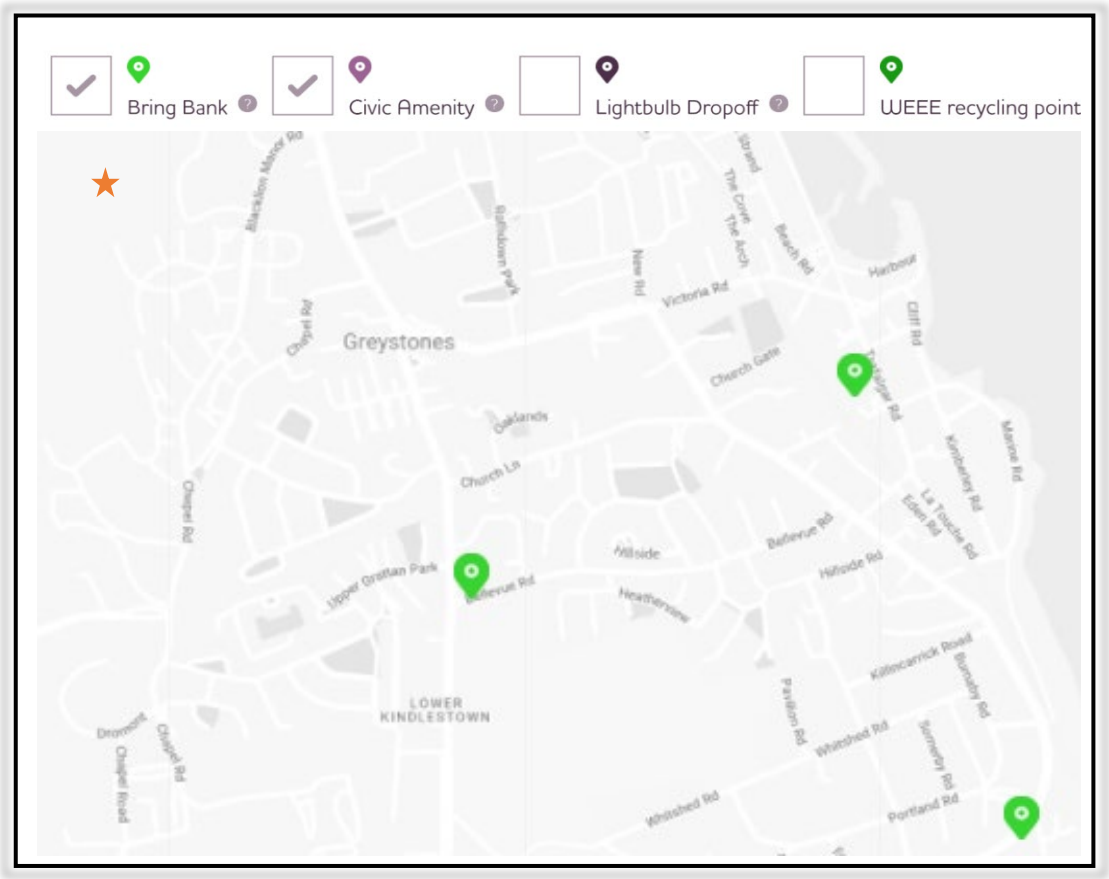

Figure 3-1 Bring Banks and Civic Amenity Recycling Centre Located in proximity to the Proposed Development (Source: Repak), site location identified with orange star.

4 WASTE GENERATION AND STORAGE

4.1 Waste Types Arising – Residential (Apartments, Duplexes and Houses)

The predicted waste types that will be generated at the proposed development residential properties include the following:

i. Mixed Municipal Waste (MSW) / General Waste;
ii. Dry Mixed Recyclables (DMR) - includes cardboard, plastic packaging, aluminium cans, tins, paper, and Tetra Pak cartons;
iii. Organic (food) waste.

In addition to the typical waste materials that will be generated on a daily basis, there will be some additional waste types generated in small quantities that will need to be managed separately including:

- Bulky wastes – including furniture, carpets, mattresses;
- Glass – bottles and jars.
- Waste electrical and electronic equipment (WEEE);
- Batteries;
- Textiles – clothes or soft furnishings;
- Light bulbs or fluorescent tubes;
- Chemicals – old medicines, paints, detergents; and
- Waste oil - cooking oil.

4.2 Waste Types Arising – Crèche Facility and Community Centre

The crèche facility and community centre will generate similar waste types to domestic waste types;

- Dry mixed recyclables
- Mixed Municipal (non-recyclable)
- Food
- Glass

with some additional commercial “office” type wastes such as paper and printer ink, batteries, and waste electrical and electronic equipment (WEEE).

4.3 List of Waste Codes

Correct classification of waste is the foundation for ensuring that the collection, transportation, storage, and treatment of waste is carried out in a manner that provides protection for the environment and human health and in compliance with legal requirements. In 1994, the *European Waste Catalogue was* published by the European Commission. In 2002, the EPA published a document titled the *European Waste Catalogue and Hazardous Waste List*. This document has been replaced by the EPA ‘*Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous’* which became valid from the 1stJuly 2018.

The waste classification system applies across the EU and is the basis for all national and international waste reporting obligations such as those associated with waste collection permits, certificates of registration, waste facility permits and EPA Waste and IED licences and EPA National Waste Database.

The EPA document '*Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous' (EPA, 2018)* consolidates the legislation and allows the generators of waste to classify the waste as hazardous or non-hazardous and in the process to assign the correct List of Waste entry.

Under the classification system, different types of wastes are fully defined by a code. The List of Waste (LoW) code (previously referred to as European Waste Code or EWC) for typical waste materials expected to be generated during the operation of the proposed development are provided in Table 4-1.

Table 4-1 Expected Waste Types and List of Waste Codes

Waste Description	List of Waste Code
Mixed Municipal Waste	20 03 01
Mixed Dry Recyclables	20 03 01
Biodegradable Kitchen Waste	20 01 08
Glass	20 01 02
Bulky wastes	20 03 07
Waste electrical and electronic equipment*	20 01 35* 21 01 36
Batteries and accumulators*	20 01 33* 20 01 34
Textiles	20 01 11
Fluorescent tubes and other mercury containing waste*	20 01 21
Chemicals (solvents, pesticides, paints & adhesives, detergents, etc.) *	20 01 13/19/27-28/29-30
Plastic	20 01 39
Metals	20 01 40
Paper and Cardboard	20 01 01

**Individual waste type may contain hazardous materials*

4.4 Waste Storage Capacity Requirements - Houses

The following housing types and numbers will be provided the development:

Table 4-2 No. of Houses and types

House Type	Description	No. Beds	Access	No.
House Type A	(Semi Detached)	4 Bed (6 Person)	ground floor	29
House Type A1	(Semi Detached)	4 Bed (6 Person)	ground floor	7
House Type B	(Mid Terrace)	3 Bed (5 Person)	ground floor	38
House Type B1	(End Terrace: Side Entry)	3 Bed (5 Person)	ground floor	3
House Type B1	(Semi D: Side Entry)	3 Bed (5 Person)	ground floor	10
House Type B2	(Semi Detached)	3 Bed (5 Person)	ground floor	98
House Type B2	(End of Terrace)	3 Bed (5 Person)	ground floor	39

House Type C	(Semi Detached)	3 Bed (5 Person)	ground floor	19
House Type D	(Semi Detached)	4 Bed (7 Person)	ground floor	22
House Type E	(Detached)	5 Bed (9 Person)	ground floor	4
House Type F	(Semi Detached)	4 Bed (7 Person)	ground floor	41
House Type F1	(Semi D: Side Entry)	4 Bed (7 Person)	ground floor	5
House Type G1	(Semi D: Split Level 1450mm Up)	4 Bed (6 Person)	ground floor	32
House Type G2	(Semi D: Split Level 1450mm Down)	4 Bed (6 Person)	ground floor	4
Total				**351**

The number of bedrooms is required to complete the calculations of waste volumes generated as per the *BS 5906:2005 Waste management in buildings — Code of practice.* The calculation for typical weekly waste arisings and subsequent storage requirements for domestic dwellings is as follows:

number of dwellings × {(volume arising per bedroom [70 l] × average number of bedrooms) + 30}[a]

[a] *Based on average household occupancy.*

Table 4-3 below includes the calculations of waste arising using the formula provided in the *BS 5906:2005 Waste management in buildings — Code of practice.* Table 4-3 details the number of dwellings for each accommodation type. The volume arising per bedroom is assumed to be 70L as per the calculation formula provided. The average number of bedrooms occupied per each accommodation type is detailed in order to complete the calculation. An additional 30L is added onto every dwelling for each calculation. It is expected that this additional volume is to allow for sufficient storage capacity in periods of seasonal variations resulting in high waste generation. The total volume of waste generated weekly from the houses is 94,600L per week, or an average of 310L per house per week.

Table 4-3 Estimated Waste Volumes for Houses

House Type	No. of dwellings	Volume waste generated per Bedroom (70L)	No. of Bedrooms	Additional 30L	Total Litres All Units	Total Litres Per Unit per week
3 Bed house	207	70	3	30	49,680	**240**
4 Bed house	140	70	4	30	43,400	**310**
5 Bed house	4	70	5	30	1,520	**380**
Total Dwellings	**351**		**Total litres**		**94,600**	**310**

4.5 Waste Storage Arrangements Houses

All houses are provided with rear gardens. All houses have space within the curtilage of the dwelling to facilitate a three-bin system for the collection in standard 240 litre wheelie bins for mixed municipal (non-recyclable), dry mixed recyclables and 120 litre wheelie bin for organic waste. The bins provided will be typical of the widely rolled out “three bin system” which is provided as standard by the waste management contractor, conforming to the requirements for residents to source segregate organic and recyclable waste from the non-recyclable waste stream.

It is concluded that adequate capacity is provided for the estimated volume of waste arising at each dwelling (as detailed in Table 4-3), through the provision of ample storage space for a three wheelie bin collection system of approximately 600 litre capacity (x2 240L and x1 120L bins) with space for larger bins if required, based on fortnightly collections, and taking into account that glass bottles generated will be recycled by the occupants at nearby bring bank facilities.

4.6 Waste Storage Capacity Requirements – Residential Apartments and Duplexes

For the apartment and duplex buildings, it is necessary to calculate the required bin storage capacity based on the number of units and the number of bedrooms in each unit. The capacity requirements have been based on a worst-case scenario of full occupancy and collections of bins every week.

Table 4-4 Description and Number of Unit Types (Apartments and Duplexes)

	1 BED	2 BED	3 BED	Total
Block A1	14	22	4	40
Block A2	9	18	3	30
Block B1	10	22	0	32
Block B2	8	18	1	27
Block C1	14	22	4	40
Block C2	10	21	3	34
Duplex	0	16	16	32
Total				**203**

The British Standard BS5906:2005 *Waste management in buildings — Code of practice* provides guidance in respect of waste generation for domestic and commercial premises to calculate the storage, containment, and equipment requirements for effective waste management. Calculations provided in this British Standard document have been used to calculate the waste storage capacity requirements for the apartment blocks in this proposed development. Table 4-4 details the Schedule of Accommodation for apartments and duplexes.

The number of bedrooms is required to complete the calculations of waste volumes generated as per the *BS 5906:2005 Waste management in buildings — Code of practice.*

The calculation for typical weekly waste arisings and subsequent storage requirements for domestic dwellings is as follows:

number of dwellings × {(volume arising per bedroom [70 l] × average number of bedrooms) + 30} [a]

[a] *Based on average household occupancy.*

Table 4-5 below includes the calculations of waste arising using the formula provided in the *BS 5906:2005 Waste management in buildings — Code of practice.* Table 4-5 details the number of bins required to service the volume of waste arisings. The volume arising per

bedroom is assumed to be 70L as per the calculation formula provided. The number of bedrooms occupied per each accommodation type is detailed in order to complete the calculation. An additional 30L is added onto every dwelling for each calculation. It is expected that this additional volume is to allow for sufficient storage capacity in periods of seasonal variations resulting in high waste generation.

Table 4-5 Calculations of Waste Arising (Apartments and Duplexes)

Block A1					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**
1 Bed	14	**70**	1	**30**	**1,400**
2 Bed	22	**70**	2	**30**	**3,740**
3 Bed	4	**70**	3	**30**	**960**
	40		**Total Litres**		**6,100**

Block A2					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**
1 Bed	9	**70**	1	**30**	**900**
2 Bed	18	**70**	2	**30**	**3,060**
3 Bed	3	**70**	3	**30**	**720**
	30		**Total Litres**		**4,680**

Block B1					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**
1 Bed	10	**70**	1	**30**	**1,000**
2Bed	22	**70**	2	**30**	**3,740**
3 Bed	0	**70**	3	**30**	**0**
	32		**Total Litres**		**4,740**

Block B2					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**
1 Bed	8	**70**	1	**30**	**800**
2Bed	18	**70**	2	**30**	**3,060**
3 Bed	1	**70**	3	**30**	**240**
	29		**Total Litres**		**4,100**

Block C1					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**
1 Bed	14	**70**	1	**30**	**1,400**
2Bed	22	**70**	2	**30**	**3,740**
3 Bed	4	**70**	3	**30**	**960**
	40		**Total Litres**		**6,100**

Block C2					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**

1 Bed	10	**70**	1	**30**	**1,000**
2Bed	21	**70**	2	**30**	**3,570**
3 Bed	43	**70**	3	**30**	**720**
	35		**Total Litres**		**5,290**

Duplex					
Type	**No. of dwellings**	**Volume per Bedroom (70L)**	**No. of Bedrooms**	**Additional 30L**	**Total Litres/ Unit/Week**
1 Bed	0	**70**	1	**30**	**0**
2Bed	16	**70**	2	**30**	**2,720**
3 Bed	16	**70**	3	**30**	**3,840**
	32			**Total Litres**	**6,560**
Total Weekly waste arising, all apartments and duplex's					**37,570**

The calculations completed in Table 4-5 conclude that typical weekly waste arising is 37,570L.

Based on weekly waste collections, it is anticipated that the equivalent of x34 no.1,100L bins will be required in the waste storage areas as detailed in Table 4-6 below (x14 no. 1,100L bins for mixed municipal waste, x17 no. 1,100L bins for dry mixed recyclables and x11 no. 660L bin for organic/food waste). The percentage of recyclable and non-recyclable wastes are set out in Table 4-7.

Table 4-6 Breakdown of Bin Numbers & Capacity for Weekly Collections (Apartments and Duplexes)

No. of Bins	Size of Bins (litres)	Total Litre Capacity/ Week (litres)	Waste Type
11	660	7,260	Food Waste
17	1100	18,700	Dry Mixed Recyclables
14	1100	15,400	Municipal Waste
TOTAL		**41,360**	

Table 4-7 Breakdown of Waste Storage Capacity into Recyclable and Non-Recyclable (Apartments and Duplexes)

		Waste Types to be Generated						Total Storage
		Food Waste		Dry-Mixed Recyclables		Municipal Waste		
Accommodation Block ID	**Total No. of Accommodation Units**	**Bin Capacity (l)**	**No. of units required**	**Bin Capacity (l)**	**No. of units required**	**Bin Capacity (l)**	**No. of units required**	**Volume Required per block (liters)**
BLOCK A1	40	660	2	1100	3	1100	2	6,820
BLOCK A2	30	660	1	1100	2	1100	2	5,060
BLOCK B1	32	660	1	1100	2	1100	2	5,060
BLOCK B2	27	660	1	1100	2	1100	2	5,060
BLOCK C1	40	660	2	1100	3	1100	2	6,820
BLOCK C2	34	660	2	1100	2	1100	2	5,720
Duplex	32	660	2	1100	3	1100	2	6,820
Total Storage Capacity Required for each waste type		**7,260**		**18,700**		**15,400**		**41,360**
% Of waste type		**17.6%**		**45.2%**		**37.2%**		**100.00%**
		63%				**37%**		

The total capacity of the number of bins actually provided is 41,360L (or the equivalent or just under x38 no. 1100L wheeled bins) which exceeds the required capacity for weekly collections.

It should be noted that the *BS 5906:2005 Standard* states "*where recycling capacity is provided, the waste capacity may be reduced, but only by up to one quarter of the recycling capacity provided*". When this capacity reduction is applied, and based on weekly waste collections, there would therefore be a requirement to accommodate storage for a volume of 36,685L, or the equivalent of just under x30 no. 1,110L wheeled bins.

On this basis, the bin storage capacity comfortably allows for weekly collections, leaving adequate contingency for more storage space should that be required during unusually high-volume periods such as Christmas.

4.7 Waste Storage Arrangements - Apartments and Duplexes

A number of dedicated, shared waste stores are provided within each of the communal amenity space to serve the apartment and duplex units. These bin stores are centrally located to ensure security and ease of access for residents throughout the development.

Apartment residents will be required to segregate waste into the following waste categories:

- Municipal Solid Waste;
- Dry Mixed recyclables; and
- Organic (food) waste.

