

# Environmental Impact Assessment Report (Addendum)

## Development of Two Data Halls and Ancillary Structures

on lands adjacent to Huntstown Power Station,  
Huntstown, North Road (R135), Finglas, Dublin 11

## Volume 3 – EIA Appendix

Prepared by: AWN Consulting, February 2022

Prepared for: Huntstown Power Company Limited

11 FEB 2022

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**FINGAL COUNTY COUNCIL REGISTER REF. FW21A/0151  
ADDITIONAL INFORMATION REQUEST RESPONSE AI 7(B)**

Prepared by

Henry J Lyon Architecture + Interiors

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Suzanne McClure  
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Re: Fingal County Council Register Ref. FW21A/O151  
Additional Information Request Response AI 7b

30 November 2021

To Whom It May Concern,

Henry J Lyons are retained to provide architectural services in relation to the above-referenced development.

This declaration is prepared in response to item 7b of the Additional Information Request (Decision Order No. PF/2194/21) dated 15 October 2021 on behalf of applicant Huntstown Power Company Limited.

Additional Information Request item 7b states the following:

- 7 (b) The landscape and visual impact assessment in the EIAR acknowledges the long term moderate negative visual impact associated with the proposed development. In light of permanent impacts of this nature, it is considered that greater consideration and information is required in respect of alternative designs for the proposed development including the specific need for a data centre of this size and scale. It is noted that reference is made to the requirements of the end user in the discussion of alternative designs and layouts. However, the end user does not appear to have been confirmed in the application documentation. The consideration of landscape impacts also states that "The subject lands are specifically zoned for this type of development". Given that data centres are not a use which is permitted in principle on H1 lands, a more considered assessment of land use zoning is required.

#### Development brief and preliminary design proposals:

The original brief aimed to optimise the development potential of the site for the deployment of a large scale data centre facility, taking advantage of the adjacency to the Huntstown Power Station.

Initial designs delivered a target gross floor area of ca. 100,000sqm for the data hall buildings, allowing for ancillary plant installations and the construction of a substation to the west of the site.

An essential element of the site response was to concentrate buildings and plant within the core of the site, providing a landscaped belt around the perimeter to mitigate visual and acoustic impact.

The most efficient arrangement comprised 3 no. data hall buildings arranged over 3 storeys. This scheme was presented at a pre-planning consultation with the Local Authority on 22 September 2020. At this meeting, concerns were raised in relation to scale, massing and distance to sensitive boundaries.

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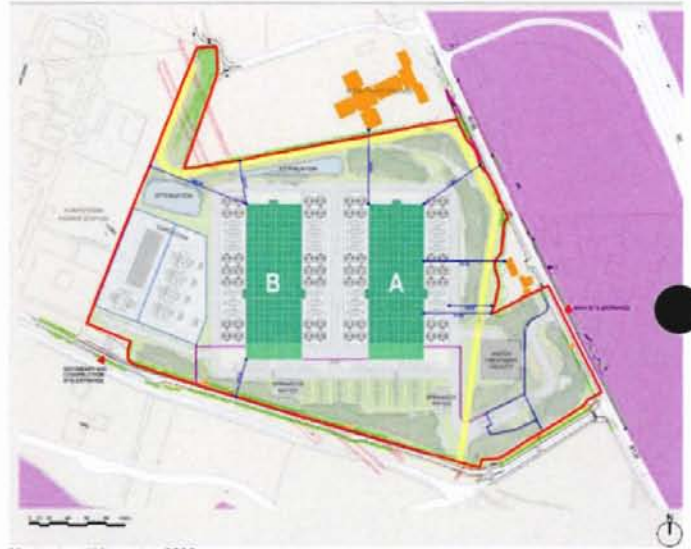
# Henry J Lyons

An alternative design was developed which reduced the site coverage, scale and massing to 2 no. data hall buildings with a total gross floor area of ca. 78,000sqm, with generous setback distances and thoughtfully landscaped areas to the north, east and south, including berms of up to 7m in height, significantly improving mitigation upon the previous design. This was presented to the Local Authority at a second pre-planning consultation on 11 November 2020.

A comparative study is shown below.



Masterplan - 22 September 2020



Masterplan - 11 November 2020



Aerial view from the south - 22 September 2020



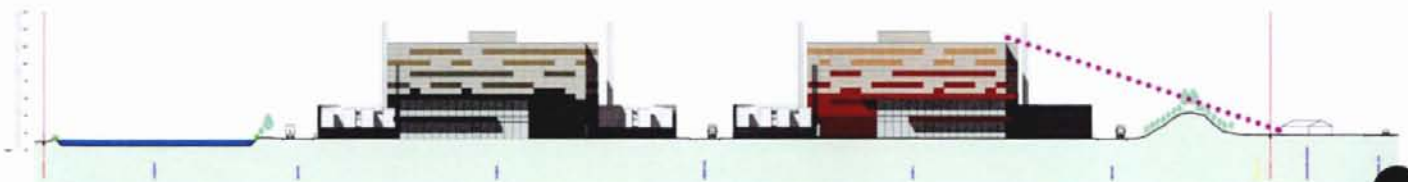
Aerial view from the south - 11 November 2020



Ground level view from the south-east - 22 September 2020



Ground level view from the south-east - 11 November 2020



Site section west-east - 11 November 2020

## Design development and Planning Application scheme:

Further design development was carried out to reduce the massing of the data hall buildings. The enhanced elevational treatment ensures that buildings are delivered to a high standard of design and finishes.

A parallel exercise took place to minimise water consumption through the use of a direct evaporative cooling solution, resulting in minor adjustments to the buildings' footprint and floor areas. The total gross floor area of the data hall buildings and ancillary structures was further reduced to ca. 75,775sqm.

Two vacant single-storey residences along the R135 North Road form part of the development site with existing structures being proposed for demolition, increasing the extent of the landscaping zone along the east boundary.



## Land use zoning:

Data centre use is considered sui generis (or 'of its own kind') in that it does not readily fit into the defined land use categories specified in the County Development Plan. Moreover, the Development Plan does not specify a definition of 'heavy industry' in its glossary of terms. Data Centre uses are neither 'Permitted in Principle' nor 'Not Permitted' and will be assessed in terms of their contribution towards (i) the achievement of the Zoning Objective and Vision Statement and (ii) their compliance and consistency with the policies and objectives of the Development Plan. The Planning Report and Chapter 3 of the EIAR and EIAR Addendum sets out the suitability of the proposed development within HI Zoning.

In addition, the subject site is located within what could be considered a "transitional zone" between the two land use zonings. The zoning to the immediate east of the site is zoned for General Employment "GE" with residential properties also located within this zoning. The proposed site layout is cognisant of the transitional nature of the site from heavy industry (quarry, power plant) to residential and general employment. The general site arrangement and mitigation measures have been carefully assessed and the proposed development is considered to represent an effective transition between land use zones.

A more detailed assessment of land use zoning is provided elsewhere in this submission.

Sincerely,

*Fernando Girbal*

Fernando Girbal  
Henry J Lyons



**APPENDIX 4.1**

**RESPONSE TO ITEM 7(B) OF THE ADDITIONAL INFORMATION REQUEST DATED  
15TH OCTOBER 2021 ON BEHALF OF THE APPLICANT HUNTSTOWN POWER  
COMPANY LTD.**

Prepared by

Kevin Fitzpatrick Landscape Architecture Ltd

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**Suzanne McClure**  
**Brock McClure Planning & Development Consultants**

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8<sup>th</sup> February 2022

**Re: Response to item 7(b) of the Additional Information Request dated 15<sup>th</sup> October 2021 on behalf of the applicant Huntstown Power Company Ltd.**

**P.A Reg. Ref: FW21A/0151**

Dear Sir/Madam

KFLA have been appointed by the client to provide landscape architectural consultancy and services in relation to the above referenced development. This letter provides a comparative study and analysis of various iterations of the site layout throughout the design process in relation to the landscape proposals and visual impact of the development.

Item 7(b) of the Additional Information Request reads as follows:

*the landscape and visual impact assessment in the acknowledgement long term moderate negative visual impact associated with the proposed development in light of permanent impacts of this nature it is considered that further consideration and information is required in respect of alternative designs for the proposed development including the specific need for a data centre of this size and scale it is noted that reference is made to the requirements of the end user in the discussion of alternative designs and layouts however the end user does not appear to have been confirmed in the application documentation the consideration of landscape impacts also states that the specific lands are specifically zoned for this type of development in that data centres are not a use which is permitted in principle on these lands a more considered assessment of landscape opinion is required*



## 1. Background

Chapter 4 (Alternatives) of the Environmental Impact Assessment Report (EIAR) submitted with the proposed development (FW21A/0151), considered 3 main design iterations developed by Henry J Lyon Architects to determine the most efficient design and layout having regard to the surrounding site context and requirements of the end user.

We refer to the Design Statement prepared by Henry J Lyon Architects submitted with the planning documentation for more information, and the Accompanying statement " *e in al o nt o ncil e ister ef dditional nformation e est es onse* )".

As stated in Chapter 4 (Alternatives) of the EIAR; the design evolved as part of a multi-disciplinary process with input from the EIAR Team, Design Team, Applicant and advice received as part of the pre-planning process with representatives of Fingal County Council.

The final design for the site layout and arrangement of buildings which was submitted as part of the application FW21A/0151 was informed by the following Accommodating the diversion of the existing 110 kV overhead power lines traversing the site (FW21A/0144), along with the location of a 220 kV substation (ABP Ref: 311528) that will provide the Data Centre with a permanent electricity supply.

Several iterations of the site layout were produced throughout the design process which explored options related to building orientation and arrangement, attenuation, internal plant and roadways and parking arrangement, all of which are summarized in this document, as well as the Design Statement by Henry J Lyon Architects, and the accompanying " *e in al o nt o ncil e ister ef dditional nformation e est es onse* )".

The site arrangements considered the environmental sensitivities associated with surrounding land use i.e. the proximity to the residential areas, the Dogs Trust, and the road frontage of the North Road (R135).

Site layout considerations were primarily made based on the following factors:

- Minimising potential impacts on the environmental and visual impact sensitivities associated with the surrounding land uses;
- Location of the proposed substation and its proximity to the future grid connection; and,
- Orientation of the main buildings to optimise the use of the space available and minimise visual and noise impact.

This FI Response letter sets out greater consideration and information in respect of the visual impact of the **alternative designs and layouts** that have were considered by the design team through the design development process prior to planning submission. This is order to demonstrate to the FCC that a robust consideration of visual impacts as set out in this document and design matters as set out within " *e in al o nt o ncil e ister ef dditional nformation e est es onse* )" informed the process by which the final submitted design was achieved.

This FI letter sets out the 3 main design iterations developed by Henry J Lyon Architects considered throughout the design process and the likelihood of potential visual impacts associated with them.

The extent of potential visual impact of the alternative layout designs of the development on the surrounding environment is considered with respect to a 4 no. photomontage views included within photomontage booklet, and considered within Section 6 of this report.

## 2. Option 1 – 22<sup>nd</sup> September 2020

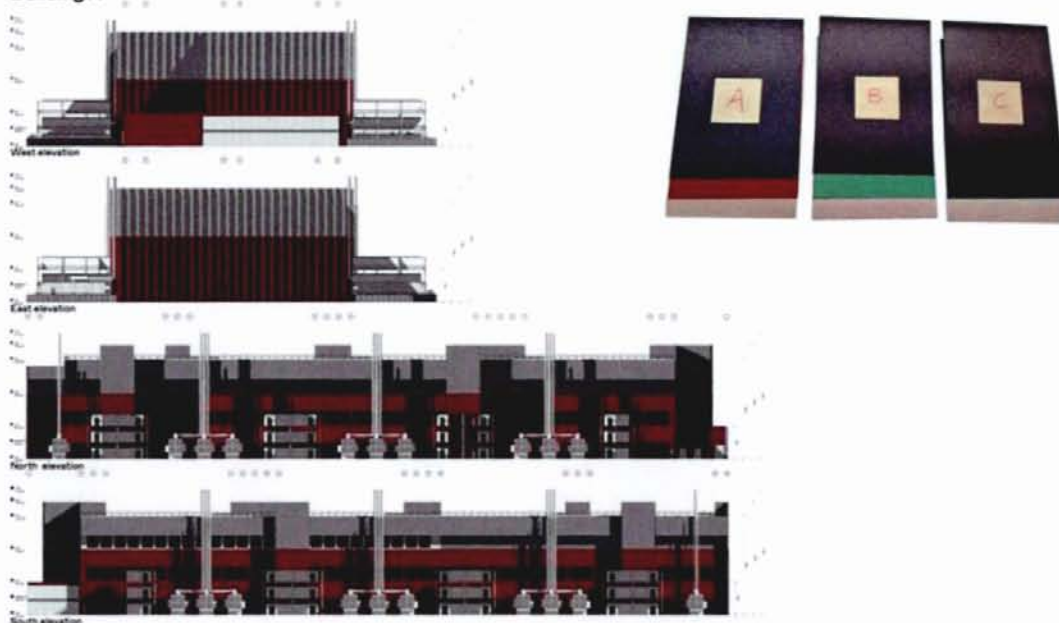
### **Landscape Proposals**

The first iteration of the site layout developed and presented to the Local Authority on the 22<sup>nd</sup> September 2020, was focused on 3 no. data halls at 3 storeys high. This site layout (Figure 1) provided a lack of space for landscape proposals, subsequently the heights achievable on earth berms were limited. The proximity of the road carriageway and parking bays to the northern and eastern site boundaries (circa. 8 m at the tightest point) dictated that the proposed combined earth berms and tree planting were reaching on average 6-7 m in this part of the site. Screening was higher in the south-eastern corner, but given that the most sensitive views were from the North and East, the site layout was inappropriate and a revised approach was required focusing screening on the most sensitive parts of the development.



*i re lternati e a o tfort e ro osed e elo ment tion*

Building A



Henry J Lyons

Data Centre Facility - Huntstown, North Road, Dublin 11, Ireland

*i re lternati e le ation for t e ro osed e elo ment tion*

### **Visual Impact Option 1**

Any negative visual impacts associated with the proposed development relate to the introduction of new buildings and built structures into the landscape along with their ancillary infrastructure and works. The positive visual impacts come from the proposed landscape scheme with the planting of a significant amount of native woodland, hedgerow and wildflower meadow and the implementation of raised earth berms.

The overall visual impact of the Option 1 was negative and significant in its entirety. The views from the West were still largely screened by intervening infrastructure, development and landscape features outside of the site boundary. However, as can be observed in the accompanying verified views, the scale and mass of the proposed data halls, from the East, was much more apparent in this version of the site design and had a very significant visual impact. The eastern-most data hall was in close proximity to the eastern site boundary, leaving inadequate space for screening options. This is most observable in photomontage views 1 and 2 where a significant portion of the building is visible. These views can be seen in the photomontage booklet accompanying this FI Response, with further analysis in Section 6 of this report.

The existing dwellings were to be retained in this option and are visible in this set of views, as a result, the green buffer between the data centre and the public road is minimal, providing an insufficient level of screening.

Although the landscape scheme would in time mature to provide a higher level of visual screening, the impact would likely take many years to reduce given the height of the buildings in contrast to the height of the proposed berms and trees.

### **3. Option 2 and Option 3 – 11<sup>th</sup> November 2020 and 4 February 2021**

### ***Landscape Proposals***

In response to the feedback from the Local Authority on Design Option 1, an alternative site design was developed and presented on 11th November 2020 (Option 2), with a largely similar design on 4 February 2021 (Option 3). This design (Figure 3 and Figure 5) included the omission of 1 no. data hall from the site layout which resulted in increased internal space and setbacks from site boundaries. The level of screening, particularly to the North and East improved under this design iteration. The relocation of the parking bays and realignment of the internal road carriageway resulted in berms reaching heights of 6-7m in the north-eastern corner of the site, which combined with tree planting to produce a visual screen of up to 11m high, increasing by 4-5m from the earlier design. The removal of the attenuation pond in the south-eastern corner of the site and similar realignment of the road carriageway and hammerhead also had a positive impact on the level of visual screening in this part of the site, where a similar height of visual screening was achieved.

The difference between Option 2 and Option 3 was largely related to design efficiency and internal plant changes that did not significantly alter the landscape plan/visual impacts.

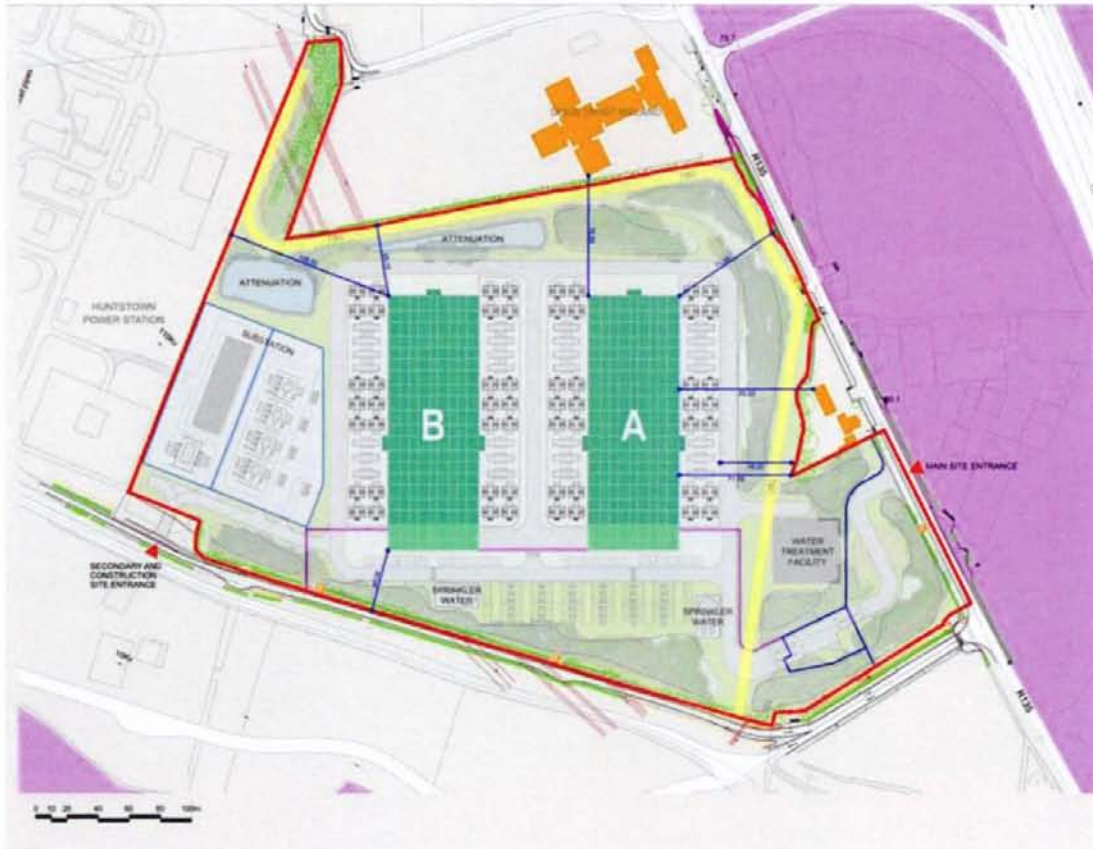


Figure 3 Alternative Layout for the Proposed Development (Option 2)

05 Proposed Development f. Building elevations

Building A

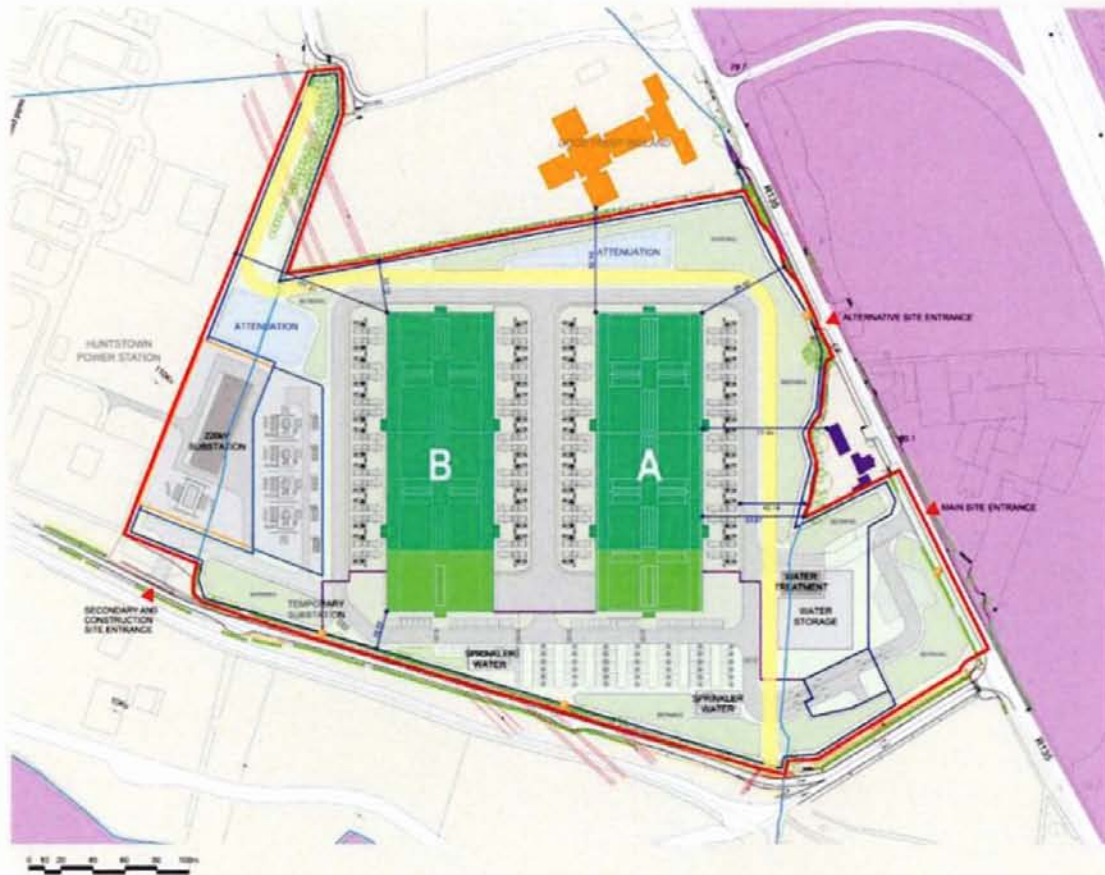


Henry J Lyons

Data Centre Facility - Huntstown, North Road, Dublin 11, Ireland

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**Visual Impact Option 2 and 3**

Any negative visual impacts associated with the proposed development relate to the introduction of new buildings and built structures into the landscape along with their ancillary infrastructure and works. The positive visual impacts come from the proposed landscape scheme with the planting of a significant amount of native woodland, hedgerow and wildflower meadow and the implementation of raised earth berms.

The visual impact of Option 2 and 3 improves on Option 1, the impact of the development in its entirety could be classified as negative and moderate. The reduction in the number of data halls combined with additional space along boundaries for landscape proposals resulted in more effective visual screening being implemented. This is most apparent in photomontage views 1, and 2, where the lower and middle sections of the data hall elevations have been successfully hidden from view. These views can be seen in the photomontage booklet accompanying this FI Response, with further analysis in Section 6 of this report. The visual impact from the North and East would still be considered negative and significant, notwithstanding this, the impact is less negative than Option 1.

Due to the reduction in scale of the buildings, the long-range views of the development improve in this iteration also.

The flues would be the most visually prominent feature and cause a significant visual impact from the North and East. Excluding the flues, it is likely that the long-term impact of the data halls would be reduced in time with the maturing of the woodland planting around the site.

#### 4. Planning Application Scheme (Chosen Option)

##### **Landscape Proposals**

The adjacent dwellings were taken into the site boundary as part of the final layout which was submitted as part of the planning application (Figure 6). This provided a more significant landscape buffer along the eastern boundary with a maximum distance of approximately 80m between the site boundary and the internal roads. Proposals included native hedgerow, woodland and copses of native trees along with the retention of the existing vegetation associated with the adjacent dwelling. Despite new constraints including the addition of an attenuation basin to the north of the data halls, a wayleave for future HV cable routes, a newly proposed water storage area in the south-eastern section of the site and a slightly larger building footprint, screening to the visually sensitive parts of the site remained achievable. Total screening heights along the north-eastern and eastern boundaries measured up to 11m, being consistent in some areas with earlier designs (Option 2 and 3) with retention of the existing vegetation along the eastern boundary providing additional screening benefits.

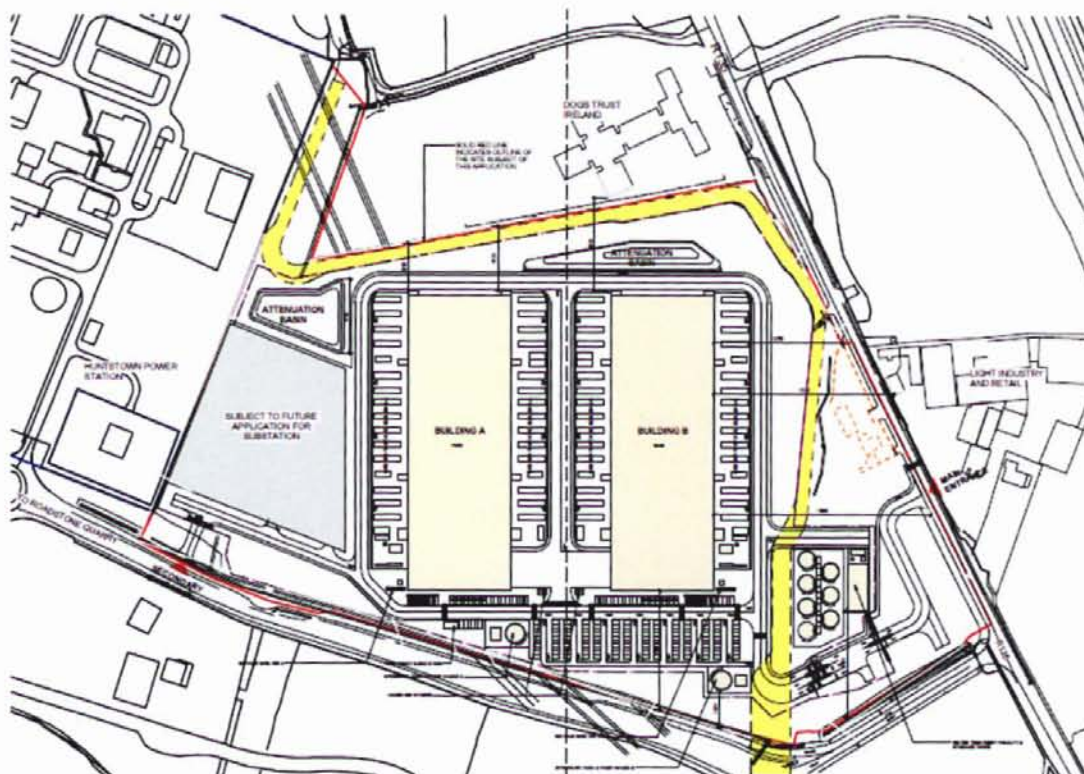


Figure 6: Alternative proposed screening elements shown

##### **Visual Impact Chosen Option**

Any negative visual impacts associated with the proposed development relate to the introduction of new buildings and built structures into the landscape along with their ancillary infrastructure and works. The positive visual impacts come from the proposed landscape scheme with the planting of a significant amount of native woodland, hedgerow and wildflower meadow and the implementation of raised earth berms.



The visual impact of the proposed development in its entirety was categorised as negative and moderate in magnitude in the long-term. The development is well hidden in the landscape from the South and West, however views from the North and East, notably the more close-range views, offer a view limited to the upper sections of the newly proposed data halls. The mitigation measures of berming and tree planting are also apparent in these views, effectively screening the lower and middle portions of the building. In respect of Views 1 and 2 in (Appendix 11.1 of the EIAR and photomontage booklet accompanying this FI Response) the views from the planning submission were assessed to have had the most significant impact, this can be attributed to their close-range nature.

The proposed flues are less intrusive in these views than in Option 2 and 3.

The adjacent dwellings are no longer visible in these views and have been replaced with a green buffer of native hedgerow, wildflower and copses of native trees. This further softens the visual impact from the East in contrast with earlier designs.

In Views 3 and 4 (Appendix 11.1 of the EIAR and photomontage booklet accompanying this FI Response) the development is also visible but has a less significant impact as the views are taken from further away and from locations where the surrounding industrial landscape is visible. The long-term benefits of the proposed landscape scheme were also considered when assessing the verified views, the maturing of the proposed woodland and additional screening benefits that this would offer would in time reduce the impact of the proposed development.

Despite the design changes in the final planning application scheme including the addition of a new HV cable route, water storage treatment area, attenuation ponds and enlarging of the building footprint, the visual impact of the development was consistent with Option 2 and 3 above.

## **5. Additional Information Response**

Visual Impact:

To address Item 3 of the AI request issued by Fingal County Council. The Applicant's design objective was to enhance the aesthetic appearance of the public facing eastern elevation. Following discussions with Executive Planner Deirdre Fallon on 28 October 2021, it was agreed that the flues associated with Building B along the eastern boundary should be designed as an architectural feature. In response to Item No. 3, of the Additional Information Request dated 15th October 2021, revised drawings have been prepared by Henry J Lyons Architects which reflect re-designed flues to the eastern elevation. Several design options were explored on foot of this request including angular shaped cladding comprising triangular and rectangular panels.

The chosen design solution includes rectangular panels that appear to be floating on the flue exterior, thus enhancing the perceived lightweight nature of the vertical flues. The flue re-design demonstrates the Applicant's intention to enhance the aesthetic appearance of the eastern elevation.

The re-designed flues now not only fulfil a functional requirement, but also create an architectural feature on site in response to request by Fingal County Council to provide a 'visual feature'

### **Land-use Zoning**

The subject lands are zoned for Heavy Industry under the Fingal County Development Plan 2017- 2023. Data centre use is considered sui generis (or 'of its own kind') in that it does not readily fit into the defined land use categories specified in the County Development Plan. Moreover, the Development Plan does not specify a definition of 'heavy industry' in its glossary of terms. Notwithstanding this, the visual impact of a data centre development would be considered to be consistent with that of industrial developments.

## 6. Comparative Assessment of Visual Impact from Specific Locations

The extent of potential visual impact of the alternative layout designs of the development on the surrounding environment is considered with respect to a 4 no. photomontage views that have been produced for the Option 1, Option 2 & 3. These views have been considered in respect of the visual impact, and compared with the original planning submission, as well as the photomontages in response to Additional Information Request Item 3.

The views 1 through 4 are identical to the original planning submission.

View 1	From the N2 slip road at the R135
<p><b>Existing View :</b> A relatively expansive view over the site with the hedgerows on site forming part of the visual ridgeline. The road is slightly elevated above the site however it is not visually prominent. The view has no significant aesthetic qualities and would be quite common in the vicinity. The Dogs Trust building is prominent in the foreground.</p>	
<p><b>Pre Planning 1 - Option 1 – 22nd September 2020</b> The visual impact of the development from this view is considered a very significant, long-term and negative impact.</p>	
<p><b>Pre Planning 2 – 11th November 2020 and 4 February 2021</b> The visual impact of the development from this view is considered to be a significant and long term negative visual impact.</p>	
<p><b>Proposed Planning View :</b> The proposed data hall buildings are visible and prominent in this view. The buildings obstruct the current expansive view and alter most of the visual ridgeline. The earth berms and woodland belt create a visual screen which reduces the area of building that is visible, notably in the north-east corner of the site, with the existing trees providing additional screening. The level of screening provided by the proposed woodland will increase as the trees mature and the magnitude of the visual impact will reduce accordingly as a significant visual screen is established. This view is from a location directly adjacent to the development and this level of impact is limited to a small area of public road.</p>	
<p><b>Predicted impact during operation:</b> A significant and long term negative visual impact. As the woodland screening matures the negative impact will reduce to a moderate long-term visual impact.</p>	
<p><b>Proposed Submission F.I. View :</b> There were no changes to the proposed landscape scheme as part of the FI response. There were design amendments to the proposed flues along the eastern elevation, however these cause no change to the visual impact. The re-designed flues now not only fulfil a functional requirement, but also create an architectural feature on site. The visual impact of the development from this view is considered to be a significant and long term negative visual impact. As the woodland screening matures the negative impact will reduce to a moderate long-term visual impact.</p>	

<b>View 2</b>	<b>From the R135 on the eastern perimeter of the site</b>
<b>Existing View :</b>	
<p>A relatively expansive view from the R135 over the site with the hedgerows on site forming part of the visual ridgeline. The pylons and power lines associated with the power station are visible along the skyline and the existing dwellings and associated low boundary walls are prominent in the foreground. The view has no significant aesthetic qualities and would be quite common in the vicinity.</p>	
<b>Pre Planning 1</b>	
<p>The visual impact of the development from this view is considered to be a significant and long term negative visual impact.</p>	
<b>Pre Planning 2</b>	
<p>The visual impact of the development from this view is considered to be a moderate and medium-term negative visual impact.</p>	
<b>Proposed View :</b>	
<p>The upper portion of one of the proposed data hall buildings is visible on the right side of the view. The section of building intrudes into the view and alters a small part of the visual ridgeline. The existing trees and vegetation are visually prominent and create a strong visual screen which reduces the area of building that is visible significantly. The proposed boundary hedgerow also adds some screening value. This view offers a direct view of the proposed landscape treatment, displaying native hedgerow, wildflower meadow and copses of native trees. The level of screening provided by the proposed woodland, located behind the existing trees, will increase as the trees mature and the magnitude of the visual impact will reduce accordingly. This view is from a location directly adjacent to the development and this level of impact is limited to a small area of public road.</p>	
<b>Predicted impact during operation:</b> A moderate and medium-term negative visual impact. As the woodland screening matures the negative impact will reduce to a slight long-term visual impact.	
<b>Proposed Submission F.I. View</b>	
<p>There were no changes to the proposed landscape scheme as part of the FI response. There were design amendments to the proposed flues along the eastern elevation, however these cause no change to the visual impact. The re-designed flues now not only fulfil a functional requirement, but also create an architectural feature on site. The visual impact of the development from this view is considered to be a moderate and medium-term negative visual impact. As the woodland screening matures the negative impact will reduce to a slight, long-term visual impact.</p>	

View 3	From the R122 to the east
<p><b>Existing View :</b> A relatively expansive view over agricultural lands towards the site. The N2 dual carriageway and the R135 lies between this location and the site. No part of the subject lands is visible in this view.</p>	
<p><b>Pre Planning 1</b> The visual impact of the development from this view is considered to be a moderate and medium-term negative visual impact.</p>	
<p><b>Pre Planning 2</b> The visual impact of the development from this view is considered to be a moderate and medium-term negative visual impact.</p>	
<p><b>Proposed View :</b> The existing hedgerow and trees form the background and visual ridgeline of this view. The proposed development, although viewed from a distance, is visible through the partial screening of the existing trees. Glimpsed views of the building are possible in winter however due to the distance to the development any element that is visible is only a very small part of the overall view. Buildings of a similar industrial/commercial use are also visible in the background, therefore the proposed development reads as a continuation of the existing built landscape. The level of screening provided by the woodland will increase as the trees mature and the magnitude of the small visual impact will reduce further.</p> <p><b>Predicted impact during operation:</b> A moderate and medium-term negative visual impact. As the woodland screening matures the negative impact will reduce further.</p>	
<p><b>Proposed Submission F.I. View</b> There were no changes to the proposed landscape scheme as part of the FI response. There were design amendments to the proposed flues along the eastern elevation, however these cause no change to the visual impact. The re-designed flues now not only fulfil a functional requirement, but also create an architectural feature on site. The visual impact of the development from this view is considered to be a moderate and medium-term negative visual impact. As the woodland screening matures the negative impact will reduce further.</p>	

<b>View 4</b>	<b>From the pedestrian fly over at M50, junction 5</b>
<b>Existing View :</b>	
A relatively expansive view over industrial landscape with some remnants of the agricultural landscape. The view is of no aesthetic value and consists of industrial clutter and detritus. No part of the subject lands is distinguishable in this view.	
<b>Pre Planning 1</b>	
The visual impact of the development from this view is considered to be a moderate and long-term negative visual impact.	
<b>Pre Planning 2</b>	
The visual impact of the development from this view is considered to be a moderate and long-term negative visual impact.	
<b>Proposed View :</b>	
The upper sections of the proposed data hall buildings are visible in the background of the view. The buildings intrude into the view and alter a small part of the visual ridgeline. Due to the amount of industrial development in this view the proposed development reads as a continuation of the existing built landscape. Existing trees and vegetation between the viewpoint and site boundary also screen the lower elements of the proposed buildings from view. This view is from an elevated walkway and is not reflective of the views offered in this area. The area from where this expansive view is offered is extremely limited.	
<b>Predicted impact during operation:</b> A moderate and long-term negative visual impact.	
<b>Proposed Submission F.I. View</b>	
There were no changes to the proposed landscape scheme as part of the FI response. The re-designed flues are not visible from this view point. The visual impact of the development from this view is considered to be a moderate and long-term negative visual impact.	

Yours sincerely,



**Matthew Mulvey** BSc (Landscape Architecture), MILI

For  
**Kevin Fitzpatrick | Landscape Architecture Ltd**



---

**APPENDIX 4.3**

**PHOTOMONTAGE VIEWS RESPONSE TO ITEM 7(B) OF THE ADDITIONAL INFORMATION REQUEST  
DATED 15TH OCTOBER 2021 ON BEHALF OF THE APPLICANT HUNTSTOWN POWER COMPANY LTD.**

Prepared by

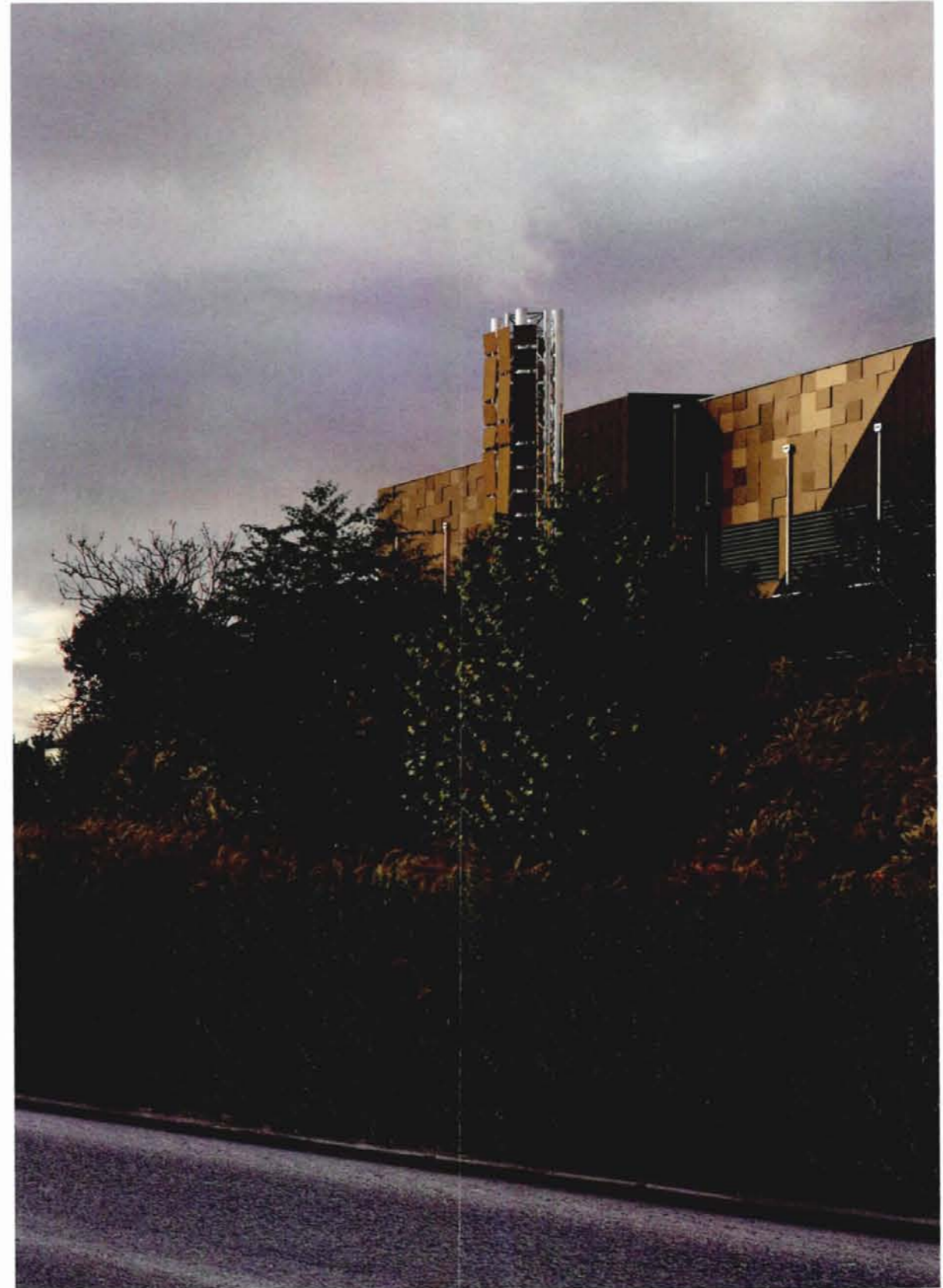
Digital Dimensions

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# Huntstown Data Centre

## Method Statement - Photo-montage production.

1. Photographs are taken from locations as advised by client with a full frame SLR digital camera and prime lens. The photographs are taken horizontally with a survey level attached to the camera. The photographic positions are marked (for later surveying), the height of the camera and the focal length of the image recorded.
2. In each photograph, a minimum of 3no. visible fixed points are marked for surveying. These are control points for model alignment within the photograph. All surveying is carried out by a qualified topographical surveyor using Total Station / GPS devices.
3. The photographic positions and the control points are geographically surveyed and this survey is tied in to the site topographical survey supplied by the Architect / client.
4. The buildings are accurately modelled in 3D cad software from cad drawings supplied by the Architect. Material finishes are applied to the 3D model and scene element are place like trees and planting to represent the proposed landscaping.
5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.
6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.
7. In the event of the development not being visible, the roof line of the development will be outlined in red if re-quested.
8. The document contains:
  - a) Site location map with view locations plotted.
  - b) Photo-montage sheet with existing or proposed conditions.
  - c) Reference information including field of view/focal length, range to site / development, date of photograph.







Location Map

Project: Huntstown Data Centre



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	04-02-2021	74°	24mm	72m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Pre Planning 1	04-02-2021	74°	24mm	72m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Pre Planning 2	04-02-2021	74°	24mm	72m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Planning Submission	04-02-2021	74°	24mm	72m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Planning Submission F.I.	04-02-2021	74°	24mm	72m	Canon EOS 5DS

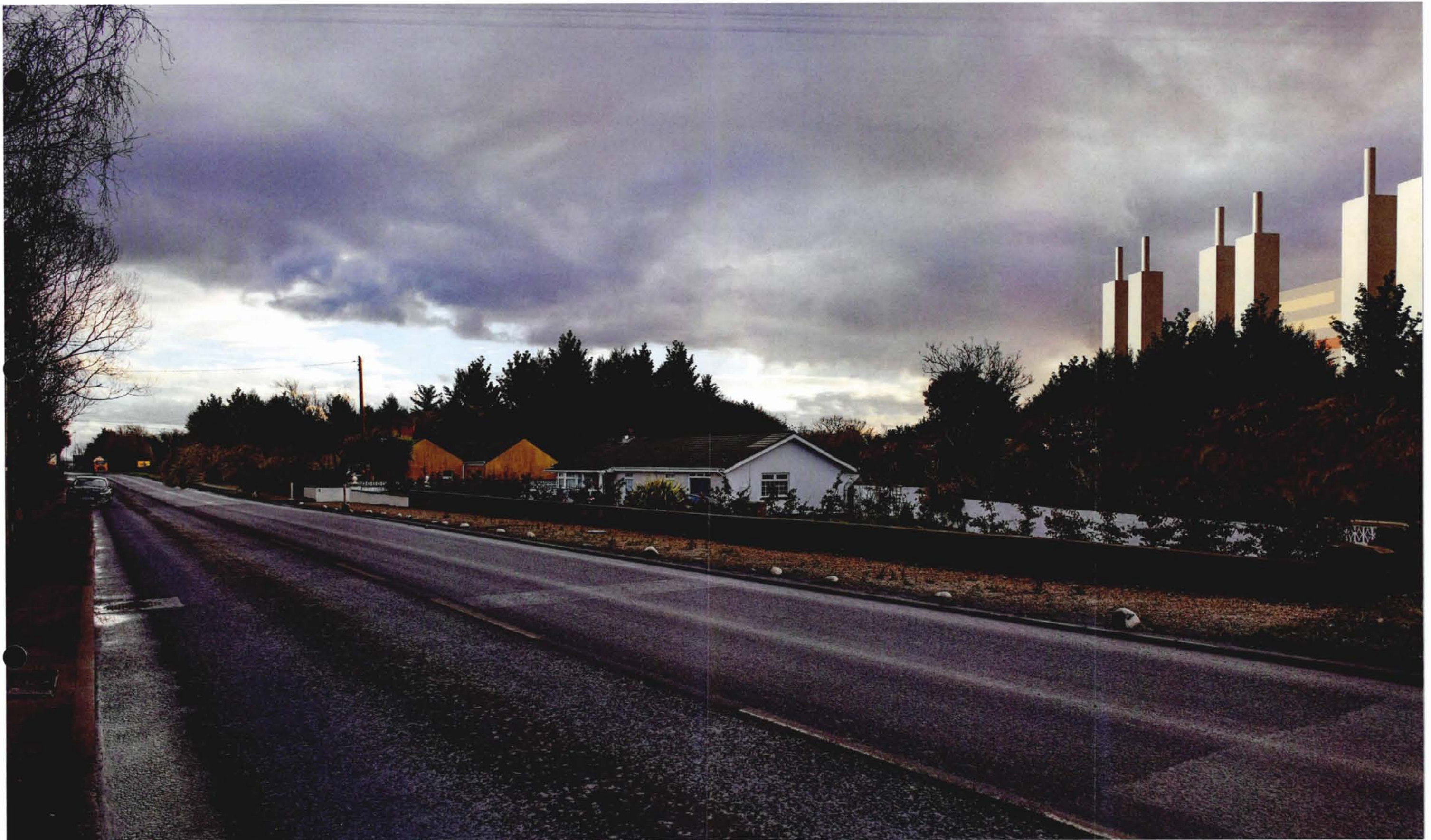


Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Pre Planning 1	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS





Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Pre Planning 2	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Planning Submission	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Planning Submission F.I.	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	04-02-2021	74°	24mm	711m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Pre Planning 1	04-02-2021	74°	24mm	711m	Canon EOS 5DS

FINGAL COUNTY COUNCIL  
PLANNING DEPARTMENT  
11 FEB 2022  
ADDITIONAL INFORMATION  
REGISTRY



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Pre Planning 2	04-02-2021	74°	24mm	711m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Planning Submission	04-02-2021	74°	24mm	711m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Planning Submission F.I.	04-02-2021	74°	24mm	711m	Canon EOS 5DS





Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	04-02-2021	74°	24mm	468m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Pre Planning 1	04-02-2021	74°	24mm	468m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Pre Planning 2	04-02-2021	74°	24mm	468m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Planning Submission	04-02-2021	74°	24mm	468m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Planning Submission F.I.	04-02-2021	74°	24mm	468m	Canon EOS 5DS

**APPENDIX 5.1**

**COMAH LAND USE PLANNING ASSESSMENT**

Prepared by

AWN Consulting

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**COMAH LAND USE  
PLANNING ASSESSMENT  
FOR  
PROPOSED DATA HALL  
DEVELOPMENT, CO. DUBLIN**

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---

Technical Report Prepared For

**Huntstown Power Company Ltd**

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Technical Report Prepared By

Mr Matthew Michie

---

Our Reference

MM/19/10948

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Date Of Issue

16 August 2021

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**Cork Office**


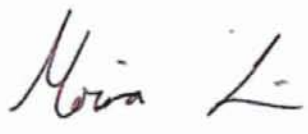
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## Document History

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MM/19/10948		16 <sup>th</sup> August 2021	
Revision Level	Revision Date	Description	Sections Affected

## Record of Approval

Details	Written by	Approved by
Signature		
Name	Mr Matthew Michie	Dr Moira Lewis
Title	Consultant	Senior Consultant
Date	16 <sup>th</sup> August 2021	16 <sup>th</sup> August 2021



## EXECUTIVE SUMMARY

This Land Use Planning assessment was completed to accompany a new planning application to Fingal County Council for the proposed data hall development that is in the vicinity of the Huntstown Power Company Limited owned site, operated by Gensys Power Limited, Huntstown Quarry, Finglas, D11. The Huntstown establishment is notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

The risk-based approach is completed in accordance with current HSA policy and taking account of the Policy and Approach of the Health and Safety Authority to COMAH Risk-based Land-use Planning (19 March 2010).