The layout and design of the apartments and duplexes should ensure that there is adequate provision for the temporary storage of segregated materials prior to deposition in communal waste storage areas. Adequate space is allocated in the kitchen area to accommodate a three-compartment bin for waste segregation at source. In-sink macerators will not be provided in the apartments.

The Management Company will be responsible for the provision of a leaflet to all new tenants encouraging good waste segregation and pictorial information detailing the waste streams that can be placed in each bin. In addition to this, clauses that support waste segregation targets will be included in relevant legal documentation e.g., tenancy agreements where possible.

A number of bin compound areas have been allocated for the apartment and duplex residents. It will be the responsibility of the residents to bring their segregated waste to the bin compound and place into the appropriately labelled bins. Each bin will be clearly labelled to identify what wastes can and cannot be placed in the bin and labels will be pictorial. The route to the bin compound area and the area itself will be wheelchair accessible, adequately lit and appropriately ventilated.

Residents will have secure access to the bin compound area (pin code or fob key). This will prevent unauthorised access to waste bins by the general public.

Any additional household wastes such as glass, bulky waste, WEEE, batteries, textiles etc. must be brought to a local recycling facility.

4.8 Apartment and Duplex Bin Compound Areas

The Department of Housing, Planning and Local Government published guidelines in March 2018 – "*Sustainable Urban Housing: Design Standards for New Apartments, Guidelines for Planning Authorities*". These Guidelines detail the provisions that need to be made for the storage and collection of waste materials in apartment schemes. These guidelines have been taken into account when preparing the design of the waste compound area.

The bin compounds for this residential apartment/duplex development are located at strategic locations around the development to service each block. The bin compounds will have the following provisions as minimum:

i. **Access:** The bin compound will be accessible for the mobility impaired.
ii. **Lighting:** The bin compound will have adequate lighting. Energy saving lighting operated on sensors is planned. This is to ensure that waste will not be tipped in dimly lit areas and that the areas do not pose as a safety risk.
iii. **Spillage & drainage:** A non-slip surface will be provided to prevent slips or falls, and the compound will have adequate drainage which will be directed to foul sewer.
iv. **Security:** The bin compound areas will have restricted access and will be accessible by tenants and residents only. This is to prevent unauthorised access to the bins by the general public.
v. **Ventilation:** A natural vent will be provided. All vents will be ducted to an external opening so that the bin storage areas will not cause an odour nuisance, taking into account the avoidance of nuisance for habitable rooms nearby.
vi. **Signage:** Pictorial signage will be provided to show residents and tenants what wastes can and cannot be placed in each bin. All signage will be provided by the management company appointed. This will be a requirement in their agreement to ensure this is included in any agreement with a waste contractor or provided by them directly.
vii. **Environmental nuisance:** The compound will be in enclosed areas to avoid environmental nuisances such as litter. Regular waste collections will be required from the waste collection providers to prevent any other environmental nuisances such as odour or vermin. The management company appointed will be required to ensure there is adequate vermin control in place.
viii. **Vehicular Access:** The development has been designed to ensure that waste collection vehicles can safely access the development to collect the bins. Vehicular access for waste collection is included in the traffic management plan for the development.

Duplexes and apartments are provided with shared bin stores at basement level containing a three-bin standard wheelie bin system. Bins will be taken from the designated bin storage areas to a designated bin marshalling area alongside the distributor road.

Figures 4-1 to 4-5 detail the typical shared bin storage areas.

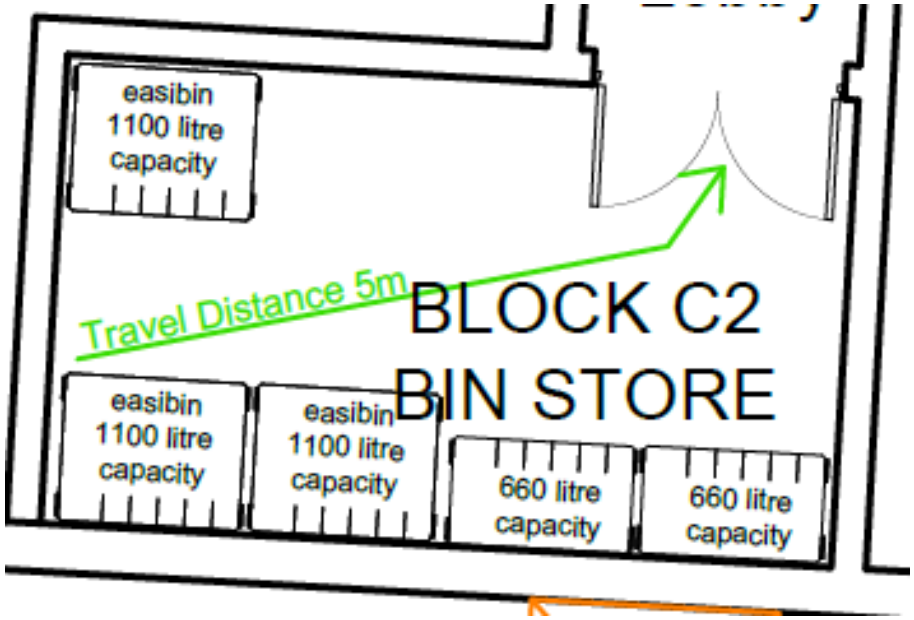

Figure 4-2 Bin Store at Block C2

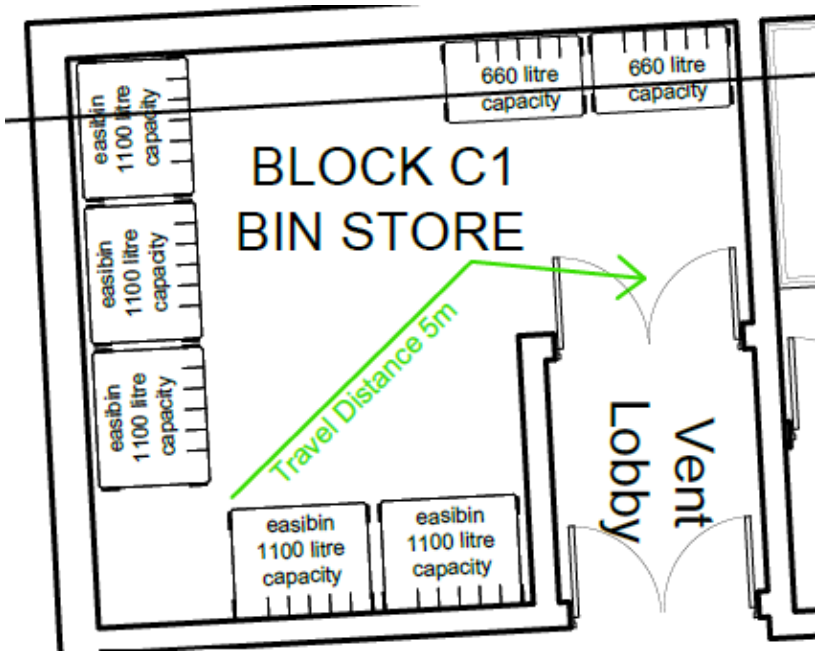

Figure 4-1 Bin Store at Block C1

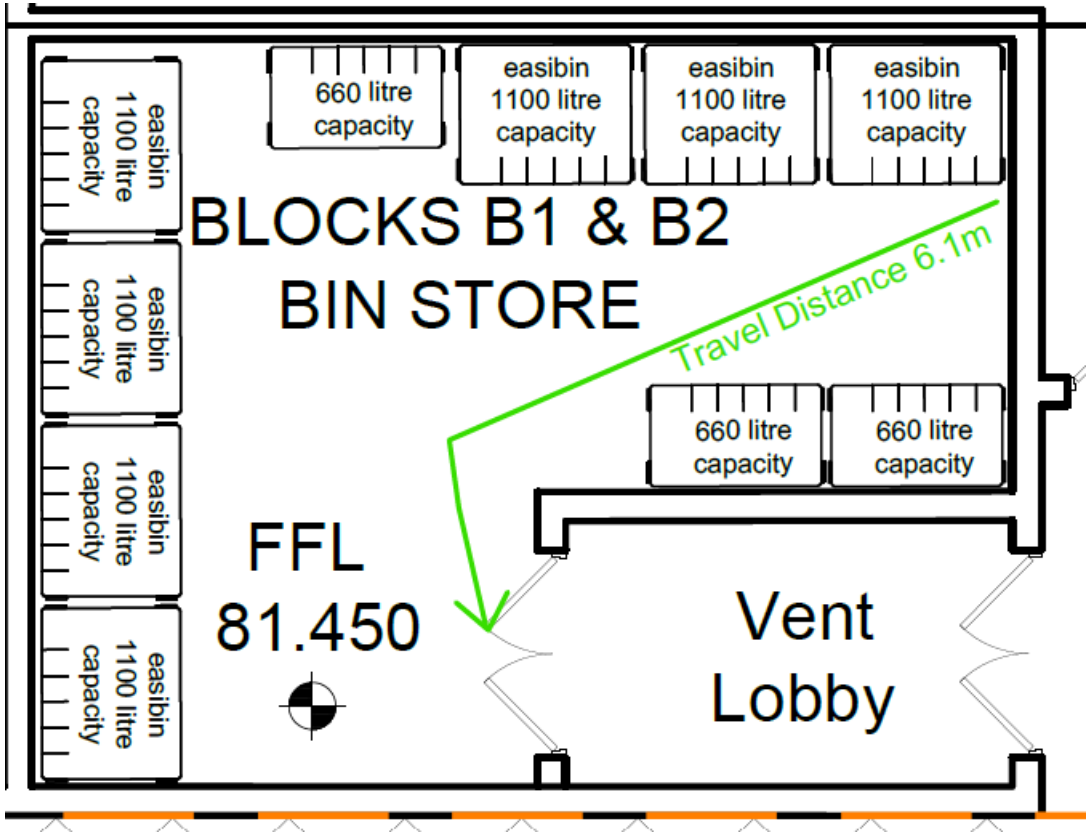

Figure 4-3 Bin Store for Block B1 and Block B2

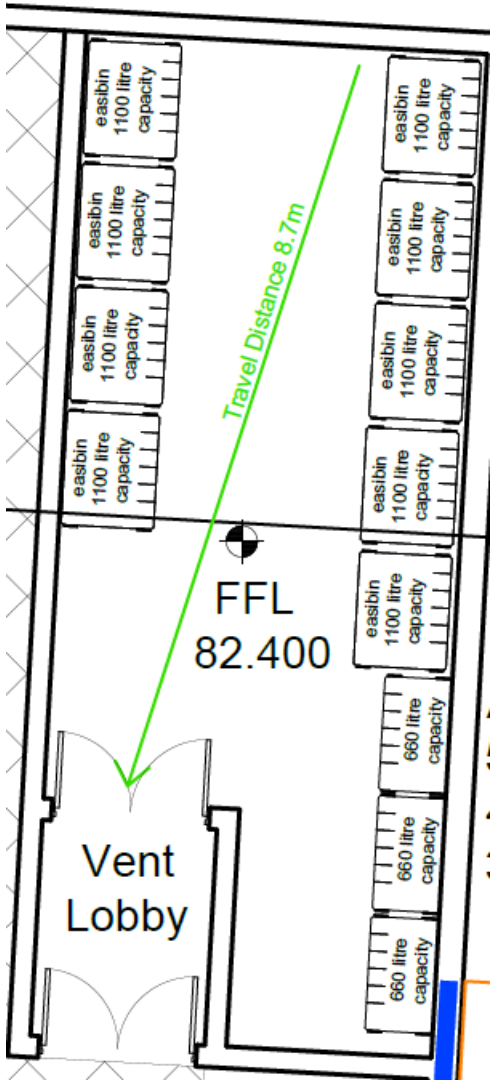

Figure 4-4 Bin Store for Block A1 and Block A2

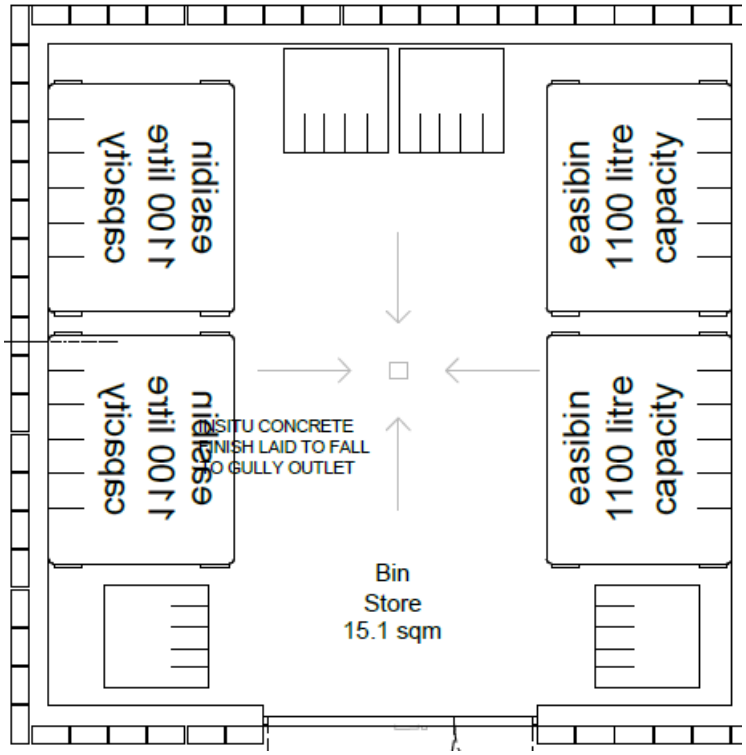

Figure 4-5 Bin Store at Duplex Blocks

4.9 Waste Storage Capacity Requirements - Crèche and Community Centre

The crèche and community centre will generate similar waste types to the domestic dwellings. It is estimated, based on the floor area of the facilities, that there will be a requirement for 1 x 1100 Litre bin for recyclables, 1 x 1100 Litre bin for non-recyclable waste and 2 x 240 litre bins for organic/food waste and glass if required at each facility. Ample space is provided in the secure crèche and community centre bin stores to accommodate these receptacles. The bin stores will only be accessible to the crèche and community centre staff and will not be accessible to residents or members of the public. The crèche and community centre may also generate some office type waste, it will be incumbent on the occupier to arrange collection of materials such as ink cartridges.

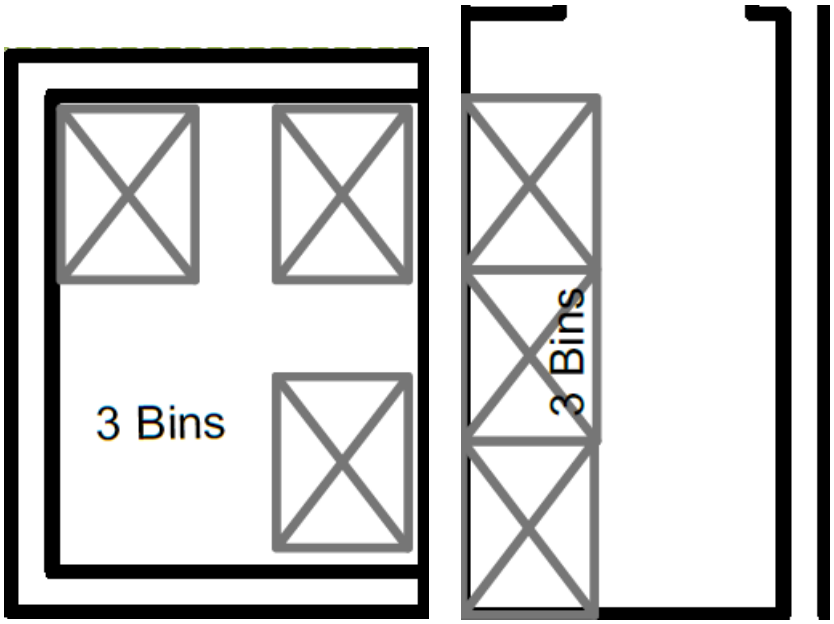

Figure 4-6 Layout of Bin Storage Area for Crèche and Community Centre

4.10 Other Waste Materials

Other waste materials such as glass bottles, bulky waste, textiles, printer toner/cartridges, WEEE and batteries and other household hazardous wastes may be generated infrequently by the occupants of the residential units. Residents will be required to suitably store these wastes within their own dwellings and dispose of them appropriately at bring centres or civic amenity facilities. Details of nearby recycling centres and bring banks is available on the Repak.ie website. All occupants will be supplied with information by the management company on the location of recycling facilities in the area.

4.11 Recycling Rates & Targets

Waste collection areas will be provided with receptacles and signage to promote a rate of 30% of the overall waste collected to be non-recyclable municipal solid waste and 70% of waste collected recyclable waste streams which will include dry mixed recyclables (packaging, papers, cardboards, plastics, aluminium, metals, and tin) and food waste.

All of the municipal solid waste (MSW) collected will be transported for further recovery. No MSW will be transported directly to landfill. All MSW will be consigned to a recovery facility where it will undergo mechanical waste recovery, or it will be consigned to a facility for energy recovery.

On review of bin usage by the appointed Management Company, MSW bins may be replaced with additional food waste or mixed dry recyclable bins to further increase waste segregation at source.

The ratio of bins is in line with the European Commission's proposal to introduce 70% plus reuse and recycling targets for municipal waste by 2030. This waste collection proposal also provides a waste management solution that has sufficient flexibility to support future targets and legislative requirements.

4.12 Bin Weight Limits & Dimensions

The WCC Bye-laws state that Waste presented for collection by a holder shall not be overloaded.

Due to the capacity of bins being provided, bins will not be overloaded and will comply with the Byelaws.

For the shared bin storage areas, crèche and community centre, it is intended to use 1,100L bins of approximately 1300mm x 1000mm x 1300mm with a load capacity of no more than 240kg which will comply with IS EN 840 1997 for dry recyclables and mixed municipal waste, and 660L bins of 1340mm x 1200mm x 700mm for organic waste. All houses will be provided with standard sized, compliant wheelie bins from their bin provider.

All bins will be color-coded and labelled to avoid cross-contamination, green bin for dry recyclables, brown bin for organic waste, black bin for mixed non-recyclable waste and blue bins for glass waste (in accordance with the Waste Action Plan for Circular Economy). Use of, and access to the waste storage area in the apartment buildings will be restricted to residents and waste contractors only. The waste storage area will not be visible to the public and it will conform to the requirements of *BS 5906: 2005 – Waste Management in Buildings – Code of Practice*.

It is envisaged that residents of the apartments and duplexes will be subjected to a service management charge where waste management will be included in the fee.

5 WASTE COLLECTION

All collections must take place in compliance with conditions of the waste contractor's Waste Collection Permit for the region and in line with the Local Authority by-laws and the Waste Management (Waste Collection Permit) Regulations 2007 as amended. All residents are obliged by law to avail of the waste management service and must comply with local By-Laws and Statutory Instruments in relation to the presentation of waste for collection.

In all cases, waste collection vehicles will service the bins and the empty bins will be returned to the waste storage areas. Bins will never be left outside the curtilage of the development. Access and egress of the waste collection vehicles will be in accordance with the Traffic Management Plan for the facility which has ensured the design allows for free-flowing movement of refuse collection vehicles throughout the development. BS 5906: 2005 – Waste Management in Buildings – Code of Practice has been taken into consideration when detailing vehicular access and egress to the development for the purposes of waste collection.

Records of the collections from the apartment blocks will be maintained by the management company for the development including reports from the facilities to which the waste is taken. Residents of individual dwellings will be responsible for maintaining their own waste collection records.

All bins in the shared waste storage areas will be accessible for collection by the waste management contractor. It will be the responsibility of the management company to ensure that bins are accessible for collection from the bin store by the waste management operatives and to assist on collection day to wheel out and replace bins during collection where required.

The staff of the crèche facility and community centre will be responsible for arranging their own waste collection, and the bins are accessible via the entrance to the side of the roadway where they can be emptied and returned to the bin compound.

Occupants of residential houses will be responsible for placing their own bins at the kerb for collection, and for the return of those bins to the storage areas within the curtilage of their dwelling in compliance with the WCC Bye Laws require that bins must not be presented before 6pm the previous night nor left out post collection beyond 9am the day following the day of collection.

6 MANAGEMENT SYSTEM

6.1 Information and Communication

Written information will be provided by the appointed management company, to each tenant or other occupier about the arrangements for waste separation, segregation, storage and presentation prior to collection. The information pack will also contain information about nearby recycling facilities. This information will also be included in information booklets provided to new occupants of properties on the development.

It shall be a condition of contract with the appointed management company to ensure that all residents will be provided with an information pack from the waste collection provider. This information pack will detail the waste streams that can and cannot be placed in the bins provided in the waste compound so that waste segregation is actively encouraged and the specific dates on which the bins will be collected are clearly identified.

A clause will be included in the contract with the waste collection provider to provide this information pack to new residents.

6.2 Waste Management Contracts

It will be a condition of any management contract at the development that adequate budgets are in place for the provision of all required waste management services including a three-bin system for the collection of separate organic waste, mixed dry recyclables, and general residual waste from the apartment/duplex buildings.

In addition to the requirements set out in Section 6.1 Information and Communication, the Management Company appointed will be required to continually monitor the performance of the waste management system. This will include routine visual checks of the bin compound area to ensure that all bins collected are returned to the bin compound area and to ensure this area is maintained so as not to cause any environmental nuisance to residents. These checks will also assess if the bins are in good condition or need to be replaced where damage is identified.

Provision for bin cleaning will be included in the contract with the waste management contractor appointed to ensure the provision of bin cleaning services or replacement of clean bins by the waste contractor.

The Management Company will review all annual waste reports from the Waste Collection Company appointed to ensure that the waste collected is in line with the European recycling targets. Where poor recycling rates are noted information leaflets will be recirculated to all residents which will include information on what materials can be recycled and the waste streams that can be placed in bins. Residents will also be reminded of legal obligations where applicable. Further communication strategy to engage tenants and owner occupiers in good waste management practices will be adopted if deemed necessary.

Contingency policies will be in place to ensure continuity of service.

7 CONCLUSIONS

By implementing design and actions outlined in this OWMP, a high level of recycling, reuse and recovery will be achieved at the development in line with European targets. Recyclables and organic waste will be segregated at source to reduce the quantity of residual waste materials requiring off-site recovery or disposal.

The source segregation of waste types as detailed in this report will help to achieve the targets set out in the *EMWR Waste Management Plan 2015 – 2021*.

The design of the waste storage area will meet the requirements as detailed in the *Sustainable Urban Housing: Design Standards for New Apartments, Guidelines for Planning Authorities.*

8 REFERENCES

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Waste Management in Buildings – Code of Practice, British Standard, BS 5906:2005, 2005.

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Mobile waste containers. Containers with four wheels with a capacity from 750 l to 1700 l with flat lid(s), for wide trunnion or BG-and/or wide comb lifting devices. Dimensions and design, British Standard, BS EN 840-4:1997, 1997.

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APPENDIX 13 B OUTLINE CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

OUTLINE CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

FOR

PROPOSED DEVELOPMENT

AT

COOLAGAD, GREYSTONES, CO. WICKLOW

March 2022

ON BEHALF OF

Cairn Homes Properties Ltd.

Prepared by
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DOCUMENT CONTROL SHEET

Client	Cairn Homes Properties Ltd.
Project Title	Coolagad, Greystones, Co. Wicklow
Document Title	Outline Construction and Demolition Waste Management Plan

Rev.	Status	Author(s)	Reviewed by	Approved by	Issue Date
01	Draft	Gareth Carroll Senior Consultant	Claire Clifford Technical Director	Claire Clifford Technical Director	07/02/2022
02	Draft [design details added]	Gareth Carroll Senior Consultant	Claire Clifford Technical Director	Claire Clifford Technical Director	15/02/2022
03	FINAL	Gareth Carroll Senior Consultant	Claire Clifford Technical Director	Claire Clifford Technical Director	23/03/2022

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The work described in this Report is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

All work carried out in preparing this report has used, and is based upon, Enviroguide's professional knowledge and understanding of the current relevant national legislation. Future changes in applicable legislation may cause the opinion, advice, recommendations or conclusions set-out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, Enviroguide has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, Enviroguide will have no obligation to advise the client of any such changes, or of their repercussions.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1 INTRODUCTION

Enviroguide Consulting (hereafter referred to as EGC) was retained by Cairn Homes Properties Ltd. (the Applicant) to prepare the Outline Construction and Demolition Waste Management Plan (CDWMP) for the Construction Phase of the Proposed Development located on lands at Coolagad, Greystones, Co. Wicklow (hereafter referred to as the Proposed Development Site).

The Proposed Development comprises the construction of a residential development. A detailed description of the Proposed Development is provided in Section 3.

1.1 Scope and Purpose of this CDWMP

The purpose of this outline CDWMP is to provide the information necessary to ensure that the management of surplus material including construction and demolition (C&D) waste at the Site is undertaken in accordance with relevant EU, National and Local Waste Management Policies, Waste Legislation, and Best Practice Guidelines, as discussed in Section 2 below.

This outline CDWMP details the legal and policy framework aimed at resource and waste management for C&D projects in Ireland. This CDWMP also includes information on the roles and responsibilities of all parties involved in the Proposed Development; the type and quantity of resources and waste to be generated by the Proposed Development and details the planned approach to the management of resources and waste on-site.

This outline CDWMP relates to the Pre-Construction Phase of the Proposed Development and will be updated by the appointed Contractor in advance of construction works commencing on-site.

As detailed in this document, the exact materials and quantities construction waste that will be generated from the proposed works will be audited throughout the project roll-out phase to prevent waste arising in the first place, and to re-use, recycle or recover waste materials where possible.

2 RELEVANT EU, NATIONAL AND LOCAL WASTE POLICY AND LEGISLATION

2.1 National Policy and Best Practice Guidelines

The Irish Government's policy document of 1998, '*Waste Management: Changing our Ways'*, represented Ireland's first steps towards identifying objectives for the prevention, minimisation, reuse, recycling, recovery, and disposal of waste, including C&D waste.

The Irish Construction Industry responded to the '*Waste Management: Changing Our Ways'* report by setting up a waste sector task force and released a report entitled '*Recycling of Construction and Demolition Waste'*. The report dealt with the development and implementation of a voluntary construction industry programme to meet the Government's objectives for the recovery of C&D waste.

The National Construction and Demolition Waste Council (NCDWC) was launched in June 2002, and subsequently produced the '*Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects*' in July 2006 in conjunction with the then Department of the Environment, Heritage and Local Government (DoEHLG). The guidelines outlined the issues that needed to be addressed at the pre-planning stage of a development all the way through to its completion. The Best Practice Guidelines also identified development thresholds above which a C&D Waste Management Plan must be prepared. The Best Practice Guidelines noted that arrangements need to be established in a manner which ensures that there is a contractual obligation on the Contractor(s) to prepare a Waste Management Plan in accordance with the above considerations at a minimum.

In 2012, the then Department of the Environment, Community and Local Government (DoECLG) (previously DoEHLG), published '*A Resource Opportunity – Waste Management Policy in Ireland*' which supported the prioritisation of the waste hierarchy and identified specific producer responsibilities for construction and demolition projects (over certain thresholds) as a key area for exploration. In 2015, the EPA's '*Design Out Waste*' report noted that the preparation of a Waste Management Plan within the early design and feasibility phases provides a framework to carry out design reviews, and should be used as an implementation, benchmarking, monitoring and reporting tool throughout the overall construction process.

The Best Practice Guidelines also reflect the current waste legislation and policy including '*A Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020-2025*' published in September 2020 by the Department of Communications, Climate Action and Environment (DCCAE) (updated in January 2021). '*A Waste Action Plan for a Circular Economy'* focuses on the prevention of waste disposal by maximising the value of material resources and reducing waste generation and also sets out a number of actions in relation to C&D including updating C&D waste management plan guidelines, putting in place incentives to encourage the use of recycled materials, further develop methods to encourage segregation of waste materials on-site and improve consistency across the waste sector.

In 2021, following a process of public consultation, the Environmental Protection Agency (EPA) produced '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects*', which supersedes the DoEHLG Best Practice Guidelines 2006. The EPA's Best Practice Guidelines (2021) set out a practical and informed common approach to preparing C&D Resource and Waste Management Plans

(RWMP) prior to construction and during construction. The Best Practice Guidelines recommend that an RWMP shall be submitted for all C&D projects to inform the planning consent process, and that the level of detail presented in the RWMP should be reflective of the scale and complexity of the project. The guidelines provide thresholds for classifying C&D projects into two different tiers with regards to resource and waste management. These thresholds are based on the principle of proportionality to ensure larger projects with larger potential resource footprints are required to more actively manage resources compared to smaller scale projects.

Other guidelines considered in the preparation of this report include '*Construction and Demolition Waste Management – a handbook for Contractors and Site Managers*' published by FÁS and the Construction Industry Federation in 2002.

These policy and guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

2.2 Regional Policy

The Proposed Development is located in Co. Wicklow and is therefore governed by the Waste Management Plan for the Eastern-Midlands Region (EMR) (2015-2021). The Waste Management Plan for the EMR is a statutory document prepared by the Local Authorities of the EMR which sets out the framework for the prevention and management of wastes in the EMR in a safe and sustainable manner. The Waste Management Plan provides policy direction, setting out what the Local Authorities want to achieve in relation to waste management and actions to achieve their targets. The strategic approach of the plan places a stronger emphasis on preventing wastes and material reuse activities, and it notes that the waste sector has the potential to play a leading role in the development of the circular economy in the EMR, and the policies and actions of the Waste Management Plan are focused on delivering this outcome.

The Waste Management Plan reflects the targets set out for C&D waste in the Waste Framework Directive (WFD), which requires a 50% reuse, recycling and materials recovery rate target of non-soil and stone construction and demolition waste to be achieved by 2020.

This RWMP sets out the waste management objectives for the Proposed Development for waste prevention, maximum recycling, reuse and recovery of resources and waste with diversion from landfill, wherever possible. It also sets out the appropriate measures to be taken regarding the collection and transport of waste from the site to prevent issues associated with litter or more serious environmental pollution (e.g., contamination of soil and/or water).

2.3 Legislative Requirements

The primary piece of legislation governing waste management in Ireland is the Waste Management Act 1996, (as amended) and all associated regulations. Waste management is also regulated by the Environmental Protection Act 1992, (as amended), Litter Pollution Act 1997, (as amended) and the Planning and Development Act 2000, (as amended).

Under the Waste Management Act, 1996, (as amended), the waste producer is responsible for waste from the time it is generated through until its legal recycling, recovery, or disposal

(including its method of disposal). This includes transportation by an authorised waste contractor.

2.4 European Communities (Waste Directive) Regulations 2011-2020

The new Waste Framework Directive (WFD) (Directive (EU) 2018/851 of the European Parliament, amending Directive 2008/98/EC on waste) was approved by the EU in July 2018. The WFD requires EU Member States to improve their waste management systems, to improve the efficiency of resource use, and to ensure that waste is valued as a resource. The new WFD was transposed into Irish law in 2020 and the European Union (Waste Directive) Regulations 2020 (S.I. No. 323 of 2020) and the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) are interpreted together as one and are collectively cited as the European Union (Waste Directive) Regulations 2011-2020.

The European Union (Waste Directive) Regulations 2011-2020 supersede a number of provisions of the Irish Waste Management Act 1996 (as amended), and associated regulations. Provisions include extended producer responsibility, the implementation of the Waste Management Hierarchy, and measures to promote the preparation of materials for re-use, recycling, and other material recovery (including beneficial backfilling operations using waste as a substitute). The WFD and the European Union (Waste Directive) Regulations 2011-2020 make specific reference to the reuse and recycling of C&D waste. Regulation 31(1)(d) requires measures to be taken to "*promote selective demolition in order to enable removal and safe handling of hazardous substances and facilitate re-use and high-quality recycling by selective removal of materials, and to ensure the establishment of sorting systems for construction and demolition waste at least for wood, mineral fractions (concrete, bricks, tiles and ceramics, stones), metal, glass, plastic and plaster*."

The European Communities (Waste Directive) Regulations 2011-2020 also transpose EU waste management targets into Irish law as statutory benchmarks, and a minimum of 70 % by weight of non-hazardous C&D waste must be prepared for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials (excluding naturally occurring material defined in category 17 05 04 in the List of Waste).

2.5 Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous

Correct classification of waste is the foundation for ensuring that the collection, transportation, storage and treatment of waste is carried out in a manner that provides protection for the environment and human health and in compliance with legal requirements.

In 1994, the European Waste Catalogue was published by the European Commission. In 2002, the EPA published a document titled the European Waste Catalogue and Hazardous Waste List. This document has been replaced by the EPA 'Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous' which became valid from the 1stJuly 2018.

The waste classification system applies across the EU and is the basis for all national and international waste reporting obligations such as those associated with waste collection permits, certificates of registration, waste facility permits, EPA Waste and Industrial Emissions licences and the EPA National Waste Database.

The EPA document 'Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous' (EPA, 2018) consolidates the legislation and allows the generators of waste to classify the waste as hazardous or non-hazardous and in the process to assign the correct List of Waste entry. Under the classification system, different types of wastes are fully defined by a code. The List of Waste (LoW) code (previously referred to as European Waste Code or EWC).