This report examines hazards associated with Fuel Oil, LPG, and Natural gas installations on site. The consequences modelling was carried out using TNO Effects Version 11.3.0 modelling software. The following is concluded:

### Natural Gas VCE within a Turbine Enclosure:

- Overpressure levels corresponding to safe and light damage extends to the proposed Data Halls;
- Overpressure levels corresponding to 1% mortality outdoors do not extend to the proposed development;
- Overpressure levels corresponding to % mortality indoors (Cat. 2) do not extend to the proposed Data Halls.

### Natural Gas Jet Fire at the GNI AGI:

- The jet flame measures up to 258 m in length (depending on wind speed);
- The thermal radiation level corresponding to 1% mortality outdoors extends to the proposed Data Hall development; therefore, there is a possibility of fatality to persons outdoors in the event of a jet fire;
- The thermal radiation level corresponding to 1% mortality indoors extends to the north west corner of the DUB40A building at the proposed development. There is a possibility of fatality to persons indoors at DUB40A in the event of a jet fire;
- The thermal radiation level corresponding to equipment damage extends to the boundary of the proposed Data Halls but does not extend to any areas with equipment.

### Bunded Pool Fire at Fuel Oil Storage Tanks

- The thermal radiation contour corresponding to the threshold of fatality (4.1 kW/m<sup>2</sup>) does not extend to the proposed Data Hall development.

### Uncontained Pool Fire following Bund Overtop

- The thermal radiation contour corresponding to the threshold of fatality does not extend to the proposed development;
- The thermal radiation contour corresponding to persons protected indoors does not extend to the proposed development.

### LPG BLEVE and Fireball

- The overpressure contour corresponding to safe distance (20 mbar) extends to the boundary of the proposed development;
- The Fireball radius does not extend to the proposed development;
- The thermal radiation corresponding to 1% fatality ( $6.8 \text{ kW/m}^2$ ) extends to the proposed development, there is potential for fatality to persons outdoors at this establishment;
- The thermal radiation level corresponding to 0% mortality indoors ( $12.7 \text{ kW/m}^2$ ) extends to the boundary of the proposed development; however, there will be no buildings in this area.

The cumulative individual risk contours for Huntstown Power Station corresponding to the boundary of the inner, middle and outer land use planning zones are illustrated as follows.



It is concluded that the LUP Outer zone of Huntstown Power Station extends to the proposed development. The individual risk contours corresponding to the Inner and Middle LUP zones do not extend to the proposed development; therefore, the level of individual risk at the proposed development is acceptable.

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## 1.0 INTRODUCTION

AWN Consulting Ltd. was requested by Huntstown Power Company to complete a COMAH Land Use Planning Assessment to accompany a new planning application to Fingal County Council (FCC) for the proposed data hall development to be located adjacent to Huntstown Power Station, Co. Dublin.

The existing Huntstown Power Company Limited owned site, operated by Gensys Power Limited is located directly to the west of the development lands. This site is a notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

This report details the following:

- Description of development;
- Background to risk assessment and land use planning context;
- Land Use Planning assessment methodology and criteria;
- Identification of Major Accident Hazards;
- Land Use Planning Assessment of Major Accident Scenarios;
- Land Use Planning Contours;
- Conclusions.

## 2.0 DESCRIPTION OF DEVELOPMENT

The proposal comprises of the demolition of two residential properties fronting the R135 (North Road), and the development of 2 no. data facility buildings arranged over 3 storeys and associated structures and infrastructure include including water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works.

The Proposed Development site is predominantly greenfield land to the north west of the M50 orbital ring in the townland of Johnstown and Coldwinders, North Road, Finglas, Dublin 11. The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Huntstown Bioenergy Plant Plant, to the east by the North Road (R135) and two residential properties fronting the R135 which form part of the subject site and to the west by Huntstown Power Station.

The proposed development will have 2 No. data hall buildings and each building will have 29 No. diesel generators (Figure 2). Each generator will have its own fuel tank with the capacity to hold up to a maximum of 45,000l of Gas oil.

The site location is illustrated on Figure 1.

### 2.1 Huntstown Power Station

The existing Huntstown Power Company Limited owned site, operated by Gensys Power Limited site is located directly to the west of the development lands. This site is a notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

Huntstown Power Station is a Combined Cycle power station providing electricity to the national grid. The site consists of two separate power plants, referred to as Phase 1 and Phase 2.

Phase 1 consists of a high efficiency 343 MW Combined Cycle Gas Turbine (CCGT) power plant operated on natural gas, with distillate oil as a standby fuel. Phase 2 consists of a high efficiency 401 MW CCGT power plant operated on natural gas, also with distillate oil as a standby fuel. Natural gas is mixed with compressed air and ignited so that the hot gas expands through the turbine which in turn generates energy through the gas turbine generators. Hot exhaust gases are passed through an exhaust duct and are used to raise steam in the waste heat recovery boiler. Steam then expands through the steam turbine to generate additional electricity.

The Huntstown site comprises the following installations with major accident potential:

- 2 no Combined Cycle Gas Turbine (CCGT) (Phase 1 and Phase 2);
- Natural Gas Supply;
- LPG tank;
- Distillate Storage.

The layout of the Huntstown Power Station is illustrated Figure 3.

The dangerous substances and quantities that may be stored at Huntstown Power Station are listed in Table 1.

Substance	Quantity (tonnes)
Hydrogen	0.13
LPG	1.53
Petroleum Products (HFO, Diesel, Petrol)	13420

**a** *Table 1* Dangerous Substances Stored at Huntstown Power Station



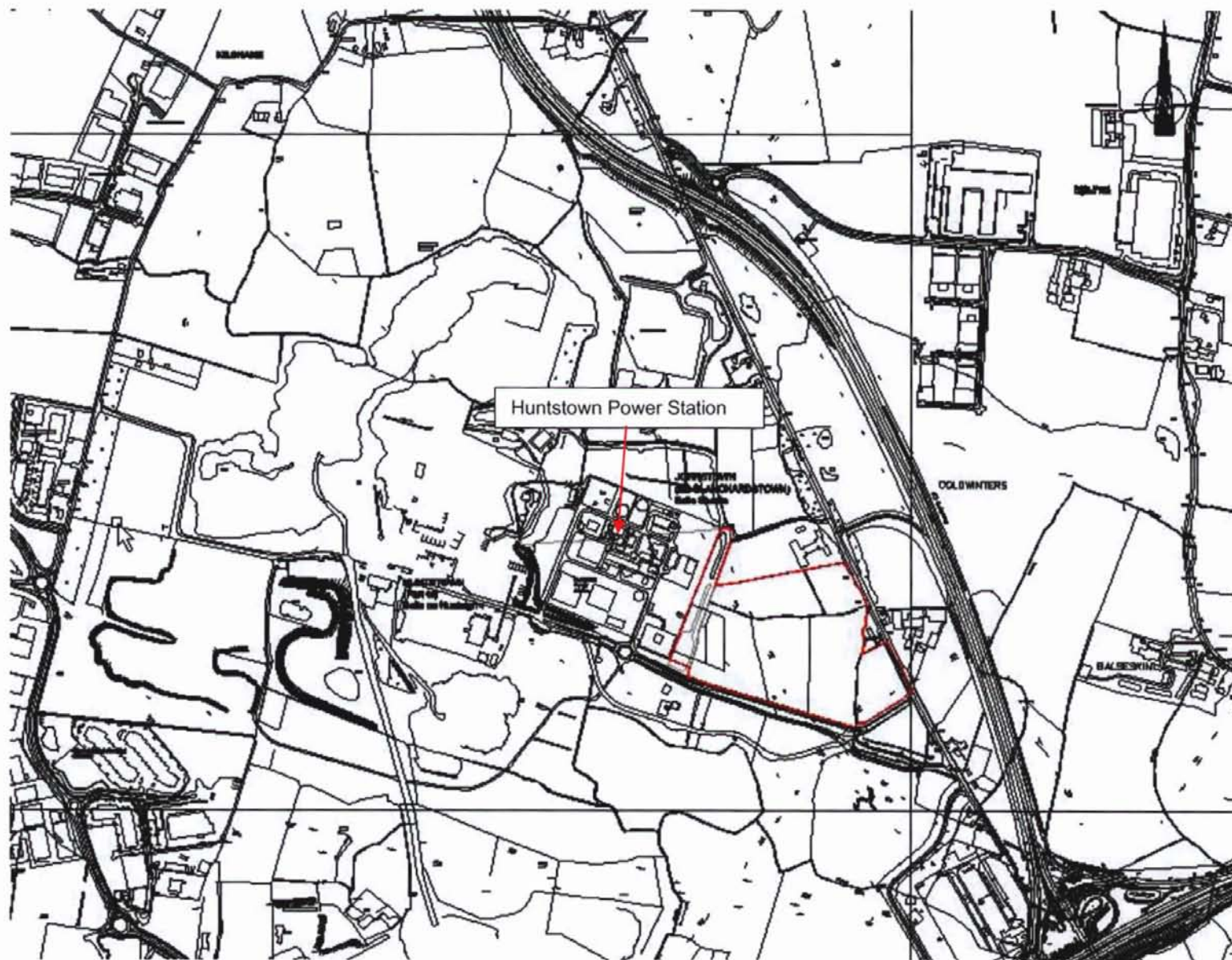


Figure 1 Site Boundary of proposed development

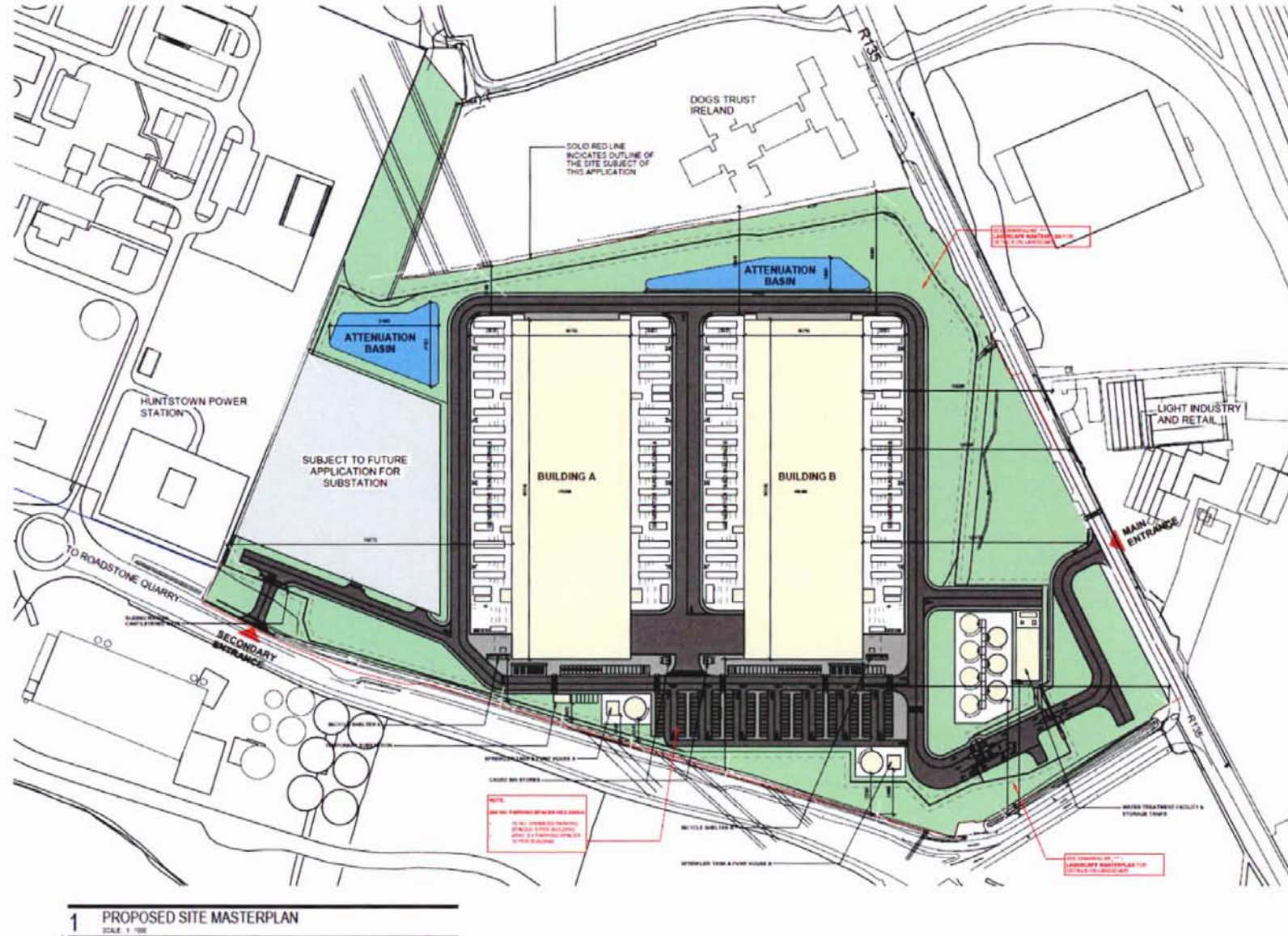


Figure 2 Proposed Site Masterplan

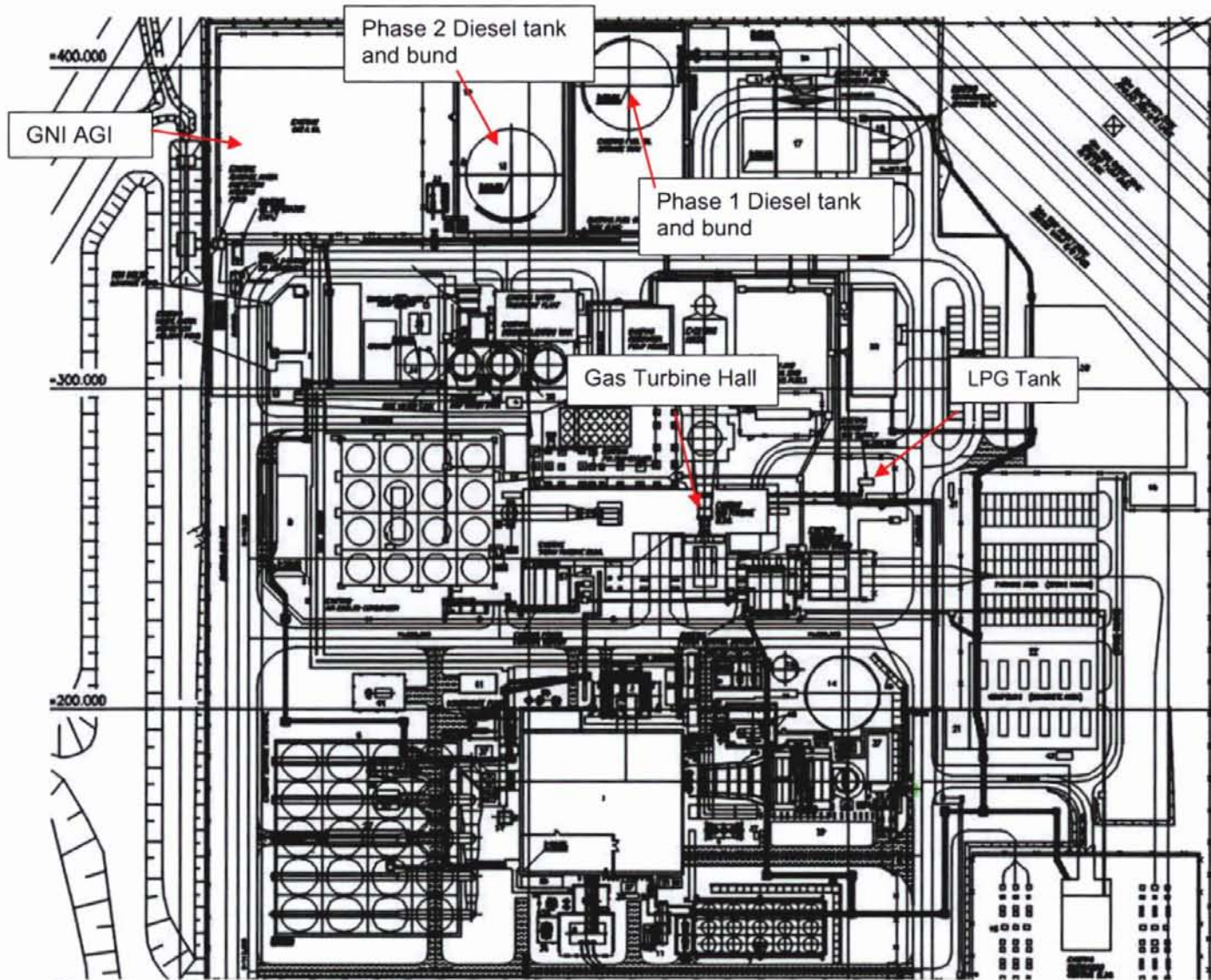


Figure 3 *ntstown ower tation ite a o t*

### 3.0 BACKGROUND TO RISK ASSESSMENT AND LAND USE PLANNING

#### 3.1 Risk Assessment – An Introduction

Trevor Kletz (Kletz, 1999) in his seminal work on the subject stated that the essential elements of quantitative risk assessment (QRA) are (i) how often is a Major Accident Hazard (MAH) likely to occur and (ii) Consequence Analysis – what is the impact of the incident:

Kletz also commented that another way of expressing this method of QRA is:

How often?

How big?

So what?

In QRA, the “how often?” question refers to the frequency of the major accident scenario and is answered with reference to historical industry data for similar incidents, or by using frequency analysis techniques.

Section 2 of the Health and Safety Authority (HSA) Land Use Planning Policy and Approach document (Introduction to Technical Aspects) describes the policy and approach as follows:

*“The policy of the HSA is that a simplified application of a risk based approach is the most appropriate for land use planning. The difficulties associated with the completion of analysis in many scenarios can be avoided by considering a small number of carefully chosen representative events whose frequency is estimated conservatively.”*

The frequency data for major accident scenarios identified in this assessment is based on these conservative frequency values.

The ‘how big’ element of the QRA was conducted using TNO Effects modelling software.

The “so what” element is perhaps the most contentious issue associated with QRA, as one is essentially asking what is an acceptable level of risk, in this case risk of fatality, posed by a facility.

It is widely accepted that “no risk” scenarios do not exist. The occupier of a house with gas fired central heating is exposed to the risk posed by the presence of a natural gas supply in the house. Statistics from the UK Health and Safety Executive (UK HSE Risks associated with Gas Supply, 1993) show that the annual risk of death from gas supply events in the UK (risks include explosion, asphyxiation by fumes from poorly vented heaters, poisoning by gas leaks) is approximately 1.1 in a million. In other words, for every 10 million persons living in houses with a gas supply, 11 will die annually from events related to the supply.

Table 2 below presents the annual fatality rates, and the risk of fatality, for a number of activities (from CIRIA Report 152, 1995) in the UK.

Risk	Annual Fatality Rate (per 1,000, 000 people at risk)	Annual Risk of Fatality
Motorcycling	20,000	1 in 50
Smoking (all causes)	3000	1 in 333
Smoking (cancer)	1200	1 in 830
Fire fighting	800	1 in 1250
Farming	360	1 in 2778
Police work (non-clerical)	220	1 in 4545
Road accidents	100	1 in 10,000
Fires	28	1 in 35,700
Natural gas supply to house	1.1	1 in 909,090
Lightning strike	0.5	1 in 2,000,000

**a le 2** Annual Fatality Rates for a Variety of Activities

Kletz has shown that the average industrial worker is exposed to a risk of accidental death of somewhere around  $1 \times 10^{-3}$  per year, for all situations (work, home, travel).

### 3.2 Land Use Planning and Risk Assessment

The Seveso III Directive (2012/18/EU) requires Member States to ensure that the objectives of preventing major accidents and limiting the consequences of such accidents

for human health and the environment are taken into account in land use planning policies

through controls on the siting of new establishments, modifications to establishments and

certain types of new developments in the vicinity of establishments. Under the 2015 COMAH Regulations, the Central Competent Authority (the Health and Safety Authority) provides land use planning advice to planning authorities.

This land use planning assessment has been carried out in accordance with the HSA's *olic and roac to is ased and se lannin*. This approach involves delineating three zones for land use planning guidance purposes, based on the potential risk of fatality from major accident scenarios resulting in damaging levels of thermal radiation (e.g. from pool fires), overpressure (e.g. from vapour cloud explosions) and toxic gas concentrations (e.g. from an uncontrolled toxic gas release).

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

- 10E-05/year Risk of fatality for Inner Zone (Zone 1) boundary
- 10E-06/year Risk of fatality for Middle Zone (Zone 2) boundary
- 10E-07/year Risk of fatality for Outer Zone (Zone 3) boundary

The process for determining the distances to the boundaries of the inner, middle and outer zones is outlined as follows:

- Determine the consequences of major accident scenarios using the modelling methodologies described in the HSA LUP Policy/Approach Document (HSA, 2010);

- Determine the severity (probability of fatality) using the probit functions specified by the HSA;
- Determine the frequency of the accident (probability of event) using data specified by the HSA;
- Determine the individual risk of fatality as follows:

$$\text{Risk} = \text{Frequency} \times \text{Severity}$$

The 2010 HSA Risk-Based LUP Policy/Approach document provides guidance on the type of development appropriate to the inner, middle and outer LUP zones. The advice for each zone is based on the UK Health and Safety Executive (HSE) Land Use Planning Methodology. The methodology sets four levels of sensitivity, with sensitivity increasing from 1 to 4, to describe the development types in the vicinity of a COMAH establishment.

The Sensitivity Levels used in the Land Use Planning Methodology are based on a rationale which allows progressively more severe restrictions to be imposed as the sensitivity of the proposed development increases. The sensitivity levels are:

- Level 1 Based on normal working population;
- Level 2 Based on the general public – at home and involved in normal activities;
- Level 3 Based on vulnerable members of the public (children, those with mobility difficulties or those unable to recognise physical danger); and
- Level 4 Large examples of Level 3 and large outdoor examples of Level 2 and Institutional Accommodation.

Table 3 details the matrix that is used by the HSA to advise on suitable development for technical LUP purposes:

Level of Sensitivity	Inner Zone (Zone 1)	Middle Zone (Zone 2)	Outer Zone (Zone 3)
Level 1	✓	✓	✓
Level 2	✗	✓	✓
Level 3	✗	✗	✓
Level 4	✗	✗	✗

Table 3 LUP Matrix

### 3.3 Land Use Planning and Societal Risk

Vrijling and van Gelder (2004) have defined Societal Risk as:

*“the relation between frequency and the number of people suffering from a specified level of harm in a given population from the realisation of specified hazards”*

An important distinction in Societal Risk assessment is the number of persons that may be affected by off-site impacts, such as people with restricted mobility or children that may be affected by the need to rapidly evacuate a significant number of people from an area.

It is therefore prudent, when considering the Societal Risk Impacts of a development, to consider the nature and extent of a population which could be located in the vicinity of establishments with major accident hazard potential, or if adjacent lands are not already

developed, to consider the nature and extent of a population which should be permitted to be located in this area.

It is recognised that it is not necessary to restrict all access by people to such lands, but it is considered prudent to restrict the number and type of persons which could be impacted.

The HSA LUP Policy and Approach document (HSA, 2010) recommends that for some types of development, particularly those involving large numbers of people, it is likely that the deciding factor from the point of view of land use planning is the societal risk, i.e. the risk of large numbers of people being affected in a single accident.

The HSA specifies the following societal risk criteria:

- Upper societal risk criterion value of 1 in 5000 for 50 fatalities (planning authority should advise against permitting the development)
- Broadly acceptable region of 1 in 100,000 for 10 fatalities (planning authority should not advise against permitting the development)
- Significant risk regions between these two values (planning authority should be advised of HSA approach to Risk-based Land Use Planning)

## 4.0 LAND USE PLANNING ASSESSMENT METHODOLOGY AND CRITERIA

This COMAH land use planning assessment has been completed in accordance with risk based approach set out in the HSA's *olic and roac to is ased and se lannin*. LUP assessments are completed in the following steps:

- Identify major accident scenarios with reference to the HSA Policy document (HSA, 2010);
- Consequence modelling of major accident scenarios;
- Assign frequencies to major accident scenarios with reference to frequency values outlined in the HSA's Policy document (HSA, 2010);
- Assessment of individual risk and generation of individual risk contours;
- Where necessary, assessment of societal risk using societal risk indices.

### 4.1 Consequence Assessment

The impacts of physical effects were determined by modelling accident scenarios using TNO Effects Version 11.3.0 modelling software.

#### 4.1.1 Flammable and Overpressure Hazards

The flammable hazards, which may be observed during major accidents, include the following:

##### *las ire*

Flash fires are associated with major accidents involving releases of flammable liquids or gases, which form a gas/vapour cloud which ignites at some point remote from the release point.

Combustion takes place relatively slowly and there is no significant overpressure. It is generally assumed that the thermal effects are limited to people within the flame envelope where there is a high probability of fatality. Flash fires would have a negligible effect on plant and buildings due to the short duration of the fire and the negligible overpressures created.

##### *a o r lo d losion*

A Vapour Cloud Explosion (VCE) may be observed during major accidents. Combustion of a flammable gas-air mixture will occur if the composition of the mixture lies in the flammable range and if an ignition source is available. When ignition occurs in a flammable region of the cloud, the flame will start to propagate away from the ignition source. The combustion products expand causing flow ahead of the flame. Initially this flow will be laminar. Under laminar or near laminar conditions the flame speeds for normal hydrocarbons are in the order of 5 to 30 m/s which is too low to produce any significant blast over-pressure. Under these conditions, the vapour cloud will simply burn, causing a flash fire. In order for a vapour cloud explosion to occur, the vapour cloud must be in a turbulent condition.

Turbulence may arise in a vapour cloud in various ways:

- By the release of the flammable material itself, for instance a jet release from a high pressure vessel.



- By the interaction of the expansion flow ahead of the flame with obstacles present in a congested area.

In the case of a vapour cloud explosion the principal parameter of interest is the overpressure observed at various locations.

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Fireballs are short-lived flames which generally result from the ignition and combustion of turbulent vapour/two-phase (i.e. aerosol) fuels in air. Releases that fuel fireballs are usually near instantaneous and commonly involve the catastrophic failure of pressurised vessels/pipelines. Fireballs can dissipate large amounts of thermal radiation, which away from their visible boundaries, may transmit heat energy that could be hazardous to life and property.

A BLEVE is an explosion which occurs when a storage vessel containing a liquid at a temperature significantly above its boiling point at normal atmospheric pressure, experiences a catastrophic failure. Unlike a vapour cloud explosion, the liquid in question does not have to be flammable, however most of the BLEVEs recorded have been associated with facilities which stored flammable material. The catastrophic failure of a storage vessel and the subsequent rapid vaporisation of the liquid within the vessel produces an explosion overpressure. A BLEVE involving flammable liquid produces both an explosion overpressure and a buoyant fireball.

#### 4.1.2 Physical Effects Modelling

The impacts of physical and health effects on workers and the general public outside of the proposed development boundary were determined by modelling accident scenarios using TNO Effects modelling software.

Thermal radiation exposure criteria is based on the concept of a 'dangerous dose'.

A 'dangerous dose' is defined by the UK Health and Safety Executive as a dose where there is extreme distress to almost everyone, with a substantial proportion of affected persons requiring medical attention and some highly susceptible people might be killed (about 1% fatalities).

#### 4.1.3 Thermal Radiation Criteria

Fire scenarios have the potential to create hazardous heat fluxes. Therefore, thermal radiation on exposed skin poses a risk of fatality.

Potential consequences of damaging radiant heat flux and direct flame impingement are categorised in Table 4 (HSA, 2010, CCPS, 2000, EI, 2007 and McGrattan et al, 2000).

Thermal Flux (kW/m <sup>2</sup> )	Consequences
1 – 1.5	Sunburn
5 – 6	Personnel injured (burns) if they are wearing normal clothing and do not escape quickly
8 – 12	Fire escalation if long exposure and no protection
32 – 37.5	Fire escalation if no protection (consider flame impingement)

Thermal Flux (kW/m <sup>2</sup> )	Consequences
31.5	US DHUD, limit value to which buildings can be exposed
37.5	Process equipment can be impacted, AIChE/CCPS
Up to 350	In flame. Steel structures can fail within several minutes if unprotected or not cooled.

**a le 4** Heat Flux Consequences

In relation to persons indoors, the HSA have specified the thermal radiation consequence criteria (from an outdoor fire) detailed in Table 5 (HSA, 2010).

Thermal Flux (kW/m <sup>2</sup> )	Consequences
> 25.6	Building conservatively assumed to catch fire quickly and so 100% fatality probability
12.7 – 25.6	People are assumed to escape outdoors, and so have a risk of fatality corresponding to that outdoors
< 12.7	People are assumed to be protected, so 0% fatality probability

**a le 5** Heat Flux Consequences Indoors

Thermal Dose Unit (TDU) is used to measure exposure to thermal radiation. It is a function of intensity (power per unit area) and exposure time:

$$\text{Thermal Dose} = I^{1.33} t$$

where the Thermal Dose Units (TDUs) are (kW/m<sup>2</sup>)<sup>4/3</sup>.s, I is thermal radiation intensity (kW/m<sup>2</sup>) and t is exposure duration (s).

The HSA recommends that the Eisenberg probit function (HSA, 2010) is used to determine probability of fatality to persons outdoors from thermal radiation as follows:

$$\text{Probit} = -14.9 + 2.56 \ln (I^{1.33} t)$$

I Thermal radiation intensity (kW/m<sup>2</sup>)

t exposure duration (s)

Probit (Probability Unit) functions are used to convert the probability of an event occurring to percentage certainty that an event will occur. The probit variable is related to probability as follows (CCPS, 2000):

$$P = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Y-5} \exp\left(-\frac{u^2}{2}\right) du$$

where P is the probability of percentage, Y is the probit variable, and u is an integration variable. The probit variable is normally distributed and has a mean value of 5 and a standard deviation of 1.

The Probit to percentage conversion equation is (CCPS, 2000):

$$P = 50 \left[ 1 + \frac{Y-5}{|Y-5|} \operatorname{erf} \left( \frac{|Y-5|}{\sqrt{2}} \right) \right]$$

The relationship between Probit and percentage certainty is presented in Table 6 (CCPS, 2000).

%	0	1	2	3	4	5	6	7	8	9
0	—	2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66
10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.36	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33
%	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
99	7.33	7.37	7.41	7.46	7.51	7.58	7.65	7.75	7.88	8.09

a le 6 Conversion from Probits to Percentage

For long duration fires, such as jet fires, it is generally reasonable to assume an effective exposure duration of 75 seconds to take account of the time required to escape (HSA, 2010). It is noted that this is a conservative estimation of the time taken to escape and is used in consequence assessment as the maximum exposure duration for heat radiation.

With respect to exposure to thermal radiation outdoors, the Eisenberg probit relationship implies:

- 1% fatality – 966 TDUs (6.8 kW/m<sup>2</sup> for 75 s exposure duration) (Dangerous Dose)
- 10% fatality – 1452 TDUs (9.23 kW/m<sup>2</sup> for 75 s exposure duration)
- 50% fatality – 2387 TDUs (13.4 kW/m<sup>2</sup> for 75 s exposure duration)

#### 4.1.4 Overpressure Criteria

Explosions scenarios can result in damaging overpressures, especially when flammable vapour/air mixtures are ignited in a congested area. Table 7 below describes blast damage for various overpressure levels (Mannan, 2012).

Side-on Overpressure (mbar)	Description of Damage
1.5	Annoying noise
2	Occasional breaking of large window panes already under strain
3	Loud noise; sonic boom glass failure
7	Breakage of small windows under strain
10	Threshold for glass breakage
20	"Safe distance", probability of 0.95 of no serious damage beyond this value; some damage to house ceilings; 10% window glass broken
30	Limited minor structural damage
35 – 70	Large and small windows usually shattered; occasional damage to window frames
>35	Damage level for "Light Damage"
50	Minor damage to house structures
80	Partial demolition of houses, made uninhabitable
70 - 150	Corrugated asbestos shattered. Corrugated steel or aluminium panels fastenings fail, followed by buckling; wood panel (standard housing) fastenings fail; panels blown in
100	Steel frame of clad building slightly distorted
150	Partial collapse of walls and roofs of houses
150-200	Concrete or cinderblock walls, not reinforced, shattered
>170	Damage level for "Moderate Damage"
180	Lower limit of serious structural damage 50% destruction of brickwork of houses
200	Heavy machines in industrial buildings suffered little damage; steel frame building distorted and pulled away from foundations
200 – 280	Frameless, self-framing steel panel building demolished; rupture of oil storage tanks
300	Cladding of light industrial buildings ruptured
350	Wooden utility poles snapped; tall hydraulic press in building slightly damaged
350 – 500	Nearly complete destruction of houses
>350	Damage level for "Severe Damage"
500	Loaded tank car overturned
500 – 550	Unreinforced brick panels, 25 - 35 cm thick, fail by shearing or flexure
600	Loaded train boxcars completely demolished
700	Probable total destruction of buildings; heavy machine tools moved and badly damaged

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There are a number of modes of explosion injury including eardrum rupture, lung haemorrhage, whole body displacement injury, missile injury, burns and toxic exposure. Table 8 describes injury criteria from blast overpressure including probability of eardrum rupture and probability of fatality due to lung haemorrhage.

Probability of Eardrum Rupture ( % )	Peak overpressure (mbar)
1 (threshold)	165
10	194
50	435
90	840
Probability of Fatality due to Lung Haemorrhage ( % )	Peak overpressure (mbar)
1 (threshold)	1000
10	1200
50	1400
90	1750

Table 9: Criteria from HSA for blast overpressure

The HSA recommends that the Hurst, Nussey and Pape probit function (HSA, 2010) is used to determine probability of fatality to persons outdoors from overpressure as follows:

$$P = 1.4 - 1.35 \ln P$$

P = Blast overpressure (psi)

The Hurst, Nussey and Pape probit relationship implies:

- 1% fatality – 168 mbar (Dangerous Dose)
- 10% fatality – 365 mbar
- 50% fatality – 942 mbar

The HSA uses relationships published by the Chemical Industries Association (CIA) to determine the probability of fatality for building occupants exposed to blast overpressure. The CIA has developed relationships for 4 categories of buildings (CIA, 2010):

- Category 1: hardened structure building (special construction, no windows);
- Category 2: typical office block (four storey, concrete frame and roof, brick block wall panels);
- Category 3: typical domestic dwelling (two storey, brick walls, timber floors); and
- Category 4: 'portacabin' type timber construction, single storey.

The CIA relationships imply the overpressure levels corresponding to probabilities of fatality of 1%, 10% and 50% detailed in Table 9 below.

Probability of fatality	Overpressure Level, mbar			
	Category 1	Category 2	Category 3	Category 4
1% fatality (dangerous dose)	435	100	50	50
10% fatality	519	183	139	115
50% fatality	590	284	300	242

Table 9: Blast overpressure response for buildings

For the purposes of this assessment, it is assumed that the vulnerability of building occupants in the vicinity of the proposed development to side-on overpressure are represented by Category 2 type structures.

#### 4.1.5 Modelling Parameters

##### *Weather Conditions*

Weather conditions at the time of a major accident have a significant impact on the consequences of the event. Typically, high wind speeds increase the impact of fires, particularly pool fires, while the associated turbulence dilutes vapour clouds, reducing the impact of toxic and flammable gas releases.

##### Atmospheric Stability Class and Wind Speed

Atmospheric stability describes the amount of turbulence in the atmosphere. The stability depends on the windspeed, time of day, and other conditions. Atmospheric stability classes are described in Table 10 (DNV, PHAST supporting documentation).

Wind speed (m/s)	Day: Solar Radiation			Night: Cloud Cover		
	Strong	Moderate	Slight	Thin, <40%	Moderate	Overcast, >80%
2	A	A-B	B	-	-	D
2 – 3	A-B	B	C	E	F	D
3 – 5	B	B-C	C	D	E	D
5 – 6	C	C-D	D	D	D	D
6	C	D	D	D	D	D

Table 10 Atmospheric Stability Class

Stability classes are described as follows:

- A very unstable (sunny with light winds)
- B unstable (moderately sunny, stronger winds than class A)
- C slightly unstable – very windy/sunny or overcast/light wind
- D neutral – little sun and high wind or overcast night
- E stable – moderately stable – less overcast and windy than class D
- F very stable – night with moderate clouds and light/moderate winds

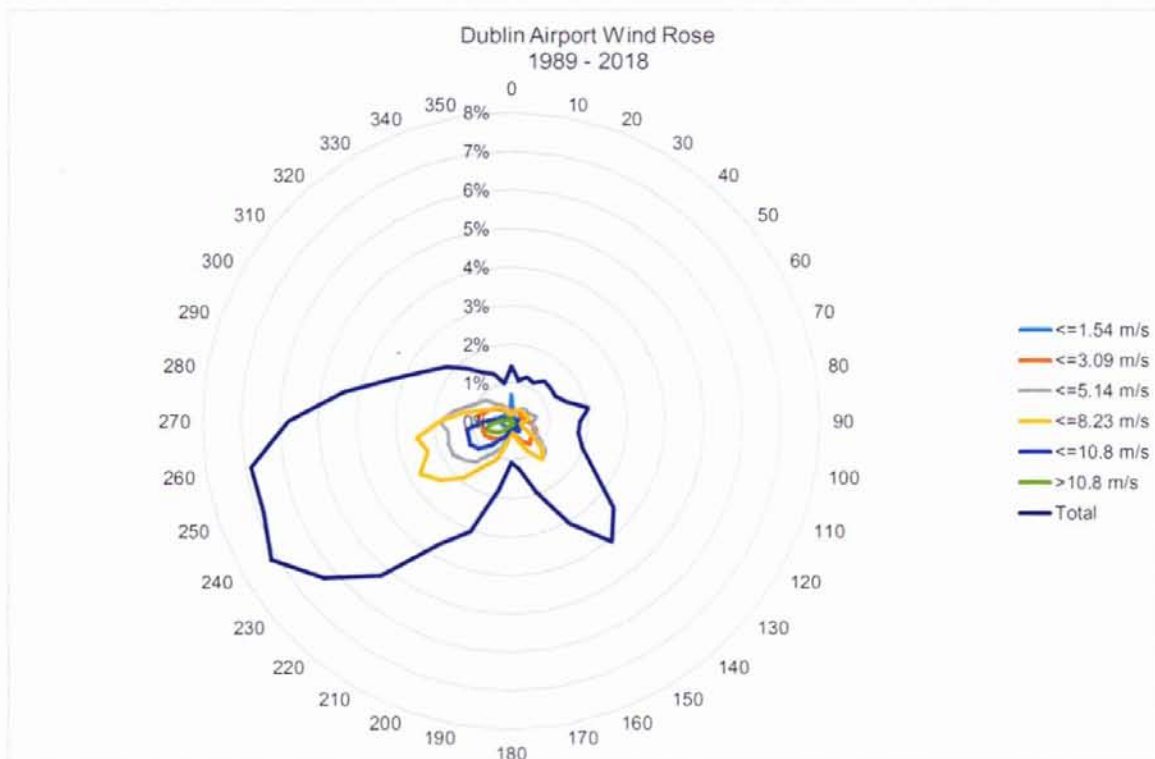
The following Pasquill stability/wind speed pairs are specified by the HSA in Ireland for consequence modelling:

- Average weather conditions are represented by stability category D and a wind speed of 5 m/s, i.e. Category D5;
- Worst case conditions for toxic dispersion are represented by stability category F and a wind speed of 2 m/s, i.e. Category F2;
- A wind speed of 10 m/s represents the worst case condition for fire scenarios, with stability category D, i.e. Category D10.

##### Wind Direction and Ambient Temperature

The nearest synoptic meteorological station to the Huntstown establishment for which long term meteorological data is available is at Dublin Airport.

Figure 4 illustrates a wind rose for Dublin Airport (1989 – 2018). It can be seen that the prevailing wind direction is from the south west (240°).



**Figure 4** Wind Rose Dublin Airport 1989 – 2018 (Met.ie)

### Ambient Temperature

The ambient and surface temperature conditions significantly impact the results of the consequence modelling. Typically, atmospheric temperatures in the Dublin area range from  $-12.2^{\circ}\text{C}$  to  $28.7^{\circ}\text{C}$  through the year (Dublin Airport 1989 – 2018 averages, [www.met.ie](http://www.met.ie)).

According to the weather data recorded between 1980 and 2018 at Dublin Airport, the average atmospheric temperature observed is  $9.8^{\circ}\text{C}$ . Therefore, an ambient temperature of  $10^{\circ}\text{C}$  has been selected to represent typical temperature conditions at the site.

### Ambient Humidity

Weather data for Dublin Airport, monthly and annual mean and extreme values datasheet supplied by Met Éireann, indicates a mean morning (09:00 UTC) relative humidity of 83% and a mean afternoon (15:00 UTC) humidity of 73.3%. Therefore, for this assessment, a representative ambient humidity of 80% has been assumed.

### Surface Roughness

Surface roughness describes the roughness of the surface over which the cloud is dispersing. Typical values for the surface roughness are as follows (DNV, PHAST supporting documentation):

Roughness length	Description
0.0002 m	Open water, at least 5 km
0.005 m	Mud flats, snow, no vegetation
0.03 m	Open flat terrain, grass, few isolated objects
0.1 m	Low crops, occasional large obstacles, $x/h > 20$
0.25 m	High crops, scattered large objects, $15 < x/h < 20$
0.5 m	Parkland, bushes, numerous obstacles, $x/h < 15$
1.0 m	Regular large obstacles coverage (suburb, forest)
3.0 m	City centre with high and low rise buildings

**a le 11** Surface Roughness

The terrain within the vicinity of the site is comprised of mainly fields with some industrial plants. A surface roughness length of 1 m has been selected for the study.

## 4.2 Individual Risk Assessment Methodology

TNO Riskcurves Version 11.3.0 modelling software is used in this assessment to calculate individual risk of fatality contours and risk based land use planning zones associated with major accident scenarios.

## 5.0 IDENTIFICATION OF MAJOR ACCIDENT HAZARDS

A major accident is defined in the 2015 COMAH Regulations as:

*"an occurrence such as a major emission fire or explosion resulting from uncontrolled developments in the course of the operation of an establishment covered by these Regulations and leading to serious danger to man, health or the environment immediate or delayed inside or outside the establishment and involving one or more dangerous substances"*

### 5.1 Vapour Cloud Explosion Scenario

There is potential for a semi-confined VCE as a result of a leak of natural gas within a turbine enclosure at Phase 1 turbine hall. The HSA LUP guidance specifies the size of the flammable cloud to be taken as the volume of the region where the release may occur (i.e. building volume). The turbine enclosure has an estimated volume of 944 m<sup>3</sup>.

Individual risks of fatality can be calculated using a probit of  $Y = 1.47 + 1.35 \ln(P)$ , with P in psi (Hurst, Nussey and Pape, 1989) for the risk to people outdoors, and the Chemical Industries Association (CIA, 2003) vulnerability curves for the risk to people indoors. See Section 4.1.4 herein.

### 5.2 Jet Fire Scenario

The HSA LUP guidance document advises that for sites such as Power Stations the most significant major accident risk is associated with potential jet fires from the gas pipelines.

Huntstown Power Station is supplied with high pressure natural gas from a pipeline at the Gas Network Ireland (GNI) AGI.



The AGI is secured by fencing, locked and regularly maintained by GNI (Huntstown personnel do not have access to it). An emergency shutoff valve on the high pressure supply pipeline can be activated from the main control room, it is pneumatically operated and fail closed. The area is ATEX rated.

Information on the GNI high pressure natural gas pipeline that supplies natural gas to Huntstown Power Station was obtained from GNI is as follows:

- 300 mm diameter
- 70 bar design pressure

The 'Wilson Model' (TNO Yellow Book, 2005) models discharge from a long pipeline.

The initial release rate mainly depends on the pipe diameter (full bore rupture scenario) or hole size, the friction flow inside the pipeline depending on the wall roughness and the initial pressure inside the pipeline. Because of the release, the pressure inside the pipeline will drop in the region of the leak first. The pressure drop 'travels' along the length of the pipeline with a velocity equal to the sound velocity. This causes the gas release to become non-stationary until the pressure drop reaches the end of the pipeline. The ongoing release can be assumed to be stationary and continuous until the pipeline is empty.

### 5.3 Pool Fire Scenario

There is potential for a pool fire as a result of a release of fuel oil from the storage tank. In order for a fire to occur at the fuel oil storage tank, it would be necessary for an accidental release of fuel to occur, for an ignition source to be present and for the released fuel oil to ignite (which is extremely unlikely at ambient temperature).

The flash point of DERV fuel oil is 68 °C, and this is the lowest temperature at which it can form an ignitable mixture with air. The fuel oil tanks are at atmospheric temperature and pressure.

The HSA COMAH LUP Guidelines (HSA, 2010) identify the following major accident events associated with large pool fires at fuel storage sites:

1. A major unbunded pool fire extending up to 100 m from the bund wall, with a total frequency of at least 10E-04/year (for a small installation, and increasing for larger installations to ensure that the risks close to large sites are not less than those for small sites, e.g. based on an event frequency of 10E-04/(100π) per metre/year along a locus 50 m from the vessel storage area).
2. A pool fire which covers the entire surface of the bund with a higher frequency of 10E-03/year.

The worst case event is taken to be a circular pool fire located adjacent to the storage bund (i.e. due to bund overtopping or bund failure). The radius (R) of the fire is taken to be given by:

$$R = 6.85 V^{0.44537}$$

with R in metres and V (volume of liquid in pool) in cubic metres, subject to a maximum diameter of 100 m (which occurs when  $V = 87 \text{ m}^3$ ), which should not normally be exceeded (unless there are special circumstances). It is typically assumed that 50% of

the maximum vessel contents may overtop the bund, which implies that the maximum 100m pool diameter occurs for vessels of over 175 m<sup>3</sup>.

The distances to thermal doses of 1800, 1000 and 500 tdu can be modelled with the value for the SEP of Xylene (surrogate for all hydrocarbons other than class I) set at 25 kW/m<sup>2</sup> and at 52 kW/m<sup>2</sup> in the case of Pentane (surrogate for class I)).

The levels of thermal radiation as a function of distance from the centre of the pool can be calculated using any standard pool fire model. The calculations are undertaken for 5 m/s wind speed, and that the radiation levels taken are those calculated in the downwind direction (this will be conservative). Risks of fatality are then calculated using the standard Eisenberg probit and an assumption that people would be exposed for a period of 75 seconds (at a constant thermal radiation level).

#### 5.4 Fireball and BLEVE

There is a potential for a BLEVE and Fireball following tank rupture the LPG storage tank.

The HSA COMAH LUP guidelines (2010) specifies a frequency of 10<sup>-4</sup> /year. This is deliberately chosen as being relatively high as it is intended to cover sites with more than one LPG vessel (up to about 10). If there are only a few vessels, and the HSA is satisfied that there is a high probability that the measures in place at the site would mitigate against BLEVEs occurring, then a lower frequency of 10<sup>-5</sup> /year per vessel may be adopted.

### 6.0 LAND USE PLANNING ASSESSMENT OF MAJOR ACCIDENT HAZARDS AT PROPOSED OCGT PLANT

The following major accident scenarios at the Huntstown Power Station that could have consequence effects at the proposed development are assessed herein:

- Vapour Cloud Explosion in a turbine enclosure;
- Jet fire from natural gas AGI area;
- Fireball and BLEVE from LPG tank rupture;
- Uncontained pool fire from Fuel Oil tank rupture and overtop.

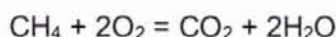
#### 6.1 Natural Gas Vapour Cloud Explosion at Turbine Enclosure

In the event of ignition of a flammable cloud of vapour following a leak of natural gas within the gas turbine enclosure, there is the potential for a vapour cloud explosion to occur with damaging levels of peak overpressure.

##### 6.1.1 VCE Model Inputs

TNO Effects Version 11.3.0 was used to model a VCE in one of the turbine enclosures.

It is assumed that an accidental release of natural gas occurs in the turbine enclosure of the Phase 1 turbine hall. In order for a vapour cloud explosion to occur, the concentration of natural gas must lie between the lower and upper flammable limits. It is assumed that concentration within the turbine enclosure is a stoichiometric mixture of air and flammable gas. The complete combustion equation for methane is:



The volume of the turbine enclosure was estimated as 944 m<sup>3</sup>. The (mass) fraction of methane within this volume was calculated as 0.056 and the total flammable mass was calculated as 63.73kg.

The VCE model inputs are detailed in Table 12:

Parameter	Units	Value	Source
Chemical name		methane	-
Temperature	°C	5	Huntstown
Volume of turbine hall	m <sup>3</sup>	944	Huntstown documents
Flammable mass	kg	63.73	Mass of methane assuming stoichiometric mixture of air and flammable vapour
Fraction of flammable cloud confined	-	1	Confined VCE within turbine enclosure
Curve number	-	7	Strong deflagration – assume high ignition energy, high obstruction and confined conditions
Wind direction	deg	240	Prevailing wind direction at nearest synoptic met station

**a** *le 12* Natural Gas VCE in Phase 1 Turbine Enclosure: Model Inputs

### 6.1.2 VCE Model Outputs

The model outputs are detailed in Table 13.

Parameter	Units	Value
Confined mass in explosive range	kg	63.73
Total combustion energy	MJ	3188.5
Maximum peak overpressure	bar	1.04

**a** *le 13* Natural Gas VCE Phase 1 Turbine Enclosure: Model Outputs

The following figures illustrate the overpressure effects following a Natural Gas VCE at the Phase 1 Turbine Enclosure

- Figure 5 Natural Gas VCE in Phase 1 Turbine Enclosure: Overpressure vs Distance
- Figure 6 Natural Gas VCE in Phase 1 Turbine Enclosure: Probability of Fatality vs Distance

Mortality results are presented for receptors outdoors and indoors in the following types of structures:

- Category 2 structures, typical office block – representative of occupied buildings on site
- Category 3 structures, residential dwellings

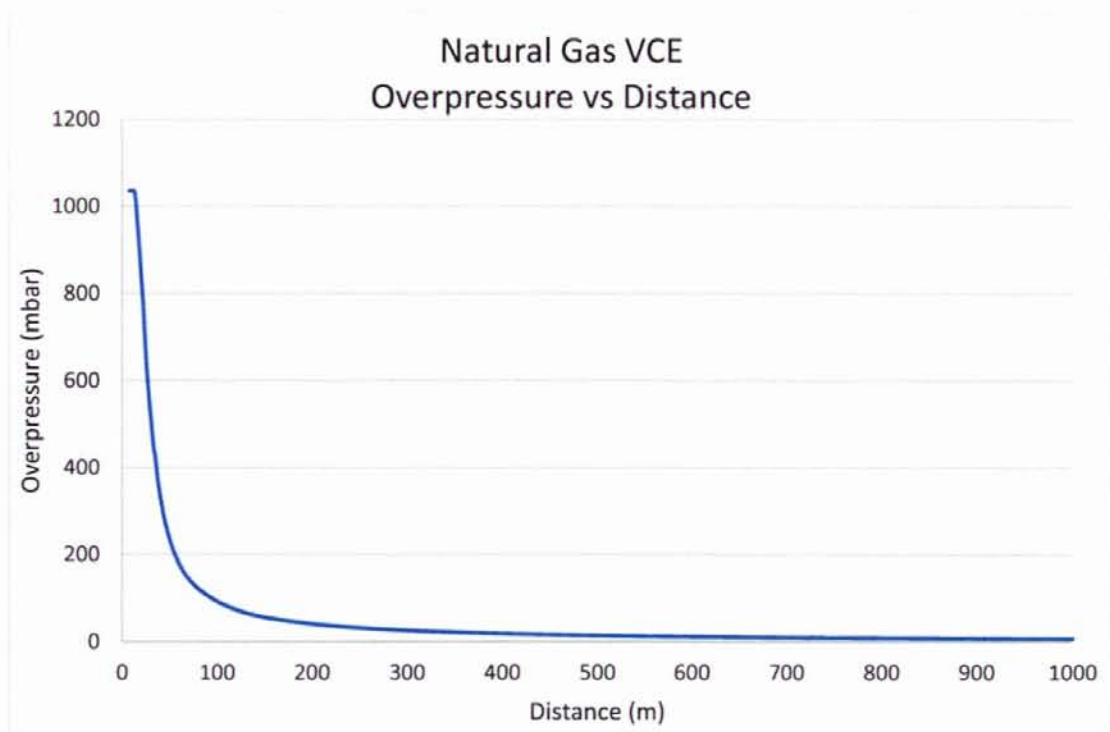


Figure 5 Natural Gas VCE in Phase 1 Turbine Enclosure: Overpressure vs Distance

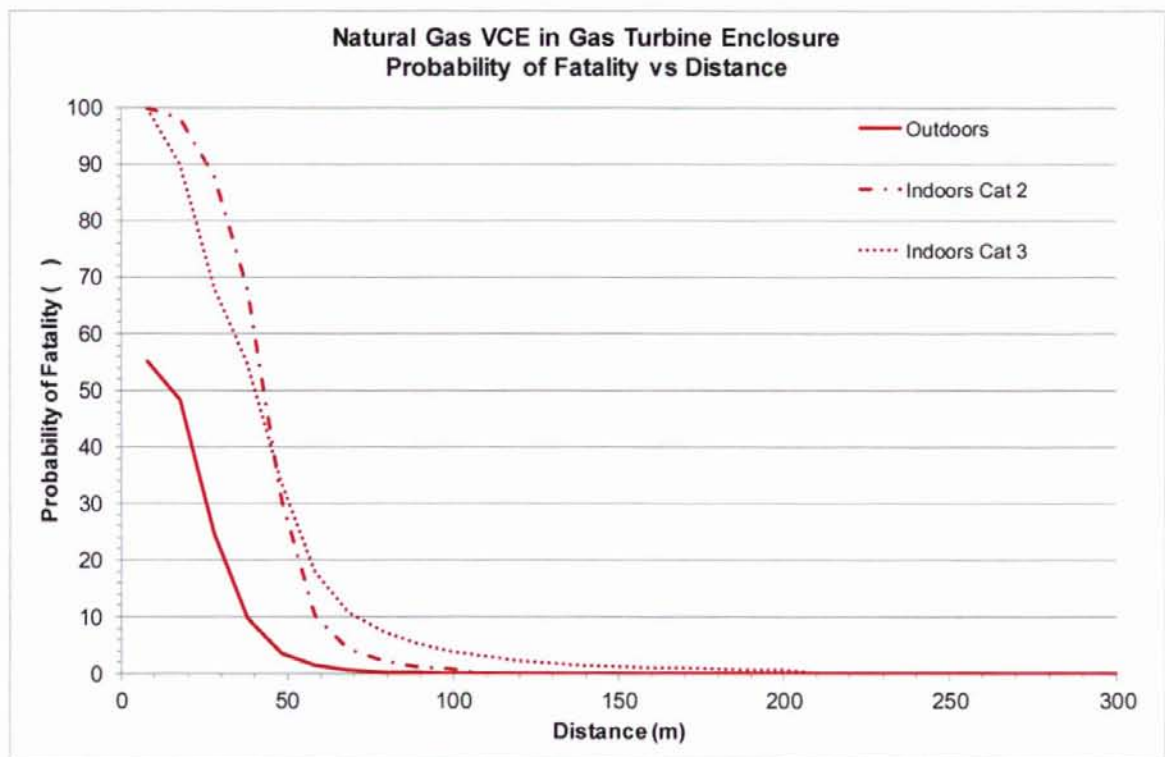


Figure 6 Natural Gas VCE in Phase 1 Turbine Enclosure: Probability of Fatality vs Distance

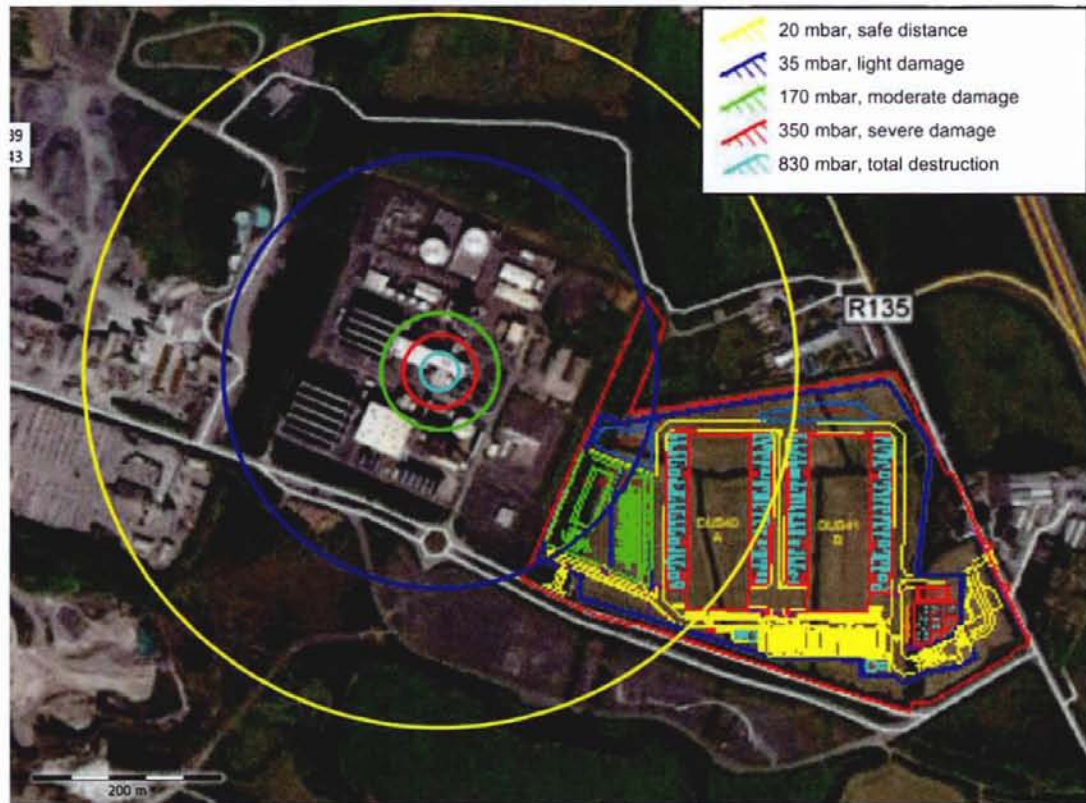


Figure Natural Gas VCE in Turbine Enclosure: Blast Damage Contours

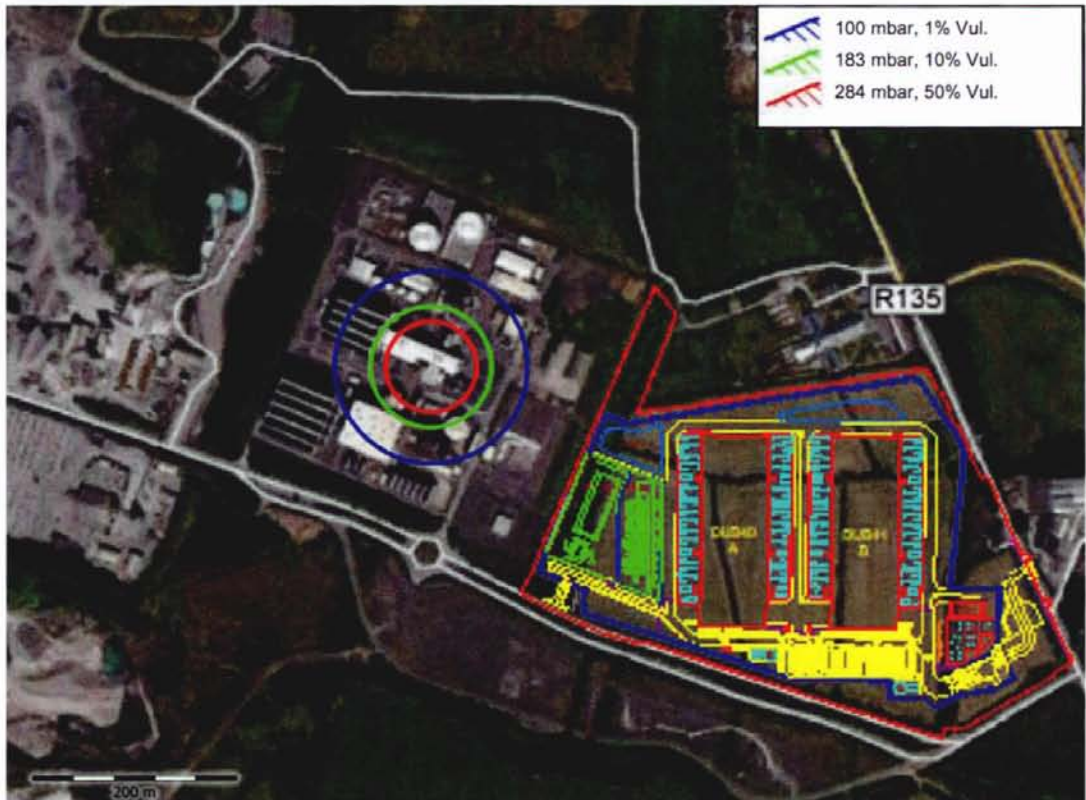
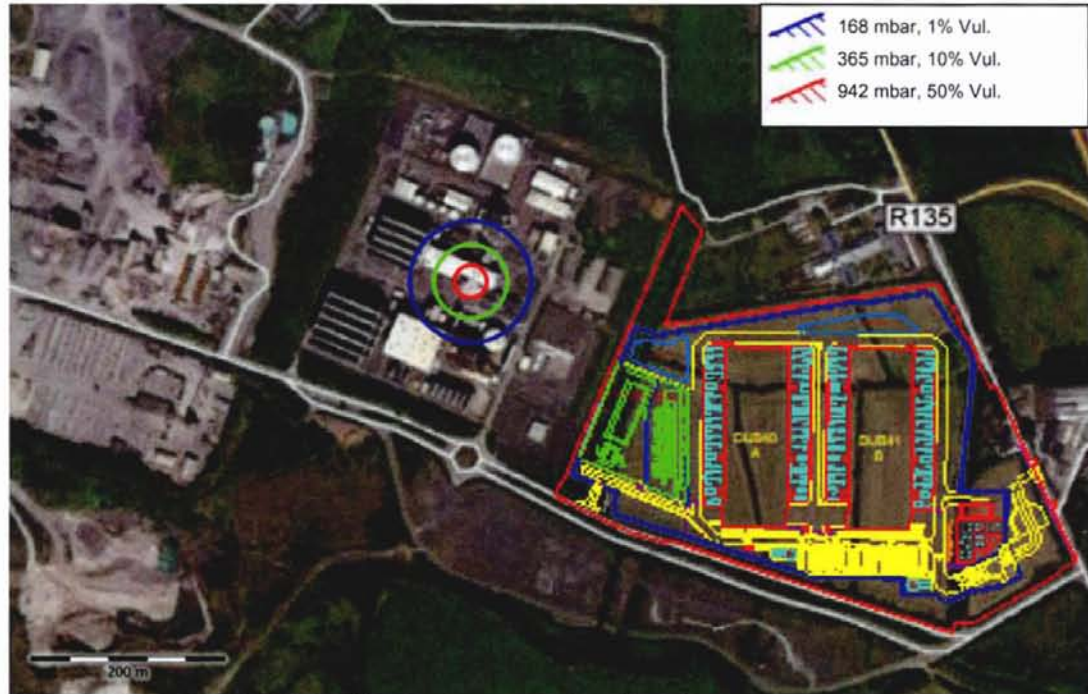


Figure Natural Gas VCE in Phase 1 Turbine Enclosure: Indoor Mortality Contours, Category 2 Buildings



**Figure** Natural Gas VCE in Turbine Enclosure: Outdoor Mortality Contours

In the event of a VCE in the Phase 1 Turbine Enclosure the following is concluded:

- Overpressure levels corresponding to safe and light damage extends to the proposed development;
- Overpressure levels corresponding to 1% mortality outdoors do not extend to the proposed development;
- Overpressure levels corresponding to 1% mortality indoors (Cat. 2) do not extend to the proposed development.

It is concluded that a VCE in the Phase 1 Turbine Enclosure is not expected to result in equipment damage or fatalities at the proposed development.

### 6.1.3 VCE Frequency

The HSA specifies a likelihood of 1E-04 per year when assessing Vapour Cloud Explosion scenarios in processing areas, for land use planning purposes.

## 6.2 Natural Gas Jet Fire

Information on the GNI high pressure natural gas pipeline that supplies natural gas to Huntstown Power Station was obtained from GNI as follows:

- 300 mm diameter;
- 70 bar design pressure;
- Approximately 1.91 km from Kilshane AGI to Huntstown AGI

The "Wilson Model" (TNO Yellow Book, 2005) models discharge from a long pipeline. The initial release rate mainly depends on the pipe diameter (full bore rupture scenario) or hole size, the friction of the flow inside the pipeline depending on the wall roughness and the initial pressure inside the pipeline. Because of the release, the pressure inside the pipeline will drop in the region of the leak at first. The pressure drop 'travels' along the length of the pipeline, with a velocity equal to the sound velocity. This causes the gas

release to become non-stationary until the pressure drop reaches the end of the pipeline. The ongoing release can be assumed to be stationary and continuous until the pipeline is empty.

### 6.2.1 Discharge Model Inputs

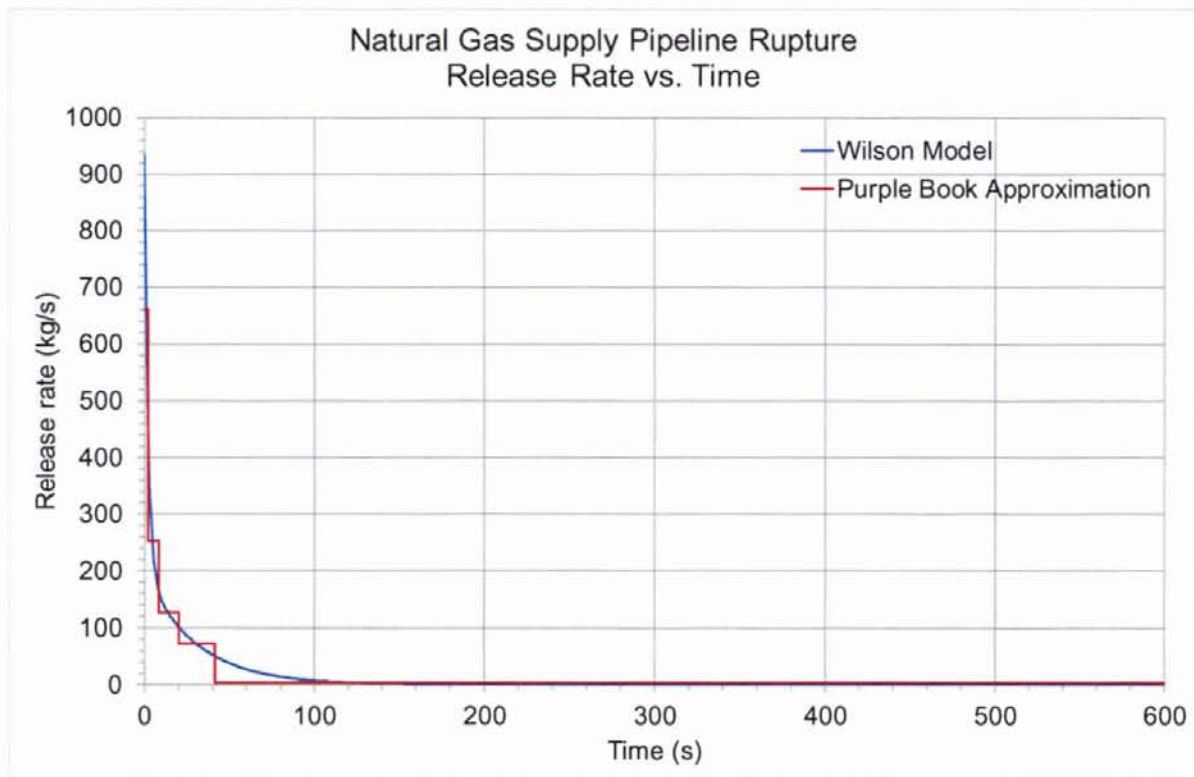
The long pipeline model inputs are detailed in Table 14.

Parameter	Units	Value	Source
Chemical name		Methane	-
Initial temperature	°C	10	Assume average ambient temperature
Initial (absolute) pressure in pipeline	bar	70	Huntstown
Pipeline diameter	mm	300	GNI Drawings
Pipeline length	km	1.91	Estimated length from Kilshane AGI to Huntstown AGI (GNI drawings and google earth)
Hole type		Guillotine fracture	Assume pipeline rupture

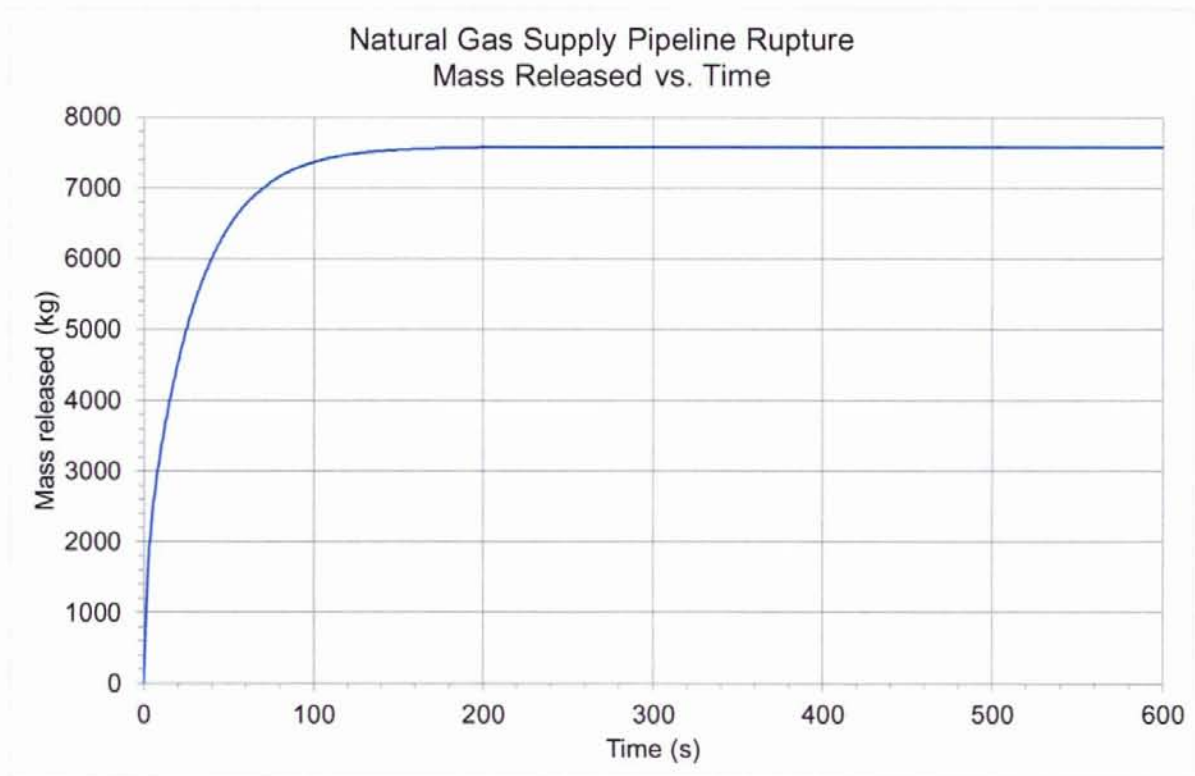
**Table 14** High Pressure Natural Gas Supply Pipeline Rupture: Discharge Model Inputs

### 6.2.2 Discharge Model Outputs

The long pipeline model calculates the drop off in release rate with time, and also the "Purple Book" representative release rate over time in 5 steps, as illustrated on Figure 10.



**Figure 1** High Pressure Natural Gas Supply Pipeline Rupture: Release Rate vs. Time



**Figure 11** High Pressure Natural Gas Supply Pipeline Rupture: Mass Released vs. Time

The long pipeline model outputs are as follows:

Pipeline volume	135 m <sup>3</sup>
Initial mass in the pipe	7,539.3 kg
Average mass flow rate	12.6 kg/s
Maximum mass flow rate	935 kg/s

Effects approximates the time-varying source term into five discrete time segments with constant outflow conditions by dividing the total mass released evenly over these five time segments – the Purple Book Approximation on the Release rate vs. Time chart above.

The following release rates are calculated for the five discrete time segments:

Segment	Time period	Release rate
1	0 – 2.29 s	660.77 kg/s
2	2.29 – 8.32s	251.51 kg/s
3	8.32 – 20.34 s	126.21 kg/s
4	20.34 – 42.26 s	72.5 kg/s
5	42.26 – 600 s	2.77 kg/s

TNO recommends that the following rules can be followed:



- For flammable substances, the outflow conditions are equal to the conditions of the first (highest) segment, having approximated the time-varying release with five time segments.

As natural gas is extremely flammable, the outflow conditions that input to the jet fire and flash fire models are equivalent to the first segment. Therefore, the mass flow rate that is input to the jet fire or flash fire models is taken as 660.77 kg/s.

### 6.2.3 Jet Fire Model Inputs

The inputs for the Jet Fire model are detailed in Table 15

Parameter	Units	Value	Source
Chemical name		Methane	-
Mass flow rate	kg/s	660.77	Long pipeline model output
Exit temperature	°C	10	Assume average ambient
Exit pressure	bar	70	Pipeline design pressure
Hole diameter	mm	300	Pipe rupture scenario
Outflow angle	deg	0	Assume horizontal release (worst case scenario)
Release height	m	1	Assumption
Ambient temperature	°C	10	Dublin Airport 1989 – 2018 averages, www.met.ie
Wind speed	m/s	2, 5, 10	HSA recommended wind speed for fire models
Receptor height	m	1.5	Assumed

a **Table 15** Natural Gas Jet Fire at GNI AGI: Model Inputs

### 6.2.4 Jet Fire Model Outputs

The Jet Fire model outputs are detailed Table 16.

Parameter	Units	2 m/s	5 m/s	10 m/s
Type of flow of met	-	Choked	Choked	Choked
Exit velocity of expanding jet	m/s	886	886	886
Angle between hold and flame axis (alpha)	deg	0	0	0
Frustum lift off height	m	64.505	51.792	42.781
Width of frustum base	m	13.041	1.8758	0.71537
Width of frustum tip	m	84.747	70.25	60.368
Length of frustum (flame)	m	258.02	207.17	171.13
Surface area of frustum	m <sup>2</sup>	45788	27667	19529
Surface emissive power	kW/m <sup>2</sup>	88.086	145.78	206.52

a **Table 16** Natural Gas Jet Fire at GNI AGI: Model Outputs

The jet fire frustum shape, and thermal radiation and probability of fatality with distance are illustrated on the following figures.

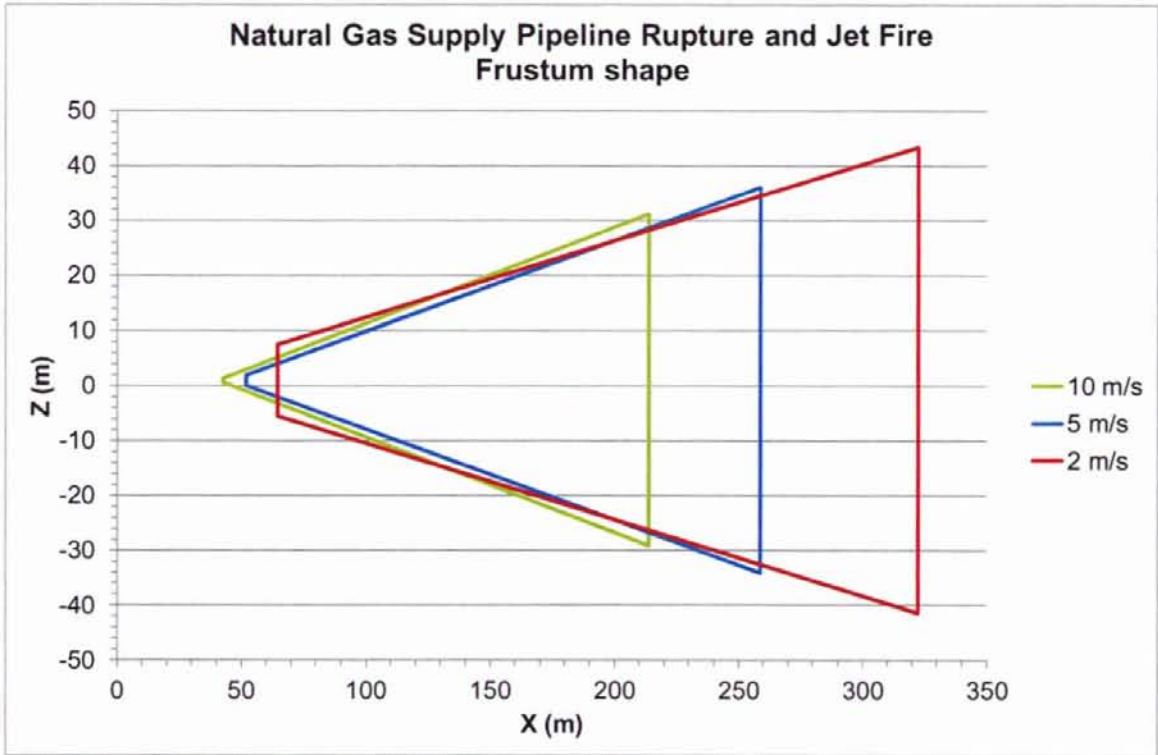


Figure 12 Natural Gas Jet Fire at GNI AGI: Frustum Shape

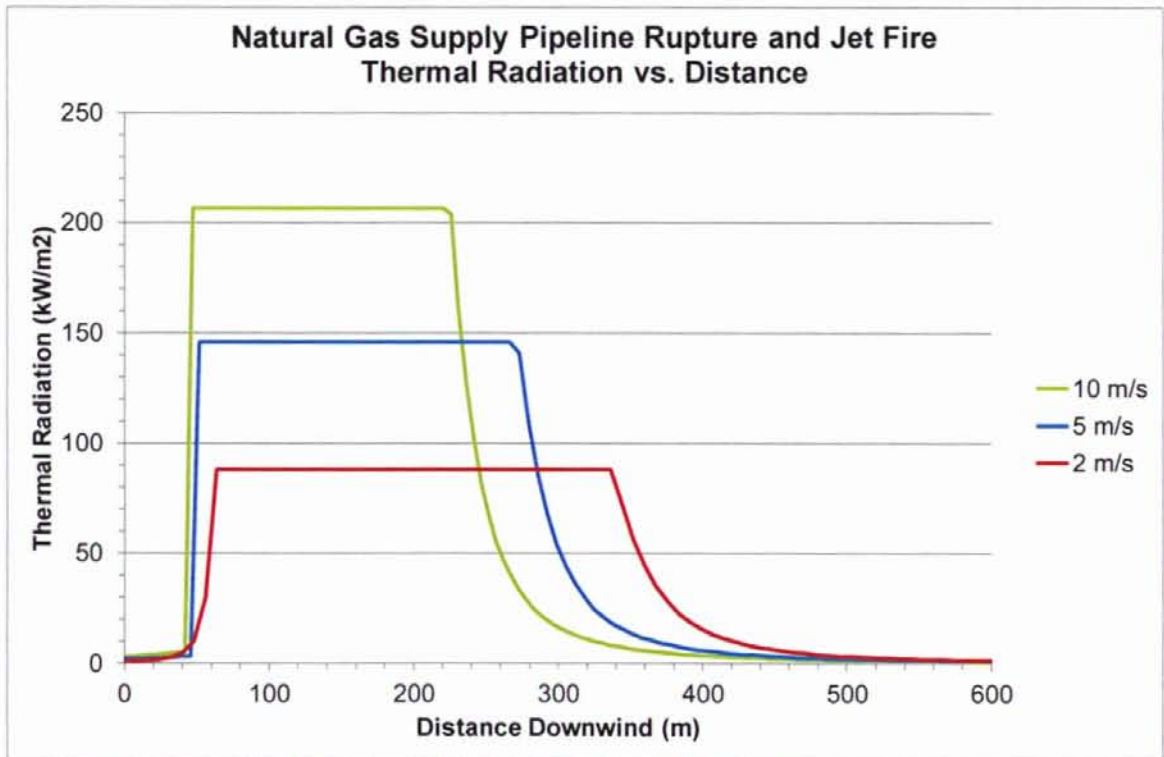


Figure 13 Natural Gas Jet Fire at GNI AGI: Thermal Radiation vs. Distance

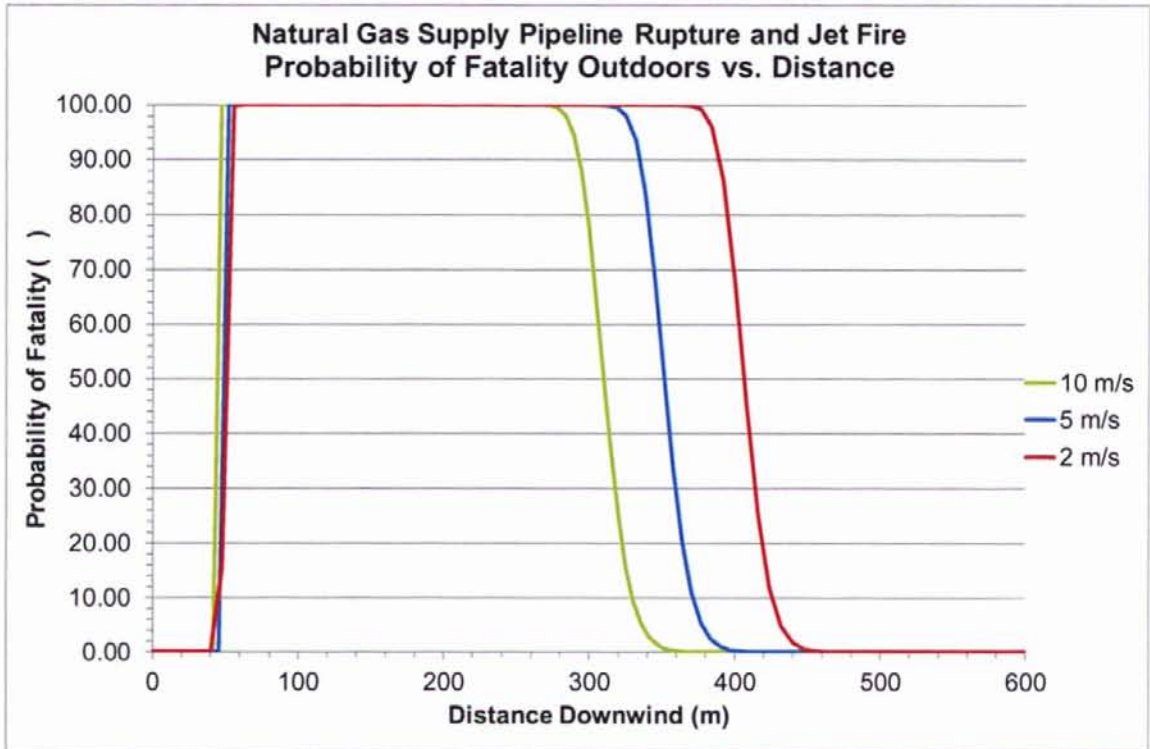


Figure 14 Natural Gas Jet Fire at GNI AGI: Probability of Fatality Outdoors vs. Distance

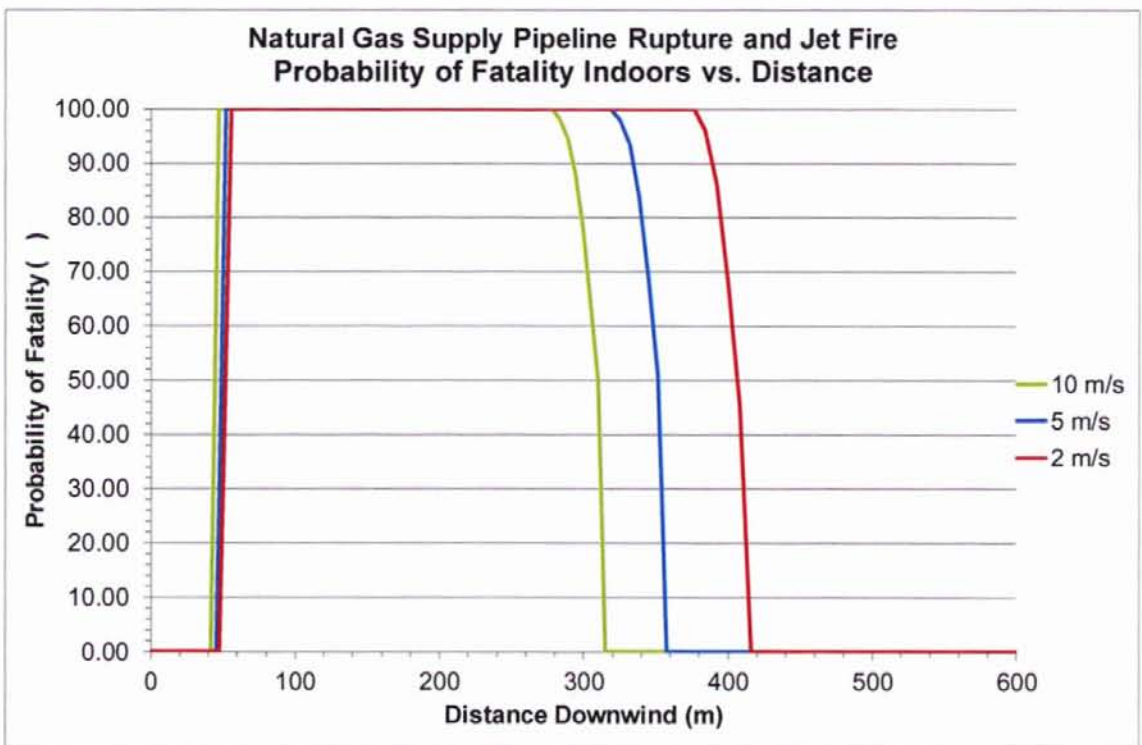


Figure 15 Natural Gas Jet Fire at GNI AGI: Probability of Fatality Indoors vs. Distance

Table 17 details distances to specified thermal radiation levels associated with

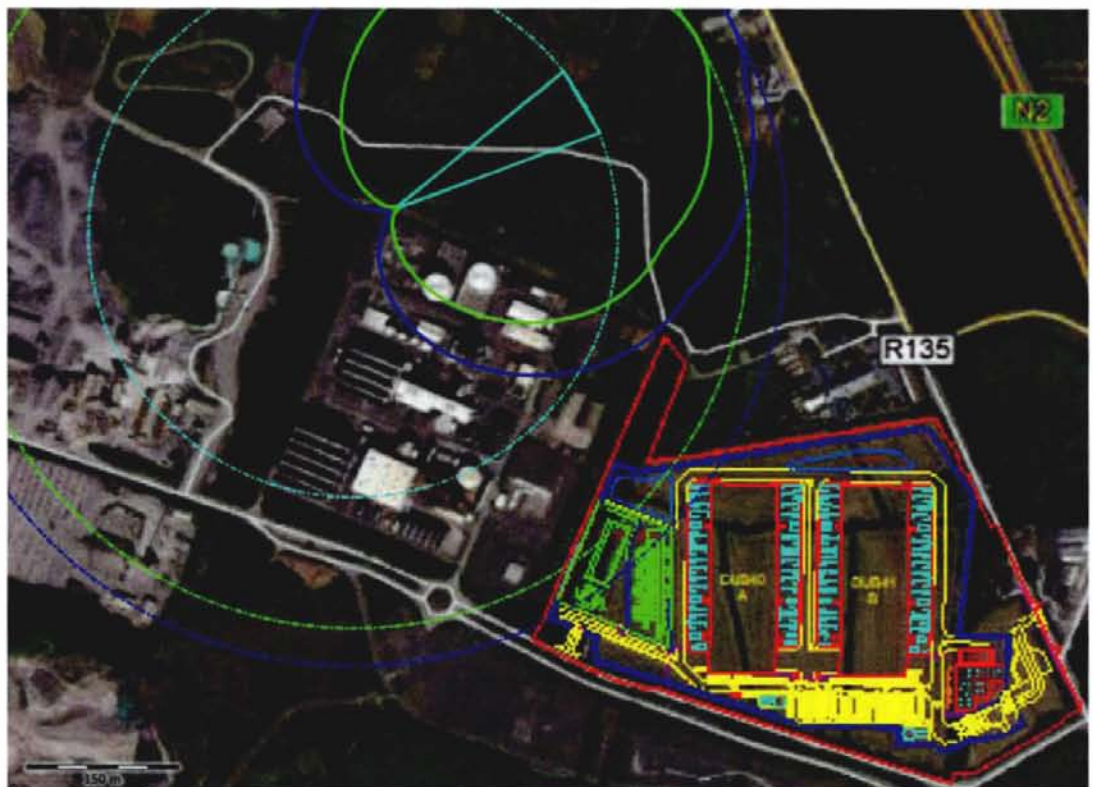
- the threshold of mortality
- 1%, 10% and 50% mortality outdoors
- 0% mortality and 100% mortality indoors
- damage to process equipment

Consequence	Thermal radiation level (kW/m <sup>2</sup> )	Distance (m)		
		2 m/s	5 m/s	10 m/s
Threshold of fatality	4.1	479	428	387
1% mortality outdoors	6.8	444	390	349
0% mortality indoors	12.7	409	354	313
100% mortality indoors	25.6	379	324	282
Equipment damage	37.5	365	310	269

**a le 1** Natural Gas Jet Fire at GNI AGI: Calculated Distances at Specified Thermal Radiation Levels

Thermal radiation contours and effect areas are presented on the following figures (for the worst case wind speed scenario):

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- Figure 17 at ral as et ire at ndoor Mortality Contours i ment ama e onto rs

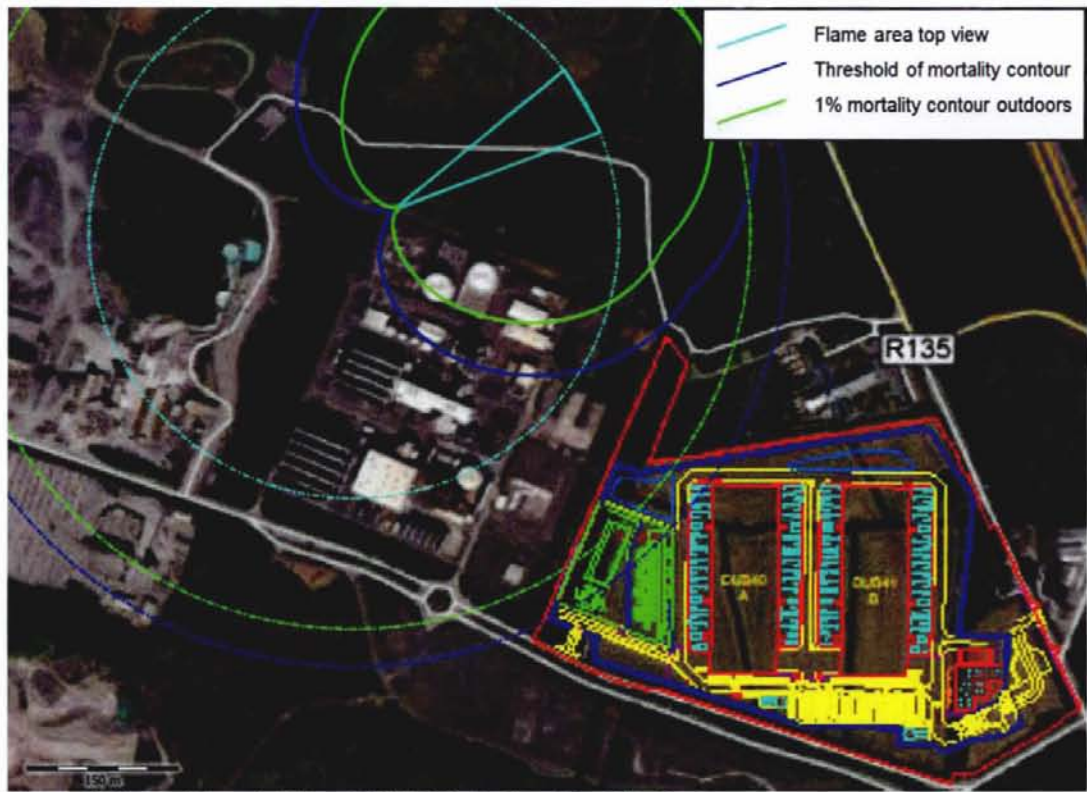


Figure 16 Natural Gas Jet Fire at GNI AGI: Outdoor Mortality Contours

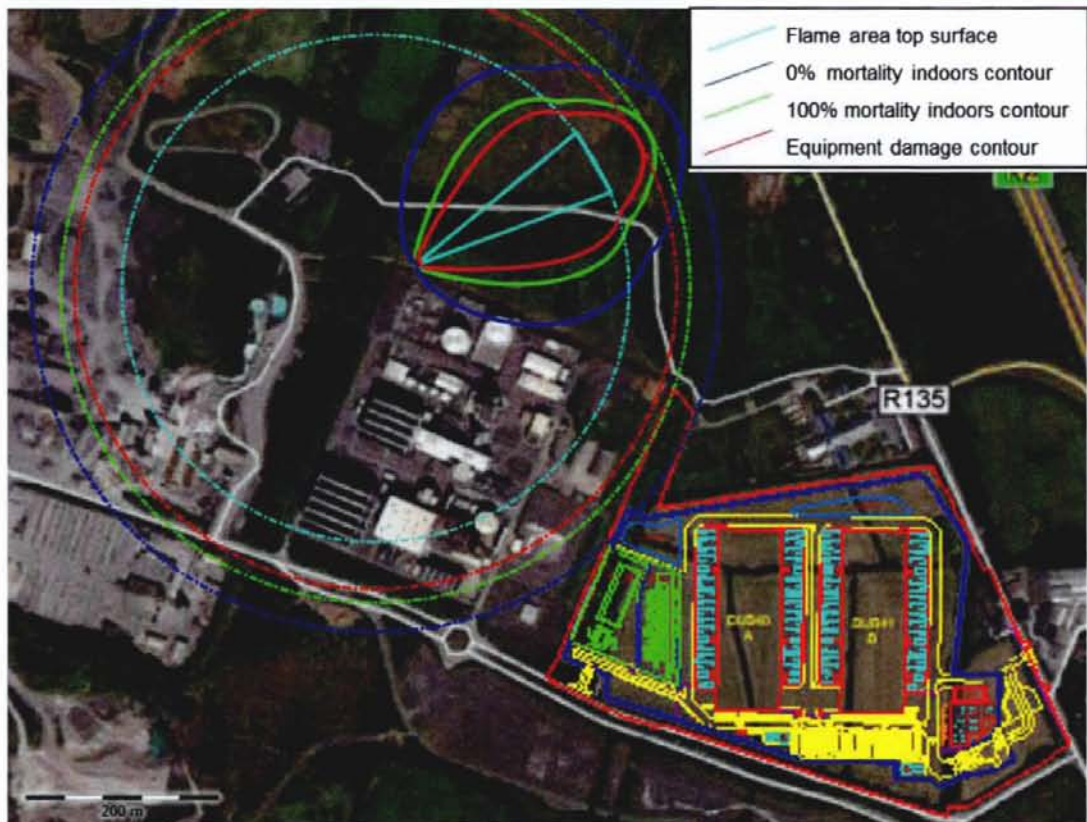


Figure 1 Natural Gas Jet Fire at GNI AGI: Indoor Mortality and Equipment Damage Contours

In the event of a natural gas jet fire following rupture of the natural gas supply line at the GNI AGI, the following is concluded:

- The jet flame measures up to 258 m in length (depending on wind speed)
- The thermal radiation level corresponding to 1% mortality outdoors extends to the proposed development; therefore, there is a possibility of fatality to persons outdoors in the event of a jet fire.
- The thermal radiation level corresponding to 1% mortality indoors extends to the north west corner of the DUB40A building. There is a possibility of fatality to persons indoors at DUB40A in the event of a jet fire.
- The thermal radiation level corresponding to equipment damage extends to the boundary of the proposed data halls but does not extend to any areas with equipment.
- GNI will be responsible for the installation, operation, and maintenance of all equipment within the AGI gas compound. All operations within the AGI will comply with standard GNI operational procedures and risk assessments and will be carried out by approved GNI contractors.