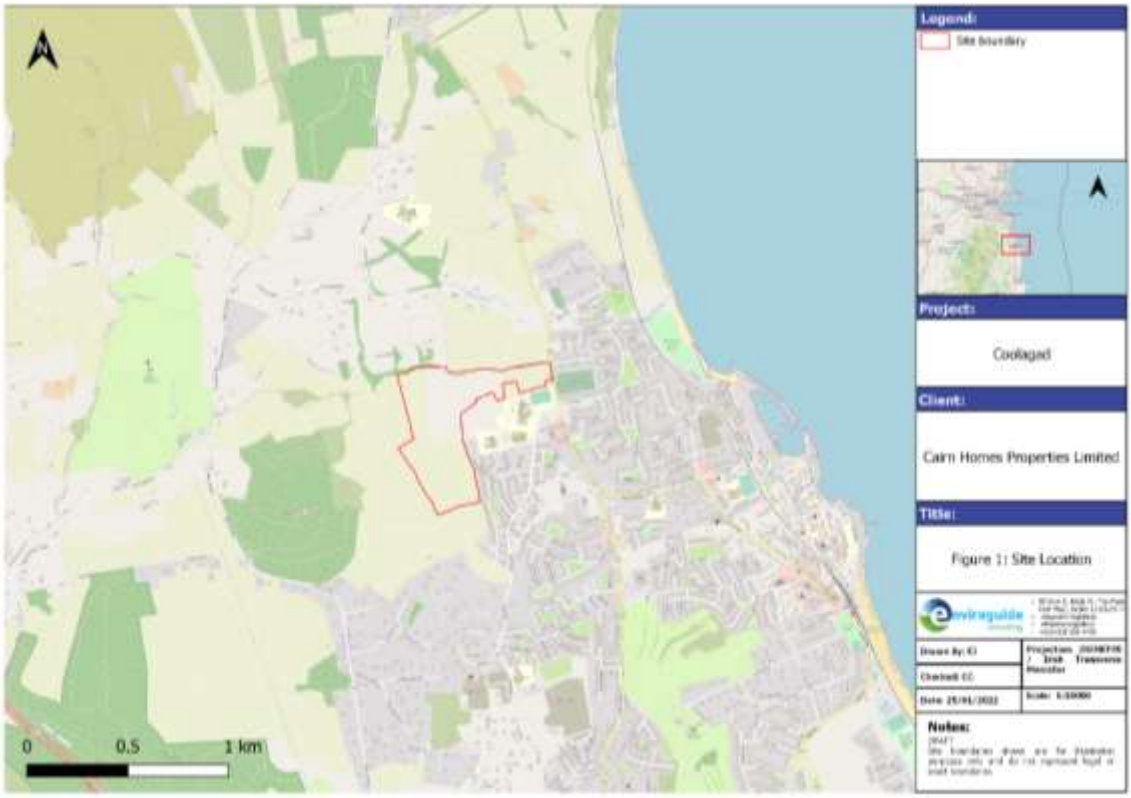
3 DESCRIPTION OF THE PROJECT

3.1 Site Location, Description and the Proposed Development

The Proposed Development Site is located at Coolagad, Greystones Co. Wicklow and the location is presented in Figure 3-1.

The proposed development consists of 586 residential units (351 houses; 203 apartments and 32 duplex units) at a site c. 26.03 ha at Coolagad, Greystones. The development will also include the provision of a community building, a creche, a sport field and a MUGA. A proposed new vehicular entrance with signalised junction from the R761 Rathdown Road to the north of Gate Lodge, Rathdown Road opposite Sea View and Redford Cemetery, providing a distributor road as part of the long-term objective to provide a northern access route from Greystones to the N11 is also proposed. The development also includes site development infrastructure, a hierarchy of internal streets including bridges, cycle paths & footpaths; new watermain connection and foul and surface water drainage; the development also provides for the upgrading of the public sewer within the wayleave of the R761/R762 (Rathdown Road) from the site entrance as far as the R762 in front of St. Kevin's National School, Rathdown Road, Greystones.

Figure 3-1. Site Location



4 WASTE MANAGEMENT TEAM

4.1 Roles and Responsibilities

4.1.1 Waste Officer

A member of the construction team will be appointed as the project "Waste Officer" to ensure commitment, operational efficiency and accountability during the Construction Phase of the Proposed Development.

The appointed Waste Officer will have overall responsibility to oversee and record everyday waste management at the Proposed Development Site.

The Waste Officer will have the authority to select a waste team, if required (i.e., members of the site crew that will aid him/her in the organisation, operation and recording of the waste management system implemented on-site).

The Waste Officer will maintain the record keeping system for waste management on-site including maintaining a log of each load of waste materials being transported off-site and maintain a record of all necessary documentation including waste transfer documents and landfill gate receipts in the waste management file.

Authority will be given to the Waste Officer to delegate responsibility to subcontractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

4.1.2 Environmental Consultant

Guidance and support will be provided to the Waste Officer by the appointed Environmental Consultant to ensure the waste management targets and deliverables are maintained to a high standard.

If required, the Environmental Consultant will also be responsible for completing waste classification of surplus soil and stone materials that may require off-site disposal in compliance with all relevant waste management legislation.

4.2 Training Provisions

4.2.1 Waste Officer Training

The Waste Officer will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on-site. The Waste Officer will also be trained in the best methods for segregation and storage of recyclable materials, have information on the materials that can be reused on-site and be knowledgeable in how to implement the project CDWMP.

4.2.2 Site Personnel Training

A basic awareness briefing will be held for all site personnel to outline the CDWMP and to detail the segregation of waste materials at source. This may be incorporated with other site training needs such as general site induction, health and safety awareness and manual handling.

This basic briefing will describe the materials to be segregated, the storage methods and the location of the Waste Storage Areas (WSAs). A sub-section on hazardous wastes will be incorporated into the briefing and the particular dangers of each hazardous waste will be explained.

5 MATERIALS AND WASTE TYPES

5.1 Details of Potential Non-Hazardous Wastes

5.1.1 Non-Hazardous C&D Waste

The Proposed Development Site is on greenfield lands and there will be no demolition works.

During the Construction Phase of the Proposed Development, it is anticipated that there will some surplus of building materials, such as timber off-cuts, broken concrete blocks, cladding, plastics, metals, and tiles generated. There may also be excess concrete during construction which will need to be disposed of. Plastic and cardboard waste from packaging and supply of materials will also be generated.

5.1.2 Inert and Non-Hazardous Soil and Stone

The Proposed Development will involve excavation of soil during the Construction Phase to depths of up to 8-9mbGL to achieve the proposed Site levels.

Soil analytical data for samples collected from across the Site are provided in the site investigation report (GII, 2018) and verify that there are no hazardous compounds in the soil sampled at the Site. This will be verified during the groundworks in accordance with the procedures outlined in Section 6.

In order to minimise the requirement for imported aggregates excavated materials will be re-used on Site where fill is required to achieve proposed Site levels and for landscaping.

The predicted quantities of cut and fill and surplus material from the bulk dig is provided in Table 5-1.

Table 5-1 Cut and Fill Analysis (AECOM, 2022)

Area (m^2)	Cut Required (m^3)	Fill Required (m^3)	Net (m^3)
193100.517	204063	102159.264	101904.631 (cut)

The overall net volume of 101,904.631 m^3 of soil will require removal from the Site. The final volume of material removed from Site may vary (typically +/- 20%) where bulking of soils on excavation occurs.

5.1.3 Other Non-Hazardous Wastes

Waste will also be generated from construction workers (e.g., organic/food waste, dry mixed recyclables (wastepaper, newspaper, plastic bottles, packaging, aluminium cans, tins and cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided on-site during the construction phase. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

5.2 Hazardous Wastes

5.2.1 Asbestos

The Site is greenfield and has not been previously developed and therefore asbestos containing materials (ACMs) will not be generated during the Construction Phase of the proposed Development.

Soil analytical data for samples collected from across the Site are provided in the site investigation report (GII, 2018) and verify that there are no ACMs in the soil.

5.2.2 Hazardous Soil and Stone

It is anticipated that there will be no hazardous soil and stone waste requiring off-site disposal generated during the Construction Phase at the Proposed Development. Soil analytical data for samples collected from across the Site are provided in the site investigation report (GII, 2018) and verify that there are no hazardous compounds in the soil sampled at the Site. This will be verified prior to removal of any soil and stone from the Site.

5.2.3 Fuel and Oils

Fuels and oils are classed as hazardous materials. The storage of small quantities of fuel will be required to allow for refuelling of machinery in the site compound and on an impermeable area with appropriate containment in place and in accordance with procedures outlined in the CEMP. All fuels and oils required to be stored at the site will be sealed, bunded and clearly marked. All tank, container and drum storage areas will be rendered impervious to the materials stored therein. Bunds and storage areas will have regard to Environmental Protection Agency guidelines 'Storage and Transfer of Materials for Scheduled Activities' (EPA, 2004) and Enterprise Ireland. Best Practice Guide BPGCS005. Oil Storage Guidelines. All tank and drum storage areas shall, as a minimum, be bunded to a volume not less than 110% of the capacity of the largest tank or drum within the bunded area. Provided that these requirements are adhered to, and site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel/oil wastage at the site.

5.2.4 Other Hazardous Substances

Any paints, glues, adhesives, and other known hazardous substances will be stored in designated areas and will be sealed, bunded and clearly marked. They will generally be present in small volumes only, ordered as needed and therefore, associated waste volumes generated will be kept to a minimum.

It is not envisaged that there will be any other hazardous waste generated throughout the construction works however if generated, on-site storage of any hazardous wastes produced (i.e., waste fuels/chemicals) will be kept to a minimum, with compliant removal off-site organised on a regular basis.

It is noted that storage of all hazardous wastes on-site will be undertaken to minimise exposure to on-site personnel and to also minimise potential for environmental impacts. A specialist hazardous waste contactor will be used to remove any hazardous waste arising.

5.3 Main C&D Waste Categories

The main non-hazardous and hazardous waste streams that could be generated by construction activities at a typical site are shown in Table 5-2. The List of Waste (LoW) code (as effected from 1 June 2015) for each waste stream is also shown.

Table 5-2 Typical Waste Types Generated and LoW Code

Waste Material	LoW Code
Concrete	17 01 01
Bricks	17 01 02
Tiles and Ceramics	17 01 03
Mixture of concrete, bricks, tiles, and ceramics	17 01 07
Wood, Glass and Plastic	17 02 01 17 02 02 17 02 03
Metals (including their alloys)	17 04 01 17 04 02 17 04 03 17 04 04 17 04 05 17 04 06 17 04 07
Non-Hazardous Soil and Stone	17 05 04
Hazardous Soil and Stone	17 05 03*
Gypsum-based construction material	17 08 02
Bituminous mixtures	17 03 02
Paper and cardboard	20 01 01
Non-Hazardous Mixed C&D Wastes	17 09 04
Electrical and electronic components	20 01 35* 20 01 36
Batteries and accumulators	20 01 33* 20 01 34
Liquid fuels	13 07 01* 13 07 02* 13 07 03*
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13* 20 01 19* 20 01 27* 20-01 28 20 01 29* 20 01 30
Insulation materials	17 06 04

5.4 Quantities of C&D Waste

Table 5-3 shows the breakdown of C&D waste types produced on a typical site based on data from the EPA National Waste Statistics (EPA, December 2021. National Waste Statistics Summary Report for 2019). The waste categories in Table 5-3 will be segregated into general waste and dry recycling categories.

Table 5-3: Quantities of C&D Materials Generated on a Typical Irish Construction Site (source: EPA, 2021)

Waste Types	%
Mixed C&D waste	30
Segregated timber, glass, and plastic	2
Bituminous Mixtures	9
Metals	14
Segregated concrete, brick, tile, and gypsum	45
Total	**100**

As outlined in Section 5.1.2 there will be an overall net volume of 101,904.631 m^3 (+/- 20%) of soil will require removal from the Site.

Where possible, surplus soil that is verified to be clean inert soil will be removed from the Site under an Article 27 By-product notification (refer to Section 5.5).

5.5 Article 27 By-product

Where appropriate the removal of surplus materials (soil and stone) as a by-product of the Proposed Development Construction Phase under an Article 27 By-product notification in accordance with Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No 126 of 2011) will be considered. Material will only be removed under an Article 27 By-product notification when it can be robustly demonstrated that all tests for Article 27 By-product are met.

5.6 Invasive Species

Invasive plant species were not identified during surveys undertaken by Altemar Ltd at the Proposed Development Site. If invasive species are identified during construction works an appropriate Invasive Alien Species (IAS) Management Plan will be developed which will identity mitigation measures to prevent uncontrolled transportation and dispersion of invasive species from the Proposed Development Site. All works will be undertaken in accordance the mitigation measures outlined in the IAS Management Plan.

6 WASTE CLASSIFICATION

The Contractor will ensure all materials identified as waste are classified in compliance with all relevant waste management legislation.

6.1.1 C&D Waste Materials

The waste classification of inert C&D wastes generated throughout the construction phase of the development including structural concrete, metal, timber, cladding, plastics, cardboard, and tiles will be based on visual observations by the Waste Officer or appointed delegate.

It is noted that there will be no crushing of concrete on-site using a mobile crushing plant. Concrete will be segregated for removal off-site to an authorised permitted/licensed waste facility for recovery, recycling.

6.1.2 Soil and Stone

Where sampling and assessment of soil and materials is required to ensure that the materials are managed and removed off-site in accordance with waste management legislation, the waste classification of sample results will be based on the following method:

- Soil sample collection and analysis in accordance with UK Environment Agency, 2021 Version 1.1 GB (EU Exit Update): Guidance on the Classification and Assessment of Waste (1st Edition v1.1.GB) Technical Guidance WM3 (UK EA, WM3 2021) and the Northern Ireland Environment Agency, 2021. Version 1.1 NI (EU Exit): Guidance on the Classification and Assessment of Waste (1st Edition v1.1.NI) Technical Guidance WM3 (NI EA, WM3 2021).
- Assessment of results to determine if the sample is a hazardous or non-hazardous waste using the http://www.hazwasteonline.com application developed by One Touch Data Limited;
- Assigning a List of Waste (LoW) Code to the sampled material in accordance with EPA guidance 'Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous' (EPA, 2018);
- Screening the sample analytical results against the waste acceptance criteria (landfill WAC) set out in the adopted EU Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC (2002);
- Screening the sample analytical results against the Maximum Concentrations and/or Soil Trigger Levels set out in the Environmental Protection Agency (2020) "Guidance on Waste Acceptance Criteria at Authorised Soil Recovery Facilities" (SRF WAC); and
- Assigning a waste category for each sample based on the methods outlined above.

7 MATERIALS AND WASTE MANAGEMENT

7.1 Opportunities for Prevention and Reduction

Opportunities for the prevention and reduction of waste will be considered throughout all stages of the Proposed Development Construction Phase. The Contractor will plan the construction process to eliminate/reduce waste; specifically, careful planning will minimise the volume arising on-site, facilitate the use of reclaimed materials in the works, and influence wastage caused by poor materials handling.

Table 7-1 shows the predicted waste generation during the Construction Phase of the Proposed Development based on the information available to date. The predicted waste amounts and breakdown rates are based on an average largescale development waste generation rate per m^2 (EPA, 2015 Research Report 146 Design Out Waste Factsheets), using the breakdown rates as outlined in Table 5-3 and the internal floor area of the Proposed Development.

Table 7-1 Predicted Quantities of Materials and Targets for Recovery

Material / Waste Type	Quantity from Proposed Development	Recycling / Recovery Rate %	Landfill Daily / Intermediate Cover %	Landfill Disposal %
Mixed C&D waste	*	92.9%	92.9%	3.1%
Segregated wood, glass, and plastic	*	100.0%	100.0%	
Bituminous Mixtures	*	100.0%	100.0%	
Metals	*	92.9%	92.9%	
Segregated concrete, brick, tile, and gypsum	*	92.9%	92.9%	3.1
Soil and Stone	101,904.631 m^3	100%	0	0
Notes: Quantity denoted * will be determined at detailed design stage.				

Until final materials and detailed construction methodologies have been confirmed, it is difficult to predict with a high level of accuracy the construction waste that will be generated from the proposed works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

The CDWMP to be updated with predicted and actual quantities as information becomes available in advance of construction works commencing on-site. The waste management objective will be to prevent waste arising in the first place, and to re-use, recycle or recover waste materials where possible. A policy of 'as needed' ordering and strict purchasing procedures will also prevent waste arisings as far as possible.

7.2 Article 27 By-product

Where appropriate the removal of surplus materials as a by-product of the Proposed Development Construction Phase under an Article 27 By-product notification in accordance with Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No 126 of 2011) will be considered. Material will only be removed under an Article 27 By-product notification when it can be robustly demonstrated that all tests for Article 27 By-product are met.

7.3 Construction Waste Management

The management of the main waste streams are detailed in the following sections,

A policy of 'as needed' ordering and strict purchasing procedures will also prevent waste arisings as far as possible and as there is no demolition phase it is anticipated that there will be minimal surplus quantities of the following materials generated.