In relation to impacts from a jet fire following rupture of the natural gas supply pipeline at the GNI AGI, it is noted that the thermal radiation impacts that are predicted are conservative as they are based on a mass flow rate of 661 kg/s, as recommended by TNO and as explained above. It is noted that after approximately 9 s the release rate will reduce to 126 kg/s and after 44 s it will reduce to less than 3 kg/s and will continue to reduce until all of the natural gas has been released from the pipeline (approximately 600 s or 10 minutes). Therefore, the estimated consequences are conservative.

#### 6.2.5 Jet Fire Frequency

The HSA Land Use Planning Guidance document does not provide a value for the failure rate of a natural gas pipeline; however, reference is made to the Purple Book (CPD, 2005) which gives a failure rate of  $3E-07/yr/m$  for a full-bore rupture from a pipeline with a diameter between 75 mm and 150 mm. The length of pipeline above ground at the AGI is 150 m. A probability of ignition of 0.09 is assigned based on the Purple Book approximation for a continuous release ( $>150$  kg/s) of a low reactive gas (methane).

Therefore, a likelihood of  $4.05E-06/year$  was used in this study.

### 6.3 **Fuel Oil Tank Rupture and Pool Fire**

Ignition of an accidental release resulting in a pool fire has been modelled using TNO Effects version 11.3.0 modelling software. The HSA COMAH LUP Guidelines (HSA, 2010) identify a bunded pool fire and an uncontained pool fire following bund overtop to be the major accident hazards associated with fuel storage.

#### 6.3.1 Bunded Pool Fire

The tank and bund properties for the Phase 1 and Phase 2 tanks are detailed in Table 18.

Parameter	Units	Value	
		Phase 1	Phase 2
Volume of liquid in tank	m <sup>3</sup>	7200	7200
Radius of vertical tank	m	14	14
Height of liquid in tank	m	11.69	11.69
Bund width	m	34	32.6
Bund length	m	62.6	62.6
Bund height	m	5.9	5.9

Parameter	Units	Value	
		Phase 1	Phase 2
Bund surface area	m <sup>2</sup>	2128.4	2040.8
Bund volume	m <sup>3</sup>	12557.6	12040.5
Available Bund Surface Area	m <sup>2</sup>	1512.6	1425.1

Table 18 Bund surface area and volume

It can be seen in Table 18 that the Phase 1 bund has a larger surface area. This will be modelled as a worst-case scenario for a bunded pool fire following fuel tank rupture.

#### Model inputs

Pool fire model inputs are detailed in Table 19.

Parameter	Units	Value	Source
Chemical name		Fuel Oil Sample	Recommended by TNO for modelling of marked fuel oil
Area of pool	m <sup>2</sup>	1512.6	Calculated
Maximum heat exposure duration	s	75	HSA LUP guidance (HSA,2010)
Surface Emissive Power	kW/m <sup>2</sup>	52	HSA LUP guidance (HSA,2010)
Temperature of pool	°C	10	Atmospheric Temperature
Wind speed	m/s	5	HSA LUP guidance (HSA,2010)
Ambient temperature	°C	10	30 year average at nearest synoptic meteorological station (Dublin Airport)
Wind direction	deg	240	Prevailing wind direction at nearest synoptic met station

Table 19 Fuel Oil Pool Fire Model Inputs

#### Model results

The thermal radiation vs distance for a bunded pool fire is illustrated on Figure 18.

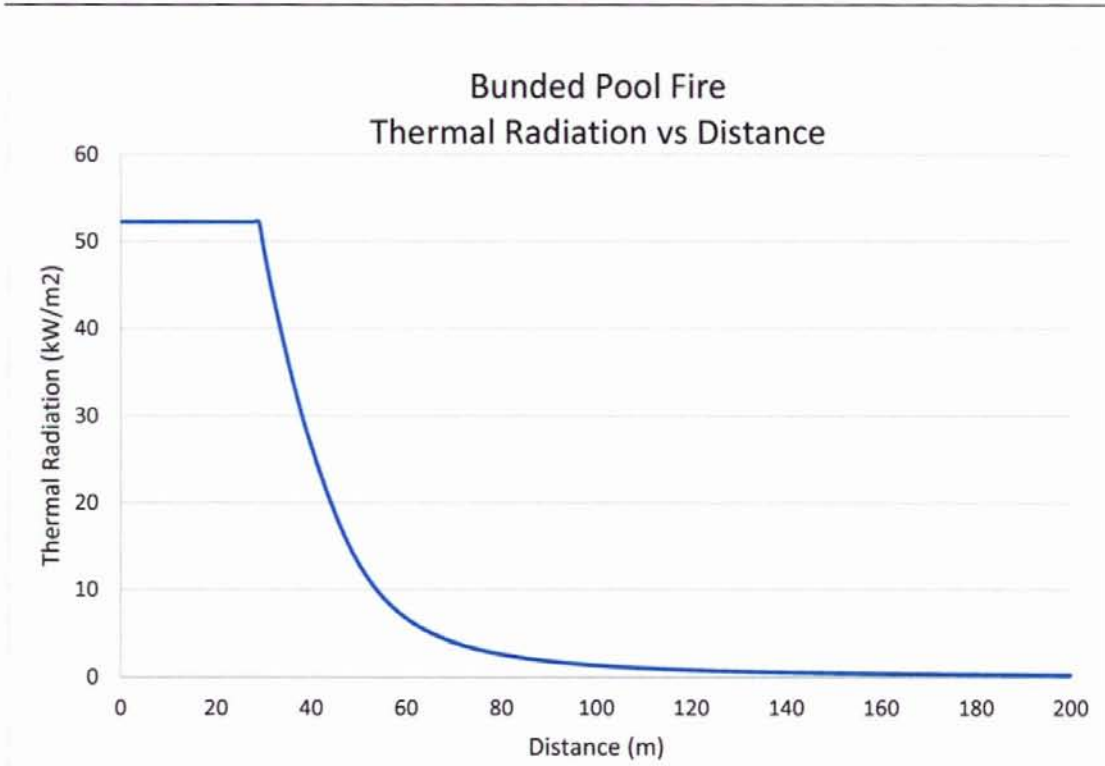


Figure 1 Bunded Pool Fire Thermal Radiation vs Distance

The thermal radiation contours corresponding to the threshold of fatality (4.1 kW/m<sup>2</sup>) are illustrated in Figure 19.



Figure 1 Bunded Pool Fire Thermal Radiation vs Distance

It is concluded that the thermal radiation contour corresponding to the threshold of fatality (4.1 kW/m<sup>2</sup>) does not extend to the proposed development.

It is concluded, that a bunded pool fire at the Phase 1 fuel storage tank is not expected to result in any thermal consequences at the proposed data halls.



### 6.3.2 Uncontained Pool Fire

#### Model Inputs

The area of the pool is calculated using the equation set out in Risk-based Land Use Planning (HSA, 2010):

$$R = 6.85V^{0.44537}$$

The tank has a volume of 7200m<sup>3</sup>, therefore, will have the maximum pool diameter as calculated by the equation above (see Section 5.3). The surface area of the pool is 7854 m<sup>2</sup>. The pool fire is centred 50m to the south-east of the bund, in the direction of the proposed halls. This is a representative worst-case scenario.

The pool fire scenario is modelled at a wind speed of 5 m/s as per the HSA's land use planning policy and approach document (HSA, 2010).

The model inputs for the uncontained pool fire are detailed in Table 20.

Parameter	Units	Value	Source
Chemical name		Fuel Oil Sample	Recommended by TNO for modelling of marked fuel oil
Area of pool	m <sup>2</sup>	7854	Calculated
Maximum heat exposure duration	s	75	HSA LUP guidance (HSA,2010)
Surface Emissive Power	kW/m <sup>2</sup>	52	HSA LUP guidance (HSA,2010)
Temperature of pool	°C	10	Atmospheric Temperature
Wind speed	m/s	5	HSA LUP guidance (HSA,2010)
Ambient temperature	°C	10	30 year average at nearest synoptic meteorological station (Dublin Airport)
Wind direction	deg	240	Prevailing wind direction at nearest synoptic met station

Table 20 Model Inputs for Uncontained Pool Fire

#### Model Outputs

The uncontained pool fire model outputs are detailed in

Parameter	Windspeed 5m/s
Combustion rate (kg/s)	267
Duration of the pool fire (s)	11055
Flame tilt (deg)	46.1
Flame temperature (°C)	708.2
Length of the flame (m)	43.9

Table 21 Uncontained Pool Fire Model Outputs

The pool fire thermal radiation and probability of fatality with distance are illustrated on the following figures.

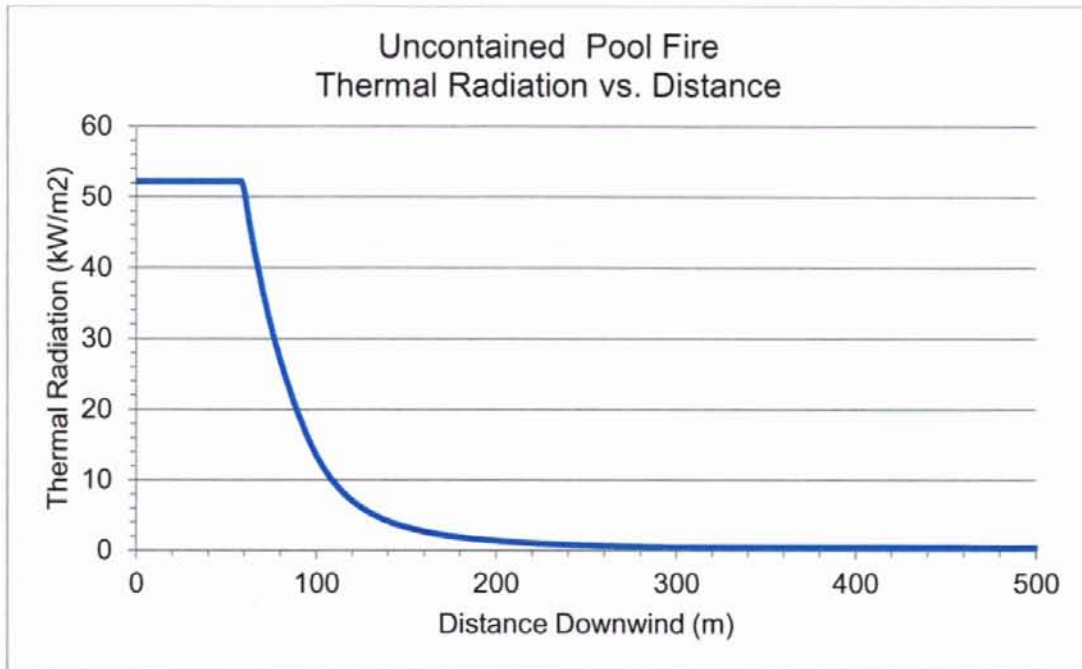


Figure 2 Thermal radiation vs distance for an uncontained pool fire

Table 22 details distances to specified thermal radiation levels associated with

- the threshold of mortality
- 1 % mortality outdoors
- 0% mortality and 100% mortality indoors
- damage to process equipment

Criterion	Thermal Radiation Level	Distance to specified levels
	kW/m <sup>2</sup>	m
Threshold of Fatality	4.1	138
1% Mortality Outdoors	6.8	121
Building protected below this level, 0% fatality probability	12.7	102
Building will catch fire quickly, 100% fatality probability	25.6	82
Damage to process equipment	37.5	69

Table 22 Distances to specified thermal radiation levels for an uncontained pool fire

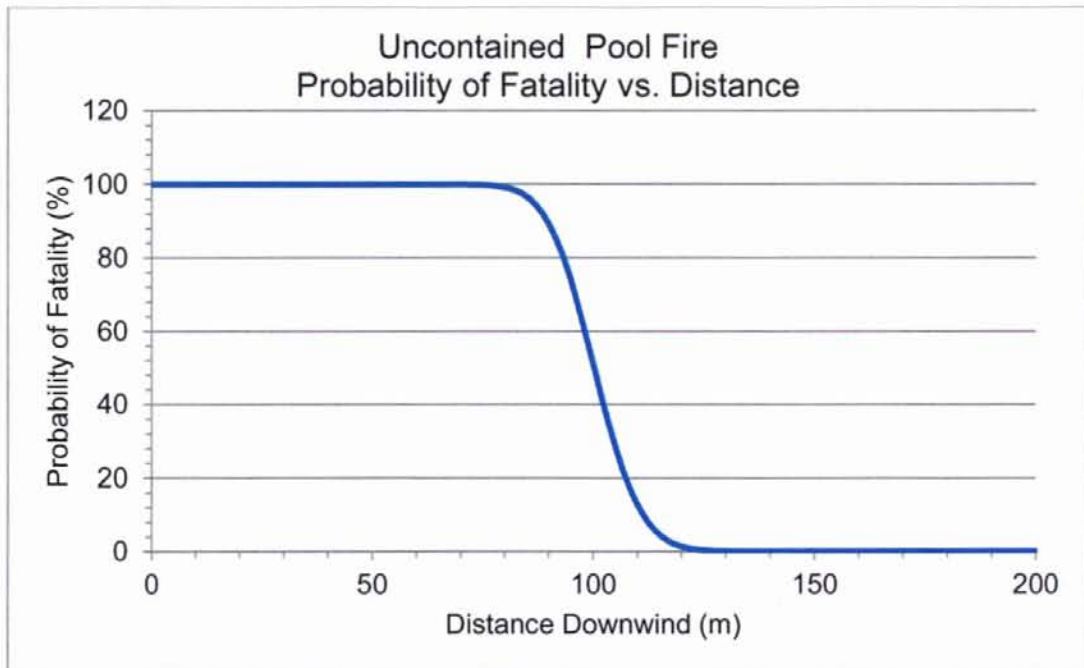


Figure 21 Uncontained Pool Fire Probability of Fatality vs. Distance

Thermal radiation contours and effect areas corresponding to the threshold of fatality ( $4.1 \text{ kW/m}^2$ ), 1% fatality ( $6.8 \text{ kW/m}^2$ ) and person protected indoors ( $12.7 \text{ kW/m}^2$ ) for an uncontained fuel oil pool fire are illustrated on Figure 22.

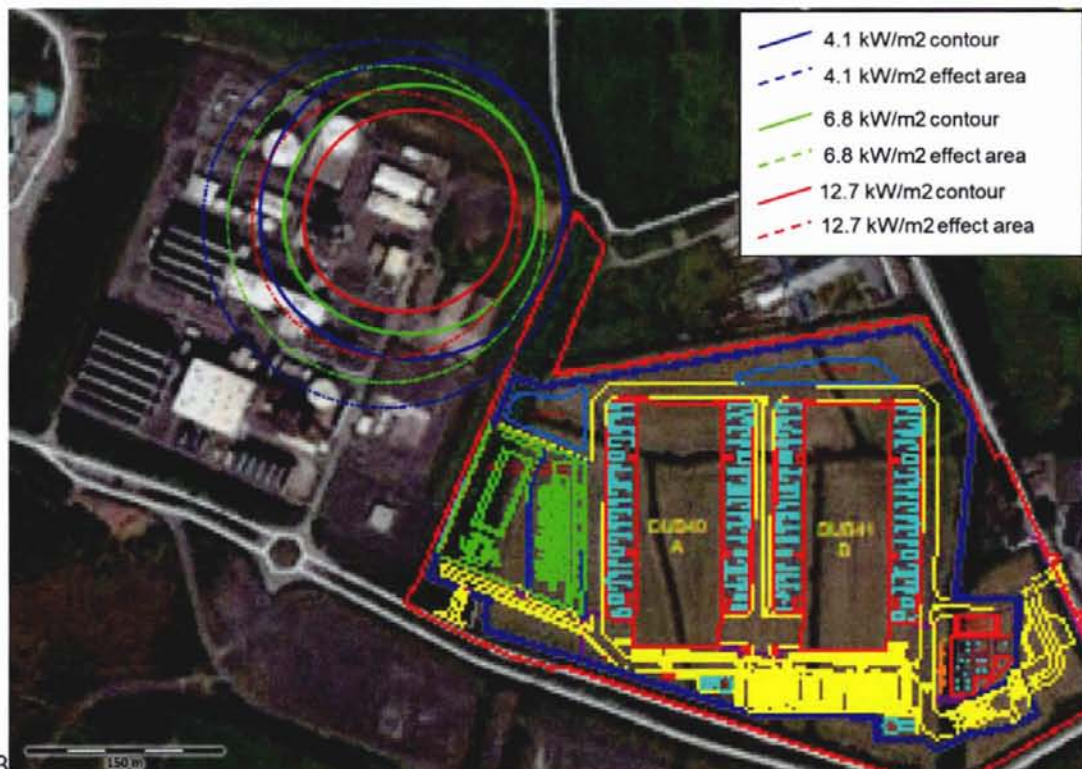


Figure 22 Uncontained Pool Fire Thermal Radiation Contours

In the event of a tank rupture resulting in a Fuel Oil uncontained pool fire, the following is concluded:

- The thermal radiation contour corresponding to the threshold of fatality does not

- extend to the proposed development.
- The thermal radiation contour corresponding to persons protected indoors does not extend to the proposed development.

It is concluded that an uncontained pool fire at the Phase 1 fuel storage tank is not expected to result in any thermal consequences at the proposed data halls.

### 6.3.3 Pool Fire Frequency

The HSA Land Use Planning Guidance document states that a pool fire which covers the entire surface of the bund has a frequency of 1E-03/year.

The HSA Land Use Planning Guidance document states for larger installations an event frequency of 10E-04/(100π) per metre/year along a locus 50 m from the vessel storage area). The fuel oil tank storage area is 259 m<sup>2</sup>, this gives a frequency of 8.23E-05/year. Therefore, as a conservative approach, a frequency of 1E-04/year is used in this study.

## 6.4 **LPG Fireball and BLEVE**

The consequences and individual risk of fatality from a BLEVE and Fireball at the LPG tank are assessed in the following sections, as well as details of the protective measures that are in place on the LPG tank.

The LPG tank is used as an ignition gas supply for Unit 1 at Huntstown. The tank has the capacity to hold 5 m<sup>3</sup> of LPG however the maximum fill level is set to 60%.

### 6.4.1 Protective Measures

The following measures are in place to prevent an accidental release of LPG from the propane tank:

- LPG tank is located in outdoor well-ventilated compound that is secured, with fencing and restricted access;
- Housekeeping ensures that there is no combustible debris in the vicinity of tank;
- Tank maintenance and testing is routinely carried out by an external approved contractor. Non-destructive examination inspections are carried out every 8 years and statutory maintenance is carried out as per advice of Competent Person under Pressure Systems Regulations Act, this role for Huntstown is looked after by Inforisk.
- ATEX zones have been identified at the LPG tank and measures are in place to prevent ignition sources within the zones as follows:
  - Control of mobile or portable equipment in classified areas
  - Tanks are earthed
  - Delivery tankers are bonded to LPG tank during unloading
  - Competent driver present during bulk liquefied gas unloading
  - Warning Ex signage is displayed in classified areas
  - Hot work permit to be issued and fully implemented in accordance with local procedures
  - Access to LPG compound is restricted to authorised personnel only
- Pressure relief valves are located on LPG tank;
- Driver training, traffic management measures and speed limits are in place on site roads to minimise the likelihood of a vehicle accidentally impacting tank.

6.4.2 Model Inputs

The LPG BLEVE and fire ball model inputs are detailed in Table 23.

Parameter	Units	Value	Source
Chemical name	-	Propane	-
Tank capacity	m <sup>3</sup>	5	Huntstown
Maximum inventory	m <sup>3</sup>	3	Huntstown
Operating temperature	°C	55	Huntstown
Ambient temperature	°C	10	30-year average at nearest synoptic meteorological station (Dublin Airport)

Table 23: Model Inputs

6.4.3 BLEVE Blast Model Outputs

The overpressure vs distance for a BLEVE is illustrated on Figure 23.

The probability of fatality vs distance is illustrated on Figure 24.

Mortality results are presented for receptors outdoors and indoors in the following types of structures:

- Category 2 structures, typical office block – representative of occupied buildings at the proposed development
- Category 3 structures, residential dwellings

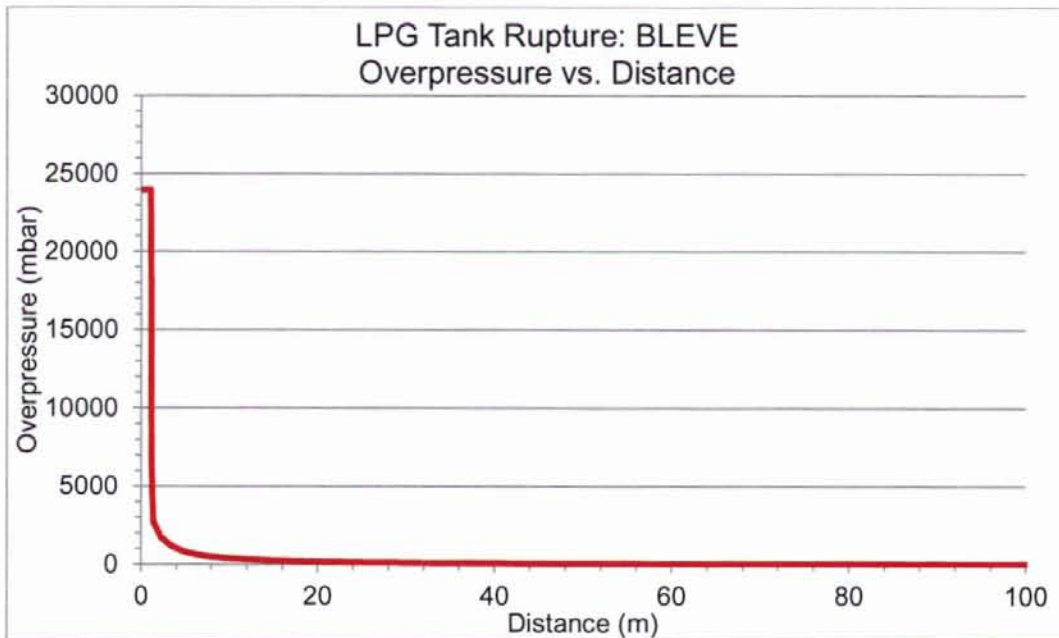


Figure 23: BLEVE Overpressure vs. Distance

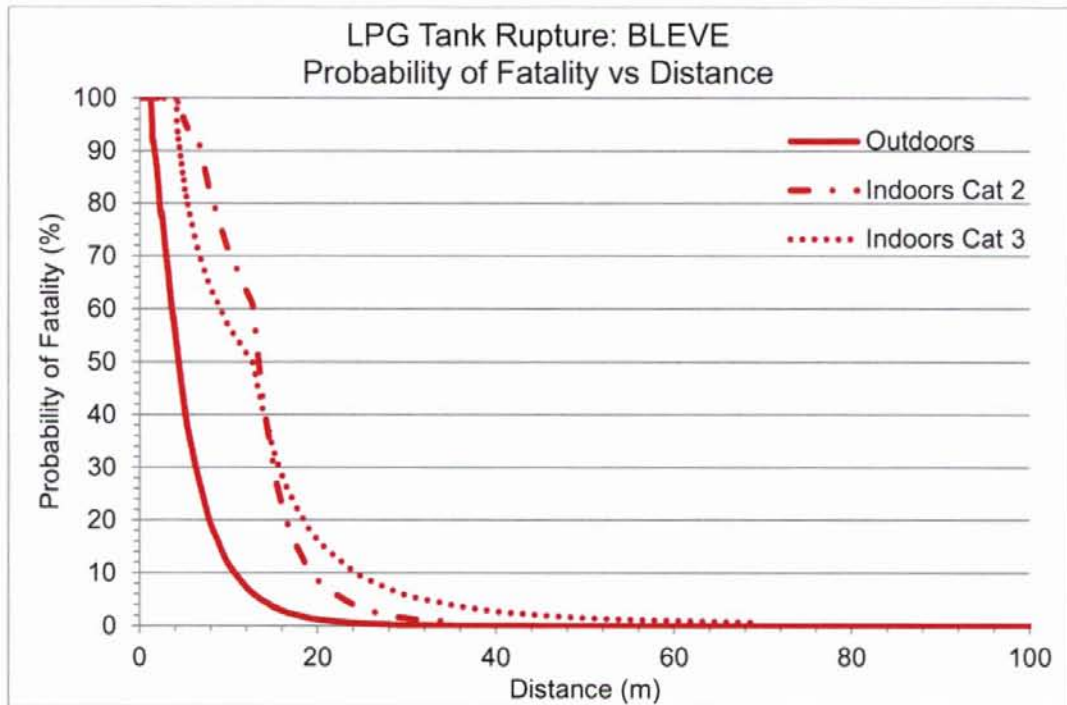


Figure 24 Probability of fatality vs distance

The following figures present overpressure contours:

- Figure 25 LPG BLEVE: Blast Damage Contours
- Figure 26 LPG BLEVE: Indoor Mortality Contours (Category 2)
- Figure 27 LPG BLEVE: Outdoor Mortality Contours

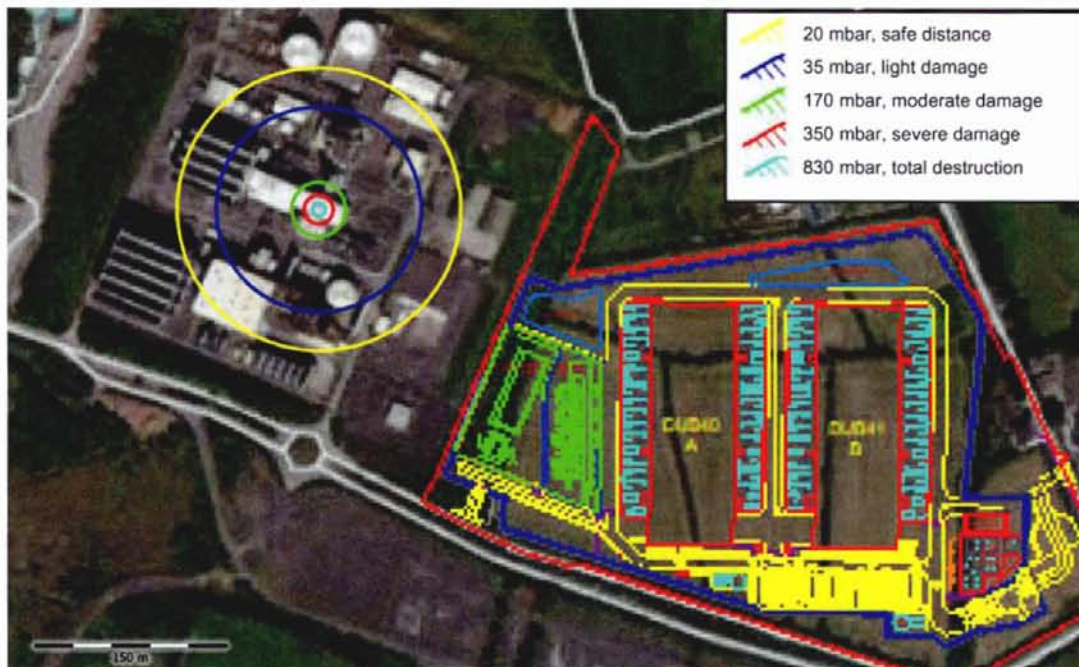


Figure 25 Blast damage contours

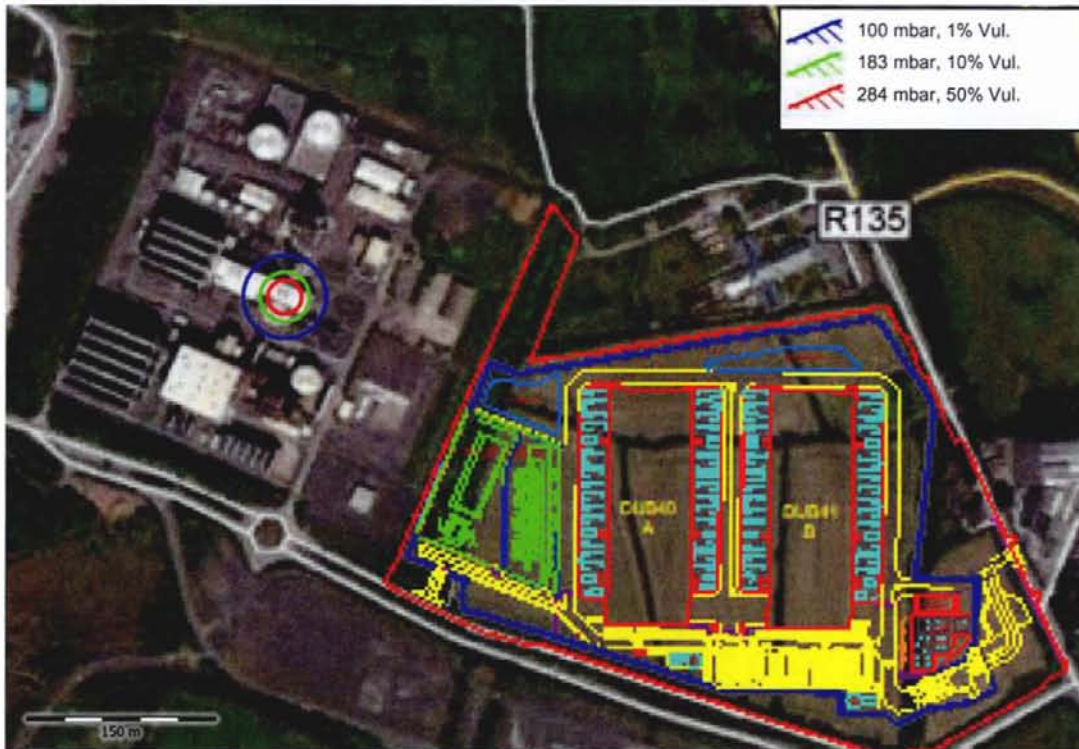


Figure 26 *ndoor ortalit onto rs ate or*



Figure 2 *tdoor ortalit onto rs*

In the event of a BLEVE following rupture of an LPG tank at Huntstown, the following is concluded:

- The overpressure contour corresponding to safe distance (20 mbar) extends to the boundary of the proposed development

It is concluded that there are no expected overpressure consequences at the proposed

development following a BLEVE at the LPG tank.

#### 6.4.4 Fireball Model Outputs

Fireball modelling results are summarised in below.

Parameter	Units	Value
Duration of the Fire Ball (s)	s	5.5
Max Diameter of the Fire Ball (m)	m	64.6
Max Height of the Fire Ball (m)	m	96.9
Surface emissive power (max) (kW/m <sup>2</sup> )	kW/m <sup>2</sup>	400

Figure 24 Fireball model outputs

It is concluded that the fireball duration is 5.5 s and the maximum fireball diameter is 64.6 m (radius 32.3 m). The fireball diameter and thermal radiation contours corresponding to the threshold of fatality (4.1 kW/m<sup>2</sup>) and 1% fatality (6.8 kW/m<sup>2</sup>) is illustrated as follows:



Figure 2 Fireball model outputs and thermal radiation contours

The thermal radiation levels corresponding to indoor mortality is illustrated on Figure 29.



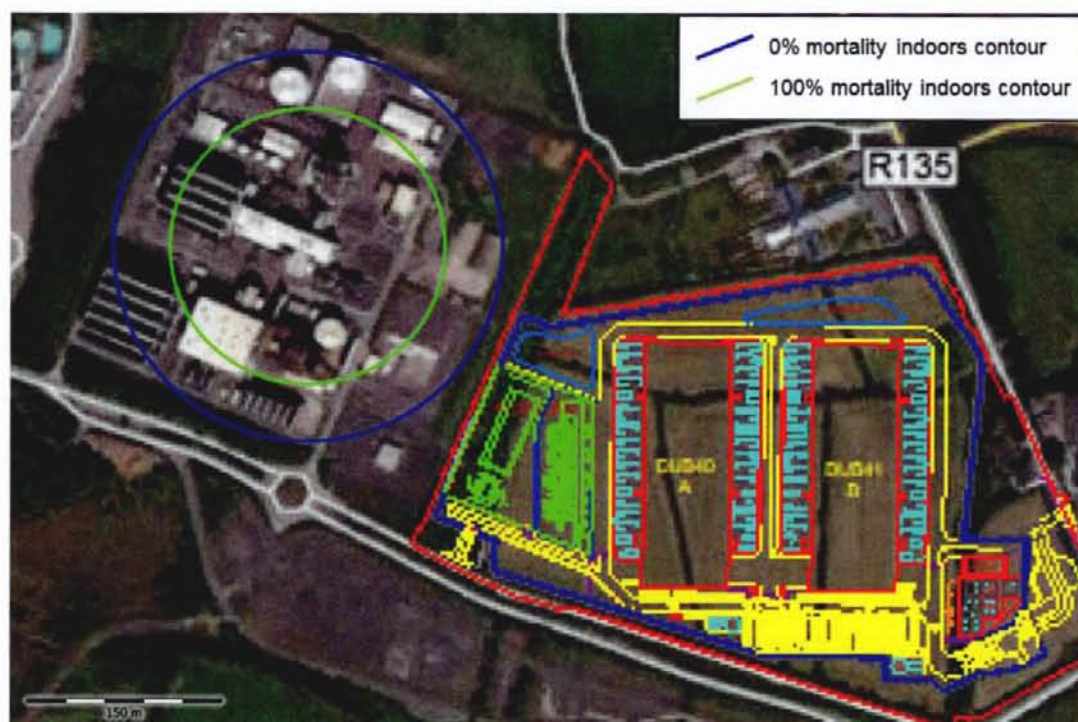


Figure 2 Fireball Indoor Mortality

In the event of a fireball following rupture of an LPG tank at Huntstown Power Station, it is concluded:

- The Fireball radius does not extend to the proposed development.
- The thermal radiation corresponding to 1% fatality ( $6.8 \text{ kW/m}^2$ ) extends to the proposed development, there is potential for fatality to persons outdoors at this establishment.
- The thermal radiation level corresponding to 0% mortality indoors ( $12.7 \text{ kW/m}^2$ ) extends to the boundary of the proposed development; however, there will be no buildings in this area.

It is concluded that there is potential for fatalities to persons outdoors at the proposed development following a Fireball at the LPG tank at the Huntstown Power Station.

#### 6.4.5 BLEVE and Fireball Frequency

There is only 1 No. small LPG tank; therefore, the likelihood of a BLEVE and fireball following rupture of an LPG vessel at Huntstown is taken as  $1\text{E}-05$  per year (HSA, 2010).

## 7.0 LAND USE PLANNING RISK CONTOURS

TNO Riskcurves Version 11.3.0 modelling software was used to model the cumulative risk contours for the establishment.

The consequence results, frequencies of major accident hazards and Dublin Airport wind speed and frequency data (see Section 4.1.5) were input to the software.

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

10E-05/year	Risk of fatality for Inner Zone (Zone 1) boundary
10E-06/year	Risk of fatality for Middle Zone (Zone 2) boundary
10E-07/year	Risk of fatality for Outer Zone (Zone 3) boundary

Risk contours for the Huntstown Power Station corresponding to the boundaries of the inner, middle and outer risk based land use planning zones are illustrated on Figure 30.

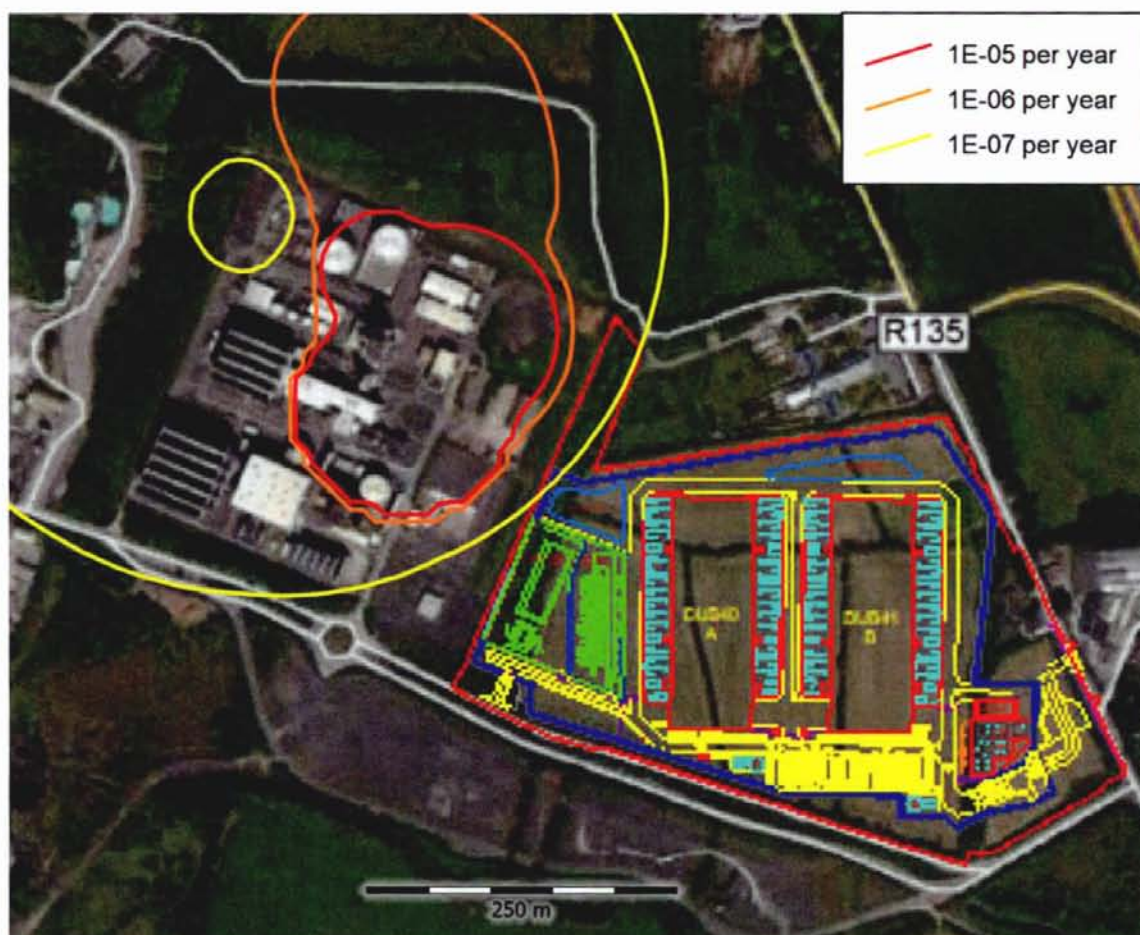


Figure 30 and se lannin ndi id al is onto rs for ntstown ower tation

It is concluded that the LUP Outer zone of Huntstown Power Station extends to the proposed development. The individual risk contours corresponding to the Inner and Middle LUP zones do not extend to the proposed development; therefore, the level of individual risk at the proposed development is acceptable.

## 8.0 CONCLUSION

A Land Use Planning assessment was completed for the proposed construction of a data halls that is in the vicinity of Huntstown Power Station, Co. Dublin. The Huntstown establishment is notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

The risk-based approach is completed in accordance with current HSA policy and taking account of the Policy and Approach of the Health and Safety Authority to COMAH Risk-based Land-use Planning (19 March 2010).

This report examines hazards associated with Fuel Oil, LPG, and Natural gas installations on site. The consequences modelling was carried out using TNO Effects Version 11.3.0 modelling software. The following is concluded:

Natural Gas VCE within a Turbine Enclosure:

- Overpressure levels corresponding to safe and light damage extends to the proposed development;
- Overpressure levels corresponding to 1% mortality outdoors do not extend to the proposed development;
- Overpressure levels corresponding to % mortality indoors (Cat. 2) do not extend to the proposed data halls.

Natural Gas Jet Fire at the GNI AGI:

- The jet flame measures up to 258 m in length (depending on wind speed);
- The thermal radiation level corresponding to 1% mortality outdoors extends to the proposed development; therefore, there is a possibility of fatality to persons outdoors in the event of a jet fire;
- The thermal radiation level corresponding to 1% mortality indoors extends to the north west corner of the DUB40A building at the proposed development. There is a possibility of fatality to persons indoors at DUB40A in the event of a jet fire;
- The thermal radiation level corresponding to equipment damage extends to the boundary of the proposed data halls but does not extend to any areas with equipment.

Bunded Pool Fire at Fuel Oil Storage Tanks

- The thermal radiation contour corresponding to the threshold of fatality (4.1 kW/m<sup>2</sup>) does not extend to the proposed development.

Uncontained Pool Fire following Bund Overtop

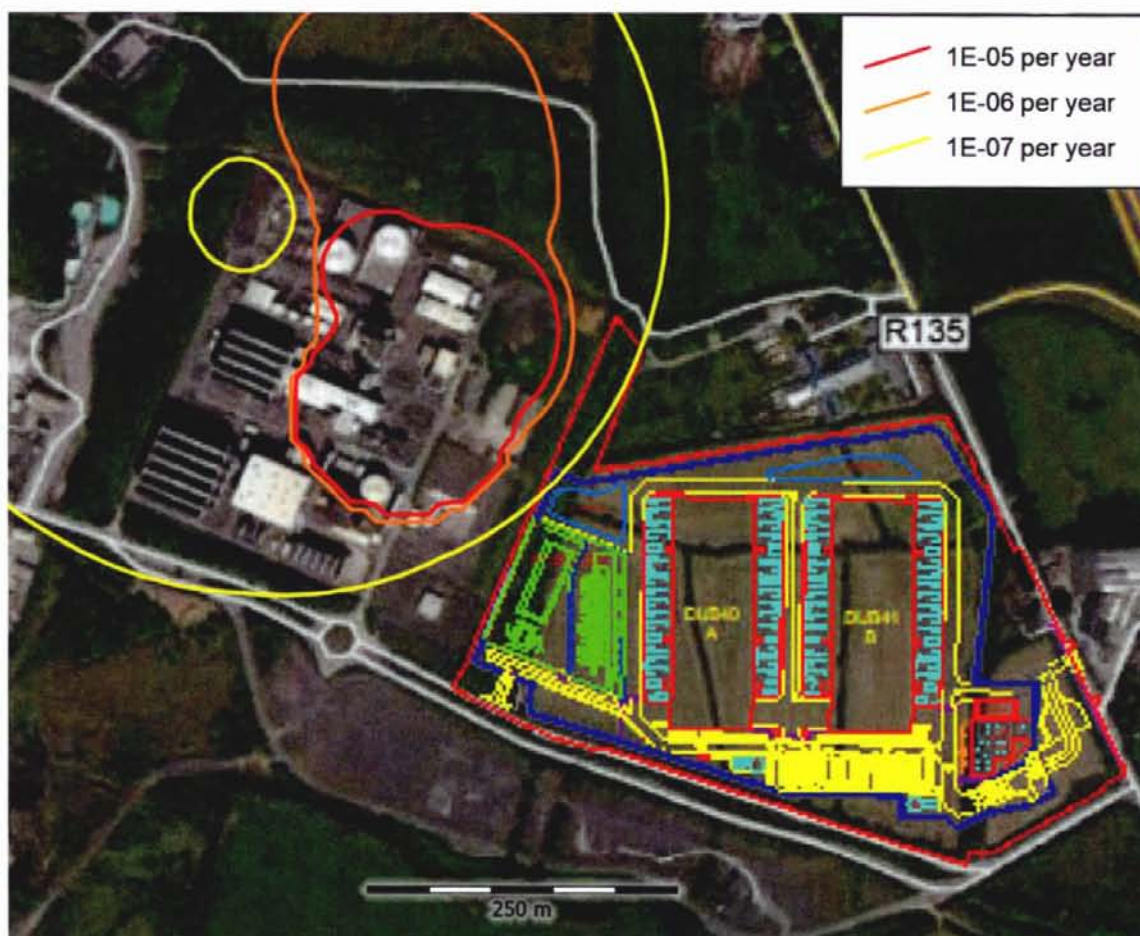
- The thermal radiation contour corresponding to the threshold of fatality does not extend to the proposed development;
- The thermal radiation contour corresponding to persons protected indoors does not extend to the proposed development.

LPG BLEVE and Fireball

- The overpressure contour corresponding to safe distance (20 mbar) extends to

- the boundary of the proposed development;
- The Fireball radius does not extend to the proposed development;
  - The thermal radiation corresponding to 1% fatality ( $6.8 \text{ kW/m}^2$ ) extends to the proposed development, there is potential for fatality to persons outdoors at this establishment;
  - The thermal radiation level corresponding to 0% mortality indoors ( $12.7 \text{ kW/m}^2$ ) extends to the boundary of the proposed development; however, there will be no buildings in this area.

The cumulative individual risk contours for Huntstown Power Station corresponding to the boundary of the inner, middle and outer land use planning zones are illustrated as follows.



It is concluded that the LUP Outer zone of Huntstown Power Station extends to the proposed development. The individual risk contours corresponding to the Inner and Middle LUP zones do not extend to the proposed development; therefore, the level of individual risk at the proposed development is acceptable.

## 9.0 REFERENCES

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**End of Report**



**APPENDIX 6.1**

**CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA  
STAGE NATIONAL ROADS AUTHORITY (NRA-TII, 2009)**



**Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (NRA)**

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale.  Degree or extent of soil contamination is significant on a national or regional scale.  Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale.  Degree or extent of soil contamination is significant on a local scale.  Volume of peat and/or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or high fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale.  Degree or extent of soil contamination is moderate on a local scale.  Volume of peat and/or soft organic soil underlying route is moderate on a local scale	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale.  Degree or extent of soil contamination is minor on a local scale.  Volume of peat and/or soft organic soil underlying route is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

**Table 2 Criteria for Rating Site Attributes – Estimation of Importance of Hydrogeological Attributes (NRA)**

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple well fields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

**Table 3 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Soil/ Geology Attribute (NRA)**

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate/remediate entire waste site. Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate/remediate significant proportion of waste site. Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves. Removal of small part of geological heritage feature. Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils. Requirement to excavate/remediate small proportion of waste site. Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

**Table 4 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrogeological Attribute (NRA)**

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer.  Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems.  Potential high risk of pollution to groundwater from routine run-off.  Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer.  Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems.  Potential medium risk of pollution to groundwater from routine run-off.  Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems.  Potential low risk of pollution to groundwater from routine run-off.  Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

**Table 5 Rating of Significant Environmental Impacts at EIS Stage (NRA)**

<b>Importance of Attribute</b>	<b>Magnitude of Importance</b>			
	<b>Negligible</b>	<b>Small Adverse</b>	<b>Moderate Adverse</b>	<b>Large Adverse</b>
<b>Extremely High</b>	Imperceptible	Significant	Profound	Profound
<b>Very High</b>	Imperceptible	Significant/moderate	Profound/Significant	Profound
<b>High</b>	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
<b>Medium</b>	Imperceptible	Slight	Moderate	Significant
<b>Low</b>	Imperceptible	Imperceptible	Slight	Slight/Moderate

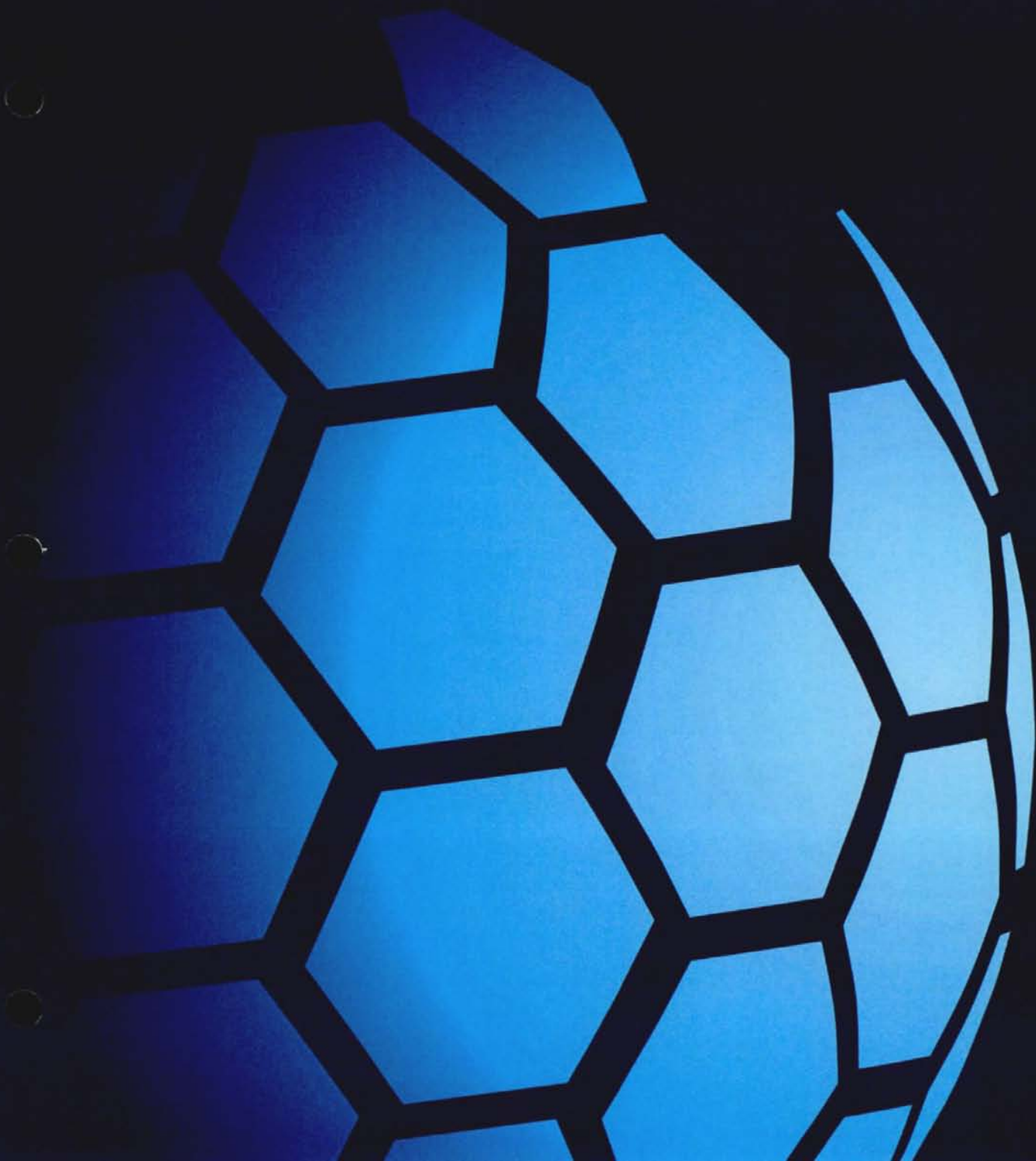
**APPENDIX 6.2**

**TRIAL PITS AND BOREHOLES LOGS**



**CAUSEWAY**  
— GEOTECH

**APPENDIX B**  
**BOREHOLE LOGS**





<b>Project No.:</b> 18-0633	<b>Project Name:</b> Huntstown_Coldwinters Site Investigation	<b>Borehole No.:</b> BH01
<b>Coordinates:</b> 312166.29 E	<b>Client:</b> Energia Renewables	Sheet 1 of 1
240970.85 N	<b>Client's Representative:</b> TOBIN Consulting Engineers	<b>Scale:</b> 1:50
<b>Ground Level:</b> 78.37 mOD	<b>Dates:</b> 27/09/2018 - 27/09/2018	<b>Driller:</b> KW
		<b>Logger:</b> CH+GH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.65)	BITMAC			
					77.72	0.65 (0.30)	MADE GROUND: Brownish grey slightly sandy angular fine to coarse GRAVEL. Sand is fine to coarse			
					77.42	0.95 (0.55)	Firm brown sandy slightly gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular			
2.00 - 2.45	SPT (S) N=16	2.00	Dry	N=16 (3,3/4,4,4,4)		1.50 (1.80)	Stiff brown sandy gravelly CLAY with occasional cobbles. (Driller's description)			
3.00 - 3.45	SPT (S) N=29	3.00	Dry	N=29 (3,5/5,7,8,9)		3.30 (1.00)	Stiff dark grey sandy gravelly CLAY with high cobble and boulder content. (Driller's description)			
4.00 - 4.45	SPT (S) N=50	4.00	Dry	N=50 (9,16/12,12,12,14)		4.30 (0.70)	Grey LIMESTONE (Driller's description)			
					73.37	5.00 (2.10)	Medium strong dark grey argillaceous LIMESTONE. Partially weathered: reduced strength, larger fracture spacing Discontinuities: 1. 0-20 degree closely spaced fractures (50/170/250), mostly planar, rough, orangish brown staining on some fracture surfaces 2. 70-90 degree closely spaced joints, undulating, smooth, orangish brown staining on some fracture surfaces			
6.50	93 89 59			9 >20 NR		7.10 (0.90)	Medium strong dark grey argillaceous LIMESTONE. Largely unweathered Discontinuities: 1. 10-20 degree closely spaced fractures (30/170/260), mostly planar, smooth 2. 79-90 degree closely spaced joints, undulating, smooth			
					71.27	8.00 (0.90)	End of Borehole at 8.00m			
8.00					70.37					

<b>Remarks</b> No groundwater encountered. BH01 was undertaken in ST01.  Terminated at scheduled depth	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time
	<b>Water Added</b>		<b>Casing Details</b>				
	From (m)	To (m)	To (m)	Diam (mm)			
	5.00	8.00					





**CAUSEWAY**  
GEOTECH

<b>Project No.:</b> 18-0633	<b>Project Name:</b> Huntstown_Coldwinters Site Investigation	<b>Borehole No.:</b> BH02
<b>Coordinates:</b> 312032.63 E	<b>Client:</b> Energia Renewables	Sheet 1 of 1
<b>Method</b> Rotary Drilling Rotary Coring	<b>Plant Used</b> Comacchio 205 Comacchio 205	<b>Top</b> 0.00 5.00
<b>Base</b> 5.00 7.00	<b>Client's Representative:</b> TOBIN Consulting Engineers	<b>Scale:</b> 1:50
<b>Ground Level:</b> 79.57 mOD	<b>Dates:</b> 28/09/2018 - 28/09/2018	<b>Driller:</b> KW
		<b>Logger:</b> CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					79.47	(0.10)	BITMAC			
					79.22	(0.25) 0.35	MADE GROUND: Light brown slightly sandy silty angular fine to coarse GRAVEL. Sand is fine to coarse.			
						(1.15)	Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.			
2.00 - 2.45	SPT (S) N=50	2.00	Dry	N=50 (6,9,12,14,12,12)	78.07	1.50 (0.40)	Firm brown sandy slightly gravelly CLAY with low cobble content. (Driller's description)			
3.00 - 3.31	SPT (S)	3.00		N=40 (10,12/40 for 160mm)	77.67	1.90	Very stiff dark grey sandy gravelly CLAY with high cobble and boulder content. (Driller's description)			
						(2.80)				
					74.87	4.70 (0.30)	BOULDER (Driller's description)			
					74.57	5.00	Boulder CLAY (Driller's description)			
						(2.00)				
					72.57	7.00	End of Borehole at 7.00m			

<b>Remarks</b> Groundwater encountered. BH02 was undertaken in ST03.	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rise to (m)	From (m)	To (m)	Time (hh:mm)
	<b>Water Added</b>		<b>Casing Details</b>				
	From (m)	To (m)	To (m)	Diam (mm)			
	4.70	7.00					



<b>Project No.:</b> 18-0633	<b>Project Name:</b> Huntstown_Coldwinters Site Investigation	<b>Borehole No.:</b> BH03
<b>Coordinates:</b> 311930.08 E	<b>Client:</b> Energia Renewables	Sheet 1 of 1
241421.73 N	<b>Client's Representative:</b> TOBIN Consulting Engineers	<b>Scale:</b> 1:50
<b>Ground Level:</b> 80.52 mOD	<b>Dates:</b> 28/08/2018 - 28/09/2018	<b>Driller:</b> KW
		<b>Logger:</b> CH+GH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.60)	[Pattern]	BITMAC		
						79.92 0.60 (0.40)	[Pattern]	MADE GROUND: Grey slightly sandy angular fine to coarse GRAVEL. Sand is fine to coarse.		
						79.52 1.00 (0.50)	[Pattern]	Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.		
						79.02 1.50	[Pattern]	Stiff to very stiff brown gravelly sandy CLAY. (Drillers's description)		
2.00 - 2.45	SPT (S) N=17	2.00	Dry	N=17 (5,3/4,4,4,5)						
						(2.50)	[Pattern]			
3.00 - 3.45	SPT (S) N=49	3.00	Dry	N=49 (8,10/12,12,11,14)						
4.00 - 4.08 4.00 - 4.08	SPT (S) 100	4.00	Dry	N=50 (75 for 75mm/50 for 0mm) 75mm/50 for 0mm		76.52 4.00	[Pattern]	Stiff grey slightly sandy gravelly CLAY with medium cobble content. (Driller's description)		
4.70	100					(1.30)				
5.30						75.22 5.30	[Pattern]	Medium strong grey argillaceous LIMESTONE. Distinctly weathered, reduced strength, much closer fracture spacing		
						(0.75)				
						74.47 6.05	[Pattern]	Discontinuities: 1. 10-20 degree closely spaced fractures (30/110/220), planar, smooth 2. 20-40 degree closely spaced fractures (50/180/260), planar, smooth 3. 70-90 degree closely spaced joints, planar, smooth		
						(0.95)				
						73.52 7.00	[Pattern]	Medium strong grey argillaceous LIMESTONE. Partially weathered: reduced strength, close fracture spacing 1. 10-20 degree closely spaced fractures (40/130/210), planar, smooth 2. 70-90 degree closely spaced joints, planar, smooth End of Borehole at 7.00m		
6.80 7.00	100 99 70									

<b>Remarks</b> No groundwater encountered. BH03 was undertaken in ST05.  Terminated at scheduled depth	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (min)
	<b>Water Added</b>		<b>Casing Details</b>				
	From (m)	To (m)	To (m)	Diam (mm)			



**CAUSEWAY**  
— GEOTECH

<b>Project No.:</b> 18-0633	<b>Project Name:</b> Huntstown_Coldwinters Site Investigation	<b>Borehole No.:</b> BH04
<b>Coordinates:</b> 311961.30 E 241127.30 N	<b>Client:</b> Energia Renewables	Sheet 1 of 2
<b>Method</b> Rotary Drilling	<b>Plant Used</b> Comacchio 205	<b>Top</b> 0.00
<b>Base</b> 10.00	<b>Client's Representative:</b> TOBIN Consulting Engineers	<b>Scale:</b> 1:50
<b>Ground Level:</b> 78.95 mOD	<b>Dates:</b> 26/09/2018 - 26/09/2018	<b>Driller:</b> KW
		<b>Logger:</b> CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					78.80	(0.15)	BITMAC			
					78.65	(0.15)	MADE GROUND: Hardcore			
						0.30		Firm greyish brown slightly gravelly sandy CLAY. (Driller's description)		
1.00 - 1.45	SPT (S) N=15	1.00	Dry	N=15 (4,3/3,4,4,4)		(1.30)				
					77.35	1.60		Stiff to very stiff grey sandy gravelly CLAY with medium cobble and boulder content. (Driller's description)		
2.00 - 2.45	SPT (S) N=24	2.00	Dry	N=24 (5,5/5,5,7,7)		(2.00)				
3.00 - 3.45	SPT (S) N=33	3.00	Dry	N=33 (6,7/8,8,8,9)						
					75.35	3.60		Very stiff dark grey sandy gravelly CLAY with high cobble and boulder content. (Driller's description)		
4.00 - 4.45	SPT (S) N=36	4.00	Dry	N=36 (9,9/9,9,9,9)						
5.00 - 5.45	SPT (S) N=44	5.00	Dry	N=44 (9,9/10,11,11,12)						
7.00 - 7.30	SPT (S)			N=50 (24,0/50 for 150mm)		(5.70)				
					69.65	9.30		Possible BEDROCK. (Driller's description)		
						(0.70)				
					68.95	10.00				

<b>Remarks</b> No groundwater encountered.  Terminated at scheduled depth	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rise to (m)	From (m)	To (m)	Time (hh:mm)
	<b>Water Added</b>		<b>Casing Details</b>				
	From (m)	To (m)	To (m)	Diam (mm)			
			10.00	150			



**CAUSEWAY**  
— GEOTECH

<b>Project No.:</b> 18-0633	<b>Project Name:</b> Huntstown_Coldwinters Site Investigation	<b>Borehole No.:</b> BH04
<b>Coordinates:</b> 311961.30 E	<b>Client:</b> Energia Renewables	Sheet 2 of 2
241127.30 N	<b>Client's Representative:</b> TOBIN Consulting Engineers	<b>Scale:</b> 1:50
<b>Ground Level:</b> 78.95 mOD	<b>Dates:</b> 26/09/2018 - 26/09/2018	<b>Driller:</b> KW
		<b>Logger:</b> CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
		10.00	Dry	26-09-2018				End of Borehole at 10.00m		

<b>Remarks</b> No groundwater encountered.  Terminated at scheduled depth	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rise to (m)	From (m)	To (m)	Time (hr:min)
	<b>Water Added</b>		<b>Casing Details</b>				
	From (m)	To (m)	To (m)	Diam (mm)			
			10.00	150			



# CAUSEWAY GEOTECH

<b>Project No.:</b> 18-0633	<b>Project Name:</b> Huntstown_Coldwinters Site Investigation	<b>Borehole No.:</b> BH05
<b>Coordinates:</b> 311477.80 E	<b>Client:</b> Energia Renewables	Sheet 1 of 1
<b>Method</b> Rotary Drilling Rotary Coring	<b>Plant Used</b> Comacchio 205 Comacchio 205	<b>Top</b> 0.00 2.00
<b>Base</b> 2.00 5.00	<b>Client's Representative:</b> TOBIN Consulting Engineers	<b>Scale:</b> 1:50
<b>Ground Level:</b> 79.02 mOD	<b>Dates:</b> 27/09/2018 - 27/09/2018	<b>Driller:</b> KW
		<b>Logger:</b> CH+GH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
1.00 - 1.45	SPT (5) N=21	1.00	Dry	N=21 (9,5/5,7,5,4)	78.87 78.72	(0.15) (0.15) (0.30)	BITMAC MADE GROUND: Hardcore fill (Driller's description)	Firm greyish brown slightly sandy slightly gravelly CLAY with low cobble content. (Driller's description)		
2.00 - 2.15 2.00 - 2.15	SPT (5)	2.00	Dry	N=50 (25 for 75mm/50 for 75mm/50 for 75mm)	77.32 77.02	1.70 (0.30) 2.00	Stiff dark grey slightly sandy slightly gravelly CLAY with low cobble content. (Driller's description)	Medium strong grey argillaceous LIMESTONE. Largely unweathered: some orangish brown discolouration on fracture surfaces		
3.50	100 65 43		5		76.02	3.00 (0.50)	Discontinuities: 1. 30-40 degree closely spaced fractures (50/100/180), undulating, rough, some orangish brown staining on fracture surfaces			
5.00	90 76 53 5		>20		75.52	3.50 (1.50)	2. 70-90 degree closely spaced fractures, undulating, rough Medium strong grey argillaceous LIMESTONE. Distinctly weathered: reduced strength, closer fracture spacing			
					74.02	5.00	Discontinuities: 1. 10-20 degree closely spaced fractures (30/170/220), undulating, rough orangish brown staining on some fracture surfaces 2. 30-40 degree closely spaced fractures (60/180/270), undulating, rough, orangish brown staining on some fracture surfaces 3. 70-90 degree closely spaced joints, undulating, rough, orangish brown staining on some fracture surfaces Medium strong grey argillaceous LIMESTONE. Distinctly weathered: reduced strength, closer fracture spacing, orangish brown staining on some fracture surfaces			
							Discontinuities: 1. 10-20 degree closely spaced fractures (90/130/220), undulating, rough, orangish brown staining on some fracture surfaces 2. 30-40 degree closely spaced fractures (70/150/230), undulating, rough, orangish brown staining on some fracture surfaces 3. 70-90 degree closely spaced fractures, undulating, rough, orangish brown staining on some fracture surfaces End of Borehole at 5.00m			

<b>Remarks</b> No groundwater encountered.  Terminated at scheduled depth	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
<b>Water Added</b>		<b>Casing Details</b>					
From (m)	To (m)	To (m)	Diam (mm)				
2.00	5.00						



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT** Huntstown Powerstation - North Dublin

**DRILLHOLE NO** RC01

**SHEET** Sheet 1 of 2

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE** Geo405

**DATE COMMENCED** 03/06/2020

**FLUSH** Air/Mist

**DATE COMPLETED** 03/06/2020

**CLIENT** Energia PLC

**INCLINATION (deg)** -90

**DRILLED BY** IGSL

**ENGINEER** AWN Consulting

**CORE DIAMETER (mm)** 80

**LOGGED BY** D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY				N = 67 (3, 7, 11, 14, 24, 18)
1												N = 87 (7, 14, 21, 27, 19, 20)
2												N = 108 (11, 24, 31, 29, 24, 24)
3												N = 89 (4, 6, 14, 24, 28, 23)
4									4.50			
5								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly GRAVEL				
6									6.00			
7								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly BOULDERS				
7.20									7.20			
8		100	87	56				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally slightly weathered.				
8.70								Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smearred, locally calcite veined (1-2mm thick). Dips are subhorizontal & locally 45-60°				
9		100	91	57								

**REMARKS**

Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

**WATER STRIKE DETAILS**

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

**GROUNDWATER DETAIL**

**INSTALLATION DETAILS**

Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
04-06-20	20.00	8.00	20.00	50mm SP					

IGSL RC FI 1.0M 22529.GPJ IGSL\_GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT** Huntstown Powerstation - North Dublin

**DRILLHOLE NO** RC01

**SHEET** Sheet 2 of 2

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE** Geo405

**FLUSH** Air/Mist

**DATE COMMENCED** 03/06/2020

**DATE COMPLETED** 03/06/2020

**CLIENT** Energia PLC  
**ENGINEER** AWN Consulting

**INCLINATION (deg)** -90

**CORE DIAMETER (mm)** 80

**DRILLED BY** IGSL

**LOGGED BY** D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.20							Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally slightly weathered.				
11	11.00	100	86	53				Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smearred, locally calcite veined (1-2mm thick). Dips are subhorizontal & locally 45-60° (continued)				
12	11.70											
13	12.50	100	97	83								
14	13.20											
15	14.00	100	93	83								
16	14.70											
17	15.50	100	98	98								
18	16.20											
19	17.00	100	99	86								
20	17.70											
21	18.50	100	97	92								
22	19.20											
23	20.00	100	100	92								

<b>REMARKS</b> End of Borehole at 20.00 m						<b>WATER STRIKE DETAILS</b>						
Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments	
											No water strike recorded	
						<b>GROUNDWATER DETAILS</b>						
<b>INSTALLATION DETAILS</b>						Date	Hole Depth	Casing Depth	Depth to Water	Comments		
Date	Tip Depth	RZ Top	RZ Base	Type		04-06-20	20.00	7.20	15.20	Water measured 10mins after end of drilling		
04-06-20	20.00	8.00	20.00	50mm SP								

IGSL RC FI 10M 22529.GPJ IGSL\_GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT**    Huntstown Powerstation - North Dublin

**DRILLHOLE NO**    RC02

**SHEET**            Sheet 1 of 3

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE**            Geo405

**FLUSH**                Air/Mist

**DATE COMMENCED** 25/05/2020

**DATE COMPLETED** 25/05/2020

**CLIENT**              Energia PLC

**ENGINEER**            AWN Consulting

**INCLINATION (deg)**    -90

**CORE DIAMETER (mm)** 80

**DRILLED BY**            IGSL

**LOGGED BY**            D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly CLAY				
1									1.50			N = 15 (2, 2, 4, 4, 3, 4)
2								SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY				
3									3.00			N = 80/125 mm (6, 3, 30, 25, 25)
4		73	52	34				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at shale laminations at 9.40-9.53m)				
4.50								Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60°				
5		80	53	21								
6												
6.60		100	88	48								
7												
8		100	91	49								
8.10												
9		100	71	34								
9.60												

**REMARKS**

Hole cased 0.00-4.50m. Set up COVID 19 Safe Working Area - 1hr.

**WATER STRIKE DETAILS**

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80				Slow

**GROUNDWATER DETAIL**

**INSTALLATION DETAILS**

Date	Tip Depth	RZ Top	RZ Base	Type
25-05-20	19.50	15.00	19.50	50mm SP

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC F10M 22529.GPJ IGSL\_GDT 8/6/20





# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>DRILLHOLE NO</b> <b>RC02</b>
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 2 of 3
<b>GROUND LEVEL (mOD)</b>		<b>DATE COMMENCED</b> 25/05/2020
<b>CLIENT</b> Energia PLC		<b>DATE COMPLETED</b> 25/05/2020
<b>ENGINEER</b> AWN Consulting		<b>DRILLED BY</b> IGSL
		<b>LOGGED BY</b> D. O'Shea
<b>RIG TYPE</b> Geo405		
<b>FLUSH</b> Air/Mist		
<b>INCLINATION (deg)</b> -90		
<b>CORE DIAMETER (mm)</b> 80		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10		100	79	42				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at shale laminations at 9.40-9.53m)				
11.10								Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smearred, locally calcite veined (1-2mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60° (continued)				
12		100	95	85								
12.60												
13		100	94	79								
14.10												
15		100	86	79								
15.60												
16		100	81	43								
17.10												
18		100	83	75								
18.60												
19		100	100	78								

<b>REMARKS</b> Hole cased 0.00-4.50m. Set up COVID 19 Safe Working Area - 1hr.						<b>WATER STRIKE DETAILS</b>					
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
						2.80	2.80				Slow
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>					
						Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type							
25-05-20	19.50	15.00	19.50	50mm SP							

IGSL RC F1.10M 22529.GPJ IGSL\_GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT**    Huntstown Powerstation - North Dublin

**DRILLHOLE NO**    RC02  
**SHEET**            Sheet 3 of 3

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE**            Geo405  
**FLUSH**                Air/Mist  
**INCLINATION (deg)**    -90  
**CORE DIAMETER (mm)** 80

**DATE COMMENCED** 25/05/2020  
**DATE COMPLETED** 25/05/2020

**CLIENT**            Energia PLC  
**ENGINEER**        AWN Consulting

**DRILLED BY**        IGSL  
**LOGGED BY**        D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20	20.20				0      250      500			End of Borehole at 20.20 m	20.20		//	
21												
22												
23												
24												
25												
26												
27												
28												
29												

**REMARKS**  
Hole cased 0.00-4.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS					
Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80				Slow

INSTALLATION DETAILS				
Date	Tip Depth	RZ Top	RZ Base	Type
25-05-20	19.50	15.00	19.50	50mm SP

GROUNDWATER DETAIL				
Date	Hole Depth	Casing Depth	Depth to Water	Comments
25-05-20	20.20	4.50	2.10	Water measured 10mins after end of drilling

IGSL RC FI 10M 22529.GPJ IGSL\_GDT\_8/6/20



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

**22529**

**CONTRACT** Huntstown Powerstation - North Dublin

**DRILLHOLE NO** **RC03**

**SHEET** Sheet 1 of 2

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE** Geo405

**FLUSH** Air/Mist

**DATE COMMENCED** 04/06/2020

**DATE COMPLETED** 04/06/2020

**CLIENT** Energia PLC  
**ENGINEER** AWN Consulting

**INCLINATION (deg)** -90

**CORE DIAMETER (mm)** 80

**DRILLED BY** IGSL

**LOGGED BY** D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			SYMMETRIX DRILLING: No recovery - observed by driller as returns of CLAY				
1									1.50			N = 18 (4, 3, 5, 4, 4, 5)
2								SYMMETRIX DRILLING: No recovery - observed by driller as returns of gravelly CLAY				
3									3.00			N = 79 (9, 14, 21, 17, 18, 23)
4								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly BOULDERS				
5									4.50			N = 90 (8, 14, 31, 23, 19, 17)
6								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly SAND				
7									7.50			N = 72 (20, 24, 17, 14, 19, 22)
8								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly GRAVEL				
9												N = 51 (4, 8, 11, 14, 12, 14)
												N = 51 (3, 5, 14, 11, 12, 14)

**REMARKS**

Hole cased 0.00-13.50m. Set up COVID 19 Safe Working Area - 1hr.

**WATER STRIKE DETAILS**

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
11.20	11.20				Slow

**GROUNDWATER DETAILS**

**INSTALLATION DETAILS**

Date	Tip Depth	RZ Top	RZ Base	Type	Comments
04-06-20	20.00	3.00	20.00	50mm SP	

IGSL RC FI 10M 22529.GPJ IGSL\_GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT** Huntstown Powerstation - North Dublin

**DRILLHOLE NO** RC03

**CO-ORDINATES**

**SHEET** Sheet 2 of 2

**GROUND LEVEL (mOD)**

**RIG TYPE** Geo405

**DATE COMMENCED** 04/06/2020

**FLUSH** Air/Mist

**DATE COMPLETED** 04/06/2020

**CLIENT** Energia PLC

**INCLINATION (deg)** -90

**DRILLED BY** IGSL

**ENGINEER** AWN Consulting

**CORE DIAMETER (mm)** 80

**LOGGED BY** D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly GRAVEL ( <i>continued</i> )	10.50			N = 25 (2, 4, 4, 8, 7, 6)
11								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly SAND				
12.00								Probable weathered ROCK - recovered as angular gravel of muddy limestone with traces of black clay	12.00			N = 25/10 mm (25, 25)
13		33	5	0								N = 25/10 mm (25, 25)
13.50								Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at shale laminations at 13.76-13.92m)	13.50			
14		100	41	34				Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-15mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60° & irregular.				
15.00		100	63	35								
16.50												
17		100	84	72								
18.00		100	40	32								
19		100	74	33								
20.00									20.00			

**REMARKS** End of Borehole at 20.00 m **WATER STRIKE DETAILS**

Hole cased 0.00-13.50m. Set up COVID 19 Safe Working Area - 1hr.	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
	11.20	11.20				Slow

**GROUNDWATER DETAIL**

<b>INSTALLATION DETAILS</b>					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
04-06-20	20.00	3.00	20.00	50mm SP	04-06-20	20.00	13.50	12.70	Water measured 10mins after end of drilling

IGSL RC F1.0M 22529.GPJ IGSL\_GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>DRILLHOLE NO</b> RC04
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 2
<b>GROUND LEVEL (mOD)</b>		<b>DATE COMMENCED</b> 02/06/2020
<b>CLIENT</b> Energia PLC		<b>DATE COMPLETED</b> 02/06/2020
<b>ENGINEER</b> AWN Consulting		<b>DRILLED BY</b> IGSL
<b>RIG TYPE</b> Geo405		<b>LOGGED BY</b> D. O'Shea
<b>FLUSH</b> Air/Mist		
<b>INCLINATION (deg)</b> -90		
<b>CORE DIAMETER (mm)</b> 80		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly CLAY				N = 64 (3, 9, 14, 19, 15, 16)
1												
2												N = 86 (5, 18, 17, 14, 26, 29)
3												
4												
4.50								SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY	4.50			N = 94 (9, 17, 24, 29, 19, 22)
5												
6.00									6.00			N = 25/20 mm (25, 25)
6.35-7.00m & 7.29-7.35m		73	11	0				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at clay/gravel-filled fractures at 6.35-7.00m & 7.29-7.35m)				
7												
7.50								Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smearred, locally calcite veined (1-8mm thick), locally penetrative iron-oxide stained. Dips are subhorizontal & locally 45-60° & irregular.				N = 25/10 mm (27, 25, 25)
8		100	43	16								
9												
9.00		100	100	47								
9.30												

<b>REMARKS</b> Hole cased 0.00-7.50m. Set up COVID 19 Safe Working Area - 1hr.						<b>WATER STRIKE DETAILS</b>				
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)
						No water strike recorded				
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>				
						Date	Hole Depth	Casing Depth	Depth to Water	Comments
02-06-20	20.00	8.00	20.00	50mm SP						

IGSL RC FI 10M 22529.GPJ IGSL.GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT**    Huntstown Powerstation - North Dublin

**DRILLHOLE NO**    RC04

**SHEET**            Sheet 2 of 2

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE**            Geo405

**FLUSH**                Air/Mist

**DATE COMMENCED** 02/06/2020

**DATE COMPLETED** 02/06/2020

**CLIENT**             Energia PLC

**INCLINATION (deg)**    -90

**DRILLED BY**         IGSL

**ENGINEER**          AWN Consulting

**CORE DIAMETER (mm)** 80

**LOGGED BY**         D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	100	95	77					Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at clay/gravel-filled fractures at 6.35-7.00m & 7.29-7.35m)				
10.80								Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smearred, locally calcite veined (1-8mm thick), locally penetrative iron-oxide stained. Dips are subhorizontal & locally 45-60° & irregular. <i>(continued)</i>				
11	100	93	86									
12.30												
13	100	91	87									
13.80												
14	100	79	39									
15.30												
16	100	79	63									
16.80												
17	100	85	83									
18.30												
19	100	98	98									
19.30												
20.00	100	100	100									

<b>REMARKS</b>						<b>WATER STRIKE DETAILS</b>					
Hole cased 0.00-7.50m. Set up COVID 19 Safe Working Area - 1hr.						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
											No water strike recorded
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAIL</b>					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments		
02-06-20	20.00	8.00	20.00	50mm SP	02-06-20	20.00	7.50	8.60	Water measured 10mins after end of drilling		

IGSL RC F10M 22529.GPJ IGSL\_GDT 8/6/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>DRILLHOLE NO</b> <b>RC05</b>
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 3
<b>GROUND LEVEL (mOD)</b>		<b>DATE COMMENCED</b> 27/05/2020
<b>CLIENT</b> Energia PLC		<b>DATE COMPLETED</b> 27/05/2020
<b>ENGINEER</b> AWN Consulting		<b>DRILLED BY</b> IGSL
<b>RIG TYPE</b> Geo405		<b>LOGGED BY</b> D. O'Shea
<b>FLUSH</b> Air/Mist		
<b>INCLINATION (deg)</b> -90		
<b>CORE DIAMETER (mm)</b> 80		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.O.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobby CLAY				
1												N = 13 (4, 3, 3, 3, 3, 4)
2												N = 33 (7, 10, 8, 8, 9, 8)
3												N = 25/20 mm (25, 25)
4	4.50							Returns of cobby GRAVEL with layers of brown slightly sandy slightly gravelly clay	4.50			
5		33	0	0								
6	6.00							SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobby CLAY	6.00			N = 10 (3, 2, 2, 2, 3, 3)
7		0	0	0								
8	7.20							Probable BOULDER - of blueish grey sandy reef limestone	7.20			
9		100	0	0								
10	8.70							Returns of brown sandy gravelly CLAY	8.70			
11		100	0	0								
12	9.70								9.70			

<b>REMARKS</b> Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.						<b>WATER STRIKE DETAILS</b>					
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
											No water strike recorded
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>					
						Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type							
27-05-20	21.70	15.00	21.70	50mm SP							

IGSL RC F1.10M 22529.GPJ IGSL.GDT B5/20



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

**CONTRACT** Huntstown Powerstation - North Dublin

**DRILLHOLE NO** RC05  
**SHEET** Sheet 2 of 3

**CO-ORDINATES**

**GROUND LEVEL (mOD)**

**RIG TYPE** Geo405  
**FLUSH** Air/Mist  
**INCLINATION (deg)** -90  
**CORE DIAMETER (mm)** 80

**DATE COMMENCED** 27/05/2020  
**DATE COMPLETED** 27/05/2020

**CLIENT** Energia PLC  
**ENGINEER** AWN Consulting

**DRILLED BY** IGSL  
**LOGGED BY** D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	100	43	32					Probable weathered ROCK - recovered as angular gravel of muddy limestone with traces of brown clay ( <i>continued</i> )	10.45			
11	11.20							Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, regular sandier layers, fossiliferous throughout), fresh to very locally slightly weathered.				
12	120	95	93					Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60°				
13	130	75	52									
14	14.20											
15	150	71	57									
16	160	97	91									
17	17.20											
18	180	89	81									
19	190	95	89									

**REMARKS**  
Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS					
Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS				
Date	Tip Depth	RZ Top	RZ Base	Type
27-05-20	21.70	15.00	21.70	50mm SP

GROUNDWATER DETAIL				
Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC F10M 22529.GPJ IGSL\_GDT\_B6/20





# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>DRILLHOLE NO</b> <b>RC05</b>
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 3 of 3
<b>GROUND LEVEL (mOD)</b>		<b>DATE COMMENCED</b> 27/05/2020
<b>CLIENT</b> Energia PLC		<b>DATE COMPLETED</b> 27/05/2020
<b>ENGINEER</b> AWN Consulting		<b>DRILLED BY</b> IGSL
		<b>LOGGED BY</b> D. O'Shea
		<b>RIG TYPE</b> Geo405
		<b>FLUSH</b> Air/Mist
		<b>INCLINATION (deg)</b> -90
		<b>CORE DIAMETER (mm)</b> 80

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20	20.20											
21	100	89	83									
21.70								End of Borehole at 21.70 m	21.70			
22												
23												
24												
25												
26												
27												
28												
29												

<b>REMARKS</b> Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.						<b>WATER STRIKE DETAILS</b>						
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments	
											No water strike recorded	
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>						
						Date	Hole Depth	Casing Depth	Depth to Water	Comments		
27-05-20	21.70	15.00	21.70	50mm SP	Water measured 10mins after end of drilling							

IGSL RC FI 10M 22529.GPJ IGSL\_GDT 8/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

**CONTRACT** Energia Power Station Hunstown

**TRIAL PIT NO.** TP01

**SHEET** Sheet 1 of 1

**LOGGED BY** I.Reeder

**CO-ORDINATES** 711,491.54 E  
741,486.07 N

**DATE STARTED** 25/05/2020

**DATE COMPLETED** 25/05/2020

**CLIENT ENGINEER** Energia  
AWN

**GROUND LEVEL (m)** 77.57

**EXCAVATION METHOD** 7 tonne excavator

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm, brown, sandy gravelly CLAY with low cobbles content		0.30	77.27		AA135977	B	0.50		
0.80	Firm to stiff, brownish grey to grey, slightly sandy gravelly CLAY with high cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		0.80	76.77						
1.50						AA135978	B	1.50		
2.20	Very stiff to hard, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		2.20	75.37		AA135979	B	2.40		
3.00						AA135980	B	3.00		
3.30	End of Trial Pit at 3.30m		3.30	74.27						

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Energia Power Station Hunstow		<b>TRIAL PIT NO.</b> <b>TP02</b>	
<b>LOGGED BY</b> I.Reeder		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT</b> Energia		<b>DATE STARTED</b> 25/05/2020	
<b>ENGINEER</b> AWN		<b>DATE COMPLETED</b> 25/05/2020	
<b>CO-ORDINATES</b> 711,676.95 E 741,544.03 N		<b>EXCAVATION METHOD</b> 7 tonne excavator	
<b>GROUND LEVEL (m)</b> 78.38			

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.25	Firm to stiff, greyish brown, sandy very gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		0.25	78.13		AA135974	B	0.70		
1.70	Stiff to very stiff, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		1.70	76.68		AA135975	B	1.70		
2.70						AA135976	B	2.70		
3.00	End of Trial Pit at 3.00m		3.00	75.38						

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Energia Power Station Hunstwon		<b>TRIAL PIT NO.</b> TP03
<b>LOGGED BY</b> I.Reeder		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 711,788.21 E 741,489.92 N		<b>DATE STARTED</b> 25/05/2020
<b>GROUND LEVEL (m)</b> 79.16		<b>DATE COMPLETED</b> 25/05/2020
<b>CLIENT ENGINEER</b> Energia AWN	<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Firm, brown, slightly sandy slightly gravelly CLAY with low cobbles content		0.30	78.86		AA135970	B	0.50		
	Firm to stiff, greyish brown, sandy gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		0.80	78.36		AA135971	B	1.00		
2.0	Very stiff to hard, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		2.30	76.86		AA135972	B	2.00		
3.0	End of Trial Pit at 3.00m		3.00	76.16		AA135973	B	3.00		

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL.GDT 5/6/20



# TRIAL PIT RECORD

**REPORT NUMBER**

22529

<b>CONTRACT</b> Energia Power Station Hunstawn		<b>TRIAL PIT NO.</b> TP04	
<b>LOGGED BY</b> I.Reeder		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>DATE STARTED</b> 25/05/2020	
<b>CO-ORDINATES</b> 711,467.40 E 741,441.88 N		<b>DATE COMPLETED</b> 25/05/2020	
<b>GROUND LEVEL (m)</b> 77.81		<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brownish grey, slightly sandy gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		0.30	77.51						
1.90	Very stiff to hard, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		1.90	75.91						
2.30	TP terminated due to big boulders End of Trial Pit at 2.30m		2.30	75.51						

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Energia Power Station Hunstow		<b>TRIAL PIT NO.</b> TP05	
<b>LOGGED BY</b> N. Scott		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>CO-ORDINATES</b> 711,600.95 E 741,429.13 N	
		<b>DATE STARTED</b> 26/05/2020	
		<b>DATE COMPLETED</b> 26/05/2020	
		<b>GROUND LEVEL (m)</b> 78.03	
		<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brown/grey, sandy gravelly silty CLAY with a medium cobble content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded.		0.30	77.73						
1.0						AA102825	B	1.00		
1.90	Very stiff to hard, black/grey, very sandy gravelly silty CLAY with a medium cobble content. Gravel is fine to coarse and angular to sub-rounded. cobbles are angular to sub-angular.		1.90	76.13						
2.0						AA102826	B	2.00		
2.60	Refusal End of Trial Pit at 2.60m		2.60	75.43						
2.50						AA102827	B	2.50		
3.0										
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

**REPORT NUMBER**

22529

<b>CONTRACT</b> Energia Power Station Hunstow		<b>TRIAL PIT NO.</b> TP06	
<b>LOGGED BY</b> N. Scott		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>DATE STARTED</b> 26/05/2020	
<b>CO-ORDINATES</b> 711,718.23 E 741,437.82 N		<b>DATE COMPLETED</b> 26/05/2020	
<b>GROUND LEVEL (m)</b> 78.77		<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.		0.30	78.47						
1.20						AA102828	B	1.20		
1.70	Very stiff to hard, black/grey, very sandy gravelly silty CLAY with a low boulder content. Gravel is fine to coarse and angular to sub-rounded. Boulders are sub-angular.		1.70	77.07						
2.90	Refusal End of Trial Pit at 2.90m		2.90	75.87		AA102829	B	2.90		

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL.GDT 5/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Energia Power Station Hunstow		<b>TRIAL PIT NO.</b> TP07	
<b>LOGGED BY</b> N. Scott		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>DATE STARTED</b> 26/05/2020	
<b>CO-ORDINATES</b> 711,795.56 E 741,382.81 N		<b>DATE COMPLETED</b> 26/05/2020	
<b>GROUND LEVEL (m)</b> 78.99		<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.		0.30	78.69						
1.0						AA102830	B	1.00		
1.80	Very stiff to hard, black/grey, very sandy gravelly silty CLAY. Gravel is fine to coarse and angular to sub-rounded.		1.80	77.19						
2.0						AA102831	B	2.00		
2.80	Refusal End of Trial Pit at 2.80m		2.80	76.19						
3.0						AA102832	B	2.80		
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529 GP.J IGSL\_GDT 5/6/20





# TRIAL PIT RECORD

**REPORT NUMBER**

22529

<b>CONTRACT</b> Energia Power Station Hunstwon		<b>TRIAL PIT NO.</b> TP08	
<b>LOGGED BY</b> N. Scott		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>CO-ORDINATES</b> 711,453.50 E 741,329.19 N	
		<b>GROUND LEVEL (m)</b> 78.04	
		<b>DATE STARTED</b> 26/05/2020	
		<b>DATE COMPLETED</b> 26/05/2020	
		<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY, with a medium cobble content and a low boulder content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are angular to sub-angular. Boulders are sub-rounded.		0.30	77.74						
1.0	Very stiff to hard, black/grey, very sandy gravelly silty CLAY with a medium cobble content. Gravel is fine to coarse and angular to sub-angular. Cobbles are sub-angular to sub-rounded.					AA102820	B	1.00		
1.80			1.80	76.24						
2.0						AA102821	B	2.00		
2.60	End of Trial Pit at 2.20m		2.60	75.44						

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Energia Power Station Hunstoun		<b>TRIAL PIT NO.</b> TP09A	
<b>LOGGED BY</b> N. Scott		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>CO-ORDINATES</b> 711,690.24 E 741,280.64 N	
		<b>DATE STARTED</b> 26/05/2020	
		<b>DATE COMPLETED</b> 26/05/2020	
		<b>EXCAVATION METHOD</b> 7 tonne excavator	
		<b>GROUND LEVEL (m)</b> 78.15	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY, with a low cobble content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are sub-angular.		0.30	77.85						
	Land Drain End of Trial Pit at 0.90m		0.90	77.25						
1.0										
2.0										
3.0										
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

**REPORT NUMBER**

22529

<b>CONTRACT</b> Energia Power Station Hunstow		<b>TRIAL PIT NO.</b> TP09B	
<b>LOGGED BY</b> N. Scott		<b>SHEET</b> Sheet 1 of 1	
<b>CLIENT ENGINEER</b> Energia AWN		<b>CO-ORDINATES</b> 711,690.01 E 741,280.12 N	
		<b>DATE STARTED</b> 26/05/2020	
		<b>DATE COMPLETED</b> 26/05/2020	
		<b>GROUND LEVEL (m)</b> 78.23	
		<b>EXCAVATION METHOD</b> 7 tonne excavator	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY, with a medium cobble content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are sub-angular.		0.30	77.93						
1.0						AA102822	B	0.90		
1.60	Very stiff to hard, black/grey, very sandy gravelly silty CLAY. Gravel is fine to coarse and angular to sub-rounded.		1.60	76.63						
2.0						AA102823	B	2.00		
2.90	Refusal End of Trial Pit at 2.90m		2.90	75.33						
3.0						AA102824	B	2.90		
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Stable

**General Remarks**  
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# TRIAL PIT RECORD

REPORT NUMBER

22529

**CONTRACT** Energia Power Station Hunstown

**TRIAL PIT NO.** TP10

**SHEET** Sheet 1 of 1

**LOGGED BY** N. Scott

**CO-ORDINATES** 711,749.71 E  
741,243.55 N

**DATE STARTED** 26/05/2020

**DATE COMPLETED** 26/05/2020

**CLIENT ENGINEER** Energia  
AWN

**GROUND LEVEL (m)** 78.23

**EXCAVATION METHOD** 7 tonne excavator

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
0.30	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.		0.30	77.93		AA102833	B	0.50		
1.50						AA102834	B	1.50		
1.90	Very stiff to hard, black/grey, very sandy gravelly silty CLAY. Gravel is fine to coarse and angular to sub-rounded.		1.90	76.33						
2.50						AA102835	B	2.50		
2.60	Refusal End of Trial Pit at 2.70m		2.60	75.63						

**Groundwater Conditions**

Dry

**Stability**

Stable

**General Remarks**

CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL\_GDT 5/6/20



# GEOTECHNICAL BORING RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin				<b>BOREHOLE NO.</b> CP01	
<b>CO-ORDINATES</b> 711,727.79 E 741,542.14 N		<b>RIG TYPE</b> DANDO 2000		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 78.44		<b>BOREHOLE DIAMETER (mm)</b> 200		<b>DATE COMMENCED</b> 26/05/2020	
		<b>BOREHOLE DEPTH (m)</b> 3.40		<b>DATE COMPLETED</b> 26/05/2020	
<b>CLIENT</b> Energia PLC		<b>SPT HAMMER REF. NO.</b>		<b>BORED BY</b> D.TOLSTER	
<b>ENGINEER</b> AWN Consulting		<b>ENERGY RATIO (%)</b>		<b>PROCESSED BY</b> F.C	

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		78.34	0.10						
	Light brown sandy SILT/CLAY with occasional gravel		78.14	0.30						
	Mottled light brown sandy SILT/CLAY with some gravel and occasional cobbles		77.64	0.80	AA135351	B	0.50			
	Soft mottled grey/brown sandy SILT/CLAY with some gravel and cobbles				AA135352	B	1.00	N = 9 (1, 2, 1, 2, 3, 3)		
					AA135353	B	1.50			
			76.54	1.90	AA135354	B	2.00			
	Soft to firm grey/black sandy SILT/CLAY with gravel and cobbles		75.94	2.50	AA135355	B	2.50	N = 9 (1, 3, 1, 2, 2, 4)		
	Very stiff to hard grey very gravelly silty CLAY with occasional cobbles				AA135356	B	3.00			
			75.04	3.40				N = 31 (5, 6, 5, 7, 7, 12)		
	Obstruction End of Borehole at 3.40 m									

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.2	3.4	2		2.50	2.50	No	1.50	20	Moderate

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
26-05-20	3.40	1.00	3.40	50mm SP	26-05-20	3.10	Nil	1.60	End of drilling

<b>REMARKS</b> Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG 22529.GPJ IGSL.GDT 8/6/20



# GEOTECHNICAL BORING RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>BOREHOLE NO.</b> CP02	
<b>CO-ORDINATES</b> 711,489.20 E 741,470.11 N		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 77.52		<b>DATE COMMENCED</b> 29/05/2020	
<b>RIG TYPE</b> DANDO 2000		<b>DATE COMPLETED</b> 29/05/2020	
<b>BOREHOLE DIAMETER (mm)</b> 200			
<b>BOREHOLE DEPTH (m)</b> 3.50			
<b>CLIENT</b> Energia PLC		<b>BORED BY</b> D.TOLSTER	
<b>ENGINEER</b> AWN Consulting		<b>PROCESSED BY</b> F.C	
<b>SPT HAMMER REF. NO.</b>			
<b>ENERGY RATIO (%)</b>			

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		77.42	0.10						
	Mottled brown sandy SILT/CLAY with occasional gravel		76.82	0.70						
1	Soft mottled grey/brown sandy SILT/CLAY with some gravel		76.02	1.50	AA135370	B	1.00	N = 9 (1, 2, 1, 2, 3, 3)		
	Stiff mottled grey sandy SILT/CLAY with some gravel and occasional cobbles		75.52	2.00	AA135371	B	1.50			
2	Stiff to very stiff black sandy gravelly CLAY with some cobbles				AA135372	B	2.50	N = 37 (3, 3, 6, 8, 8, 15)		
3										
4	Obstruction End of Borehole at 3.50 m		74.02	3.50				N = 50/150 mm (11, 14, 23, 27)		
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.6	2.8	0.75							No water strike
3.3	3.5	2							

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
29-05-20	3.50	1.00	3.50	50mm SP					

<b>REMARKS</b> Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub)	UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG 22529.GPJ IGSL\_GDT B/E/20



# GEOTECHNICAL BORING RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>BOREHOLE NO.</b> CP03	
<b>CO-ORDINATES</b> 711,670.95 E 741,397.02 N		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 78.88		<b>DATE COMMENCED</b> 27/05/2020	
<b>RIG TYPE</b> DANDO 2000		<b>DATE COMPLETED</b> 28/05/2020	
<b>BOREHOLE DIAMETER (mm)</b> 200			
<b>BOREHOLE DEPTH (m)</b> 4.20			
<b>CLIENT</b> Energia PLC		<b>SPT HAMMER REF. NO.</b>	
<b>ENGINEER</b> AWN Consulting		<b>ENERGY RATIO (%)</b>	
		<b>BORED BY</b> D.TOLSTER	
		<b>PROCESSED BY</b> F.C	

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL	XG	78.78	0.10						
0.10	Light brown very sandy SILT/CLAY with occasional gravel	XG	78.08	0.80	AA135359	B	0.50			
0.80	Soft to firm mottled brown sandy SILT/CLAY with some gravel	XG			AA135360	B	1.00	N = 10 (1, 2, 2, 3, 2, 3)	○	○
1.00		XG			AA135361	B	1.50			
1.50		XG	76.98	1.90	AA135362	B	2.00			
1.90	Stiff mottled grey and grey/brown sandy SILT/CLAY with some gravel and occasional cobbles	XG	76.48	2.40	AA135363	B	3.00	N = 22 (1, 4, 4, 4, 7, 7)	○	○
2.40	Stiff to very stiff grey black sandy gravelly SILT/CLAY with cobbles and occasional boulders	XG			AA135364	B	4.00			
3.00		XG						N = 36 (7, 7, 8, 9, 9, 10)	○	○
3.60	XG									
4.20	Obstruction End of Borehole at 4.20 m	XG	74.68	4.20				N = 50/150 mm (7, 12, 26, 24)	○	○

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4	4.2	2							No water strike

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
28-05-20	4.20	1.00	4.20	50mm SP					

<b>REMARKS</b> Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub)	<b>UT - Undisturbed 100mm Diameter Sample</b> <b>P - Undisturbed Piston Sample</b> <b>W - Water Sample</b>
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IGSL BH LOG 22529.GPJ IGSL.GDT 06/20



# GEOTECHNICAL BORING RECORD

REPORT NUMBER

22529

CONTRACT Huntstown Powerstation - North Dublin

BOREHOLE NO. CP04

CO-ORDINATES 711,570.63 E  
741,329.35 N  
GROUND LEVEL (m AOD) 78.04RIG TYPE DANDO 2000  
BOREHOLE DIAMETER (mm) 200  
BOREHOLE DEPTH (m) 3.90

SHEET Sheet 1 of 1

DATE COMMENCED 28/05/2020  
DATE COMPLETED 29/05/2020CLIENT Energia PLC  
ENGINEER AWN ConsultingSPT HAMMER REF. NO.  
ENERGY RATIO (%)BORED BY D.TOLSTER  
PROCESSED BY F.C.