7.3.1 Concrete

The waste majority of concrete generated as part of the construction works is expected to be clean, non-hazardous material. There will be no crushing of concrete on-site using a mobile crushing plant. Concrete will be segregated for removal off-site to an authorised permitted/licensed waste facility for recovery and/ or recycling.

7.3.2 Tarmacadam

Where possible it is anticipated that tarmacadam generated during site clearance works will be reused onsite (e.g., capping layer below access roads) subject to assessment of the suitability for use in accordance with engineering and environmental specifications for the Proposed Development. However, where the removal offsite of tarmacadam's is required, it will be segregated pending removal to an authorised permitted/licensed waste facility for recovery and/ or recycling.

7.3.3 Tiles, Ceramics and Gypsum

Tiles, ceramics and gypsum generated as part of the construction and demolition works will be segregated into dedicated skips/receptacles and recycled off-site at an authorised recycling facility. Under no circumstances, will gypsum containing materials (e.g., plasterboard) be stored with mixed waste. The appointed Waste Officer or delegate will ensure that supply of new plasterboard is carefully monitored to minimise waste.

7.3.4 Timber Glass and Hard Plastic

Glass, hard plastic (e.g., material cut offs) and timber that is uncontaminated (i.e., free from paints, preservatives, glues etc.) will be segregated into dedicated skips/receptacles and recycled off-site at an authorised recycling facility, where possible.

7.3.5 Metal

Metals will be segregated into mixed ferrous, aluminium cladding, high grade stainless steel, low grade stainless steel etc., where practical and stored in skips and recycled off site at an authorised recycling facility.

7.3.6 Waste Electrical and Electronic Equipment (WEEE)

Any WEEE will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling.

7.3.7 Other Recyclables

Where any other recyclable wastes such as cardboard and soft plastic are generated, these will be segregated at source into dedicated skips and removed off-site.

7.3.8 Non-Recyclable Waste

C&D waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some contaminated cardboards, will be placed in separate skips or other receptacles. Prior to removal from site, the non-recyclable waste skip/receptacle will be examined by the appointed Waste Officer or delegate to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

7.3.9 Hazardous Wastes

On-site storage of any hazardous wastes produced will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes on-site will be undertaken so as to minimise exposure to on-site personnel and the public and to also minimise potential for environmental impacts. Hazardous wastes will be recovered, wherever possible, and failing this, disposed of appropriately. Hazardous wastes produced (i.e., waste fuels/chemicals) will be kept to a minimum, with removal off-site organised on a regular basis by an appointed specialist hazardous waste contactor.

As the Site is greenfield, hazardous soil and stone is not expected to be encountered.

7.3.10 Inert / Non-hazardous Soil and Stone

It is estimated that approximately 101,904.631m^3 of excavated inert and non-hazardous soil and stone generated during the Construction Phase of the Proposed Development.

If any surplus soil that is verified to be clean inert soil is to be removed from the Site under an Article 27 By-product notification to the EPA all statutory requirements of Article 27 By-product under the Waste Directive Regulations must be demonstrated to the satisfaction of the EPA. A separate assessment would be required to verify that the any surplus material meets the four conditions of Article 27 by-product prior to notifying the EPA or moving material off-site.

Where the material cannot be re-used as a by-product and is deemed to be a waste it will be consigned to an authorised facility permitted to accept it in accordance with all relevant waste management legislation.

7.4 Segregation of Waste On-Site

Material will be segregated on-site for the appropriate waste stream and disposal destination. The Waste Officer or appointed delegate will ensure waste streams are adequately identified. The segregation and management of waste storage and stockpiling will be routinely inspected and audited by the Waste Officer and audit findings recorded in the CDWMP records.

There will be no crushing of concrete on-site using a mobile crushing plant. Concrete will be segregated for removal off-site to an authorised permitted/licensed waste facility for recovery, recycling.

C&D waste will be segregated on-site into labelled dedicated skips / receptacles. Where the on-site segregation of certain waste types is not practical, off-site segregation will be carried out an authorised waste recovery facility.

Dedicated bunded storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc., if required.

Waste materials generated from site office and canteen will be segregated into general waste, biodegradable waste and dry recycling and stored in appropriate refuse bins in a dedicated storage area on-site, where it is practical.

In the event of material being temporarily stockpiled on-site for reuse in the proposed development or in the event of material excavated pending waste classification for removal off-site, the material will be temporarily stockpiled in a designated area on-site. Stockpiles of different waste material will be located, maintained, and separated by a sufficient distance to prevent any inadvertent mixing of excavated material. All stockpiles will be clearly identified (e.g., signage) and recorded on a site map. Additional details on the management of stockpiles and procedures to prevent environmental and nuisance issues will be documented in the Construction and Environmental Management Plan (CEMP) which will be developed by the appointed Contractor in advance of construction works commencing on-site.

Any heavily contaminated material/soil that may be encountered will need to be segregated in accordance with the measures outlined in the CEMP for appropriate sampling, waste classification and authorised removal off-site.

The Construction Environmental Site Manager will ensure that site personnel involved in the excavation and removal of waste soil materials at the site are informed of and can identify the different waste types and categories of waste soil materials encountered on-site.

7.5 Storage of Waste Policy

Waste storage, fuel storage and stockpiling and movement are to be undertaken with a view to protecting the underlying soils and groundwater. Waste will be stored on-site, including non-hazardous soil and stone and inert C&D wastes, in such a manner as to:

- Prevent environmental pollution (bunded and/or covered storage, minimise noise generation and implement dust/odour control measures, as may be required);
- Maximise waste segregation to minimise potential cross contamination of waste streams and facilitate subsequent re-use, recycling, and recovery; and
- Prevent hazards to site workers and the public during construction phase (largely noise, vibration and dust).
- Prevent risks to sensitive receptors including environmental, human health and archaeological sites within the Site (refer to CEMP).

8 ESTIMATED COST OF WASTE MANAGEMENT

An outline of the costs associated with different aspects of waste management is provided below.

The total cost of C&D waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

8.1 Reuse

By reusing materials on site, there will be a reduction in the transport and recycle/recovery/disposal costs associated with the requirement for a waste contractor to take the material off-site.

Surplus clean and inert soils, gravel, stones etc. which cannot be reused on site may be used as capping material for landfill sites, or for the reinstatement of quarries etc. This material is often taken free of charge or a reduced fee for such purposes, reducing final waste disposal costs.

8.2 Recycling

Salvageable metals will earn a rebate which can be offset against the costs of collection and transportation of the skips.

Clean uncontaminated cardboard and certain hard plastics can also be recycled. Waste contractors will charge considerably less to take segregated wastes, such as recyclable waste, from a site than mixed waste.

Timber can be recycled as chipboard. Again, waste contractors will charge considerably less to take segregated wastes such as timber from a site than mixed waste.

8.3 Disposal

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Leinster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy introduced under the Waste Management (Landfill Levy) (Amendment) Regulations 2012. In addition to disposal costs, waste contractors will also charge a collection fee for skips.

Collection of segregated C&D waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a licensed or permitted facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill. Clean soil, rubble, etc. is also used as fill/capping material, wherever possible

9 OFF-SITE REMOVAL OF WASTE

9.1 Removal and Disposal of Surplus and Waste Materials

Removal and recovery/recycling/disposal of all waste materials will be carried out in accordance with the Waste Management Act 1996 and as amended, S.I. No. 820/2007 - Waste Management (Collection Permit) Regulations 2007 and as amended and S.I. No. 821/2007 - Waste Management (Facility Permit and Registration) Regulations 2007 and as amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO.

9.2 Waste Management Procedure

All waste will be documented prior to leaving the site. Waste will be weighed or logged by the contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the nominated project Waste Officer.

Prior to any removal of waste from the site, written confirmation will be obtained from the receiving waste facility, that acceptance of the waste will be in accordance with all waste management legislation and the conditions of the receiving waste facility licence or permit. A copy of the applicable licences and permits will be obtained and retained on-site.

If the waste is being transported to another site, a copy of the Local Authority waste Certificate of Registration (COR) or permit, or EPA Licence for that site will be provided to the Waste Officer.

If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) notification document will be obtained from the National Transfrontier Shipment of Waste Office (NTFSO) (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination. A receipt from the final destination facility of the material will be kept as part of the on-site waste management records. The Waste Officer will undertake regular audits of waste paperwork to ensure traceability of all loads off site to the final authorised destination facility.

To control off-site movements of waste a comprehensive docketing / waste tracking system will be implemented on-site. A daily record (including preparing and reconciling waste transfer note) of excavation at, and dispatch from the site will be maintained on-site.

All material excavated or segregated for off-site disposal will be transferred from site under chain of custody or waste dispatch dockets that will record:

- Date and time of transfer;
- Name of Carrier;
- National Waste Collection Permit Number and details
- Vehicle Registration and Name of Driver;
- List of Waste (LOW) Code;
- Waste Classification and origin of material at the site;
- Details of waste including quantity (tonnes/litres as appropriate)
- Details of proposed treatment (Reuse/Recycling/Disposal) including appropriate disposal/recovery code;
- Destination of load (receiving facility);

- Destination facility Waste Licence or Waste Permit number and details;
- Confirmation of receipt and acceptance at the final designated waste facility.

Chain of custody / waste dispatch dockets will be issued in triplicate. On dispatch the docket will be signed by the issuing operative and one copy retained on-site. The remaining two copies will accompany the load and be signed or stamped by the receiving facility.

To ensure complete site records are maintained on-site, a copy of the completed chain of custody / waste dispatch docket will have a copy of the weighbridge docket from the receiving facility attached and retained with the waste management records for the site. The completed chain of custody / waste dispatch docket will be maintained in the waste management file.

All loads will be checked prior to exiting the site. In addition to logging the trucks of waste materials, all trucks will be visually inspected to ensure the loads are within the permissible haulage limits. All trucks and skips will be covered, and any loose debris removed prior to leaving the Proposed Development Site.

All necessary documentation requirements will be fulfilled prior to transfer of material. A log of each load of waste materials being transported off-site will be compiled that will include details of the waste collection permit or skip operator licence, load of materials, name of the destination facility and serial number on the accompanying waste docket. In addition, the stamped dockets and gate receipts will be cross checked against details of the outgoing load and details entered on the log sheet. A record of all necessary documentation including waste transfer documents and landfill gate receipts will be stored in the waste management file.

Some of the sub-contractors on-site will generate waste in relatively low quantities. The transportation of non-hazardous waste by persons who are not directly involved with the waste business, at weights less than or equal to 2 tonnes, and in vehicles not designed for the carriage of waste, are exempt from the requirement to have a waste collection permit (Ref. Article 30 (1) (b) of the Waste Collection Permit Regulations 2007 as amended). Any sub-contractors engaged that do not generate more than 2 tonnes of waste at any one time can transport this waste off-site in their work vehicles (which are not designed for the carriage of waste). However, they are required to ensure that the receiving facility has the appropriate COR / permit / licence and the waste generated must be ancillary to their own activities.

9.3 Off-Site Destinations for Waste Materials

All waste materials that will be required to be transported off-site for further treatment or disposal will be undertaken in compliance with all Waste Management Legislation and all waste materials will only be transferred to appropriately permitted or licensed waste management facilities.

Details of the nominated waste facilities proposed for each specified waste type will be provided by the appointed Contractor in advance of construction works commencing on-site.

The Waste Officer will be required to maintain a detailed register of the nominated waste facilities (i.e., facility location, waste facility permit / licence number and expiry / renewal date) proposed for each specified waste type and to obtain a copy of all waste facility licences/permits which will be retained within the waste management file.

The expiry dates on all licences and permits will be reviewed routinely by the Waste Officer as part of the waste audits. The Waste Officer will ensure that only facilities with a valid permit or licence a will be retained for off-site management of waste.

9.4 Waste Collection and Transport

Only carriers/hauliers with a valid NWCPO issued Waste Collection Permit which authorises the transport of the applicable List of Waste (LoW) Code and delivery to the receiving facility will be appointed to transport the waste from the Project Opera Development Site.

Details of the nominated carriers/hauliers proposed for each specified waste type will be provided by the appointed Contractor in advance of construction works commencing on-site.

The Waste Officer will be required to maintain a detailed register of the waste haulage contractors (i.e., haulage contractor name, address, waste collection permit / skip operator licence number and expiry date) proposed for each specified waste type and to obtain a copy of all the applicable permits / licences which will be retained within the waste management file.

The expiry dates on all permits will be reviewed routinely as part of the waste audits. Only haulage contractors with a valid permit will be retained for off-site removal of waste.

10 RECORD KEEPING

Records will be kept for all waste material which leaves the site, either for reuse on another site, recycling, recovery or disposal.

All necessary documentation requirements will be fulfilled prior to transfer of material.

A copy of the receiving waste facility permits and licences with all appendices will be retained onsite.

A copy of the NWCPO waste collection permit with all appendices will also be retained on-site.

It will be the responsibility of the Waste Officer to record the following:

- Waste removed for reuse off-site;
- Waste removed for recycling;
- Waste removed for disposal; and
- Reclaimed waste materials brought to site for reuse (if required).

All waste will be documented prior to leaving the site. These waste records will be provided and maintained on site by the Waste Officer.

For each movement of waste on-site or off-site, a signed docket will be obtained by the Waste Officer or delegate from the contractor, detailing the date, vehicle registration, driver name and signature weight and type of the material and the source and destination of the material. This will be carried out for each material type. This system will also be linked with the delivery records. In this way, the percentage of construction waste generated for each material can be determined. The system will allow the comparison of these figures with the targets established for the recovery, reuse and recycling of construction waste and to highlight the successes or failures against these targets. Certificates of recycling/recovery will be obtained from the facility to which the waste has been consigned, in order to confirm receipt and trace the waste to end destination. This documentation will be cross checked with removal dockets to ensure that all waste removed from the site has been accounted for and accepted at end destinations.

Where additional sampling and assessment of soil and materials is required to ensure that the materials are managed and removed off-site in accordance with waste management legislation, the designated Environmental Consultant will produce waste classification reports detailing the findings of any additional assessment required. All existing and future waste classification report(s) will be maintained in the waste management file.

The waste register and recording templates are included in Appendix A.

10.1 Register of Documents

A live register of documents will be maintained digitally as part of this waste management plan is outlined below. It will be the responsibility of the appointed Waste Officer to ensure that the register of documents is updated as appropriate.

1. Waste Facility Acceptance Letters.
2. Approved Receiving Waste Facility Permits and Licences.
3. Approved NWCPO Permits.
4. Waste Management Log Sheet – Digital Log to be Maintained On-Site.

5. Chain of Custody / Waste Dispatch Dockets
6. Landfill Gate Receipts.
7. Waste Classification Reports
8. Invasive Species Survey Reports

11 AUDIT AND INSPECTION

The Waste Officer or delegate will be responsible for conducting waste inspections at the site during the construction phase of the development to ensure the compliance with waste management procedures as outlined above to ensure that all procedures are strictly adhered to.

Waste skips/receptacles and stockpiles (if required) will be inspected daily by the Waste Officer to ensure materials are segregated on-site for the appropriate waste stream and disposal destination.

Regular audits will be undertaken by the Waste Officer or designate which shall include checking the following in relation to waste management on-site:

- Segregation and storage practices;
- Recycling rates;
- Litter prevention practices;
- Documentation for waste removed;
- Documentation for waste received at destination facilities;
- Centrally recorded waste data;
- Waste collection permits for all waste hauliers used; and
- Waste management facility permits/licences for all waste management facilities used.
- A review of all waste facility and collection permits/licences being used for waste from the site will be carried out routinely to ensure that all permits and licences are not within 6 months of expiration. Any permits/licences within 6 months of the expiry date will be reviewed in detail.

Daily site inspections shall be carried out to check for housekeeping, litter, and correct segregation. More detailed waste audits shall be carried out on a bi-weekly basis. Where poor segregation practices are observed, littering is apparent or housekeeping falls below standard, a non-conformance shall be raised with the Site Manager for corrective action.

Regular checks shall be carried out to ensure that all waste is accounted for, and full load traceability exists. Where gaps are identified in the records available, a root cause analysis shall be carried out and a preventive measure put in place to ensure that this does not happen in future. Any missing documentation will be sought from the waste haulier and the waste destination in the event that it is not present for audit and inspection.

12 CONSULTATION WITH RELEVANT BODIES

12.1 Local Authority

The local authority (Wicklow County Council) will be consulted as required.

All waste management documentation and records maintained digitally on site will be made available to Wicklow County Council or other relevant statutory bodies authorities as requested.

13 REFERENCES

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UK Environment Agency, 2021. Version 1.1 NI (EU Exit): Guidance on the Classification and Assessment of Waste (1st Edition v1.1.NI) Technical Guidance WM3.

Waste Management Act 1996 (No. 10 of 1996) as amended 2001 (No. 36 of 2001), 2003 (No 27 of 2003) and 2011 (No. 20 of 2011).

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Waste Management (Facility Permit and Registration) Regulations 2007,(S.I No. 821 of 2007) as amended 2008 (S.I No. 86 of 2008) as amended 2014 (S.I No. 320 and No. 546 of 2014) and as amended 2015 (S.I. No. 198 of 2015).

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Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998).

Appendix A

Waste Tracking Register

LoW Code	Description	Volume Generated (tonnes)	Prevention (tonnes) (non-waste)	Reused (tonnes) (non-waste)	Recycled (tonnes) (waste)	Recovered (tonnes) (waste)	Disposed (tonnes) (waste)	Unit Cost Rate (€/tonne)	Total Cost (€)
17 01 01	Concrete								
17 01 02	Bricks								
17 01 03	Tiles and Ceramics								
17 02 01	Wood								
17 02 02	Glass								
17 02 03	Plastic								
17 03 02	Bituminous Mixtures								
17 04 01	Copper, Bronze, Brass								
17 04 02	Aluminium								
17 04 03	Lead								
17 04 04	Zinc								
17 04 05	Iron and Steel								
17 04 06	Tin								
17 04 07	Mixed Metals								
17 04 11	Cables								
17 05 04	Soil and Stone								
17 06 04	Insulation Material								
17 08 02	Gypsum								
17 09 04	Mixed C&D Waste								
17 01 06*	Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substance								

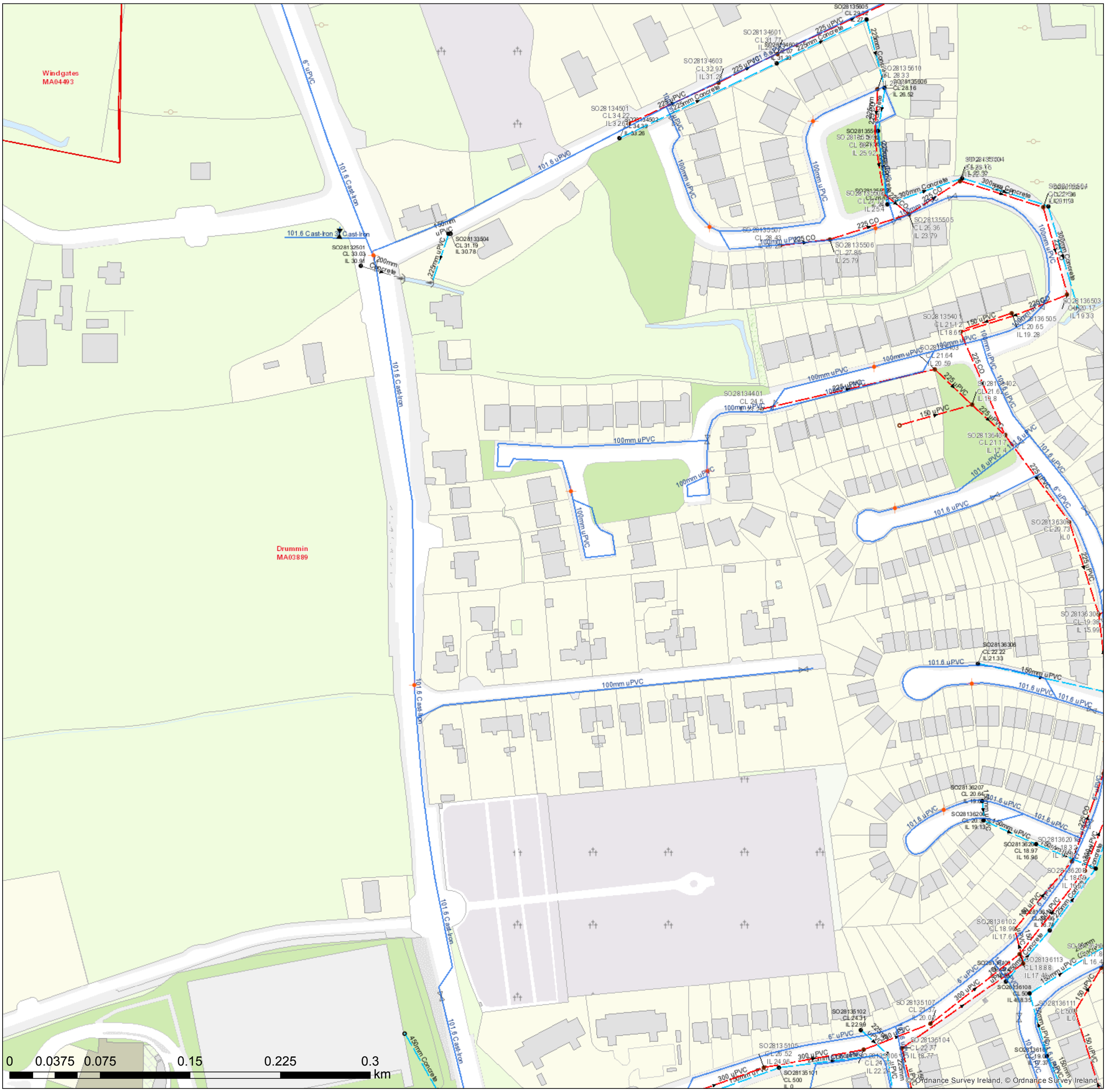
17 02 04*	Glass, plastic and wood containing or contaminated with hazardous substances								
17 03 01*	Bituminous mixtures containing coal tar								
17 04 09*	Metal waste contaminated with hazardous substances								
17 05 03*	Soil and stones containing hazardous substances								
17 06 05*	Construction materials containing asbestos								
	Other resources (nonwaste materials) (specify as needed)								
	Other wastes (specify as needed)								

Waste Consignment Register

No.	Date	Haulage Contractor	National Waste Collection Permit No.	Vehicle Registration	LoW Code	Waste Collection Docket No.	Destination Facility	Facility Permit/Licence No.	Destination Facility Docket No.	Quantity (Tonne)

APPENDIX 14 A EXISTING RECORD DRAWINGS – FOUL AND WATERMAIN NETWORKS

Irish Water Web Map



Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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Print Date: 06/08/2020

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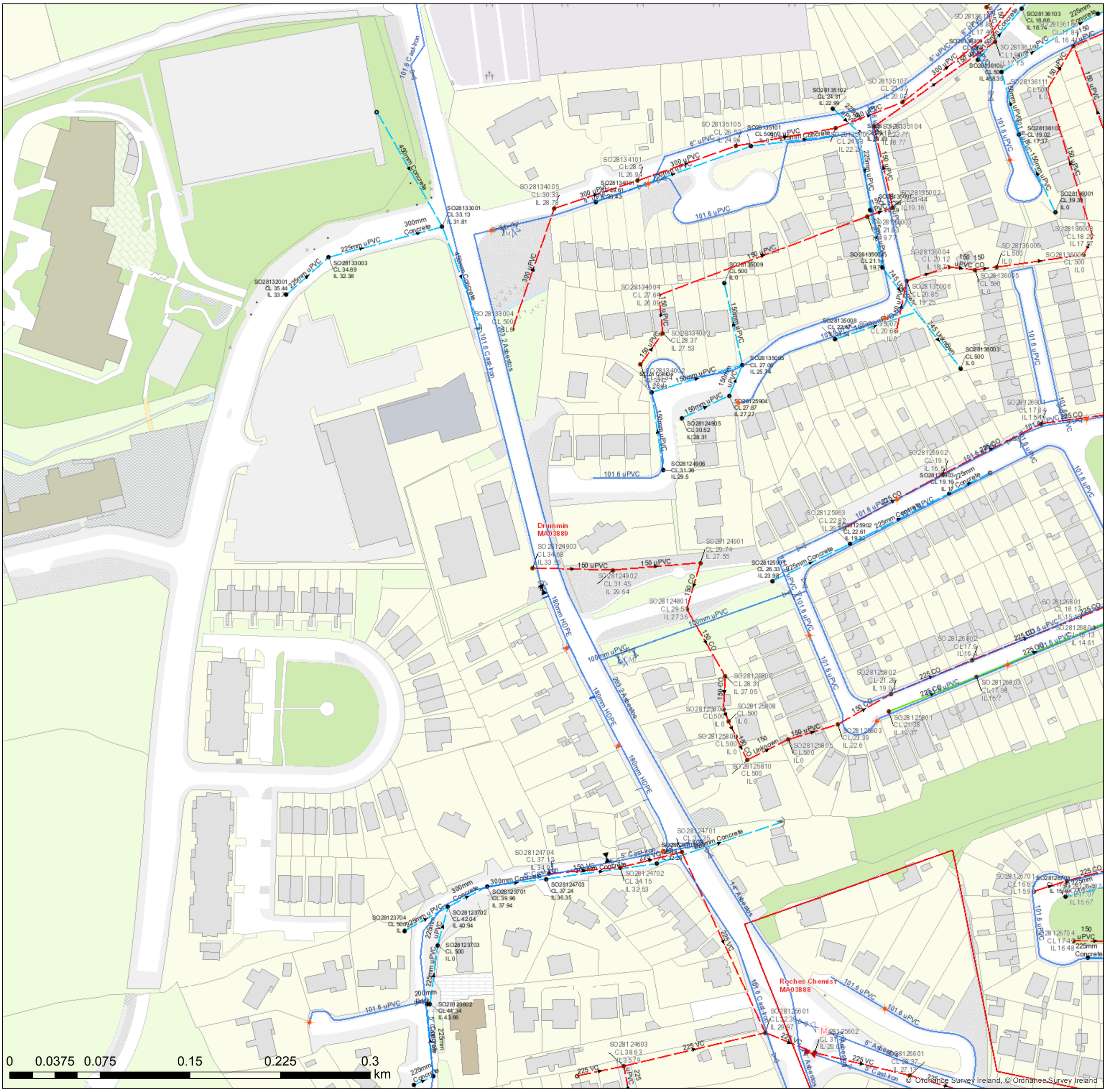
Irish Water Web Map



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- Standard
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- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

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- Gully
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- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

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- Stormwater Chambers

Discharge Type
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- Soakaway
- Other; Unknown

Gas Networks Ireland
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- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

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- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
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Non Service Categories
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Print Date: 06/08/2020

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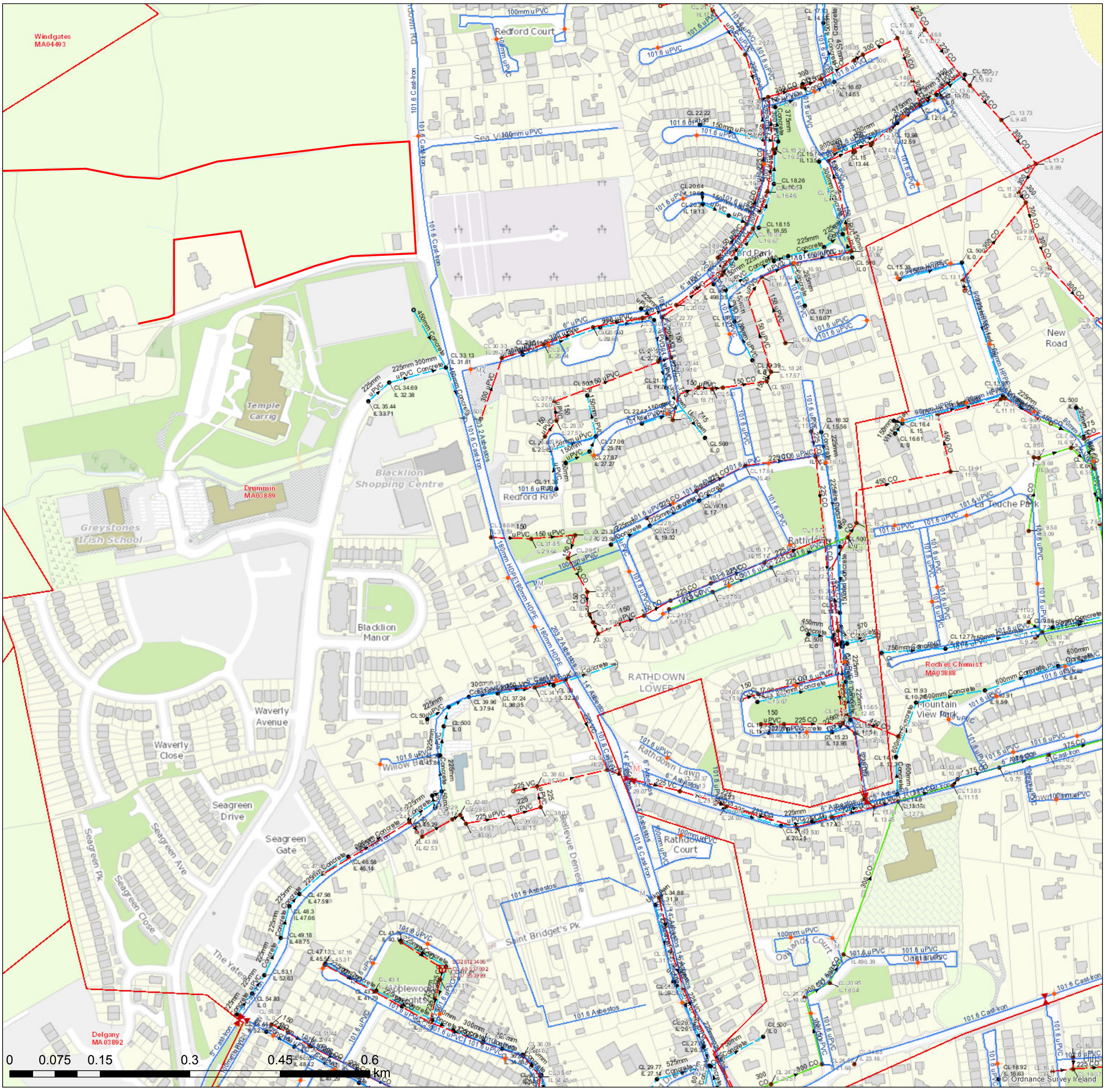
Irish Water Web Map



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- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

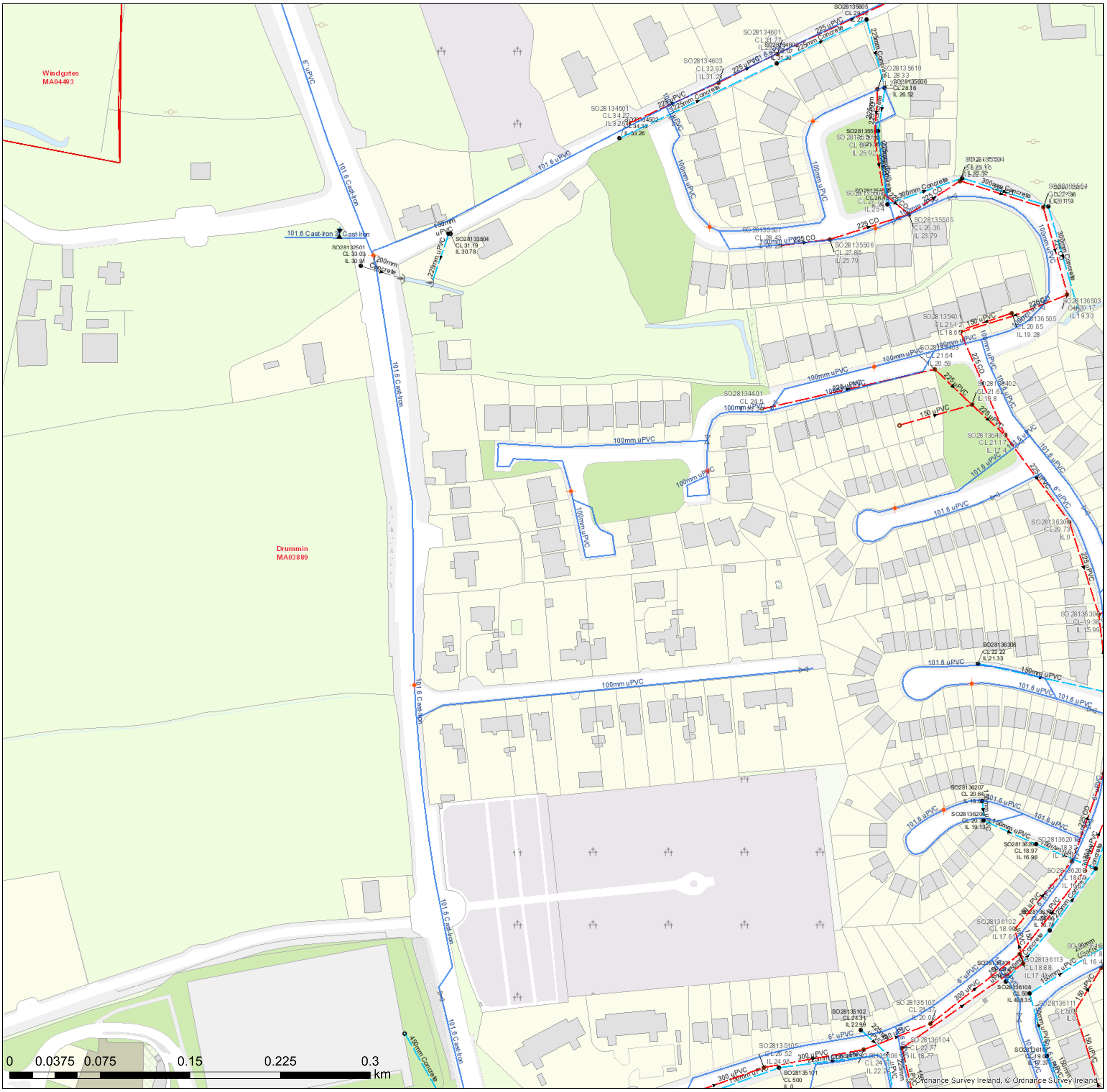
UISCE ÉIREANN : IRISH WATER

Print Date: 06/08/2020

Printed by:Irish Water

APPENDIX 14 B EXISTING RECORD DRAWINGS – SURFACE WATER NETWORK

Irish Water Web Map



Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
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- LV Overhead Three Phase
- LV Overhead Single Phase
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- Abandoned