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		77.89	0.15						
	Mottled light brown sandy SILT/CLAY with occasional gravel		77.34	0.70	AA135365	B	0.50			
	Firm grey/brown sandy SILT/CLAY with some gravel		76.64	1.40	AA135366	B	1.00	N = 17 (1, 3, 3, 4, 5, 5)		
	Firm to stiff dark grey sandy SILT/CLAY with some gravel and occasional cobbles		76.14	1.90	AA135367	B	1.50			
	Very stiff mottled grey/black sandy silty gravelly CLAY with some cobbles and occasional boulders				AA135368	B	2.00	N = 48 (4, 5, 9, 10, 13, 16)		
					AA135369	B	3.00	N = 39 (11, 10, 11, 15, 12, 1)		
	Obstruction End of Borehole at 3.90 m		74.14	3.90				N = 50/75 mm (20, 30, 50)		

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.1	3.3	0.75		4.00	4.00	No	No	20	Seepage
3.7	3.9	1.5							
INSTALLATION DETAILS				GROUNDWATER PROGRESS					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
29-05-20	3.90	1.00	3.90	50mm SP					

REMARKS Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .

## Sample Legend

D - Small Disturbed (tub)  
B - Bulk Disturbed  
LB - Large Bulk Disturbed  
Env - Environmental Sample (Jar + Vial + Tub)UT - Undisturbed 100mm Diameter Sample  
P - Undisturbed Piston Sample  
W - Water Sample





# GEOTECHNICAL BORING RECORD

REPORT NUMBER

22529

<b>CONTRACT</b> Huntstown Powerstation - North Dublin		<b>BOREHOLE NO.</b> CP05	
<b>CO-ORDINATES</b> 711,736.38 E 741,285.66 N		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 78.93		<b>DATE COMMENCED</b> 27/05/2020	
<b>RIG TYPE</b> DANDO 2000		<b>DATE COMPLETED</b> 27/05/2020	
<b>BOREHOLE DIAMETER (mm)</b> 200			
<b>BOREHOLE DEPTH (m)</b> 4.10			
<b>CLIENT</b> Energia PLC		<b>SPT HAMMER REF. NO.</b>	
<b>ENGINEER</b> AWN Consulting		<b>ENERGY RATIO (%)</b>	
		<b>BORED BY</b> D.TOLSTER	
		<b>PROCESSED BY</b> F.C	

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		78.83	0.10						
	Light brown very sandy SILT/CLAY with occasional gravel		78.23	0.70	AA130397	B	0.50			
	Firm mottled brown sandy SILT/CLAY with some gravel				AA130398	B	1.00		N = 15 (2, 2, 3, 3, 3, 6)	
			77.23	1.70	AA130399	B	1.50			
	Very stiff mottled grey and grey/brown sandy SILT/CLAY with some gravel and occasional cobbles				AA130400	B	2.00		N = 61 (10, 14, 17, 18, 15, 11)	
			76.63	2.30	AA130401	B	2.50			
	Very stiff to hard mottled grey/black sandy silty gravelly CLAY with some cobbles and occasional boulders				AA130402	B	3.00		N = 39 (6, 8, 8, 10, 12, 9)	
			74.83	4.10	AA130403	B	4.00		N = 50/75 mm (18, 32, 50)	
	Obstruction End of Borehole at 4.10 m									

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.4	2.5	0.5							No water strike
3.9	4.1	2							

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
27-05-20	4.10	1.00	4.10	50mm SP					

<b>REMARKS</b> Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG 22529.GPJ IGSL.GDT 8/6/20

**APPENDIX 6.3**

**SOIL AND GROUNDWATER QUALITY RESULTS**

**Table 1** Analytical test results compared to LQM/CIEH thresholds

Sample ID	Laboratory	Report	Sample Type	Sample Depth	Sample Date	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10
						EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT
						20/6/35	20/6/35	20/6/35	20/6/35	20/6/35	20/6/35	20/6/35	20/6/35	20/6/35	20/6/35
						Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
						1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90
						25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameters	Units	LOD	LQM/CIEH S4ul for HHRA Residential Threshold (mg/kg)	LQM/CIEH S4ul for HHRA Commercial Threshold (mg/kg)											
Arsenic	mg/kg	<0.5	40	640	12.6	11	10.6	10.7	9.7	10.2	8.3	11.1	11.2	8.6	
Cadmium	mg/kg	<0.1	85	190	2	1.2	2.2	2.5	2.4	2.3	1.6	2.4	1.9	1.4	
Chromium III	mg/kg	<0.5	910	8,600	23.4	24.9	24	22.8	24.1	20.1	18.4	26.1	25.3	24.7	
Copper	mg/kg	<1	7,100	68,000	38	36	29	24	24	29	19	29	27	21	
Mercury	mg/kg	<0.1	1.2	56 <sup>ms</sup> (25.8)	-	-	-	-	-	-	-	-	-	-	
Nickel	mg/kg	<0.7	180	980	40.5	46.9	37.8	37.5	40	41.9	33.9	43.9	37.7	33	
Selenium	mg/kg	<1	430	12,000	-	-	-	-	-	-	-	1.00	1.00	-	
Zinc	mg/kg	<5	40,000	730,000	80	98	74	69	77	74	52	81	70	55	
Benzene	mg/kg	<0.003	0.38	27	-	-	-	-	-	-	-	-	-	-	
Toluene	mg/kg	<0.003	880 <sup>ms</sup> (889)	56,000 <sup>ms</sup> (889)	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	mg/kg	<0.003	83	5,700 <sup>ms</sup> (518)	-	-	-	-	-	-	-	-	-	-	
m & p-Xylene	mg/kg	<0.005	161	12,800 <sup>ms</sup> (625&576)	-	-	-	-	-	-	-	-	-	-	
o-Xylene	mg/kg	<0.003	88	6,600 <sup>ms</sup> (478)	-	-	-	-	-	-	-	-	-	-	
Aliphatic															
>C8-C8	mg/kg	<0.1	100	3,200 (304) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>C8-C10	mg/kg	<0.1	27	7,800 (144) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>C10-C12	mg/kg	<0.2	130 (48) <sup>ms</sup>	2,000 (78) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>C12-C16	mg/kg	<4	1100 (24) <sup>ms</sup>	9,700 (48) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>C16-C35	mg/kg	<7	65000 (8.48) <sup>ms</sup>	1,600,000	-	-	-	-	-	-	-	-	-	-	
>C35-C44*	mg/kg	<7	65000 (8.48) <sup>ms</sup>	1,600,000	-	-	-	-	-	-	-	-	-	-	
Aromatics															
>EC7-EC7	mg/kg	<0.1	370	26,000 (1220) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>EC7-EC8	mg/kg	<0.1	880	56,000 (389) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>EC8-EC10	mg/kg	<0.1	47	3,500 (613) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>EC10-EC12	mg/kg	<0.2	250	16,000 (364) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>EC12-EC16	mg/kg	<4	1,800	36,000 (189) <sup>ms</sup>	-	-	-	-	-	-	-	-	-	-	
>EC16-EC21	mg/kg	<7	1,900	28,000	-	-	-	-	-	-	-	-	-	-	
>EC21-EC35	mg/kg	<7	1,900	28,000	-	-	-	-	-	-	-	-	-	-	
>EC35-EC44**	mg/kg	<7	1,900	28,000	-	-	-	-	-	-	-	-	-	-	
Acenaphthene	mg/kg	<0.05	3,000 <sup>ms</sup> (57.0)	84,000 <sup>ms</sup> (57.0)	-	-	-	-	-	-	-	-	-	-	
Acenaphthylene	mg/kg	<0.03	2,900 <sup>ms</sup> (86.1)	83,000 <sup>ms</sup> (86.1)	-	-	-	-	-	-	-	-	-	-	
Anthracene	mg/kg	<0.04	31,000 <sup>ms</sup> (1.17)	520,000	-	-	-	-	-	-	-	-	-	-	
Benzo(a)anthracene	mg/kg	<0.06	11	170	-	-	-	-	-	-	-	-	-	-	
Benzo(a)pyrene	mg/kg	<0.04	3.2	35	-	-	-	-	-	-	-	-	-	-	
Benzo(b)fluoranthene	mg/kg	<0.05	3.9	44	-	-	-	-	-	-	-	-	-	-	
Benzo(g)herylene	mg/kg	<0.04	360	3,900	-	-	-	-	-	-	-	-	-	-	
Benzo(k)fluoranthene	mg/kg	<0.02	110	1,200	-	-	-	-	-	-	-	-	-	-	
Chrysene	mg/kg	<0.02	30	350	-	-	-	-	-	-	-	-	-	-	
Dibenz(ah)anthracene	mg/kg	<0.04	0.31	3.5	-	-	-	-	-	-	-	-	-	-	
Fluoranthene	mg/kg	<0.03	1,500	23,000	-	-	-	-	-	-	-	-	-	-	
Fluorene	mg/kg	<0.04	2,800 <sup>ms</sup> (30.9)	63,000 <sup>ms</sup> (30.9)	-	-	-	-	-	-	-	-	-	-	
Indeno(123cd)pyrene	mg/kg	<0.04	45	500	-	-	-	-	-	-	-	-	-	-	
Naphthalene	mg/kg	<0.04	2	190 <sup>ms</sup> (76.4)	-	-	-	-	-	-	-	-	-	-	
Phenanthrene	mg/kg	<0.03	1,300 <sup>ms</sup> (36.0)	22,000	-	-	-	-	-	-	-	-	-	-	
Pyrene	mg/kg	<0.03	3,700	54,000	-	-	-	-	-	-	-	-	-	-	

Legend  
 0.45 Results exceed LQM/CIEH S4ul for HHRA Residential Threshold without homegrown produce at 1% SOM (mg/kg)  
 0.45 Results exceed LQM/CIEH S4ul for HHRA Commercial Threshold at 1% SOM (mg/kg)  
 - Results below LOD  
 nv Guideline threshold value not available

Notes  
 HHRA 2015 - LQM/CIEH Suitable 4 Use Levels based on 'Commercial' and/or 'residential' land use using 1% SOM. Metals are compared against a 6% SOM  
 \* Aliphatic >C35-C40 was considered  
 \* Aromatic >EC35-EC40 was considered  
 \* Aromatic >C35-C40 was considered  
 Sol : sol S4UL presented exceed the solubility saturation limit, which is presented in brackets  
 Vap : vap S4UL presented exceed the vapour saturation limit which is presented in brackets




**Table 2** Analytical test results compared to WAC thresholds

Sample ID				TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10		
Laboratory				EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT		
Report				20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735		
Sample Type				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Depth				1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90		
Sample Date				25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020		
Parameters	Units	LOD	Landfill Waste Acceptance Criteria Limits												
			Inert Waste Landfill	Stable Non-reactive	Hazardous Waste Landfill										
<b>Solid Waste Analysis</b>															
Total Organic Carbon	%	<0.02	3	5	8	0.4	0.36	0.3	0.56	0.44	0.41	0.36	0.42	0.47	0.42
Sum of BTEX	mg/kg	<0.025	6	nv	nv	-	-	-	-	-	-	-	-	-	-
Sum of 7 PCBs	mg/kg	<0.035	1	nv	nv	-	-	-	-	-	-	-	-	-	-
Mineral Oil	mg/kg	<30	500	nv	nv	-	-	-	-	-	-	-	-	-	-
PAH Sum of 6	mg/kg	<0.22	nv	nv	nv	-	-	-	-	-	-	-	-	-	-
PAH Sum of 17	mg/kg	<0.64	100	nv	nv	-	-	-	-	-	-	-	-	-	-
<b>Eluate Analysis</b>															
Arsenic	mg/kg	<0.025	0.5	2	25	-	-	-	-	-	-	-	-	-	-
Barium	mg/kg	<0.03	20	100	500	0.03	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	<0.005	0.04	1	5	-	-	-	-	-	-	-	-	-	-
Chromium	mg/kg	<0.015	0.5	10	70	-	-	-	-	-	-	-	-	-	-
Copper	mg/kg	<0.07	2	50	100	-	-	-	-	-	-	-	-	-	-
Mercury	mg/kg	<0.0001	0.01	0.2	2	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/kg	<0.02	0.5	10	30	0.09	0.11	0.13	0.16	0.11	0.18	0.23	0.18	0.17	0.07
Nickel	mg/kg	<0.02	0.4	10	40	-	-	-	-	-	-	-	-	-	-
Lead	mg/kg	<0.05	0.5	10	50	-	-	-	-	-	-	-	-	-	-
Antimony	mg/kg	<0.02	0.06	0.7	5	-	-	-	-	-	-	-	-	-	-
Selenium	mg/kg	<0.03	0.1	0.5	7	-	-	-	-	-	-	-	-	-	-
Zinc	mg/kg	<0.03	4	50	200	-	-	-	-	-	-	-	-	-	-
Chloride	mg/kg	<3	800	15,000	25,000	-	5	-	-	-	-	-	-	4	4
Fluoride	mg/kg	<3	10	150	500	4	5	5	5	4	4	4	4	4	5
Sulphate as SO4	mg/kg	<5	1,000	20,000	50,000	18	-	-	9	-	10	-	5	-	7
Total Dissolved Solids	mg/kg	<350	4,000	60,000	100,000	870	660	820	540	910	730	590	470	580	620
Phenol	mg/kg	<0.1	1	nv	nv	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/kg	<20	500	800	1,000	20	-	30	-	-	-	30	20	-	20

**Notes:**

XX	Exceedence Inert Waste Limit
XX	Exceedence Stable Non-reactive Waste Limit
XX	Exceedence Hazardous Waste Limit
-	Results below LOD
nv	No value



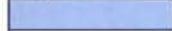
**Table 3** Landfill gas results

Location	Date	Landfill Gas Parameters			
		CH <sub>4</sub> %	CO <sub>2</sub> %	O <sub>2</sub> %	H <sub>2</sub> S ppm
CP01	18/06/2020	0	0.5	20.6	0
CP02	18/06/2020	0	0.8	19.4	0
CP03	18/06/2020	0	0.7	19.9	0
CP04	18/06/2020	0	0.3	20.4	0
CP05	18/06/2020	0	0.5	20	0

**Table 4** Analytical test results for the groundwater samples – Metals Suite.

<b>Laboratory Test Results: WATER Metals Suite</b>								
<b>Client:</b> Huntstown Power Company								
<b>Location:</b> Lands to the east of Huntstown Powerstation								
<b>AWN Ref:</b> Huntstown EIAR								
<b>Ref:</b> 20/7327								
Sample ID	Details				Groundwater			
					RC01	RC02	RC05	
Laboratory					EEL	EEL	EEL	
Sample Type					Primary	Primary	Primary	
Sample Date					08/06/2020			
Parameters	Units	MDL	GTV (Groundwater)	IGV (Groundwater)				
Arsenic	ug/l	<2.5	7.5	10	8	-	8.5	
Boron	ug/l	<12	750	1000	21	16	31	
Cadmium	ug/l	<0.5	3.75	5	-	-	-	
Chromium	ug/l	<1.5	37.5	30	-	-	-	
Copper	ug/l	<7	1500	30	-	-	-	
Lead	ug/l	<5	18.75	10	-	-	-	
Mercury	ug/l	<1	0.75	1	-	-	-	
Nickel	ug/l	<2	15	20	-	-	-	
Selenium	ug/l	<3	<i>nv</i>	<i>nv</i>	-	-	-	
Zinc	ug/l	<3	75	100	13	10	5	

<b>Key</b>		
	Value exceeds the Threshold Value (Groundwater)	
GTV	Groundwater Threshold Value	
IGV	Interim Guideline Value	<u>Underlined</u> = IGV Threshold values exceeded
MDL	Method Detection Limit	
-	Less than the MDL	
nv	No Value	nt Not tested

**Table 5** Analytical test results for the groundwater samples – Hydrocarbons.

Laboratory Test Results: WATER Hydrocarbon Suite							
Client: Huntstown Power Company							
Location: Lands to the east of Huntstown Powerstation							
AWN Ref: Huntstown EIAR							
Ref: 20/7327							
Sample ID	Details				Groundwater		
					RC01	RC02	RC05
Laboratory					EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date					08/06/2020		
Parameters	Units	MDL	GTV (Groundwater)	IGV (Groundwater)			
PAH 16 Total	ug/l	<0.195	7.5	0.1	-	-	-
Benzo(b)fluoranthene	ug/l	<0.01	187.5	0.5	-	-	-
Benzo(k)fluoranthene	ug/l	<0.01	<i>nv</i>	<i>nv</i>	-	-	-
Methyl Tertiary Butyl Ether	ug/l	<0.1	<i>nv</i>	30	-	-	-
Benzene	ug/l	<0.5	0.75	1.0	-	-	-
Toluene	ug/l	<5	525	10	-	-	-
Ethylbenzene	ug/l	<1	<i>nv</i>	10	-	-	-
p/m-Xylene	ug/l	<2	<i>nv</i>	10	-	-	-
o-Xylene	ug/l	<1	<i>nv</i>	10	-	-	-
Total aliphatics C5-35	ug/l	<10	<i>nv</i>	<i>nv</i>	-	-	-
Total aromatics C5-35	ug/l	<10	<i>nv</i>	<i>nv</i>	-	-	-
Total aliphatics and aromatics (C5-35)	ug/l	<10	<i>nv</i>	10	-	-	-
Total 7 PCBs	ug/l	<0.7	<i>nv</i>	0.01	-	-	-

Key	
	Value exceeds the Threshold Value (Groundwater)
GTV	Groundwater Threshold Value
IGV	Interim Guideline Value <span style="margin-left: 100px;"><u>Underlined</u> = IGV Threshold values exceeded</span>
MDL	Method Detection Limit
-	Less than the MDL
nv	No Value <span style="margin-left: 100px;"><i>nt</i> Not tested</span>

**Table 6** Analytical test results for the groundwater samples – General Suite.

Laboratory Test Results: WATER General Suite							
Client: Huntstown Power Company							
Location: Lands to the east of Huntstown Powerstation							
AWN Ref: Huntstown EIAR							
Ref: 20/7327							
Sample ID	Details				Groundwater		
					RC01	RC02	RC05
Laboratory					EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date					08/06/2020		
Parameters	Units	MDL	GTV (Groundwater)	IGV (Groundwater)			
<b>Anions &amp; Cations</b>							
Chloride	mg/l	0.3	24-187.5	30	<u>40.1</u>	24.4	<u>41.8</u>
Ortho Phosphate as PO4	mg/l	0.05	<i>nv</i>	200	<0.06	<0.06	<0.06
Ammoniacal Nitrogen as N	mg/l	0.03	<i>nv</i>	<i>nv</i>	0.15	-	0.33
Total Nitrogen	mg/l	1	<i>nv</i>	<i>nv</i>	1.3	2.5	1.5
PCBs (Total vs Aroclor 1254)	ug/l	<0.2	<i>nv</i>	<i>nv</i>	-	-	-
<b>Key</b>							
					Value exceeds the Threshold Value (Groundwater)		
GTV			Groundwater Threshold Value				
IGV				Interim Guideline Value <u>Underlined</u> = IGV Threshold values exceeded			
MDL			Method Detection Limit				
-			Less than the MDL				
nv			No Value <i>nt</i> Not tested				

**Table 7** Field parameters for all three (3) no. monitoring wells on the subject site

Field Parameters							
Client: Huntstown Power Company							
Location: Lands to the east of Huntstown Powerstation							
AWN Ref: Huntstown EIAR							
Ref: 20/7327							
Sample ID	Date sampled	Full Depth (mbTOC)	WL (mbTOC)	pH	Temp (°C)	EC (uS/cm)	Comments/ observations
<b>Groundwater</b>							
			-	-	-	(800 or 1875) <sup>(note 1)</sup>	Groundwater Regulations SI No. 9 of 2010, and 366 of 2016
			-	≥6.5 and ≤9.5	-	1000	EPA IGVs (2003)
RC01	08/06/2020	19.37	2.18	8.15	11.8	541	Clean Clear NEC
RC02	08/06/2020	18.65	4.27	7.30	11.5	987	Slight grey coloration NEC
BH3	08/06/2020	19.70	8.50	7.25	12.1	1188	Slight grey coloration NEC
<i>(Note 2)</i>							
Key: <i>Groundwater levels measured in metres below top of casing (mbTOC)</i>							
Bold = exceeds the Regulations		<i>Underlined</i> exceeds the standard (EPA IGV)					
NCS = No Signs of Contamination							
Note 1 Different GW Thresholds apply to different status classification tests						NEC - No evidence of contamination	
Note 2 Irish Drinking Water Regulations, 1988 (S.I. No. 81 of 1988), 25 Deg C							

**Table 8** Analytical test results for the groundwater samples – VOCs.

Laboratory Test Results: WATER Volatile Organic Compounds (VOCs)					Groundwater		
Client: Huntstown Power Company					RC01	RC02	RC05
Location: Lands to the east of Huntstown Powerstation					EEL	EEL	EEL
AWN Ref: Huntstown EIAR					Primary	Primary	Primary
Ref: 20/7327					08/06/2020		
Sample ID	Details				Groundwater		
					RC01	RC02	RC05
Laboratory					EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date					08/06/2020		
Parameters	Units	MDL	GTV (Groundwater)	IGV (Groundwater)			
Dichlorodifluoromethane	ug/l	<2		nv	-	-	-
Methyl Tertiary Butyl Ether	ug/l	<0.1	nv	30	-	-	-
Chloromethane	ug/l	<3			-	-	-
Vinyl Chloride	ug/l	<0.1	0.375		-	-	-
Bromomethane	ug/l	<1			-	-	-
Chloroethane	ug/l	<3		nv	-	-	-
Trichlorofluoromethane	ug/l	<3			-	-	-
1,1-Dichloroethene (1,1 DCE)	ug/l	<3			-	-	-
Dichloromethane (DCM)	ug/l	<3			-	-	-
trans-1-2-Dichloroethene	ug/l	<3			-	-	-
1,1-Dichloroethane	ug/l	<3	nv	3	-	-	-
cis-1-2-Dichloroethene	ug/l	<3			-	-	-
2,2-Dichloropropane	ug/l	<1		nv	-	-	-
Bromochloromethane	ug/l	<2			-	-	-
Chloroform	ug/l	<2		12	-	29	-
1,1,1-Trichloroethane	ug/l	<2		500	-	-	-
1,1-Dichloropropene	ug/l	<3		nv	-	-	-
Carbon tetrachloride	ug/l	<2			-	-	-
1,2-Dichloroethane	ug/l	<2	2.25	3	-	-	-
Benzene	ug/l	<0.5	0.75	nv	-	-	-
Trichloroethene (TCE)	ug/l	<3	7.5	10	-	-	-
1,2-Dichloropropane	ug/l	<2			-	-	-
Dibromomethane	ug/l	<3		nv	-	-	-
Bromodichloromethane	ug/l	<2			-	-	-
cis-1-3-Dichloropropene	ug/l	<2	nv		-	-	-
Toluene	ug/l	<0.5		10	-	-	-
trans-1-3-Dichloropropene	ug/l	<2		nv	-	-	-
1,1,2-Trichloroethane	ug/l	<2			-	-	-
Tetrachloroethene (PCE)	ug/l	<3	7.5	10	-	-	-
1,3-Dichloropropane	ug/l	<2			-	-	-
Dibromochloromethane	ug/l	<2		nv	-	-	-
1,2-Dibromoethane	ug/l	<2			-	-	-
Chlorobenzene	ug/l	<2		1	-	-	-
1,1,1,2-Tetrachloroethane	ug/l	<2		nv	-	-	-
Ethylbenzene	ug/l	<0.5		10	-	-	-
p/m-Xylene	ug/l	<1		10	-	-	-
o-Xylene	ug/l	<0.5			-	-	-
Styrene	ug/l	<2			-	-	-
Bromoform	ug/l	<2			-	-	-
Isopropylbenzene	ug/l	<3			-	-	-
1,1,2,2-Tetrachloroethane	ug/l	<4			-	-	-
Bromobenzene	ug/l	<2			-	-	-
1,2,3-Trichloropropane	ug/l	<3			-	-	-
Propylbenzene	ug/l	<3			-	-	-
2-Chlorotoluene	ug/l	<3	nv		-	-	-
1,3,5-Trimethylbenzene	ug/l	<3		nv	-	-	-
4-Chlorotoluene	ug/l	<3			-	-	-
tert-Butylbenzene	ug/l	<3			-	-	-
1,2,4-Trimethylbenzene	ug/l	<3			-	-	-
sec-Butylbenzene	ug/l	<3			-	-	-
4-Isopropyltoluene	ug/l	<3			-	-	-
1,3-Dichlorobenzene	ug/l	<3			-	-	-
1,4-Dichlorobenzene	ug/l	<3			-	-	-
n-Butylbenzene	ug/l	<3			-	-	-
1,2-Dichlorobenzene	ug/l	<3		10	-	-	-
1,2-Dibromo-3-chloropropane	ug/l	<2		nv	-	-	-
1,2,4-Trichlorobenzene	ug/l	<3		0.4	-	-	-
Hexachlorobutadiene	ug/l	<3		0.1	-	-	-
Naphthalene	ug/l	<2		1	-	-	-
1,2,3-Trichlorobenzene	ug/l	<3		nv	-	-	-

<b>Key</b>	<b>BOLD</b> Value exceeds the Groundwater Guideline Value (Groundwater)	<u>Underlined</u> exceeds the EPA IGV
	GTV Groundwater Threshold Value	
	IGV Interim Guideline Value	
	MDL Method Detection Limit	
	- Less than the MDL	
	nv no criteria value available	



**Table 9** Analytical test results for the groundwater samples – SVOCs'

Laboratory Test Results: WATER Semi-Volatile Organic Compounds (SVOCs)								
Client: Huntstown Power Company								
Location: Lands to the east of Huntstown Powerstation								
AWN Ref: Huntstown EIAR								
Ref: 20/7327								
Sample ID	Details					Groundwater		
						RC01	RC02	RC05
Laboratory						EEL	EEL	EEL
Sample Type						Primary	Primary	Primary
Sample Date						08/06/2020		
Parameters	Units	MDL	GTV (Groundwater)	IGV (Groundwater)				
2-Chlorophenol	ug/l	<1		200	-	-	-	
2-Methylphenol	ug/l	<0.5			-	-	-	
2-Nitrophenol	ug/l	<0.5			-	-	-	
2,4-Dichlorophenol	ug/l	<0.5		<u>nv</u>	-	-	-	
2,4-Dimethylphenol	ug/l	<1			-	-	-	
2,4,5-Trichlorophenol	ug/l	<0.5			-	-	-	
2,4,6-Trichlorophenol	ug/l	<1		200	-	-	-	
4-Chloro-3-methylphenol	ug/l	<0.5			-	-	-	
4-Methylphenol	ug/l	<1		<u>nv</u>	-	-	-	
4-Nitrophenol	ug/l	<10			-	-	-	
Pentachlorophenol	ug/l	<1			-	-	-	
Phenol	ug/l	<1		0.5	-	-	-	
2-Chloronaphthalene	ug/l	<1			-	-	-	
2-Methylnaphthalene	ug/l	<1		<u>nv</u>	-	-	-	
Bis(2-ethylhexyl) phthalate	ug/l	<5			-	-	-	
Butylbenzyl phthalate	ug/l	<1			-	-	-	
Di-n-butyl phthalate	ug/l	<1.5		2	-	-	-	
Di-n-Octyl phthalate	ug/l	<1			-	-	-	
Diethyl phthalate	ug/l	<1		<u>nv</u>	-	-	-	
Diethyl phthalate	ug/l	<1			-	-	-	
1,2-Dichlorobenzene	ug/l	<1			-	-	-	
1,2,4-Trichlorobenzene	ug/l	<1			-	-	-	
1,3-Dichlorobenzene	ug/l	<1	<u>nv</u>		-	-	-	
1,4-Dichlorobenzene	ug/l	<1			-	-	-	
2-Nitroaniline	ug/l	<1		<u>nv</u>	-	-	-	
2,4-Dinitrotoluene	ug/l	<0.5			-	-	-	
2,6-Dinitrotoluene	ug/l	<1			-	-	-	
3-Nitroaniline	ug/l	<1			-	-	-	
4-Bromophenylphenylether	ug/l	<1		10	-	-	-	
4-Chloroaniline	ug/l	<1			-	-	-	
4-Chlorophenylphenylether	ug/l	<1			-	-	-	
4-Nitroaniline	ug/l	<0.5			-	-	-	
Azobenzene	ug/l	<0.5		<u>nv</u>	-	-	-	
Bis(2-chloroethoxy)methane	ug/l	<0.5			-	-	-	
Bis(2-chloroethyl)ether	ug/l	<1			-	-	-	
Carbazole	ug/l	<0.5			-	-	-	
Dibenzofuran	ug/l	<0.5			-	-	-	
Hexachlorobenzene	ug/l	<1		0.03	-	-	-	
Hexachlorobutadiene	ug/l	<1		0.10	-	-	-	
Hexachlorocyclopentadiene	ug/l	<1			-	-	-	
Hexachloroethane	ug/l	<1		<u>nv</u>	-	-	-	
Isophorone	ug/l	<0.5			-	-	-	
N-nitrosodi-n-propylamine	ug/l	<0.5			-	-	-	
Nitrobenzene	ug/l	<1		10	-	-	-	

Key		
<b>BOLD</b>	Value exceeds the Groundwater Guideline Value (Groundwater)	<u>Underlined</u> exceeds the EPA IGV
	GTV Groundwater Threshold Value	
	SWTV Surface Water Threshold Value	
	MDL Method Detection Limit	
	- Less than the MDL	
	nv no criteria value available	



**APPENDIX 6.4**  
**LABORATORY RESULTS**



AWN Consulting  
Tecpro Building  
Clonshaugh Business & Technology Park  
Dublin  
Dublin 17  
Ireland



**Attention :** Jonathan Gauntlet  
**Date :** 3rd June, 2020  
**Your reference :** Huntstown Phase 11  
**Our reference :** Test Report 20/6735 Batch 1  
**Location :** Huntstown Site  
**Date samples received :** 28th May, 2020  
**Status :** Final report  
**Issue :** 1

Ten samples were received for analysis on 28th May, 2020 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Authorised By:**



**Bruce Leslie**  
Project Manager

Please include all sections of this report if it is reproduced

# Element Materials Technology

Client Name: AWN Consulting  
 Reference: Huntstown Phase 11  
 Location: Huntstown Site  
 Contact: Jonathan Gauntlett  
 EMT Job No: 20/6735

Report: Solid  
 Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	LOD/LOR	Units	Method No.
Antimony	4	2	2	2	2	3	2	2	2	2	<1	mg/kg	TM30/PM15
Arsenic *	12.6	11.0	10.6	10.7	9.7	10.2	8.3	11.1	11.2	8.6	<0.5	mg/kg	TM30/PM15
Barium *	214	94	69	85	61	65	59	73	91	102	<1	mg/kg	TM30/PM15
Cadmium *	2.0	1.2	2.2	2.5	2.4	2.3	1.6	2.4	1.9	1.4	<0.1	mg/kg	TM30/PM15
Chromium *	23.4	24.9	24.0	22.8	24.1	20.1	18.4	26.1	25.3	24.7	<0.5	mg/kg	TM30/PM15
Copper *	36	36	29	24	24	29	19	29	27	21	<1	mg/kg	TM30/PM15
Lead *	37	22	17	15	14	14	12	13	15	12	<5	mg/kg	TM30/PM15
Mercury *	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum *	3.2	2.6	3.2	3.6	3.2	4.0	3.3	4.1	3.7	1.9	<0.1	mg/kg	TM30/PM15
Nickel *	40.5	46.9	37.8	37.5	40.0	41.9	33.9	43.9	37.7	33.0	<0.7	mg/kg	TM30/PM15
Selenium *	<1	<1	<1	<1	<1	<1	<1	1	1	<1	<1	mg/kg	TM30/PM15
Total Sulphate as SO4 *	358	222	312	299	281	291	286	292	243	268	<50	mg/kg	TM50/PM29
Water Soluble Boron *	0.3	0.2	0.4	0.2	0.3	0.3	0.3	0.3	0.2	0.3	<0.1	mg/kg	TM74/PM32
Zinc *	80	98	74	69	77	74	52	81	70	55	<5	mg/kg	TM30/PM15
<b>PAH MS</b>													
Naphthalene *	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene *	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene *	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene *	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene *	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene *	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene *	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene *	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene *	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(b)fluoranthene *	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene *	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene *	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene *	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total *	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	92	91	92	93	94	93	92	90	83	92	<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM6/PM16

# Element Materials Technology

Client Name: AWN Consulting  
 Reference: Huntstown Phase 11  
 Location: Huntstown Site  
 Contact: Jonathan Gauntlett  
 EMT Job No: 20/6735

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020			
TPH CWG													
Aliphatics													
>C5-C6*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16*	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21*	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35*	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/PM8/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16*	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21*	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35*	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/PM8/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52	<52	<52	<52	<52	<52	mg/kg	TM5/PM8/PM16
>EC6-EC10*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
MTBE*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Benzene*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Toluene*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Ethylbenzene*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
m/p-Xylene*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
o-Xylene*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
PCB 28*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs*	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

# Element Materials Technology

Client Name: AWN Consulting  
 Reference: Huntstown Phase 11  
 Location: Huntstown Site  
 Contact: Jonathan Gauntlet  
 EMT Job No: 20/6735

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	LOD/LOR	Units	Method No.
Phenol*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM26/PM21
Natural Moisture Content	13.7	13.1	13.2	10.9	10.4	12.2	11.4	11.3	10.6	11.9	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.1	11.6	11.7	9.8	9.4	10.8	10.2	10.1	9.6	10.6	<0.1	%	PM4/PM0
Hexavalent Chromium*	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Chromium III	23.4	24.9	24.0	22.8	24.1	20.1	18.4	26.1	25.3	24.7	<0.5	mg/kg	NONE/NONE
Total Cyanide*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Total Organic Carbon*	0.40	0.36	0.30	0.56	0.44	0.41	0.36	0.42	0.47	0.42	<0.02	%	TM21/PM24
Sulphide	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM107/PM45
Elemental Sulphur	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	mg/kg	TM108/PM114
pH*	8.58	8.63	8.60	8.69	8.68	8.64	8.69	8.67	8.64	8.64	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1031	0.1023	0.104	0.1095	0.1017	0.1017	0.1005	0.1015	0.102	0.1439		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17

# Element Materials Technology

Client Name: AWN Consulting  
 Reference: Huntstown Phase 11  
 Location: Huntstown Site  
 Contact: Jonathan Gauntlet  
 EMT Job No: 20/6735

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	LOD/LOR	Units	Method No.
Dissolved Antimony *	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) *	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic *	<0.0025	<0.0025	0.0032	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) *	<0.025	<0.025	0.032	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium *	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) *	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Boron *	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	mg/l	TM30/PM17
Dissolved Boron (A10) *	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	mg/kg	TM30/PM17
Dissolved Cadmium *	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) *	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium *	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) *	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper *	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) *	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead *	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) *	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum *	0.009	0.011	0.013	0.016	0.011	0.018	0.023	0.018	0.017	0.007	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) *	0.09	0.11	0.13	0.16	0.11	0.18	0.23	0.18	0.17	0.07	<0.02	mg/kg	TM30/PM17
Dissolved Nickel *	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) *	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium *	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) *	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc *	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) *	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF *	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF *	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	<0.3	mg/l	TM173/PM0
Fluoride	4	5	5	5	4	4	4	4	4	5	<3	mg/kg	TM173/PM0
Sulphate as SO4 *	1.8	<0.5	<0.5	0.9	<0.5	1.0	<0.5	0.5	<0.5	0.7	<0.5	mg/l	TM38/PM0
Sulphate as SO4 *	18	<5	<5	9	<5	10	<5	5	<5	7	<5	mg/kg	TM38/PM0
Chloride *	<0.3	0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.4	0.4	<0.3	mg/l	TM38/PM0
Chloride *	<3	5	<3	<3	<3	<3	<3	<3	4	4	<3	mg/kg	TM38/PM0
Ammoniacal Nitrogen as N *	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.04	<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as N *	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	<0.3	mg/kg	TM38/PM0
Dissolved Organic Carbon	2	2	3	<2	<2	2	3	2	<2	2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	20	<20	30	<20	<20	<20	30	20	<20	20	<20	mg/kg	TM60/PM0
Total Dissolved Solids *	87	66	82	54	91	73	59	47	58	62	<35	mg/l	TM20/PM0
Total Dissolved Solids *	870	660	820	540	910	730	590	470	580	620	<350	mg/kg	TM20/PM0



Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	87.2
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>3</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP1</b>			
<b>Depth/Other</b>	<b>1.00-1.20</b>			
<b>Sample Date</b>	<b>25/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

<b>Solid Waste Analysis</b>				
Total Organic Carbon (%)	0.40	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10 mg/kg</b>	<b>mg/kg</b>		
Arsenic	<0.025	0.5	2	25
Barium	0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.09	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	18	1000	20000	50000
Total Dissolved Solids	870	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000



Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>6</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP2</b>			
<b>Depth/Other</b>	<b>1.00-1.30</b>			
<b>Sample Date</b>	<b>25/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

<b>Solid Waste Analysis</b>				
Total Organic Carbon (%)	0.36	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10 mg/kg</b>	<b>mg/kg</b>		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.11	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	5	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	660	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	81.8
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.6

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>12</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP4</b>			
<b>Depth/Other</b>	<b>1.10-1.30</b>			
<b>Sample Date</b>	<b>25/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

<b>Solid Waste Analysis</b>				
Total Organic Carbon (%)	0.56	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10 mg/kg</b>	<b>mg/kg</b>		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.16	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	9	1000	20000	50000
Total Dissolved Solids	540	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.8
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>15</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP5</b>			
<b>Depth/Other</b>	<b>0.75-0.90</b>			
<b>Sample Date</b>	<b>26/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

<b>Solid Waste Analysis</b>				
Total Organic Carbon (%)	0.44	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10 mg/kg</b>	<b>mg/kg</b>		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.11	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	910	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg) =	-	Dry Matter Content Ratio (%) =	88.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>18</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP6</b>			
<b>Depth/Other</b>	<b>1.00-1.20</b>			
<b>Sample Date</b>	<b>26/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

Solid Waste Analysis	
Total Organic Carbon (%)	0.41
Sum of BTEX (mg/kg)	<0.025
Sum of 7 PCBs (mg/kg)	<0.035
Mineral Oil (mg/kg)	<30
PAH Sum of 6 (mg/kg)	<0.22
PAH Sum of 17 (mg/kg)	<0.64

3	5	6
6	-	-
1	-	-
500	-	-
-	-	-
100	-	-

Eluate Analysis	10:1 concn leached	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
	A10 mg/kg	mg/kg		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.18	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	10	1000	20000	50000
Total Dissolved Solids	730	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

Mass of sample taken (kg) =	-	Dry Matter Content Ratio (%) =	89.1
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>21</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP7</b>			
<b>Depth/Other</b>	<b>1.00-1.30</b>			
<b>Sample Date</b>	<b>26/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

Solid Waste Analysis	
Total Organic Carbon (%)	0.36
Sum of BTEX (mg/kg)	<0.025
Sum of 7 PCBs (mg/kg)	<0.035
Mineral Oil (mg/kg)	<30
PAH Sum of 6 (mg/kg)	<0.22
PAH Sum of 17 (mg/kg)	<0.64

**FINGAL COUNTY COUNCIL  
PLANNING DEPARTMENT**

**11 FEB 2022  
ADDITIONAL INFORMATION  
REGISTRY**

Eluate Analysis	10:1 concn leached
	A10
	mg/kg
Arsenic	<0.025
Barium	<0.03
Cadmium	<0.005
Chromium	<0.015
Copper	<0.07
Mercury	<0.0001
Molybdenum	0.23
Nickel	<0.02
Lead	<0.05
Antimony	<0.02
Selenium	<0.03
Zinc	<0.03
Chloride	<3
Fluoride	4
Sulphate as SO4	<5
Total Dissolved Solids	590
Phenol	<0.1
Dissolved Organic Carbon	30

3	5	6
6	-	-
1	-	-
500	-	-
-	-	-
100	-	-

Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
mg/kg		
0.5	2	25
20	100	300
0.04	1	5
0.5	10	70
2	50	100
0.01	0.2	2
0.5	10	30
0.4	10	40
0.5	10	50
0.06	0.7	5
0.1	0.5	7
4	50	200
800	15000	25000
10	150	500
1000	20000	50000
4000	60000	100000
1	-	-
500	800	1000

Mass of sample taken (kg) =	-	Dry Matter Content Ratio (%) =	89.0
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

EMT Job No	20/6735	Landfill Waste Acceptance Criteria Limits		
Sample No	24	Inert	Stable Non-reactive	Hazardous
Client Sample No	TP8			
Depth/Other	1.10-1.30			
Sample Date	26/05/2020			
Batch No	1			

Solid Waste Analysis					
Total Organic Carbon (%)	0.42		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg)	<30		500	-	-
PAH Sum of 6 (mg/kg)	<0.22		-	-	-
PAH Sum of 17 (mg/kg)	<0.64		100	-	-

Eluate Analysis	10:1 concn leached	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
	A10 mg/kg	mg/kg		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.18	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	5	1000	20000	50000
Total Dissolved Solids	470	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.6
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>27</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP9</b>			
<b>Depth/Other</b>	<b>1.20-1.40</b>			
<b>Sample Date</b>	<b>26/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

<b>Solid Waste Analysis</b>				
Total Organic Carbon (%)	0.47	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10 mg/kg</b>	<b>mg/kg</b>		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.17	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	4	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	580	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	62.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>30</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP10</b>			
<b>Depth/Other</b>	<b>0.75-0.90</b>			
<b>Sample Date</b>	<b>26/05/2020</b>			
<b>Batch No</b>	<b>1</b>			
<b>Solid Waste Analysis</b>				

Total Organic Carbon (%)	0.42	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10</b>	<b>mg/kg</b>		
	<b>mg/kg</b>			
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.07	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	4	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	7	1000	20000	50000
Total Dissolved Solids	620	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000

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Mass of sample taken (kg) =	-	Dry Matter Content Ratio (%) =	86.1
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.79

<b>EMT Job No</b>	<b>20/6735</b>	<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>9</b>	<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP3</b>			
<b>Depth/Other</b>	<b>0.50-1.00</b>			
<b>Sample Date</b>	<b>25/05/2020</b>			
<b>Batch No</b>	<b>1</b>			

<b>Solid Waste Analysis</b>				
Total Organic Carbon (%)	0.30	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

<b>Eluate Analysis</b>	<b>10:1 concn leached</b>	<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10 mg/kg</b>	<b>mg/kg</b>		
Arsenic	0.032	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.13	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	820	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

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**Client Name:** AWN Consulting  
**Reference:** Huntstown Phase 11  
**Location:** Huntstown Site  
**Contact:** Jonathan Gauntlet

**Matrix :** Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
20/6735	1	TP1	1.00-1.20	1-3	No interpretation possible
20/6735	1	TP2	1.00-1.30	4-6	No interpretation possible
20/6735	1	TP3	0.50-1.00	7-9	No interpretation possible
20/6735	1	TP4	1.10-1.30	10-12	No interpretation possible
20/6735	1	TP5	0.75-0.90	13-15	No interpretation possible
20/6735	1	TP6	1.00-1.20	16-18	No interpretation possible
20/6735	1	TP7	1.00-1.30	19-21	No interpretation possible
20/6735	1	TP8	1.10-1.30	22-24	No interpretation possible
20/6735	1	TP9	1.20-1.40	25-27	No interpretation possible
20/6735	1	TP10	0.75-0.90	28-30	No interpretation possible

Client Name: AWN Consulting  
 Reference: Huntstown Phase 11  
 Location: Huntstown Site  
 Contact: Jonathan Gauntlet

**Note:**  
 Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/6735	1	TP1	1.00-1.20	2	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP2	1.00-1.30	5	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP3	0.50-1.00	8	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP4	1.10-1.30	11	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP5	0.75-0.90	14	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP6	1.00-1.20	17	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP7	1.00-1.30	20	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD

Client Name: AWN Consulting  
 Reference: Huntstown Phase 11  
 Location: Huntstown Site  
 Contact: Jonathan Gauntlet

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/6735	1	TP7	1.00-1.30	20	02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP8	1.10-1.30	23	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP9	1.20-1.40	26	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD
20/6735	1	TP10	0.75-0.90	29	02/06/2020	General Description (Bulk Analysis)	Soil/Stones
					02/06/2020	Asbestos Fibres	NAD
					02/06/2020	Asbestos ACM	NAD
					02/06/2020	Asbestos Type	NAD
					02/06/2020	Asbestos Level Screen	NAD

**Client Name:** AWN Consulting  
**Reference:** Huntstown Phase 11  
**Location:** Huntstown Site  
**Contact:** Jonathan Gauntlet

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/6735						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

# NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/6735

## SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

## WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

## DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

## SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

## DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

## BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

## NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

**REPORTS FROM THE SOUTH AFRICA LABORATORY**

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

**Measurement Uncertainty**

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

**ABBREVIATIONS and ACRONYMS USED**

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range



EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PMB	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PMB	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PMB	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.	Yes		AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009; SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009; SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009; SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes		AD	Yes

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
TM108	Determination of Elemental Sulphur by Reversed Phase High Performance Liquid Chromatography with Ultra Violet spectroscopy.	PM114	End over end extraction of dried and crushed soil samples for organic analysis. The solvent mix varies depending on analysis required			AD	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

AWN Consulting  
Tecpro Building  
Clonshaugh Business & Technology Park  
Dublin  
Dublin 17  
Ireland



**Attention :** Jonathan Gauntlet  
**Date :** 12th June, 2020  
**Your reference :** Huntstown, Energia  
**Our reference :** Test Report 20/7327 Batch 1  
**Location :** Coldwinters, Huntstown  
**Date samples received :** 10th June, 2020  
**Status :** Final report  
**Issue :** 1

Three samples were received for analysis on 10th June, 2020 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.  
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Authorised By:**



**Bruce Leslie**  
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: AWN Consulting  
 Reference: Huntstown, Energia  
 Location: Coldwinters, Huntstown  
 Contact: Jonathan Gauntlet  
 EMT Job No: 20/7327

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle  
 H=H<sub>2</sub>SO<sub>4</sub>, Z=ZnAc, N=NaOH, HN=HNO<sub>3</sub>

EMT Sample No.	1-6	7-12	13-18								LOD/LOR	Units	Method No.
	Sample ID	BH01	BH02	BH04									
Depth											Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	V H H N P G	V H H N P G	V H H N P G										
Sample Date	08/06/2020	08/06/2020	08/06/2020										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	1	1	1										
Date of Receipt	10/06/2020	10/06/2020	10/06/2020										
Dissolved Arsenic *	8.0	<2.5	8.5								<2.5	ug/l	TM30/PM14
Dissolved Boron	21	16	31								<12	ug/l	TM30/PM14
Dissolved Cadmium *	<0.5	<0.5	<0.5								<0.5	ug/l	TM30/PM14
Total Dissolved Chromium *	<1.5	<1.5	<1.5								<1.5	ug/l	TM30/PM14
Dissolved Copper *	<7	<7	<7								<7	ug/l	TM30/PM14
Dissolved Lead *	<5	<5	<5								<5	ug/l	TM30/PM14
Dissolved Mercury *	<1	<1	<1								<1	ug/l	TM30/PM14
Dissolved Nickel *	3	<2	<2								<2	ug/l	TM30/PM14
Dissolved Selenium *	<3	<3	<3								<3	ug/l	TM30/PM14
Dissolved Zinc *	13	10	5								<3	ug/l	TM30/PM14
<b>PAH MS</b>													
Naphthalene *	<0.1	<0.1	<0.1								<0.1	ug/l	TM4/PM30
Acenaphthylene *	<0.013	<0.013	<0.013								<0.013	ug/l	TM4/PM30
Acenaphthene *	<0.013	<0.013	0.019								<0.013	ug/l	TM4/PM30
Fluorene *	<0.014	<0.014	0.016								<0.014	ug/l	TM4/PM30
Phenanthrene *	<0.011	<0.011	0.040								<0.011	ug/l	TM4/PM30
Anthracene *	<0.013	<0.013	<0.013								<0.013	ug/l	TM4/PM30
Fluoranthene *	<0.012	<0.012	<0.012								<0.012	ug/l	TM4/PM30
Pyrene *	<0.013	<0.013	<0.013								<0.013	ug/l	TM4/PM30
Benzo(a)anthracene *	<0.015	<0.015	<0.015								<0.015	ug/l	TM4/PM30
Chrysene *	<0.011	<0.011	<0.011								<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene *	<0.018	<0.018	<0.018								<0.018	ug/l	TM4/PM30
Benzo(a)pyrene *	<0.016	<0.016	<0.016								<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene *	<0.011	<0.011	<0.011								<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene *	<0.01	<0.01	<0.01								<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene *	<0.011	<0.011	<0.011								<0.011	ug/l	TM4/PM30
PAH 16 Total *	<0.195	<0.195	<0.195								<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.01	<0.01	<0.01								<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.01	<0.01	<0.01								<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	83	79	84								<0	%	TM4/PM30
Methyl Tertiary Butyl Ether *	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10
Benzene *	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
Toluene *	<5	<5	<5								<5	ug/l	TM15/PM10
Ethylbenzene *	<1	<1	<1								<1	ug/l	TM15/PM10
m/p-Xylene *	<2	<2	<2								<2	ug/l	TM15/PM10
o-Xylene *	<1	<1	<1								<1	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	99	103	73								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	102	101	85								<0	%	TM15/PM10

**Element Materials Technology**

**Client Name:** AWN Consulting  
**Reference:** Huntstown, Energia  
**Location:** Coldwinters, Huntstown  
**Contact:** Jonathan Gauntlet  
**EMT Job No:** 20/7327

**Report :** Liquid

**Liquids/products:** V=40ml vial, G=glass bottle, P=plastic bottle  
 H=H<sub>2</sub>SO<sub>4</sub>, Z=ZnAc, N=NaOH, HN=HNO<sub>3</sub>

EMT Sample No.	1-6	7-12	13-18							Please see attached notes for all abbreviations and acronyms			
	Sample ID	BH01	BH02	BH04									
Depth													
COC No / misc													
Containers	V H HN P G	V H HN P G	V H HN P G										
Sample Date	08/06/2020	08/06/2020	08/06/2020										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	1	1	1										
Date of Receipt	10/06/2020	10/06/2020	10/06/2020							LOD/LOR	Units	Method No.	
TPH CWG													
<b>Aliphatics</b>													
>C5-C6 *	<10	<10	<10							<10	ug/l	TM36/PM12	
>C6-C8 *	<10	<10	<10							<10	ug/l	TM36/PM12	
>C8-C10 *	<10	<10	<10							<10	ug/l	TM36/PM12	
>C10-C12 *	<5	<5	<5							<5	ug/l	TM5/PM16/PM30	
>C12-C16 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
>C16-C21 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
>C21-C35 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
Total aliphatics C5-35 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
<b>Aromatics</b>													
>C5-EC7 *	<10	<10	<10							<10	ug/l	TM36/PM12	
>EC7-EC8 *	<10	<10	<10							<10	ug/l	TM36/PM12	
>EC8-EC10 *	<10	<10	<10							<10	ug/l	TM36/PM12	
>EC10-EC12 *	<5	<5	<5							<5	ug/l	TM5/PM16/PM30	
>EC12-EC16 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
>EC16-EC21 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
>EC21-EC35 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
Total aromatics C5-35 *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
Total aliphatics and aromatics(C5-35) *	<10	<10	<10							<10	ug/l	TM5/PM16/PM30	
PCBs (Total vs Aroclor 1254)	<0.2	<0.2	<0.2							<0.2	ug/l	TM17/PM30	
Chloride *	40.1	24.4	41.8							<0.3	mg/l	TM38/PM0	
Ortho Phosphate as PO <sub>4</sub> *	<0.06	<0.06	<0.06							<0.06	mg/l	TM38/PM0	
Total Oxidised Nitrogen as N *	<0.2	1.7	<0.2							<0.2	mg/l	TM38/PM0	
Ammoniacal Nitrogen as N *	0.15	<0.03	0.33							<0.03	mg/l	TM38/PM0	
Total Nitrogen	1.3	2.5	1.5							<0.5	mg/l	TM38/PM125/PM30	

# Element Materials Technology

**Client Name:** AWN Consulting  
**Reference:** Huntstown, Energia  
**Location:** Coldwinters, Huntstown  
**Contact:** Jonathan Gauntlet  
**EMT Job No:** 20/7327

**SVOC Report :** Liquid

EMT Sample No.	1-6	7-12	13-18												
<b>Sample ID</b>	BH01	BH02	BH04												
<b>Depth</b>															
<b>COC No / misc</b>															
<b>Containers</b>	V H H N P G	V H H N P G	V H H N P G												
<b>Sample Date</b>	08/06/2020	08/06/2020	08/06/2020												
<b>Sample Type</b>	Ground Water	Ground Water	Ground Water												
<b>Batch Number</b>	1	1	1												
<b>Date of Receipt</b>	10/06/2020	10/06/2020	10/06/2020												
Please see attached notes for all abbreviations and acronyms															
													LOD/LOR	Units	Method No.
<b>SVOC MS</b>															
<b>Phenols</b>															
2-Chlorophenol *	<1	<1	<1										<1	ug/l	TM16/PM30
2-Methylphenol *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1	<1	<1										<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1	<1	<1										<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
4-Methylphenol	<1	<1	<1										<1	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<10										<10	ug/l	TM16/PM30
Pentachlorophenol	<1	<1	<1										<1	ug/l	TM16/PM30
Phenol	<1	<1	<1										<1	ug/l	TM16/PM30
<b>PAHs</b>															
2-Chloronaphthalene *	<1	<1	<1										<1	ug/l	TM16/PM30
2-Methylnaphthalene *	<1	<1	<1										<1	ug/l	TM16/PM30
<b>Phthalates</b>															
Bis(2-ethylhexyl) phthalate	<5	<5	<5										<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1	<1	<1										<1	ug/l	TM16/PM30
Di-n-butyl phthalate *	<1.5	<1.5	<1.5										<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1	<1	<1										<1	ug/l	TM16/PM30
Diethyl phthalate *	<1	<1	<1										<1	ug/l	TM16/PM30
Dimethyl phthalate	<1	<1	<1										<1	ug/l	TM16/PM30
<b>Other SVOCs</b>															
1,2-Dichlorobenzene *	<1	<1	<1										<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene *	<1	<1	<1										<1	ug/l	TM16/PM30
1,3-Dichlorobenzene *	<1	<1	<1										<1	ug/l	TM16/PM30
1,4-Dichlorobenzene *	<1	<1	<1										<1	ug/l	TM16/PM30
2-Nitroaniline	<1	<1	<1										<1	ug/l	TM16/PM30
2,4-Dinitrotoluene *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	<1	<1	<1										<1	ug/l	TM16/PM30
3-Nitroaniline	<1	<1	<1										<1	ug/l	TM16/PM30
4-Bromophenylphenylether *	<1	<1	<1										<1	ug/l	TM16/PM30
4-Chloroaniline	<1	<1	<1										<1	ug/l	TM16/PM30
4-Chlorophenylphenylether *	<1	<1	<1										<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
Azobenzene *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether *	<1	<1	<1										<1	ug/l	TM16/PM30
Carbazole *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
Dibenzofuran *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
Hexachlorobenzene *	<1	<1	<1										<1	ug/l	TM16/PM30
Hexachlorobutadiene *	<1	<1	<1										<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1	<1	<1										<1	ug/l	TM16/PM30
Hexachloroethane *	<1	<1	<1										<1	ug/l	TM16/PM30
Isophorone *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine *	<0.5	<0.5	<0.5										<0.5	ug/l	TM16/PM30
Nitrobenzene *	<1	<1	<1										<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	122	119	127										<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	128	127	129										<0	%	TM16/PM30



# Element Materials Technology

Client Name: AWN Consulting  
 Reference: Huntstown, Energia  
 Location: Coldwinters, Huntstown  
 Contact: Jonathan Gauntlet  
 EMT Job No: 20/7327

VOC Report : Liquid

EMT Sample No.	1-6	7-12	13-18									Please see attached notes for all abbreviations and acronyms			
												LOD/LOR	Units	Method No.	
<b>Sample ID</b>	BH01	BH02	BH04												
<b>Depth</b>															
<b>COC No / misc</b>															
<b>Containers</b>	V H H N P G	V H H N P G	V H H N P G												
<b>Sample Date</b>	08/06/2020	08/06/2020	08/06/2020												
<b>Sample Type</b>	Ground Water	Ground Water	Ground Water												
<b>Batch Number</b>	1	1	1												
<b>Date of Receipt</b>	10/06/2020	10/06/2020	10/06/2020												
VOC MS															
Dichlorodifluoromethane	<2	<2	<2								<2	ug/l	TM15/PM10		
Methyl Tertiary Butyl Ether *	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10		
Chloromethane *	<3	<3	<3								<3	ug/l	TM15/PM10		
Vinyl Chloride *	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10		
Bromomethane	<1	<1	<1								<1	ug/l	TM15/PM10		
Chloroethane *	<3	<3	<3								<3	ug/l	TM15/PM10		
Trichlorofluoromethane *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,1-Dichloroethene (1,1 DCE) *	<3	<3	<3								<3	ug/l	TM15/PM10		
Dichloromethane (DCM) *	<5	<5	<5								<5	ug/l	TM15/PM10		
trans-1-2-Dichloroethene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,1-Dichloroethane *	<3	<3	<3								<3	ug/l	TM15/PM10		
cis-1-2-Dichloroethene *	<3	<3	<3								<3	ug/l	TM15/PM10		
2,2-Dichloropropane	<1	<1	<1								<1	ug/l	TM15/PM10		
Bromochloromethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Chloroform *	<2	29	<2								<2	ug/l	TM15/PM10		
1,1,1-Trichloroethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
1,1-Dichloropropene *	<3	<3	<3								<3	ug/l	TM15/PM10		
Carbon tetrachloride *	<2	<2	<2								<2	ug/l	TM15/PM10		
1,2-Dichloroethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Benzene *	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10		
Trichloroethane (TCE) *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,2-Dichloropropane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Dibromomethane *	<3	<3	<3								<3	ug/l	TM15/PM10		
Bromodichloromethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
cis-1-3-Dichloropropene	<2	<2	<2								<2	ug/l	TM15/PM10		
Toluene *	<5	<5	<5								<5	ug/l	TM15/PM10		
trans-1-3-Dichloropropene	<2	<2	<2								<2	ug/l	TM15/PM10		
1,1,2-Trichloroethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Tetrachloroethene (PCE) *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,3-Dichloropropane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Dibromochloromethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
1,2-Dibromoethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Chlorobenzene *	<2	<2	<2								<2	ug/l	TM15/PM10		
1,1,1,2-Tetrachloroethane *	<2	<2	<2								<2	ug/l	TM15/PM10		
Ethylbenzene *	<1	<1	<1								<1	ug/l	TM15/PM10		
m/p-Xylene *	<2	<2	<2								<2	ug/l	TM15/PM10		
o-Xylene *	<1	<1	<1								<1	ug/l	TM15/PM10		
Styrene	<2	<2	<2								<2	ug/l	TM15/PM10		
Bromoform *	<2	<2	<2								<2	ug/l	TM15/PM10		
Isopropylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,1,2,2-Tetrachloroethane	<4	<4	<4								<4	ug/l	TM15/PM10		
Bromobenzene *	<2	<2	<2								<2	ug/l	TM15/PM10		
1,2,3-Trichloropropane *	<3	<3	<3								<3	ug/l	TM15/PM10		
Propylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
2-Chlorotoluene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,3,5-Trimethylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
4-Chlorotoluene *	<3	<3	<3								<3	ug/l	TM15/PM10		
tert-Butylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,2,4-Trimethylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
sec-Butylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
4-Isopropyltoluene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,3-Dichlorobenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,4-Dichlorobenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
n-Butylbenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,2-Dichlorobenzene *	<3	<3	<3								<3	ug/l	TM15/PM10		
1,2-Dibromo-3-chloropropane	<2	<2	<2								<2	ug/l	TM15/PM10		
1,2,4-Trichlorobenzene	<3	<3	<3								<3	ug/l	TM15/PM10		
Hexachlorobutadiene	<3	<3	<3								<3	ug/l	TM15/PM10		
Naphthalene	<2	<2	<2								<2	ug/l	TM15/PM10		
1,2,3-Trichlorobenzene	<3	<3	<3								<3	ug/l	TM15/PM10		
Surrogate Recovery Toluene D8	99	103	73								<0	%	TM15/PM10		
Surrogate Recovery 4-Bromofluorobenzene	102	101	85								<0	%	TM15/PM10		

**Client Name:** AWN Consulting  
**Reference:** Huntstown, Energia  
**Location:** Coldwinters, Huntstown  
**Contact:** Jonathan Gauntlet

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/7327						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

## NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/7327

### SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

### WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

### DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

### SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

### DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

### BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

### NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

**REPORTS FROM THE SOUTH AFRICA LABORATORY**

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

**Measurement Uncertainty**

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

**ABBREVIATIONS and ACRONYMS USED**

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 20/7327

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				

EMT Job No: 20/7327

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009; SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/CP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes			
TM38/TM125	Total Nitrogen/Organic Nitrogen by calculation	PM0	No preparation is required.				



**APPENDIX 6.5**

**OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN**

Prepared by

Clifton Scannell Emerson Associates

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**Clifton Scannell Emerson**  
Associates

# Outline Construction Environmental Management Plan

## Huntstown Data Centre Facility

**energia**  
group

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Client: Huntstown Power Company  
Ltd.

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Date: 5<sup>th</sup> March 2021

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Job Number: 20\_099

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Civil  
Engineering

Structural  
Engineering

Transport  
Engineering

Environmental  
Engineering

Project  
Management

Health  
and Safety

CONSULTING ENGINEERS





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## Document Control Sheet

Project Name: Huntstown Data Centre Facility  
Project Number: 20\_099  
Report Title: Outline Construction Environmental Management Plan  
Filename: 20\_099-CSE-00-XX-RP-C-004

Issue No.	Issue Status	Date	Prepared by	Checked by
1.0	DRAFT	05/03/2021	EK	CD
1.1	DRAFT	09/04/2021	EK	CD
1.2	DRAFT	07/05/2021	EK	CD
1.3	DRAFT	25/07/2021	PM	CD
1.4	FINAL	04/08/2021	PM	CD

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## 1 INTRODUCTION

This Outline Construction Environmental Management Plan (CEMP) has been prepared by Clifton Scannell Emerson Associates (CSEA) on behalf of Huntstown Power Company Ltd. in support of a planning application to Fingal County Council for planning permission for the proposed development of a greenfield site of approximately 13.3 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

This Outline CEMP defines the approach to environmental management at the site during the construction phase. It provides a basis for achieving and implementing the construction related mitigation measures identified in the Environmental Impact Assessment Report (EIAR) and promotes best environmental on-site practices for the duration of the construction phase.

The outline CEMP provides a framework from which a final CMP (Construction Management Plan) will be developed to avoid, minimise or mitigate any construction effects on the environment prior to commencement on site.

The contractor will prepare specific method statements, which should identify perceived risks to the environment and detail mitigation measures to be employed which will negate the risk to the environment.

The main issues that have been considered within this document are as follows;

- Description of works;
- Construction programme and phasing;
- Site logistics;
- Workforce;
- Public relations and community liaison;
- Construction traffic and access; and
- Safety, health and environmental management.

Preparation of the final CEMP should comply with the Mitigation Measures presented in the EIAR and all additional measures, as outlined in the decision of the Planning Authority, may be added to following consultation with relevant consultees in preparation of specific method statements prior to commencement of works.

## 2 DESCRIPTION OF THE PROJECT

### 2.1 Subject Site Characteristics

The subject site is located to the north west of the M50 orbital ring in the townland of Huntstown, North Road, Finglas, Dublin 11. The overall site extends to over 13.3 ha. of mainly greenfield (agricultural) lands located within the administrative area of Fingal County Council (Blanchardstown Division).

The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Anaerobic Digestion Plant, to the east by the North Road (R135) and two residential properties fronting the R135 which form part of the subject site and to the west by Huntstown Power Station.

A number of large logistics warehouse parks are located to the north east of the site including Dublin Airport Logistics Park and Vantage Business Park, Coldwinters, granted under Ref. F17A/0769 and further amended under Refs. FW19A/0053 and FW20A/0044. Several small scale commercial and service uses are scattered along the frontages of the R135 including: a garden centre; veterinary clinic and car repair facility.

The greenfield site is free from development. The topography of the site falls slightly in an east west direction (77.5AOD - 79.5AOD). An archaeological feature is identified south of the northern site boundary. A series of hedgerows are located throughout the site including the site perimeter. There are no known protected structures on site, nor is the site located within an architectural conservation area.

A drainage ditch located on the western site boundary separates the subject site from the adjoining Huntstown Power Plant. A set of 110kv and 38kv overhead lines traverse the site in a north - south direction connecting to the Finglas 220Kv substation complex to the south east of the site. The overhead lines are subject of the separate planning application which proposes the undergrounding of lines and removal of lattice towers and polesets to facilitate future development the site.

The subject site is highly accessible to the national road network and is located less than 1km from the M50/N2 interchange and approximately 0.1km from the Coldwinters exit on the N2. The site is directly accessible from the R135 via a service road to the south leading to Huntstown Quarry and Power Station.

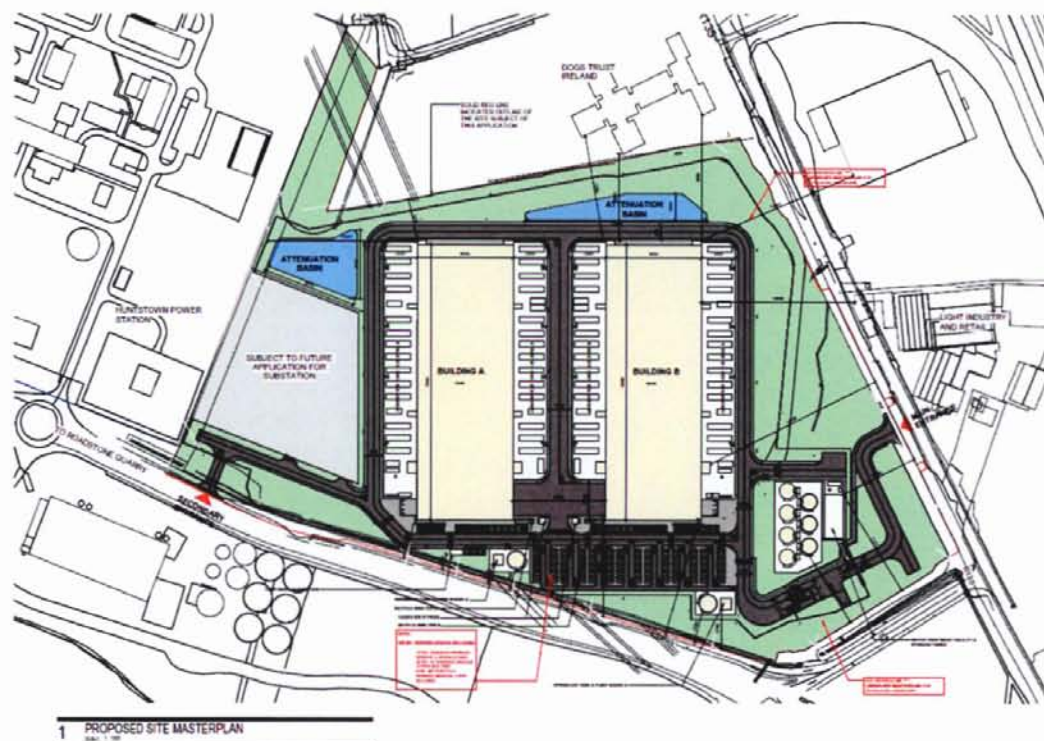
The subject site is identified in Figure 2.1 overleaf.



**Figure 2.1:** Aerial View showing the site outlined in red.

## 2.2 Description of Characteristics of the Proposed Development

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Fig 2.2 below.



**Figure 2.2 – Proposed Site Masterplan**

The proposed development is described as follows:

Huntstown Power Company Limited intend to apply for a 10 year permission for development at this site of c.13.3ha on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11. The development will consist of the following:

- Demolition of 2 no. existing residential dwellings and ancillary structures to the east of the site (c.344sqm total floor area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;
- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m<sup>3</sup> and c.6.35m high), 2 no. sprinkler tanks (c.670m<sup>3</sup> each and c.7.2m high) with 2 no. pump houses each (c.40sqm c. 6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing up to c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no. bicycle spaces, 208 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.

### 3 CONSTRUCTION PROGRAMME AND PHASING

The Proposed Development will be built on a phased basis to meet customer demand with the following estimated timelines. Note that a construction overlap period is assumed for the two buildings, such that first building developed will be in its final fit out phase when the second building is at peak construction.

#### **Proposed Development/Construction of the First Building:**

- Construction Start – Q3 2021
- Commence Operation of first data storage room – Q1 2024
- Full Operation – Q1 2025

#### **Indicative Development/Construction of the Second Building:**

- Construction Start – Q1 2024
- Commence Operation of first data storage room – Q4 2026
- Full Operation – Q4 2027

#### **HV Substation:**

- Construction Start – TBC\* (subject to separate SID application)
- Construction Complete – TBC\* (subject to separate SID application)

\*Subject to Grant of Planning it is assumed that construction will run in parallel to the First Building being developed.

#### **Site Preparation**

It is proposed that the accesses and haul roads for vehicles, the contractors' compound and fencing will be established for the proposed development utilising the existing entrance from the R135 road as the primary construction entrance for this development.

The construction compound will facilitate office, portable sanitary facilities, equipment storage, parking etc. for contractors. It will be used for the duration of the works.

The primary activities that will be required during the site preparation phase for the development will be site clearance, excavations and levelling of the site to the necessary base level for construction, surveying and setting out for structures and any rerouting of services/connections to services.

A combination of excavators, trucks and other soil shifting plant will commence the main site clearance and levelling aspects.



## **Building Construction Works**

### *Foundations and Structure*

Following the completion of site clearance and levelling, all structures will require foundations to the structural engineers specifications. Building structures will comprise of standard structural steel frames.

It is anticipated that foundations will require moderate scale excavations. Local minor dewatering may be required during excavation works and groundworks.

### *Levelling/Cut and Fill*

It is predicted that the majority of the cut material generated during site preparation/levelling (6,306 m<sup>3</sup>) will be reused to form landscaping berms on site. In addition, topsoil (29,311m<sup>3</sup>) will also be stripped from the site and may also be used in the landscaping berms.

Circa 81,929m<sup>3</sup> fill will be required to facilitate construction of the proposed roads, carparks, buildings and landscaping berms. It is assumed that the majority (but not all) of the topsoil/cut material will be re-used on site with some export required with final estimates to be refined at a later date.

Contractors will be required to submit and adhere to a method statement (including the necessary risk assessments) and indicating the extent of the areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.

Any temporary storage of spoil required will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc.

### *Building Envelopes and Finishes*

The outer finishing of the building envelopes are intended to be of a high quality and appearance as per the architects drawings.

### *Roads, Services and Landscaping*

Sections of the internal road system will be completed as part of the Building A permitted development as detailed on the architects phasing drawings.

Landscaping will be undertaken in accordance with the landscape plan for the proposed development.

## 4 EXCAVATION

### 4.1 *Archaeological and Architectural Heritage*

An archaeo-geophysical survey followed by a preliminary programme of archaeological testing has been undertaken for the site. These studies identified the probable remains of an oval enclosure with a possible entranceway to the south. Within the enclosure are numerous responses and trends, most likely representing the remains of pits and ditches. To the east of the enclosure is another curvilinear ditch-type response and numerous trends, suggesting a possible outer ditch and associated field system. External to the enclosure ditch, one curvilinear feature and eight linear features were identified that may be related to an outer enclosure and associated field system. An isolated pit, possibly unrelated to the activity associated with the enclosure, was identified c. 50m to the southeast of the main area of activity. The composition of the fill of this pit was similar to that found in burnt mound activity. No evidence of an associated burnt mound was identified, so it is possible that this feature had a "pot boiler" type function.

A further, more detailed programme of pre-development archaeological testing and the subsequent excavation of features, deposits or structures identified (under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht) is currently being undertaken by AMS Ltd. to fully assess the potential for archaeological remains across the development site.

Archaeological excavation and preservation by record of features, deposits or structured identified is recommended, under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. This covers the archaeological features encountered to date and potential further archaeological features encountered during the programme of further testing. Further detail is provided within Chapter 12 of the Environmental Impact Assessment Report (EIAR) submitted with this application.

### 4.2 *Ground Condition*

Ground works will be required to clear the site and to facilitate construction of building foundations, access roads, the installation of utilities and landscaping. The Land, Soils, Geology & Hydrogeology Chapter of the EIAR (Chapter 6) details the existing ground conditions at the site and provides a summary of the anticipated stratigraphy of the soil beneath the site.

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services and landscaping will require 81,929 m<sup>3</sup> of fill material. Some existing topsoil/cut material may be able to be re-used as fill or as topsoil in landscaped areas with estimates to be refined at a later date.

Any surplus material that requires removal from site for offsite reuse, recovery and/or disposal and any potentially contaminated material (in the unlikely event that it is encountered), should be segregated, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled '*Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous*' using the *HazWasteOnline* application (or similar approved classification method). If the material is to be disposed of to landfill, it will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* and landfill specific criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.

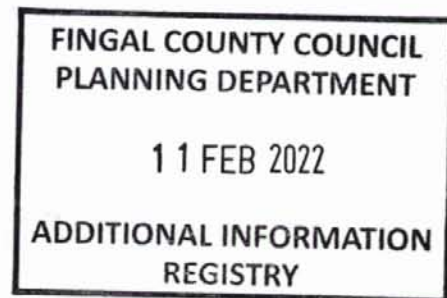
Project Number: 20\_099

Project: Huntstown Data Centre Facility

Title: Outline Construction Environmental Management Plan

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The surplus soils and stones may be suitable for acceptance at either inert or non-hazardous soil recovery facilities/landfills in Ireland or, in the event of hazardous material being encountered, be transported for treatment/recovery or exported abroad for disposal in suitable facilities.



## **5 SITE LOGISTICS**

### **5.1 Site Establishment and Security**

The site office and welfare facilities will be situated on site at an agreed location within the site boundary.

All of the sub-contractors as well as the main contractor and project managers will occupy offices in the same area. The site parking for staff, contractors and visitors will also be located in this area. It is proposed to provide 200 spaces on site for parking with up to 500 no. offsite parking spaces being made available at a suitable location such as the Dublin Airport Authority Surface Car Parks (subject to separate agreement). Allowing for a car occupancy of 1.5 average this provides parking for 1,050.

### **5.2 Consents and Licences**

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. These will include, but are not limited to:

- Site notices;
- Construction commencement notices; and
- Licence to connect to existing utilities and mains sewers, where required.
- Road opening licences.

### **5.3 Service and Utilities**

Welfare facilities (canteens, toilets etc.) will be available within the construction compound on site. Temporary connections to the existing estate services in the existing estate road will be utilised to provide service and utilities subject to relevant applications and approvals.

### **5.4 Material Handling and Storage**

Key materials will include, steel structure, concrete, cladding, ducting and piping. A 'Just in Time' delivery system will operate to minimise storage of materials, the quantities of which are unknown at this stage.

Where possible it is proposed to source general construction materials from the surrounding area to minimise transportation distances.

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles in a secure compound area within the contractors' compound on site. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications) to prevent spillage.

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries/trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway.

The majority of construction waste materials generated will be soil from excavation works. Soil requiring removal offsite will be removed from site regularly to ensure there is minimal need for stockpiling.

## **5.5 Visitor Management**

Visitors will only be allowed to enter the main site compound at the eastern boundary of the site from the R135 Road or via designated pedestrian access gates. A dedicated, secured footpath to the security office is established at the gate for registration and obtaining PPE prior to entering the site. A log will be maintained by security to control access to the site. Visitors will be required to attend a site-specific induction to allow access to the site unless being accompanied by an inducted member of the site team.

Visitors will then be taken by an inducted member of the construction team to the required area of the site.

## **5.6 Site Working Hours**

Construction of the proposed development would take place over a period of approximately 75 months from the commencement of construction for site development works.

Majority of works are to be done off-road within the site boundary, with the exception of service connections which will be done under licence from the Local Authority and Utility providers.

During the off-road section of works, construction staffing personnel will arrive prior to 07.00am to mitigate against traffic peak. Site development and building works shall be carried out only between the hours of 08.00 to 19.00 Mondays to Fridays inclusive, between 08.00 to 14.00 on Saturdays.

Deviation from these times will only be allowed in exceptional circumstances where prior written approval has been received from Fingal County Council. Such approval may be given subject to conditions pertaining to the particular circumstances being set by Fingal County Council.

## **5.7 Employment and Management Workforce**

Construction traffic would consist of the following:

- Private vehicles belonging to site construction staff;
- Private vehicles belonging to site security staff;
- Occasional Private vehicles belonging to professional staff (i.e. design team, utility companies);
- Construction material delivery;  
and
- Excavation plant and dumper trucks used for site development works.

It is anticipated that the worst case construction traffic impact for the proposed development would occur in Q4 2022, when Building A is at peak construction.

Construction traffic has been estimated using data obtained from a similar data centre facility development that used a similar construction methodology to the current development. The following construction data has been used to estimate peak daily construction traffic:

- Average construction staff for one data centre facility: 600;
- Peak construction staff for one data centre facility: 1,050;
- Average cars/ day for one data centre facility: 400 with max 200 on site – shared with Sub-Station Development. Construction of the latter managed to ensure they do not peak at the same time;

- Peak cars/day for one data centre facility: 700.
- Peak HGVs/day for one data centre facility: 110; and
- Peak LGVs/ day for one data centre facility: 30.

All employees working on the site will be required to have a Safe Pass Card (or similar approved Construction Health & Safety card), manual handling training and the necessary certificates to operate machinery, as required. The details of training required, records maintained, and induction procedures will be outlined in the Main Contractor's Health and Safety Plan(s).

## 6 CONSTRUCTION TRAFFIC AND SITE ACCESS

During construction of the proposed development, construction traffic will travel to and from the site via the construction site access located on the east section of the site. It is expected that the origins and destinations of construction traffic will continue to match the distribution of traffic currently using the surrounding road network with the majority of construction traffic via the N2 National Road. As noted in Section 5.1 a total of 500 car parking spaces will be provided off-site at the Dublin Airport Authority Surface Car Parks (subject to agreement) or other suitable location in order to minimise traffic movements to and from the site.

The following measures will be put in place during the construction works:

- The contractor will be required to provide wheel cleaning facilities, and regular cleaning of the main access road;
- Temporary car parking facilities for the construction workforce will be provided within the site and the surface of the car park will be prepared and finished to a standard sufficient to avoid mud spillage onto adjoining roads;
- Monitoring and control of construction traffic will be ongoing during construction works. Construction Traffic Management will minimise movements during peak hours.
- Construction Traffic routes minimising traffic impact on surrounding residential development will be used by construction vehicles.
- Provide off-site car parking in Dublin Airport Authority Surface Car Parks.

### **Traffic Queueing**

Material deliveries and collections from site will be planned, scheduled and staggered to avoid any unnecessary build-up of construction works related traffic.

### **Site Hoarding and Security Fencing**

Security fencing will be established around the site compound.

Site access will be restricted by dedicated security personnel who will check all incoming and outgoing vehicles and workers.

## 7 SAFETY, HEALTH AND ENVIRONMENTAL CONSIDERATIONS DURING CONSTRUCTION WORKS

The appointed main contractor will be required to prepare a Construction Health & Safety Plan which will be put in place prior to commencement of the works. At a minimum, this plan will include:

- *Construction Health & Safety training requirements;*
- *Induction procedures;*
- *Emergency protocols; and*
- *Details of welfare facilities.*

### 7.1 Air Quality

This section describes the site policy with regard to dust management and the specific mitigation measures which will be put in place during construction works. The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following measures have been formulated by drawing on best practice guidance from Ireland, the UK and the US, such as:

- 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014);
- 'Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings' (The Scottish Office, 1996);
- 'Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance' (UK Office of Deputy Prime Minister, 2002);
- 'Controlling Particles, Vapours & Noise Pollution From Construction Sites' (BRE, 2003);
- 'Fugitive Dust Technical Information Document for the Best Available Control Measures' (USEPA, 1997); and
- 'Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition' (periodically updated) (USEPA, 1986).

### Site Management

The site activities will be undertaken with due consideration of the surrounding environment and the close proximity of sensitive receptors such as watercourses, residents and pedestrians. Dust management during the construction phase will be the most important aspect in terms of minimising the impacts of the project on the surrounding air quality. The following measures will also be implemented to ensure impacts are minimised:

- Complaint registers will be kept detailing all telephone calls and letters of complaint received in connection with construction activities, together with details of any remedial actions carried out;
- Equipment and vehicles used on site will be in good condition such that emissions from diesel engines etc. are not excessive; and
- Pre-start checks will be carried out on equipment to ensure they are operating efficiently and that emission controls installed as part of the equipment are functional.

### Dust Control Measures

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design, planning and effective control strategies. The siting of construction activities and the limiting of stockpiling will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust



nuisance. In addition, good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures quickly before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (UK Office of Deputy Prime Minister (2002), BRE (2003)). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent will monitor the contractors' performance to ensure that the proposed mitigation measures are implemented, and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board will also include head/regional office contact details;
- Community engagement shall be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein; and
- The procedures put in place will be reviewed at regular intervals and monitoring conducted and recorded by the principal contractor. It is recommend that reviews are conducted on a monthly basis as a minimum.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

### **Site Roads**

Site access routes (particularly unpaved routes) can be a significant source of fugitive dust from construction sites if control measures are not in place. The most effective means of suppressing dust

emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25% to 80%.

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles;
- Bowsers will be available during periods of dry weather throughout the construction period. Research shown found that the effect of surface watering is to reduce dust emissions by 50%. The bowser will operate during dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible; and
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

#### **Land Clearing/Earth Moving**

Land clearing/earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

The movement of truck containing materials with a potential for dust generation to an off-site location will be enclosed or covered.

#### **Stockpiling**

The location and moisture content of rubble stockpiles are important factors which determine their potential for dust emissions. The following measures will be put in place:

- Overburden material will be protected from exposure to wind by storing the material in sheltered parts of the site, where possible stockpiles should be located downwind of sensitive receptors;
- Regular watering will take place during dry/windy periods to ensure the moisture content is high enough to increase the stability of the soil and suppress dust;
- There will be no storage of soil along the cable route; and
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

#### **Site Traffic on Public Roads**

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash; and
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.

### **General**

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory management of dust by the construction contractor.

The key features with respect of dust control will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

## **7.2 Ecology**

The proposed development will have a neutral imperceptible effect on designated sites within the zone of impact of the development site. The proposed development is located in an area of low ecological value and as such predicted to have a neutral imperceptible effect on biodiversity. A full assessment of the ecology has been undertaken and is included in chapter 8 of the EIAR.

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March 1<sup>st</sup> to August 31<sup>st</sup>. If this cannot be enforced then the site will be surveyed for the presence of nesting birds and/or nests prior to cutting and if none are recorded the vegetation may be removed within 48 hours.

Mature trees, which are to be removed, shall be felled in the period early September to late October, or early November, in order to avoid the disturbance of any roosting bats as per Transport Infrastructure Ireland (TII and formerly the National Roads Authority) guidelines (NRA 2006a and 2006b). Tree felling shall be completed by Mid-November at the latest because bats roosting in trees are vulnerable to disturbance during their hibernation period (November – April). Ivy-covered trees, once felled, shall be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight.

A bat specialist will survey the trees to be felled for roosting bats prior to felling and will provide detailed measures for any roosts found at that time.

The mature trees that are to be removed, should, due to the passage of time, again be surveyed for bat presence by a suitably experienced specialist on the day of felling. If several bats are found within any one tree, that specific tree should be left in-situ while an application for a derogation licence is made to the National Parks and Wildlife Service to allow its legal removal.

The trees identified as having potential for use by bats should be felled carefully to avoid hard shocks which may injure any bats within. Large mature trees with bat roosting potential such as those onsite should essentially be felled by gradual dismantling by tree surgeons. Care should be taken when removing larger branches as removal of loads may cause cracks or crevices to close, crushing any animals within. Such cracks should be wedged open prior to load removal. If single bats are found during tree felling operations, they should be transferred to the previously erected bat boxes onsite (see below).

Loss of linear habitats within and surrounding the site will be partially compensated for by the provision of alternative linear habitats around the site boundary to ensure connectivity with surrounding ecological

corridors. It is predicted that there would be a loss of c. 730m of internal hedgerow and that c. 1.7 km of hedgerow would be retained and conserved in situ.

In order to minimise the extent of light spill onto perimeter habitats, all lights that are pole mounted will be directional and/or cowed to ensure that light is directed downward and inwards. Lights will be programmed or otherwise to be off unless required.

### **7.3 Noise and Vibration**

Noise impacts arising from earthworks and construction activities have the potential to cause annoyance or nuisance to local residents in the area.

The earthworks will generate typical construction activity related noise and vibration sources from use of a variety of plant and machinery such as rock breakers (where required), excavators, lifting equipment, dumper trucks, compressors and generators.

The noise limits to be applied for the duration of the infrastructure works are those specified in the B Category of BS 5228. This has been discussed as part of the EIAR – Chapter 10, Noise and Vibration and all relevant mitigation measures are to be implemented.

It should be noted the Contractor shall liaise with the operators of the Dog's Trust site to the north in order to manage impacts during the construction phase.

Vibration limits to be applied for the infrastructure works are those specified in BS 5228 – code of practice for noise and vibration control on construction and open sites. This has been discussed as part of the EIAR – Chapter 10, Noise and Vibration and all relevant mitigation measures are to be implemented.

Any noise complaints related to activities at the site will be logged and investigated and, where required, measures taken to ameliorate the source of the noise complaint.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. excavation close to a property, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

All works on site shall comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities.

In general, the contractor shall implement the following mitigation measures during the proposed infrastructure works:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul roads well maintained and avoid steep gradients.
- Minimise drop height of materials.
- Start-up plant sequentially rather than all together

More specifically the Contractor shall ensure that:

- In accordance with "Best Practicable Means", plant and activities to be employed on site are reviewed to ensure that they are the quietest available for the required purpose.
- Where required, improved sound reduction methods are used e.g. enclosures.

- Site equipment is located away from noise sensitive areas, as much as physically possible.
- Regular and effective maintenance by trained personnel is carried out to reduce noise and / or vibration from plant and machinery.
- Hours are limited during which site activities likely to create high levels of noise and vibration are carried out.
- A site representative responsible for matters relating to noise and vibration will be appointed prior to construction on site.

Reference Chapter 10 of the EIAR for further guidance on the management of noise and vibration.

## **7.4 Waste Management**

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment.

Chapter 15 of EIA Report contains a detailed description of waste management relating to construction of the proposed development. A site-specific Construction and Demolition Waste Management Plan is included as Appendix 15.1 of the EIA Report. The C&D Waste Management Plan has been prepared in accordance with the Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG & NCDWC, 2006). This C&D Waste Management Plan will be refined and updated in advance of the works to ensure best practice is followed in the management of waste from the proposed development.

Adherence to the C&D Waste Management Plan prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2011 as amended 7, associated Regulations 7, the Litter Pollution Act of 1997 as amended 8 and the Eastern-Midlands Region Waste Management Plan 2015 – 2021 9, and achieve optimum levels of waste reduction, re-use and recycling.

The following mitigation measures will be implemented during the construction phase:

- Building materials will be chosen with an aim to 'design out waste';
- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery – it is anticipated that the following waste types, at a minimum, will be segregated:
  - Concrete rubble (including ceramics, tiles and bricks);
  - Plasterboard;
  - Metals;
  - Glass; and
  - Timber.
- Left over materials (e.g. timber off-cuts, broken concrete blocks/bricks) and any suitable construction materials shall be re-used on-site, where possible;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site;
- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably banded areas, where required);

- A waste manager will be appointed by the main contractor(s) to ensure effective management of waste during the excavation and construction works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered where possible to avoid material designated for disposal;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licenced facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

The management of all hazardous waste materials, if they occur, shall be coordinated in liaison with Health and Safety Management.

#### **7.4.1 Waste Minimisation**

Waste minimisation measures proposed are summarised as follows:

- Materials will be ordered on an 'as needed' basis to prevent over supply;
- Materials will be correctly stored and handled to minimise the generation of damaged materials;
- Materials will be ordered in appropriate sequence to minimise materials stored on site; and
- Sub-contractors will be responsible for similarly managing their wastes.

All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste.

#### **7.4.2 Waste Storage**

A dedicated and secure compound containing bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities are to be stored, is to be established within permitted site compound.

Waste materials generated will be segregated on at the site compound, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

The site construction manager will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

#### **7.4.3 Responsibility**

It will be the responsibility of the construction manager to ensure that a written record of all quantities and natures of wastes removed from the site are maintained on-site in a waste file (in hardcopy or electronically).

It is the responsibility of the project manager or his/her delegate that all contracted waste haulage drivers hold an appropriate waste collection permit for the transport of waste loads and that all waste materials are delivered to an appropriately licenced or permitted waste facility in compliance with the relevant Regulations.

The contractor, as part of regular site inspection audits, will determine the effectiveness of the waste management strategy and will assist the project manager in determining the best methods for waste minimisation, reduction, re-use, recycling and disposal as the construction phase progresses and waste materials are generated.

Prior to commencement of the excavation and construction activity and removal of any waste off-site, details of the proposed destination of each waste material will be provided to the local authority.

## **7.5 Surface Water Management**

Run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations (up to 3m) during and after heavy rainfall events to ensure that the trenches are kept relatively dry.

Mitigation measures that will be put in place during the construction phase to ensure protection of surface waterbodies are detailed in Section 7.6.2 of Chapter 7 (Hydrology) of the EIA Report.

These measures are in compliance with the following relevant CIRIA guidance documents:

- CIRIA, (2001), *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532)* Construction Industry Research and Information Association;
- CIRIA (2002) *Control of water pollution from construction sites: guidance for consultants and contractors (SP156)* Construction Industry Research and Information Association;
- CIRIA (2005), *Environmental Good Practice on Site (C650)*; Construction Industry Research and Information Association;
- BPGCS005, *Oil Storage Guidelines*;
- Eastern Regional Fisheries Board, (2006), *Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*;
- CIRIA 697 (2007), *The SUDS Manual*; and
- *UK Pollution Prevention Guidelines, (PPG)* UK Environment Agency, 2004.