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Water Non Service Assets
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- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
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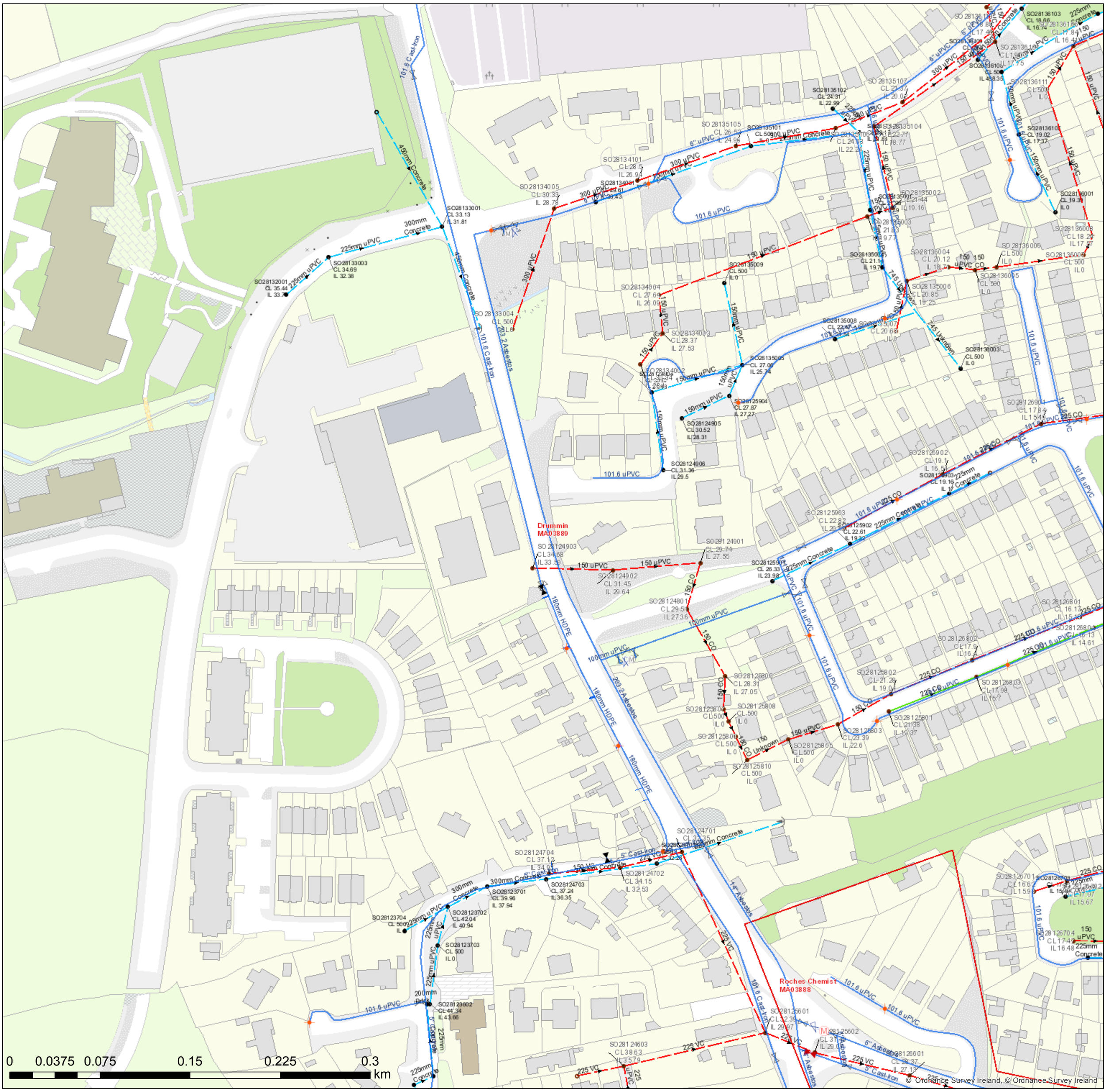
UISCE ÉIREANN : IRISH WATER

Print Date: 06/08/2020

Printed by:Irish Water

Irish Water Web Map



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- Gravity - Unknown
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- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
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- Lamphole
- Hydrobrake
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Discharge Type
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- Overflow
- Soakaway
- Standard Outlet
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Cleanout Type
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- Flushing Structure
- Other; Unknown

Sewer Inlets
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- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

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- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

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- Lamphole
- Hydrobrake
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- LV Overhead Single Phase
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- Abandoned

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- Under Construction
- Out of Service
- Decommissioned

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- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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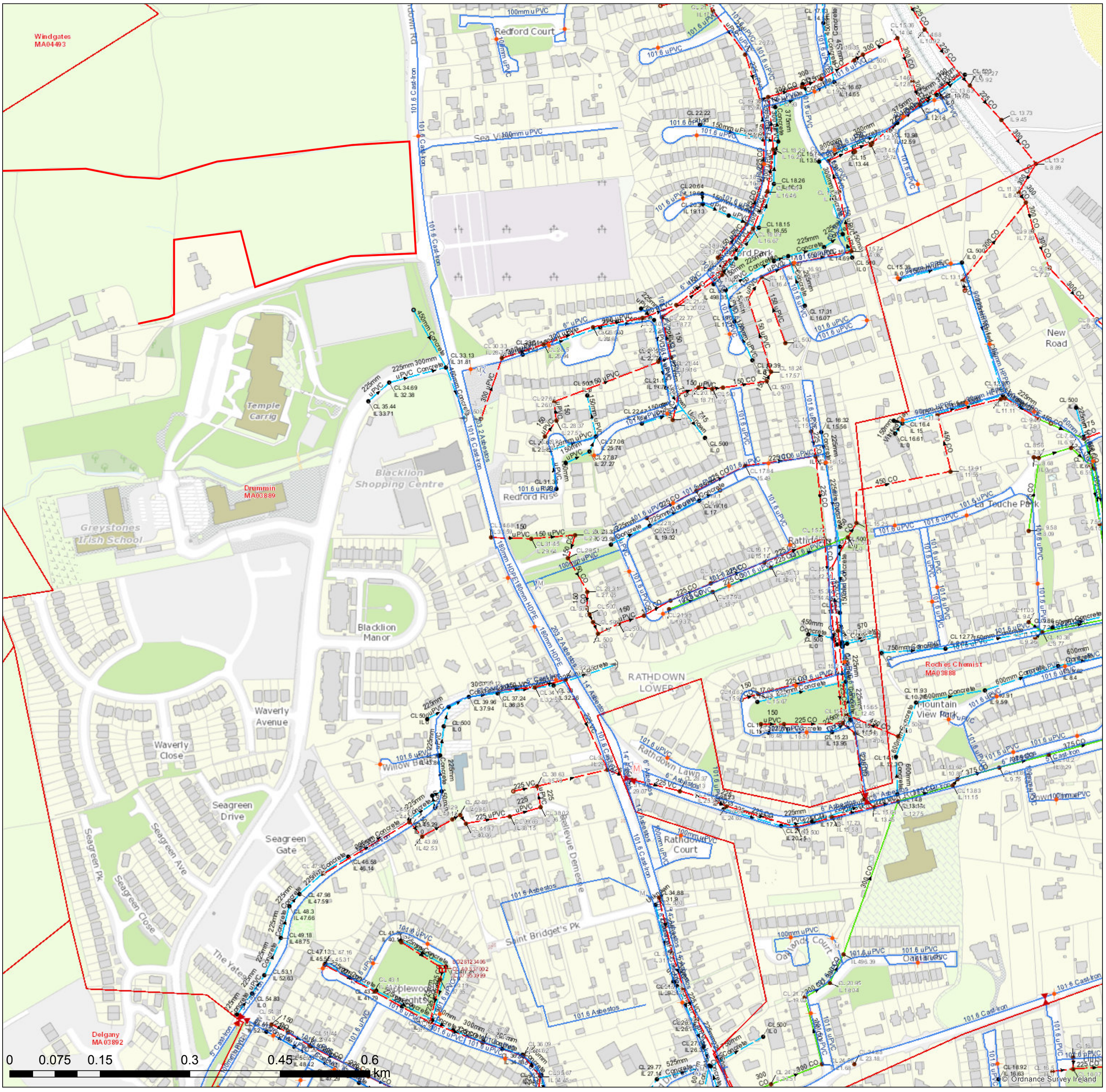
Print Date: 06/08/2020

Printed by:Irish Water

Irish Water Web Map



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- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
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- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
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- Standard
- Other; Unknown

Storm Manholes
- Standard
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- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

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- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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Print Date: 06/08/2020

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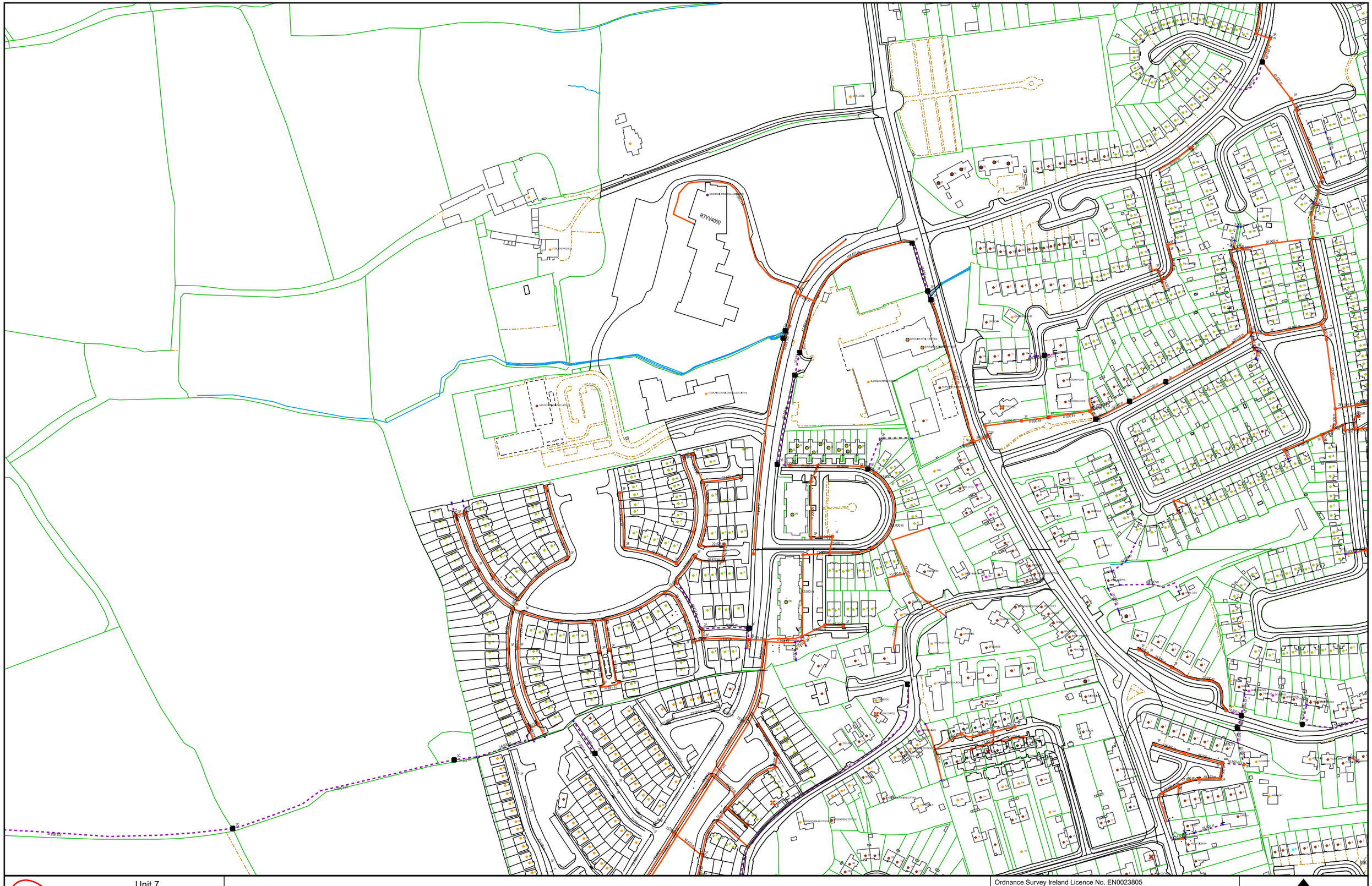
APPENDIX 14 C EXISTING RECORD DRAWINGS – TELECOMMUNICATIONS NETWORK



Unit 7,
Westgate Business Park,
Ballymount,
Dublin 24.

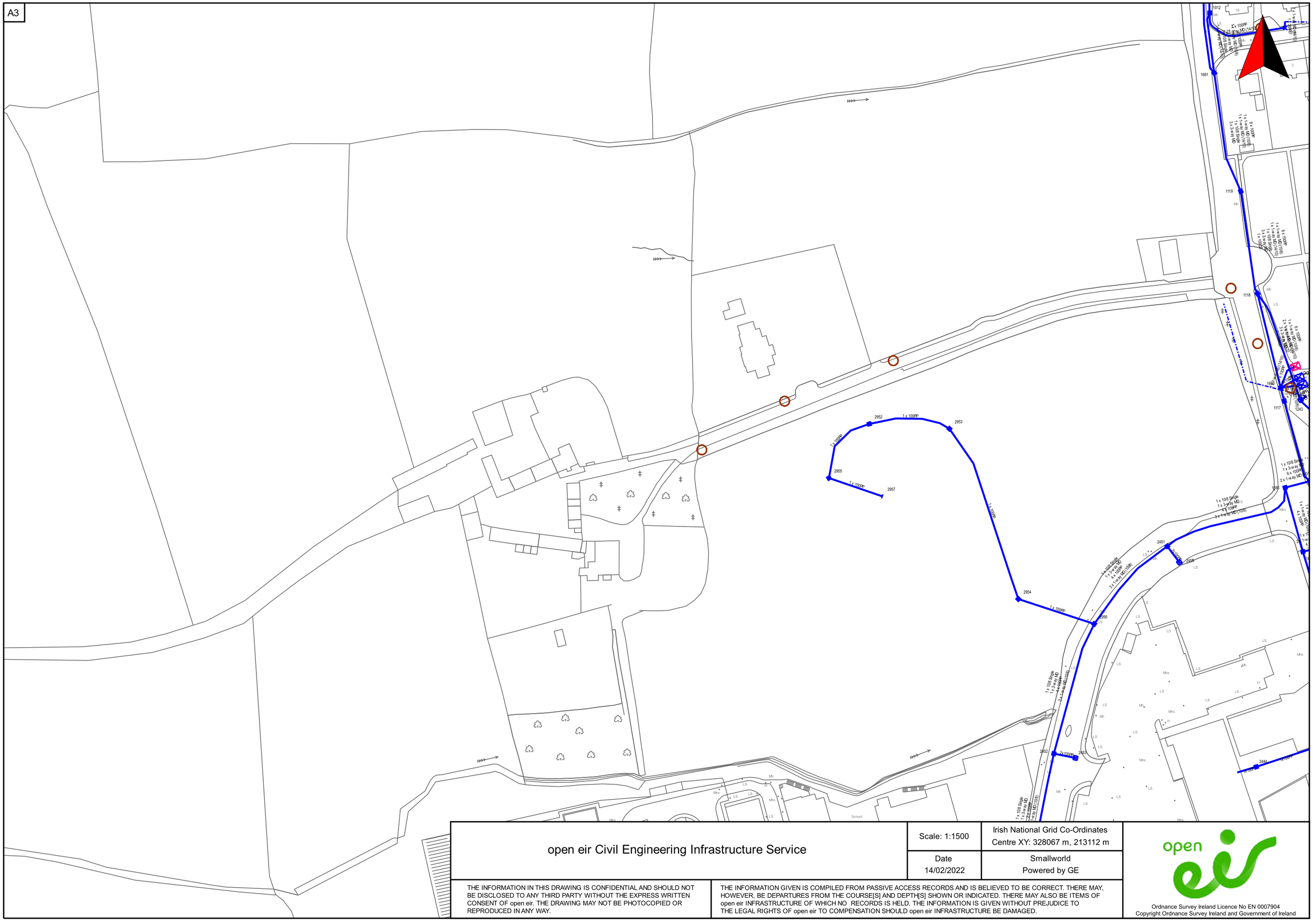
PROJECT NAME

DESIGNED BY:

Produced on: 11/02/2022

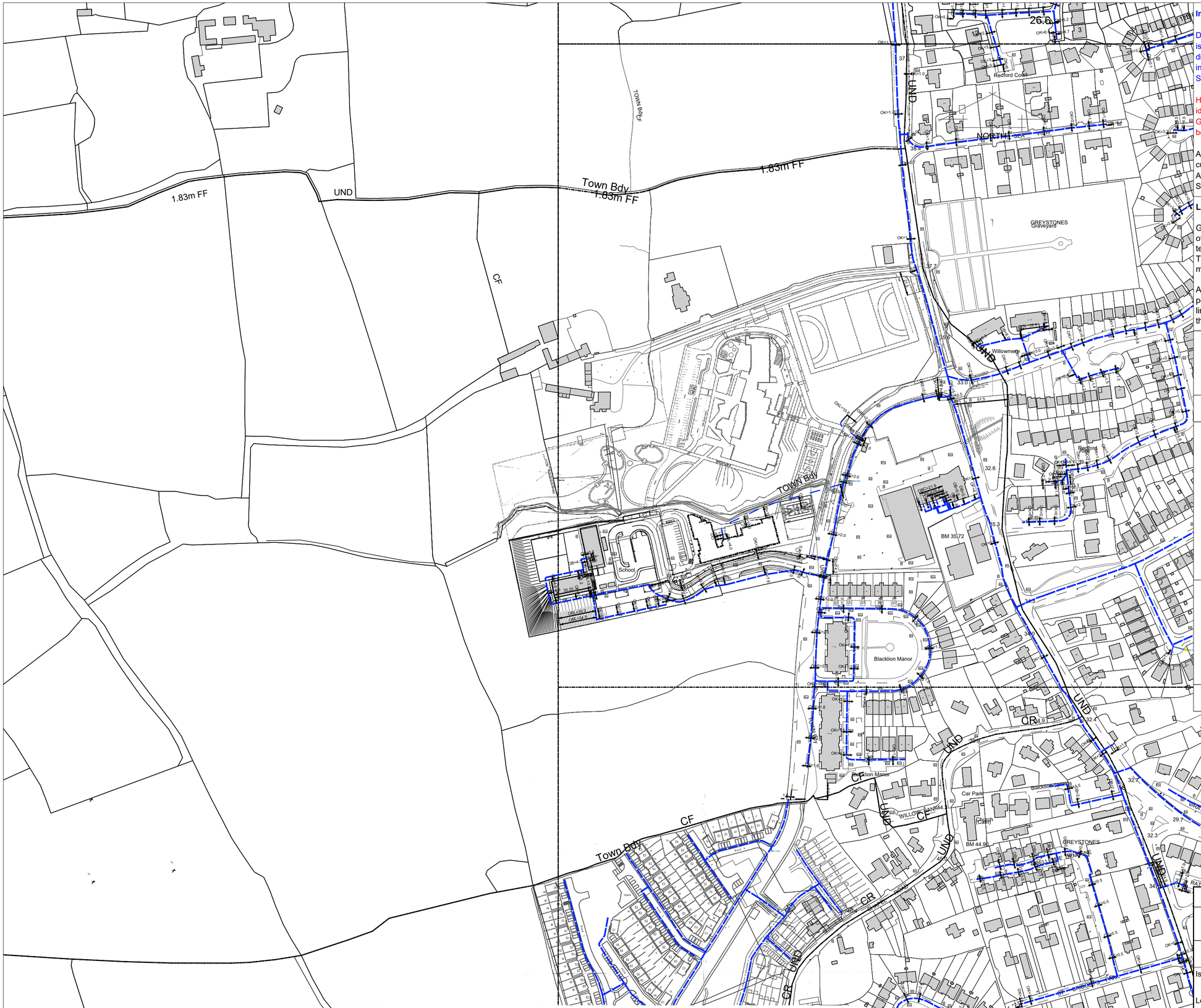
@ A3

A3



open eir Civil Engineering Infrastructure Service	Scale: 1:1500	Irish National Grid Co-Ordinates Centre XY: 328067 m, 213112 m
	Date 14/02/2022	Smallworld Powered by GE

APPENDIX 14 D EXISTING RECORD DRAWINGS – GAS NETWORK



Important Safety Notice:

Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe.
Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1800 427 747.

All work in the vicinity of the gas 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 (01 614 7000) or can be downloaded at www.hsa.ie.

Legal Notice:

Gas Networks Ireland (GNI) and its affiliates, accept no responsibility for the accuracy of any information contained in this document including data concerning location and technical designation of the gas distribution and transmission network (the Information). The Information should not be relied on for accurate distance or depth of cover measurements.

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 or consequential loss, arising out of or in connection with the use or re-use of the Information.

- Aurora Telecom Fibre Optic Cable
- Aurora Telecom Duct
- Aurora Telecom Sub-duct
- Aurora Telecom Inserted Gas Pipe

Contact Aurora Telecom on 1800-427-399 or (01)203-0120.

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted Pipe (Medium Pressure)
- Inserted Pipe (Low Pressure)
- Distribution Pipe (Abandoned)

.C=?	Cover (depth in meters)		Pressure Monitor
	CP Test Point		Protection (Sleeve)
	End Cap		Protection (Slabbing)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification **		Transition

** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue:	Waterman Moylan
Location:	Greystones Co Wicklow
Plot Date: 14/02/2022	Contact: O Gregan
Plotted by: KOC	Scale: 1:2500

APPENDIX 14 E EXISTING RECORD DRAWINGS – ESB NETWORK

ESB Networks

TITLE:

20220211-019_A0

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 11-Feb-2022

** SCALE: 1:2000

** SCALE WHEN PRINTED ON AN A0 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING:
(A) UP-TO-DATE MAP RECORDS (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES
(C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A0 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

X,Y: 326668 , 213606

X,Y: 328989 , 213606

X,Y: 328989 , 212067

TEMPLE CARRIG UPPER
205 15

TEMPLECARRIG DOYLE

TEMPLECARRIG WEST
782 5

TEMPLECARRIG MID WST
783 5

TEMPLECARRIG SUTTON

TEMPLECARRIG S
494 15

RAHEEN
550 15

REDFORD BRIDGE
21 100 DV

ST CRISPINS
285 WT 20 DV

COOLAGAD COOKE

COOLAGAD
403 15

BALLYDONAGH E
534 15 DV

EIRCELL
177 100 DV

KINDLESTOWN WOOD
402 15 DV

KELLYS

LBFM

3X1X630 KIOSK

3X1/70 XLP

4X185 XLP

150 AAAC

300 ACSR

PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES (PLEASE SEE ENCLOSED SHEET) IN ADVANCE OF THE WORKS

APPENDIX 15 HIGH LEVEL FIRE SAFETY REVIEW

COOLAGAD, GREYSTONES, CO. WICKLOW
HIGH LEVEL FIRE SAFETY REVIEW

FI/4866/rp/04ch
25th March 2022

INTRODUCTION

The project is the construction of a new residential development at Coolagad, Greystones, Co. Wicklow.

The development will consist of:

- 586 residential units including: -
  - 351 two storey houses
  - 203 no. apartments provided within 6 no. blocks (over basement) with residential amenity facilities.
  - 32 no. duplex units within 2 no. three -storey blocks
- Single storey community building
- Creche building
- Bin/ bike stores

It is noted that the two storey houses do not require a Fire Safety Certificate (FSC) application to be submitted, however the remaining buildings (as identified above) will require FSC applications to be submitted to the local authority.

The following is a high-level review of the proposed fire strategy for the development outlining relevant Building Regulations Part B guidance for the buildings requiring FSC applications and any potential fire engineering solutions for aspects of the design which do not comply with standard code guidance.

As part of our review, advice is given in relation to means of escape, external fire spread and firefighting access requirements.

We have reviewed the latest information received (provided for the above development) and have the following comments regarding the fire strategy proposals for the development. This technical note is not intended for submission to the approving fire brigade authorities. It is only for the purpose of establishing fire strategy in relation to the planning application.

BUILDING REGULATIONS GUIDANCE

The primary guidance documents relevant to this project is Technical Guidance Document – B (TGD – B: 2020) and BS 5588 Part 1 (residential units).

Building Regulations are functional however, and there is no requirement to follow TGD – B guidance. Alternative fire engineering solutions are possible, provided they are designed and demonstrated to achieve an equivalent standard of safety as that in the code. It should be noted that any Fire Safety Certificate applications or fire engineering solutions within these documents may carry approvals risks and therefore would by subject to Wicklow Fire Brigade (WFB) approval.

Richard Parker
richard.parker@jensenhughes.com
O: +353 1 661 4925

MEANS OF ESCAPE

The means of escape for the respective buildings requiring a Fire Safety Certificate application to be submitted to the local authority, will be in accordance with the recommendations of Technical Guidance Document – B (TGD-B 2020) and BS 5588 Part 1 (where applicable).

EXTERNAL FIRE SPREAD (ELEVATIONS)

External surfaces of walls of all blocks that have a height to roof level greater than 18m and located more than 1m away from the relevant boundary should achieve Class B – s3, d2 (European) or Class 0 (National).

In addition, any insulation material used in drained/ventilated cavities and/or external leaf cladding systems in external wall construction in any block more than 18m high, should be non-combustible in accordance with the recommendations of TGD-B. However, it is noted that it is current local Fire Brigade policy to look for non-combustible materials in the external wall build-up of residential units (inner and outer leafs), in line with BS 9991 guidance.

Where a building is less than 18m in height, current code guidance (TGD B 2020, etc.) does not restrict the use of non-combustible insulation within the external wall cavity.

The amount of glazing permitted on a building elevation is controlled by Building Regulations, to prevent radiant fire spread to adjacent properties. The calculation to determine the amount of permitted glazing is based on the following: -

1. The distance to the relevant boundary; and
2. The width of the elevation; and
3. The height of the compartment
4. The provision of life safety sprinklers

The closer the elevation is to a boundary, or the larger the compartment size of that elevation, then the less glazing or unprotected area of the elevation is permitted.

For the purpose of this review the elevations have not been fully assessed, as this in only a requirement at construction phase. However, it is envisaged that this will not be an issue due to the distances to the relevant boundaries and the high level of compartmentation of some of the buildings within the development.

FIREFIGHTING ACCESS

Fire hydrants should comply with the requirements of BS 750: 2012 & EN 14339:2005 Specification for underground fire hydrants and surface box frames and covers. All hydrants will be conspicuously marked in accordance with BS 3251: 1976 Specification of indicator plates for fire hydrants and emergency water supplies.

Hydrants should be provided on the basis of one per 1,000m^2 of the ground floor area of each building. The hydrants should be located such that: -

- The distance from the building is not less than 6m or more than 46m.
- The distance from a hydrant to a vehicle access roadway or hard standing for fire appliances is not more than 30m.
- They are on the same site as the building or are provided by the local authority on the road adjacent to the site.

Perimeter access should be provided to each of the buildings requiring FSC applications (except for the apartment blocks) in accordance with the requirements of Table 5.1 of TBD-B.

Table 5.1	**Vehicle access to buildings**		
Volume of building (m^3)	**Height of top storey above ground (m)**	**Provide vehicle access**	**Type of appliance**
up to 7,000	under 10	at rate of 2.4 m in length for every 90 m^2 of ground floor area	pump
	over 10	to 15% of perimeter	high reach
7,000-28,000	up to 10	to 15% of perimeter	pump
	over 10	to 50% of perimeter	high reach
28,500-56,000	up to 10	to 50% of perimeter	pump
	over 10	to 50% of perimeter	high reach
56,000-85,000	up to 10	to 75% of perimeter	pump
	over 10	to 75% of perimeter	high reach
over 85,000	up to 10	to 100% of perimeter	pump
	over 10	to 100% of perimeter	high reach

To ensure sufficient hose coverage to the apartment blocks (i.e. all areas within each apartment are reachable within 45m of the fire mains outlet point at each floor level), dry riser inlet should be provided adjacent to each stair core entrance of the apartment blocks, which should be accessed from the podium level. The design and construction of the dry risers within the apartment blocks will be in compliance with BS 9990: 2015. However, it is noted that the dry riser strategy identified above for the apartment blocks (as opposed to perimeter access) will be subject to WFB approval.

Where access roadways are provided within the site of the apartment blocks (i.e., the podium level), turning facilities for appliances, in accordance with the requirements of Table 5.2 should be provided in any dead-end access route that is more than 20m long.

Table 5.2	**Vehicle access route specifications**					
Appliance type	Minimum width of road between kerbs (m)	Minimum width of gateways between kerbs (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5
High Reach	3.7	3.1	26	29	4	16.25

A 1m^2 AOV or openable window (in non-residential units) should be provided at the top of each escape stair. Where AOV's are provided, they should also be remotely openable by a fire fighter with the provision of a switch at the bottom.

Photovoltaic Panels at Roof Level

If applicable, the provision of a Photovoltaic System (PVS) should be designed and installed to current best practice and include measures to minimize the risk of electrocution to firefighters in the event of an incident. The Fire Department will require that the installation will be designed incorporating the technical guidance contained in: -

- RC62: Recommendations for fire safety with photovoltaic panel installations, as published by the Fire Protection Association/RISC Authority; and
- NFPA 1 (Fire Code) Section 11.12 for PV Systems; and
- MCS/ECA's Guide to installation of PV Systems.
- I.S. 10101: 2020

Furthermore, the Fire Department will also typically require the following: -

- The roof covering or decking under the arrays shall be of non-combustible materials.
- The building shall have adequate and appropriate warning signages for firefighters to inform them of the presence of a PV System in the building, per Section 712.514 of I.S. 10101: 2020.
- Only solar cables suitable for outdoor applications and severe weather conditions and UV radiation are to be used.

Green Roof

If applicable, a green roof on the development should be designed and installed to current best practices in accordance with the technical guidance contained in: -

- BS 8616: 2019 – Specification for performance parameters and test methods green roof substrates.
- Fire Performance of Green Roofs and Walls - DCLG UK: 2013.
- Green Roof Code of Best Practice UK: 2014.

In accordance to Section 4.5.1 of Fire Performance of Green Roofs and Walls - DCLG UK: 2013, fire breaks should be provided around all openings and vertical elements on all types of green roofs. The fire breaks should consist of paving slabs or non-vegetated strips of pebbles with a depth of 75mm and diameter between 20 and 50mm for a width of 500mm.

Whilst fire spread to a green roof via penetrations such as roof lights, pipes or vents in the roof is not in itself a breach of requirements B1 to B5, these fire breaks should be provided around such penetrations so that basic maintenance procedures can be carried out.

In addition, fire breaks should be provided in 1m strips every 40m across extensive green roofs. It should be noted that an extensive green roof is classified as a lightweight, low maintenance roof system typically with low growing ground cover, e.g. mosses, herbaceous plants, succulents and other hardy plant species planted in a shallow substrate. The depth of the growing medium is typically between 80 and 150mm on a well-designed system. The organic content of the growing layer is usually less than 20%. Generally, this type of roof does not normally require irrigation and is low in nutrients.

In accordance to Section 4.5.2 of Fire Performance of Green Roofs and Walls - DCLG UK: 2013, in order for green roofs to comply with requirement B4, the depth of the growing layer should be a minimum of 80mm, and the organic content should not exceed 50%. In accordance with Table 8 of BS 9991:2015, roof coverings with the designation AA, AB or AC are permitted on buildings where the minimum distance from any point on the relevant boundary is less than 6m.

The structural roof deck should comply with requirement for B3, i.e. the roof covering has the designation AA, AB or AC (National class) or BROOF(t4) (European class).

In addition to the above, to help maintain the vegetation barrier a retention angle should be included between the growing layer and the pebble margin/paving in accordance with Section 3.5 of Green Roof Code of Best Practice UK: 2014. This area should also be subjected to routine maintenance to remove any invasive plant species.

It should be noted that rest of recommendations from the Green Roof Code of Best Practice UK: 2014 have been already outlined as part of the Fire Performance of Green Roofs and Walls requirements.