## 8 SUMMARY

This Outline CEMP sets out the overall management strategy for construction works for the proposed development.

The Outline CEMP aims to ensure the management of construction activity is carried out in a planned, structured and considerate manner which minimises the impacts of the works on the local environment, residents and commercial activities in the vicinity of the site. Due to the nature of construction works, there may be unforeseen events which occur at the site and the project team will actively manage any changes and discuss with the relevant authorities, where required. The Outline CEMP will form a basis for the CEMP to be developed by the Contractor. The CEMP will form a live document which will be updated as and when required.

The project team are committed to ensuring that the construction activities to be carried out are pro-actively managed to minimise potential impacts.



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**APPENDIX 7.1**

**CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA  
STAGE NATIONAL ROADS AUTHORITY (NRA-TII, 2009)**

**Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Hydrological Attributes (NRA)**

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery. Locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding. Locally important amenity site for wide range of leisure activities.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes. Quality Class C (Biotic Index Q3, Q2-3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1). Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

**Table 2 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrological Attribute (NRA)**

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss or extensive change to a waterbody or water dependent habitat. Increase in predicted peak flood level >100mm. Extensive loss of fishery. Calculated risk of serious pollution incident >2% annually. Extensive reduction in amenity value.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm. Partial loss of fishery. Calculated risk of serious pollution incident >1% annually. Partial reduction in amenity value.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm. Minor loss of fishery. Calculated risk of serious pollution incident >0.5% annually. Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level. Calculated risk of serious pollution incident <0.5% annually.
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10mm. Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually.
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50mm. Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually.
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm

**Table 3 Rating of Significant Environmental Impacts at EIS Stage (NRA)**

<b>Importance of Attribute</b>	<b>Magnitude of Importance</b>			
	<b>Negligible</b>	<b>Small Adverse</b>	<b>Moderate Adverse</b>	<b>Large Adverse</b>
<b>Extremely High</b>	Imperceptible	Significant	Profound	Profound
<b>Very High</b>	Imperceptible	Significant/moderate	Profound/Significant	Profound
<b>High</b>	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
<b>Medium</b>	Imperceptible	Slight	Moderate	Significant
<b>Low</b>	Imperceptible	Imperceptible	Slight	Slight/Moderate

**APPENDIX 7.2**

**FLOOD RISK ASSESSMENT**

Prepared by

Clifton Scannell Emerson Associates

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Clifton Scannell Emerson  
Associates

## Flood Risk Assessment Huntstown Data Centre Facility

**energia**  
group

Client: Huntstown Power Company  
Ltd.

Date: 9<sup>th</sup> April 2021

Job Number: 20\_099

Civil  
Engineering

Structural  
Engineering

Transport  
Engineering

Environmental  
Engineering

Project  
Management

Health  
and Safety

CONSULTING ENGINEERS



## Document Control Sheet

Project Name: Huntstown Data Centre Facility  
Project Number: 20\_099  
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1.2	DRAFT	07/05/2021	CD	PM
1.3	PLANNING	04/08/2021	CD	PM



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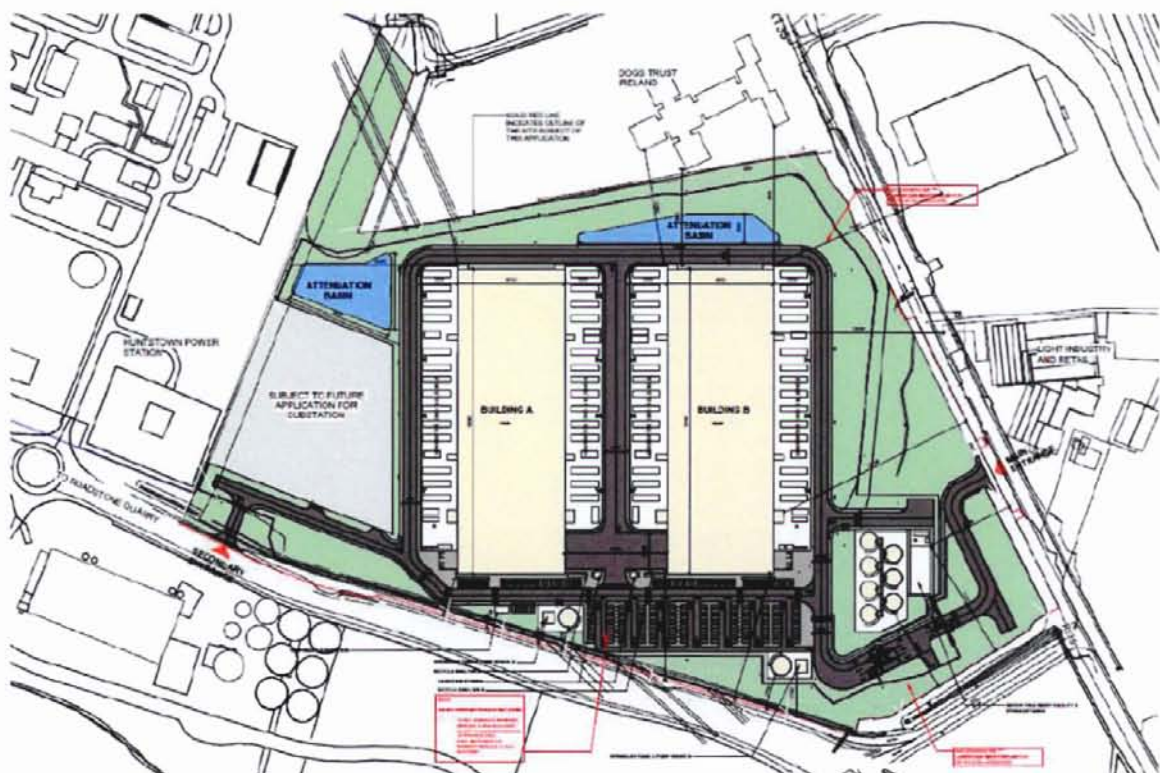
## 1 Introduction

### 1.1 Background

CSEA was requested to undertake a Flood Risk Assessment (FRA) to support the submission of a planning application by Energia for the proposed data storage and energy centre development on site at Huntstown Co. Dublin.

The proposed development of a greenfield site of approximately 12.86 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Figure 1.1 below:-



**Figure 1.1 – Proposed Site Masterplan**

The proposed development is described as follows:

- Demolition of 2 no. existing residential dwellings to the east of the site (c. 344 sqm in area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;

- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m<sup>3</sup> c.6.35m high), 2 no. sprinkler tanks (c.670m<sup>3</sup> each and c.7.2m high) with 2 no. pump houses each (c.40sqm c.6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no bicycle spaces, 200 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.

## 1.2 Background Information

### 1.2.1 Catchment-based Flood Risk Assessment and Management

Catchment-based Flood Risk Assessment and Management (CFRAM) program has been implemented by the Office of Public Works (OPW) as a competent authority in Ireland for the EU floods directive. Over 29 Flood Risk Management Plans (FRMPs) have been prepared in coordination with the implementation of the Water Framework Directive (WFD). The FRMPs involved undertaking detailed engineering assessment and producing flood protection measures. The assessment addressed the potential impact of the proposed measures on waterbodies hydromorphology and quality status.

### 1.2.2 OPW Flood Guidelines for Planning Authorities

The purpose of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the OPW in 2009 (OPW Guidelines) is to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

### 1.2.3 Objectives of OPW Guidelines

Floods can have broad range of impact on people, property, infrastructure and the environment. Flood can cause damage to the infrastructure including electricity and other utilities with significant detrimental impacts on local and regional economies. This may also cause long-term closure of businesses leading to economic loss other than the damage caused during the event. The core objectives of the OPW Guidelines include:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

### 1.2.4 Flood Risk Assessment FRA Key Concepts

For carrying out a Site-specific Flood Risk Assessment (SSFRA), the OPW Guidelines recommend using Source-Path-Receptor concept model to identify where the flood originates from, what is the floodwaters path and the areas in which assets and people might be affected by such flooding (section 2.18 of the OPW Guidelines, 2009). Figure 2 show a schematic representation of S-P-R model.

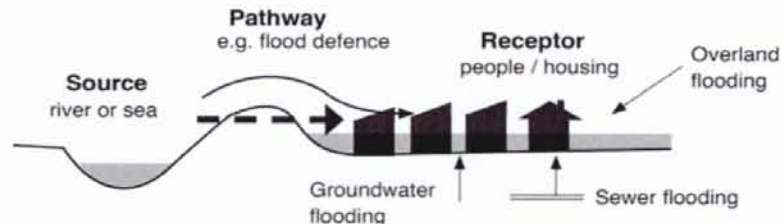


Figure 2 Source-Path-Receptor Model (extracted from OPW Guidelines, 2009)

The other key concept in flood management is the "Flood Risk". It is "the combination of the likelihood of flooding and the potential consequences arising". Consideration of flood risk must be addressed in terms of:

- The likelihood of flooding. Expressed as percentage probability or exceedance each year; and;
- The consequences of flooding as the associated hazard e.g. flood depth and velocity.

Flood risk is then expressed with the relationship:

$$\text{Flood Risk} = \text{Likelihood of flooding} \times \text{Consequences of flooding.}$$

### 1.2.5 Flood Zones

Flood Zone is the spatial inundation area that fall within a range of likelihood of flooding. The OPW Guidelines specified three levels of flood zones:

**Flood Zone A** where the probability of flooding from rivers and the sea is highest (greater than 1% Annual Exceedance Probability (AEP) or 1 in 100 for river flooding or 0.5% AEP or 1 in 200 for coastal flooding);

**Flood Zone B** where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding);

**Flood Zone C** where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in Zones A or B.



Figure 3 Example of the three flood risk zones (extracted from OPW Guidelines, 2009)

According to the OPW Guidelines, the planning implication of each of the zones mentioned above are:  
**Zone A** - High probability of flooding. Most types of development would be considered inappropriate in this zone.

**Zone B** - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone

**Zone C** - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

### 1.2.6 Sequential Approach

Sequential approach is an important tool used in the planning process which gives preference to locate a new development in the Low Flood Risk Zone and ensures that it does not have an adverse impact of flooding.

According to the sequential approach, If the development lies within a Flood Zone, it is required to consider measures for mitigating flood impact to an acceptable level. It is also required to provide justifications and strategic reasons for locating a proposed development on a higher risk flood zone (see Figure 4 and 5 below).

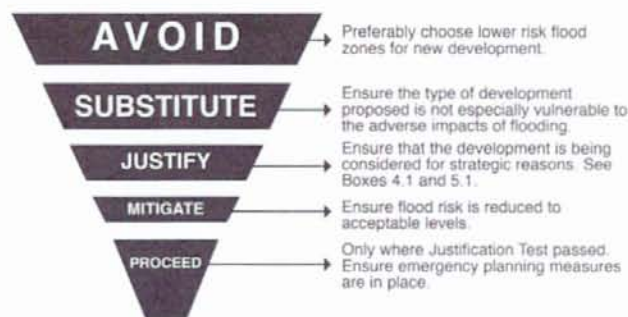


Figure 4 FRA Sequential Approach (extracted from OPW Guidelines, 2009)

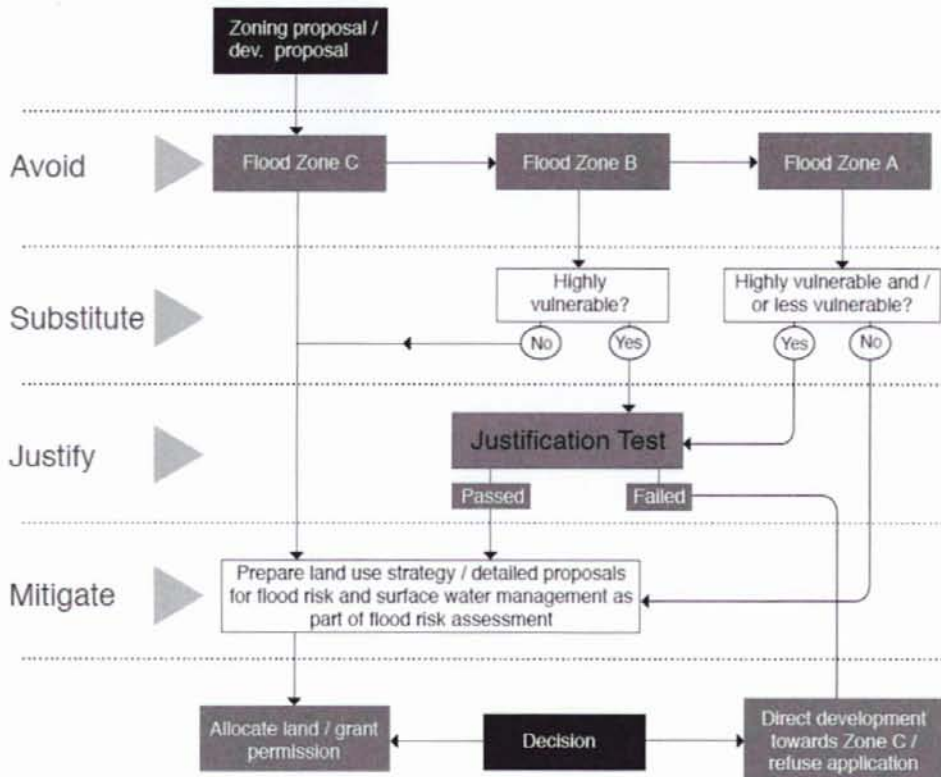


Figure 5 Sequential approach mechanism in the planning process (extracted from OPW Guidelines, 2009)

### 1.2.7 Development Classification

The OPW Guidelines provided three vulnerability categories based on the type of development which are:

- **Highly vulnerable:** This includes essential infrastructure, such as primary transport and utilities distribution, electricity generating power stations and sub-stations
- **Less vulnerable:** This category includes Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
- **Water compatible:** Includes water-based flood control and recreational developments and other amenity open space, outdoor sports and recreation and essential facilities such as changing rooms.

The OPW Guidelines, as described in Section 2.2.4 of this report, sets out a sequential approach which makes use of flood risk assessment and classifies vulnerability of flooding of different types of development.

Table 3.2 of the OPW Guidelines illustrates those types of development that would be appropriate to each flood zone (reproduced in Table 1 below) and those that would be required to meet a Justification Test in accordance to Box. 5.1 in the Guidelines.

---

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

**Table 1 Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009).**

## 2 Stage 1 - Flood Risk Identification

### 2.1 General

In this stage of the FRA, we use the existing information to identify any flooding issues related to the site that may require any further investigation.

### 2.2 Source of Information

Information source reviewed for flood risk identification are listed in table 2 below:

	Information Source	Remarks
1	Information on watercourse and streams in the study area such as those available from OS Maps, EPA and GeoHive	An extract from EPA map viewer <a href="https://gis.epa.ie/EPAMaps/">https://gis.epa.ie/EPAMaps/</a> ; with active <i>stream</i> and <i>flow direction</i> layers in Figure 6 shows the presence of a ditch running through the proposed site that originates from an adjacent 3 <sup>rd</sup> part land.
2	Predictive and historic flood maps and benefiting lands maps available on <a href="http://www.floodmaps.ie">www.floodmaps.ie</a> .	No flood events were recorded near the site. See Fig 6 overleaf.
3	Predictive fluvial, coastal, pluvial and groundwater flood maps available on <a href="http://www.floodinfo.ie">www.floodinfo.ie</a> .	The proposed development is located outside the extents of the 1 in 1000 year (0.1% AEP). See Fig 6 overleaf.
4	Site Investigation (IGSL Report No. 22529)	Groundwater monitoring in standpipes identified ground water 1.5m to 4.0m below existing ground level.

Table 2 Information Source Consulted



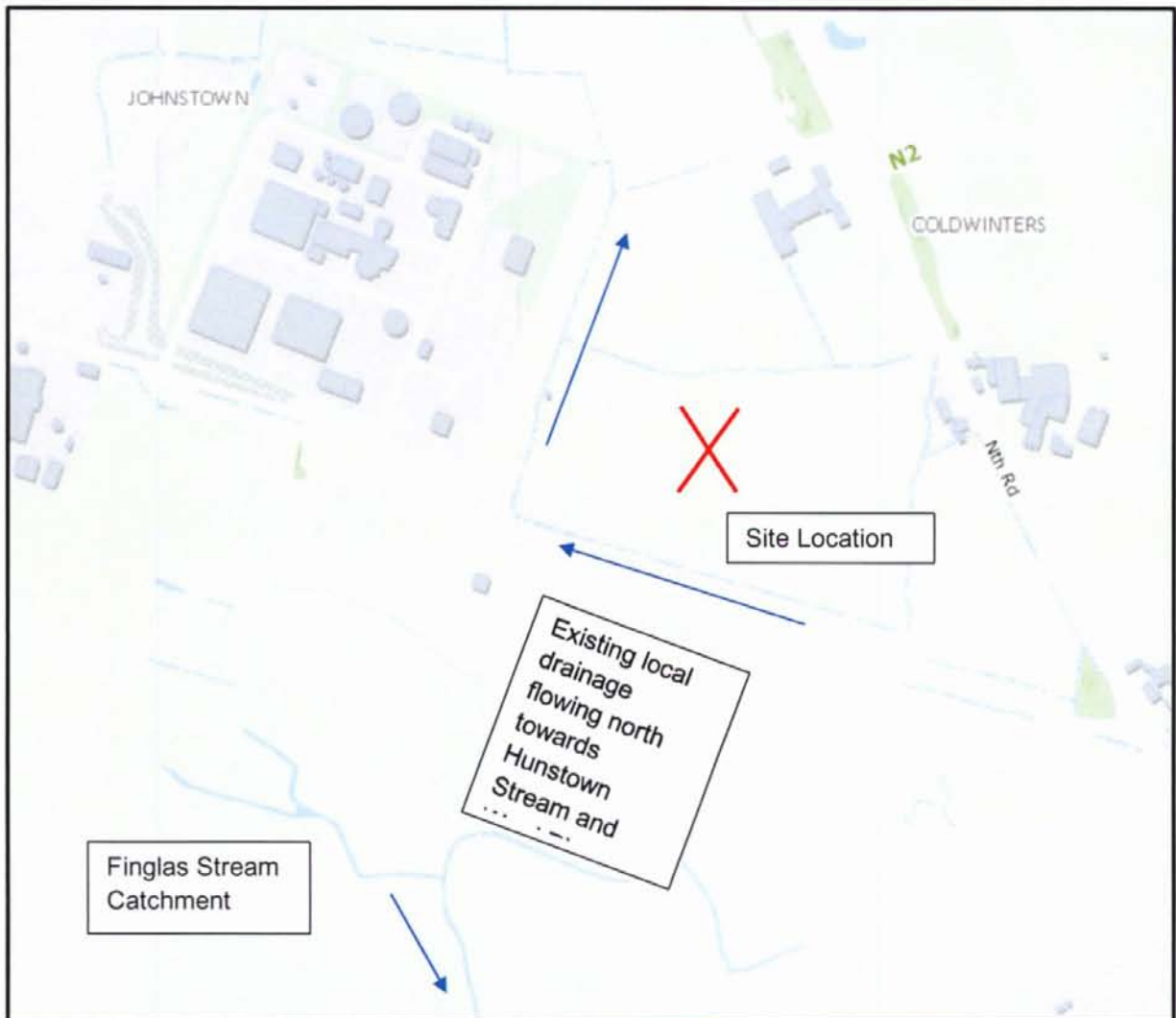


Figure 6 – Extract from GeoHive Mapping indicating location of Stream traversing site

The existing ditch which crosses the site originates adjacent to the southern site boundary and flows in a northerly direction where it forms the Huntstown Stream which drains to the Ward River.

### 2.3 Source-Path Receptor

A Source-Pathway-Receptor model has been produced to assess the possible sources of floodwater and their likelihood, the pathways by which flood water reaches receptors and the receptors that could be affected by potential flooding, as summarized in Table 2 below.

Source	Path	Receptor	Likelihood	Impact	Risk
Tidal	Tidal flooding from coasts 12.0 km away from the site	People and Property (the proposed development).	Remote	High	Very Low

Source	Path	Receptor	Likelihood	Impact	Risk
Fluvial	Flooding from the Huntstown Stream.	People and Property (the proposed development).	Remote - Site is at the head of the catchment and is not subject to flooding in the 1:1000 year event.	High	Very Low
Fluvial	Flooding from the existing ditches running through the site	People and Property (the proposed development).	Remote Ditches traversing the site to be diverted.	High	Very Low
Pluvial/Surface Water	Flooding from surcharging of the development's proposed surface water network	People and Property (the proposed development).	Possible	High	Moderate
Pluvial/Surface Water	Flooding from rise in water levels in the attenuation basins	People and Property (the proposed development).	Possible	High	Moderate
Ground Water	Rising GWL on the site	People and Property (the proposed development).	Possible	High	Moderate
Other Source	Flooding due to human or mechanical error in sizing of Petrol interceptor or the hydrobrake/ blockage at any drainage system component.	People and Property (the proposed development).	Possible	High	Moderate

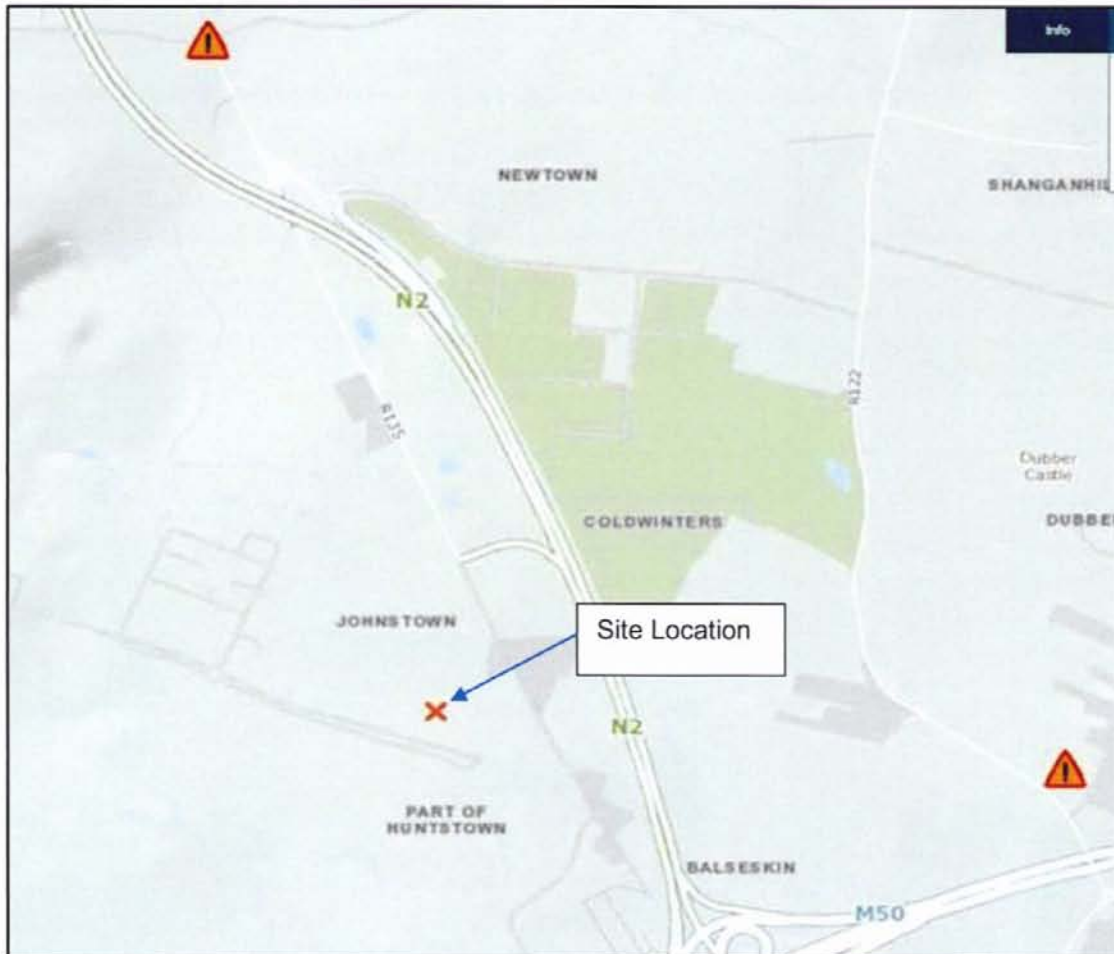
**Table 2 Source-Path-Receptor analysis**

From the SPR analysis presented above, it is noted that the proposed development site is not subject to tidal (Coastal) or fluvial flooding and therefore very low risk of flooding. However, Moderate risk remains from internal drainage system service to the development.

### 3 Stage 2: Initial Flood Risk Assessment

#### 3.1 Fluvial Flooding

OPW flood mapping for the site was reviewed See Fig 7 below.



**Fig 7 – OPW Flood Mapping**

As can be seen above the site is not subject to flood in the 1:1000 year event (0.1% AEP) and falls within Flood Zone C.

There is no history of flood on the site. The two closest historical events were at Kilshane Cross circa 1.3 km to the north (caused by overland flow from agricultural land) and at Dubber Cross circa 1.4 km to the east (caused by a ditch overflowing into a pumping station). Both of these events occurred in 2002.

#### 3.2 Ditch Diversion

As noted in section the proposed development site is traversed by an existing local drainage ditch which flows to the north towards the Huntstown Stream. It is proposed to divert this ditch by means of a piped culvert which has been designed in accordance with the OPW Guidelines for the Construction, Replacement or Alteration of Bridges and Culverts. Details of the design of the ditch diversion, and

associated engineering calculations, are provided in the Engineering Planning Report (Document No. 20\_099-CSE-00-XX-RP-C-005).

### 3.3 Pluvial Flooding from Surface Water Drainage

The Source-Pathway-Receptor model presented in Stage 1 indicated the likelihood of Fluvial and Pluvial flooding types within the site. The identified risk of flooding in the study area is primarily associated with the future drainage networks service to the proposed development (see Figure 8).

The drainage system has a potential to cause local flooding unless it is designed in accordance with the regulations e.g. Greater Dublin Strategic Drainage Study (GDSDS) and to take account of flood 100-year storm return periods plus 10% allowance for climate change.

Proper operation and maintenance of the drainage system should be implemented to reduce the pluvial flood risk due to human/ mechanical error. Appendix A presents a proposed Operation and Maintenance O&M Plan for the drainage system in the development.



Fig 8 – Proposed Site Drainage Network

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### **3.4 Ground Water Flooding**

Based on the geotechnical investigation on the site, ground water was encountered in monitoring wells at 1.5 m to 4.0 m BGL. During the site walkover survey, no marshy ground was observed. No groundwater wells or marsh areas are located within the site (based on review of information available on EPA and OSI websites). Therefore, the risk of groundwater flooding occurring at the site is considered negligible.

### **3.5 Flood Zone Category**

Following the assessment of the flood risks to the site and the available information it is considered that the proposed site is located within Flood Zone C as per the OWP Guidelines and as indicated by the CFRAMS maps refer to Appendix B. Therefore, the proposed development on the subject site is appropriate for this flood zone category, and a justification test is not required.

## 4 Conclusion

This Flood Risk Assessment for the proposed development was undertaken to the requirements of the OPW Guidelines, 2009, "Planning System and Flood Risk Management Guidelines for Planning Authorities". Following the flood risk assessment stages, it was determined that the site is within Flood Zone C as defined by the Guidelines and based on the CFRAMS mapping. Therefore, the development on the subject site is appropriate for the site's flood zone category and a justification test as outlined in the Guidelines is not required. The Guidelines sequential approach is met with the Justify & Mitigate principals being achieved. A regularly maintained drainage system would ensure that the network remains effective and in good working order should a large pluvial storm occur.

Project Number: 20\_099

Project: Huntstown Data Centre Facility

Title: Flood Risk Assessment

---



**Clifton Scannell Emerson**  
Associates

## **Appendix A Surface Water Operation and Maintenance (O&M) Activities**

All operation and maintenance activities should be in accordance to the following guidelines:

- Greater Dublin Strategic Drainage Study GSDSDS- Volume 3 – Environmental Management
- CIRIA 2015SuDS Manual, Part E - Chapter 32

Considerations for surface water O&M:

Requirement	Assessment/Action
<b>Maintenance access – ensuring appropriate and long-term access to all points in the system where future maintenance may be required</b>	A standard minimum of 600mm diameter opening is provided for all manhole, chambers and treatment system. Removable gullies grate opening with a minimum size of 450mm X 320mm.
<b>Forebays and/or appropriate pre-treatment structures to facilitate the sediment management process.</b>	Service manholes are proposed upstream and downstream of the attenuation system. Road gullies and the petrol interceptor will also facilitate sediment management process.
<b>Bypass systems or appropriate temporary drainage infrastructure for use if required during sediment management or other maintenance activities.</b>	Not required
<b>The availability of disposal areas for organic arisings (green waste) and sediments.</b>	To be included as part of maintenance contract of the development.

Types of SuDS systems used that require O&M activities:

- **Detention Pond:** 3no. of proposed ponds.
- **Soakaway:** N/A.
- **Pervious Paving:** proposed permeable paving areas proposed within the development area
- **Treatment system:** proposed petrol interceptor as part of road and parking drainage system


O&M activities required as following:

Operation and maintenance activities	SuDS Component			
	Attenuation Tank	Soakaway	Pervious Paving	Treatment System
O&M Activities				
<b>Regular maintenance</b>				
Inspection	■	■	■	■
Litter/debris removal	■		■	
Grass cutting			■	
Weed/invasive plant control	■		■	
Shrub management			■	■
Shoreline vegetation management				
Aquatic vegetation management				
<b>Occasional maintenance</b>				
Sediment management	■	■	■	■
Vegetation/plant replacement				
Vacuum sweeping and brushing			■	
<b>Remedial maintenance</b>				
Structure rehabilitation/repair	□	□		□
Infiltration surface reconditioning		□		
■ Will be required				
□ May be required				



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FINGAL COUNTY COUNCIL  
PLANNING DEPARTMENT

11 FEB 2022

ADDITIONAL INFORMATION  
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**APPENDIX 8.1**

**APPROPRIATE ASSESSMENT SCREENING REPORT**

Prepared by

Moore Group – Environmental Services



Report for the purposes of  
Appropriate Assessment Screening

Huntstown Overall Development:  
Data Centre and 220 kV Substation

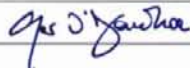
Prepared by: Moore Group – Environmental Services

8 February 2022



On behalf of:  
Huntstown Power Company Limited

<b>Project Proponent</b>	Huntstown Power Company Limited
<b>Project</b>	Huntstown Overall Development: Data Centre and 220 kV Substation
<b>Title</b>	Report for the purposes of Appropriate Assessment Screening Huntstown Overall Development: Data Centre and 220 kV Substation

<b>Project Number</b>	19169	<b>Document Ref</b>	19169 Huntstown DSFSS ASS1 Rev10
<b>Revision</b>	<b>Description</b>	<b>Author</b>	<b>Date</b>
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<b>Moore Archaeological and Environmental Services Limited</b>			

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## Abbreviations

AA	Appropriate Assessment
EEC	European Economic Community
EPA	Environmental Protection Agency
EU	European Union
GIS	Geographical Information System
LAP	Local Area Plan
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
OSI	Ordnance Survey Ireland
pNHA	proposed Natural Heritage Area
SAC	Special Area of Conservation
SPA	Special Protection Area
SuDS	Sustainable Drainage System
WFD	Water Framework Directive

# 1. Introduction

## 1.1. General Introduction

This report for the purposes of Appropriate Assessment (AA) Screening has been prepared to support a Planning Application for the Proposed Development (described in Section 3 below). This report contains information required for the competent authority to undertake screening for Appropriate Assessment (AA) in respect of the construction and operation and decommissioning of a Data Storage Facility and 220 kV Substation at Huntstown, Co. Dublin (Fingal) (hereafter referred to as the Overall Development) to determine whether it is likely individually or in combination with other plans and projects to have a significant effect on any European sites, in light of best scientific knowledge.

Where the 'Data Centre' or Data Storage Facility is referred to, this refers to FFC Reg Ref. FW21A/0151, lodged by Huntstown Power Company for the construction of 2 no. data centre buildings and associated works, on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

Where the '220kV Substation'; is referred to, this includes the lodgement of an application for a Strategic Infrastructural Development to An Bord Pleanála (Reg Ref. SID/03/21) for the construction of a 2 storey 220kV Gas Insulated Switchgear (GIS) substation known as 'Mooretown' and associated works on Lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

Where the 'Overall Development' is referred to, this relates to the entirety of the project i.e., the Data Centre (and associated works) and the Substation (and associated works).

Having regard to the provisions of the Planning and Development Act 2000 – 2021 (the "Planning Acts") (section 177U), the purpose of a screening exercise under section 177U of the PDA 2000 is to assess, in view of best scientific knowledge, if the proposed development, individually or in combination with another plan or project is likely to have a significant effect on a European site.

If it cannot be *excluded* on the basis of objective information that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site then it is necessary for the competent authority to carry out a Stage 2 appropriate assessment under section 177V of the Planning Acts.

When screening the project, there are two possible outcomes:

- the project poses no potential for a likely significant effect and as such requires no further assessment;  
or
- the project has potential to have likely significant effect (or this is uncertain) unless mitigation measures are applied, and therefore an AA of the project is necessary.



This report has been prepared by Moore Group - Environmental Services to enable Fingal County Council to carry out AA screening in relation to the Overall Development. The report was compiled by Ger O'Donohoe (B.Sc. Applied Aquatic Sciences (GMIT, 1993) & M.Sc. Environmental Sciences (TCD, 1999)) who has 27 years' experience in environmental impact assessment and has completed numerous Appropriate Assessment Screening Reports and Natura Impact Statements on terrestrial and aquatic habitats for various development types.

## 1.2. Legislative Background - The Habitats and Birds Directives

Article 6 of the Habitats Directive is transposed into Irish Law inter alia by the Part XAB of the Planning Acts (section 177U and 177V) governing the requirement to carry out appropriate assessment screening and appropriate assessment, where required, per Section 1.1 above.

The Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) is the main legislative instrument for the protection and conservation of biodiversity in the European Union (EU). Under the Habitats Directive, Member States are obliged to designate Special Areas of Conservation (SACs) which contain habitats or species considered important for protection and conservation in a EU context.

The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds), transposed into Irish law by the Bird and Natural Habitats Regulations 2011, as amended, is concerned with the long-term protection and management of all wild bird species and their habitats in the EU. Among other things, the Birds Directive requires that Special Protection Areas (SPAs) be established to protect migratory species and species which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

SACs designated under the Habitats Directive and SPAs, designated under the Birds Directive, form a pan-European network of protected sites known as Natura 2000. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs. These sites are also referred to as European sites.

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects likely to have a significant effect on Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out an appropriate assessment if required (Appropriate Assessment (AA)). Article 6(4) establishes requirements in cases of imperative reasons of overriding public interest:

**Article 6(3):** *“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to an appropriate assessment of its implications for the site in view of the site’s conservation objectives. In light of the conclusions of the assessment of the implications for the*

*site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.”*

## 2. Methodology

The Commission’s methodological guidance (EC, 2002, 2018, 2021 see Section 2.1 below) promotes a four-stage process to complete the AA and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1 and 2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

**Stage 1 Screening:** This stage examines the likely effects of a project either alone or in combination with other projects upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant. In order to screen out a project, it must be excluded, on the basis of objective information, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

**Stage 2 Appropriate Assessment:** In this stage, there is a consideration of the impact of the project with a view to ascertain whether there will be any adverse effect on the integrity of the Natura 2000 site either alone or in combination with other projects or plans, with respect to the site’s structure and function and its conservation objectives. Additionally, where there are predicted impacts, an assessment of the potential mitigation of those impacts is considered.

**Stage 3 Assessment of Alternative Solutions:** This stage examines alternative ways of implementing the project that, where possible, avoid any adverse impacts on the integrity of the Natura 2000 site.

**Stage 4 Assessment where no alternative solutions exist and where adverse impacts remain:** Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the sites will be necessary.

To ensure that the Proposed Development complies fully with the requirements of Article 6 of the Habitats Directive and all relevant Irish transposing legislation, Moore Group compiled this report to enable Fingal County Council to carry out AA screening in relation to the Overall Development to determine whether the Overall Development or in combination with another plan or project will have a significant effect on a Natura 2000 site.

### 2.1. Guidance

This report has been compiled in accordance with guidance contained in the following documents:

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010 rev.).
- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10 & PSSP 2/10.
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001); hereafter referred to as the EC Article 6 Guidance Document.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC Environment Directorate-General, 2000); hereafter referred to as MN2000.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC, 2018).
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EC, 2021).
- Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021).
- Office of the Planning Regulator (OPR) Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021).

## 2.2. Data Sources

Sources of information that were used to collect data on the Natura 2000 network of sites, and the environment within which they are located, are listed below:

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
  - National Parks & Wildlife (NPWS) protected site boundary data;
  - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
  - OSI/Environmental Protection Agency (EPA) rivers and streams, and catchments;
  - Open Street Maps;
  - Digital Elevation Model over Europe (EU-DEM);
  - Google Earth and Bing aerial photography 1995-2022;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from [www.npws.ie](http://www.npws.ie) including:
  - Natura 2000 - Standard Data Form;
  - Conservation Objectives;
  - Site Synopses;
- National Biodiversity Data Centre records;
  - Online database of rare, threatened and protected species;
  - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and

- Relevant Development Plans;
  - Fingal County Development Plan 2017-2023

### 3. Description of the Development

#### 3.1. Data Centre & Associated Development

The Data Centre development works will include site clearance and preparation, demolition of two residential properties fronting the R135 and the development of two no. data facility buildings (Building DUB40, Building DUB41) arranged over three storeys and associated structures and infrastructure including a water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works.

The 220kV substation compound and subsurface grid connection forms part of a separate Strategic Infrastructure Development (SID) application (ABP Ref: 311528) to An Bord Pleanála (ABP), that is accompanied by an EIAR and an AA Screening report, because ABP (ABP-306723-20) confirmed that the proposed development falls within the scope of section 182A of the Planning Acts and is 'deemed' strategic infrastructure.

#### 3.2. Substation and Associated Development

The Overall Development will comprise of the proposed data centre, as well as a 220kV GIS Substation, which is the subject of an SID application to An Bord Pleanála (ABP Ref. 311528). In order to assess the components of the overall development, the AA Screening will assess the Substation Project in terms of in combination effects with the Data Centre Project, and the in combination effects of *other* plans and projects.

The 220kV Substation comprises the construction of a two storey 220 kV Gas Insulated Switchgear (GIS) substation known as 'Mooretown' comprising switchgear floor, cable pit/entry room, generator room, relay room, battery room, workshop, toilet, store room, mess room, hoist space, stair cores and circulation areas (c.2,068 sqm total gross floor area) with an overall height of c.17m located within an overall EirGrid and Customer compound (c.11,231 sqm in area). Lightning electrodes are attached to the roof of the substation building resulting in an overall height of c.20m. The compound includes 4 no. 220/20 kV transformers, 4 no. 20 kV switchgear buildings and 1 no. 20 kV control room buildings (c.5 m high and c. 35.5 sqm in area each), 220 kV series coil (equipment), fire walls (ranging from c.10 m-12.5 m high), lightning finials and monopoles (c.20 m high). The overall compound is surrounded by a c.2.6 m high palisade fence. The 220kV Substation will serve the data centre proposed under concurrent application Reg. Ref. FW21A/0151.

The underground cable (Cable No. 1) will follow a route originating at the proposed Mooretown Substation extending south and then west along the private road connecting the North Road with Huntstown Power Station

and Huntstown Quarry. The route terminates at a proposed joint bay on the existing Corduff cable route. The underground cable (Cable No. 2) will follow a route originating at the proposed Mooretown Substation Compound / series coil extending south across the internal road connecting the North Road with Huntstown Power Station and Huntstown Quarry. The route terminates at a proposed joint bay on the existing Finglas cable route. Removal of the redundant sections of the 220 kV Corduff cables and 220 kV Finglas cables serving the existing AIS bay to Huntstown Power Station. The underground cable (Cable No. 3) will follow a route originating at the Mooretown GIS Substation extending south and then west to the adjacent existing ESB Huntstown A AIS station. The route terminates in the ESB Huntstown A AIS Station. The underground cable (Cable No. 4) will follow a route originating at the Mooretown GIS Substation extending south and then west to the adjacent existing Huntstown B AIS station. The route terminates in the ESB Huntstown B AIS Station.

The development includes all associated and ancillary site development and construction works, services provision, drainage works, connections to the substations, all internal road/footpath access routes, landscaping and boundary treatment works, vehicular access onto the private road to the south of the site and provision of 9 no. car parking spaces in the overall compound.

Figure 1 shows the Overall Development location (substation and data centre) and Figure 2 shows a detailed view of the 220kV Substation Development on recent aerial photography.



Figure 1. Showing the Overall Development location at Huntstown, Co. Dublin.



Figure 2. Showing the Data Centre Development boundary on recent aerial photography.



Figure 3. Showing the 220kV Substation Development boundary on recent aerial photography.





Figure 4. Plan of the Data Centre Development.

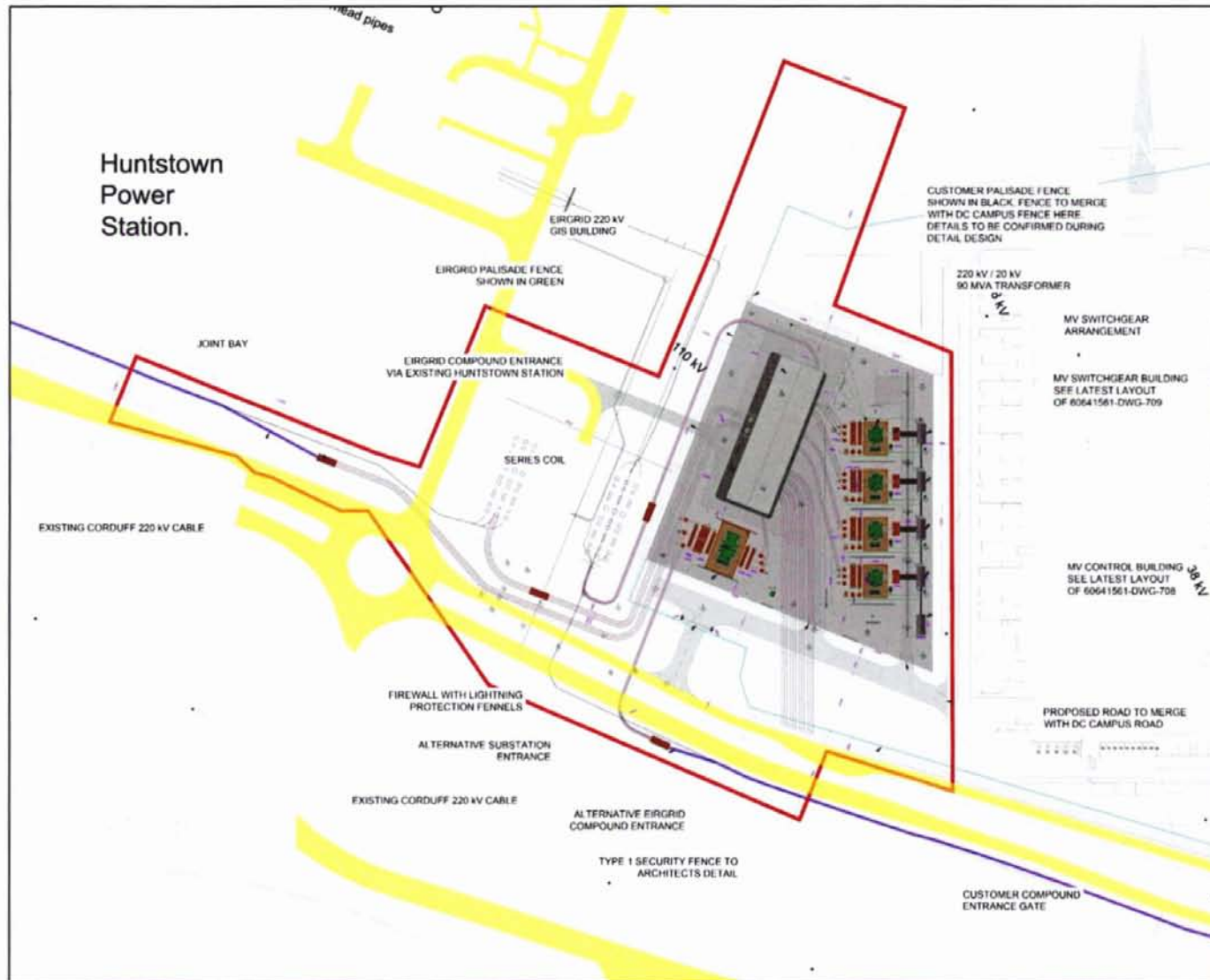


Figure 5. Plan of the 220kV Substation Development.

## 4. Identification of Natura 2000 Sites

### 4.1. Description of Natura Sites Potentially Significantly Affected

The Department of Housing, Planning and Local Government (previously DoEHLG)'s Guidance on Appropriate Assessment (2009) recommends an assessment of European sites within a Zone of Influence (Zoi) of 15km. However, this distance is a guidance only and a zone of influence of a proposed development is the geographical area over which it could affect the receiving environment in a way that could have significant effects on a European site, having regard to its Qualifying Interests and Site Conservation Objectives. In accordance with the OPR Practice Note, PN01, the Zoi should be established on a case-by-case basis using the Source- Pathway- Receptor framework and not by arbitrary distances (such as 15km).

The Zone of Influence may be determined by considering the Proposed Development's potential connectivity with European sites, in terms of:

- Nature, scale, timing and duration of works and possible impacts, nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Sensitivity and location of ecological features.

The potential for source pathway receptor connectivity is firstly identified through GIS interrogation and detailed information is then provided on sites with connectivity. European sites that are located within a potential Zone of Influence of the Overall Development are listed in Table 1 and presented in Figures 6 and 7, below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website ([www.npws.ie](http://www.npws.ie)) on 3 February 2022. This data was interrogated using GIS analysis to provide mapping, distances, locations and pathways to all sites of conservation concern including pNHAs, NHAs and European sites.

*Table 1 European Sites located within the potential Zone of Influence<sup>1</sup> of the Overall Development.*

Site Code	Site name	Distance (km) <sup>2</sup>
000199	Baldoyle Bay SAC	11.53
000205	Malahide Estuary SAC	9.53
000206	North Dublin Bay SAC	10.47
000208	Rogerstown Estuary SAC	12.63
000210	South Dublin Bay SAC	10.74
001398	Rye Water Valley/Carton SAC	11.97
004006	North Bull Island SPA	10.46

<sup>1</sup> All European sites potentially connected irrespective of the nature or scale of the Proposed Development.

<sup>2</sup> Distances indicated are the closest geographical distance between the proposed Project and the European site boundary, as made available by the NPWS.

Site Code	Site name	Distance (km) <sup>2</sup>
004015	Rogerstown Estuary SPA	13.24
004016	Baldoyle Bay SPA	11.58
004024	South Dublin Bay and River Tolka Estuary SPA	8.08
004025	Malahide Estuary SPA	9.57

The internal ditches of the Overall Development areas primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter of the proposed data centre site. This larger ditch is intermittently hydraulically linked to the Huntstown Stream depending on flow rates, which eventually leads north converging with several other streams to the Ward River c. 6.6km downstream. The Ward River flows northeast to Malahide Estuary SAC and SPA over 15 river km downstream.

There is no connectivity or pathways to any other European sites.

The Qualifying Interests (QIs) and Special Conservation Interests (SCIs) of the European sites in the Zone of influence of the Overall Development are provided in Table 2 below.

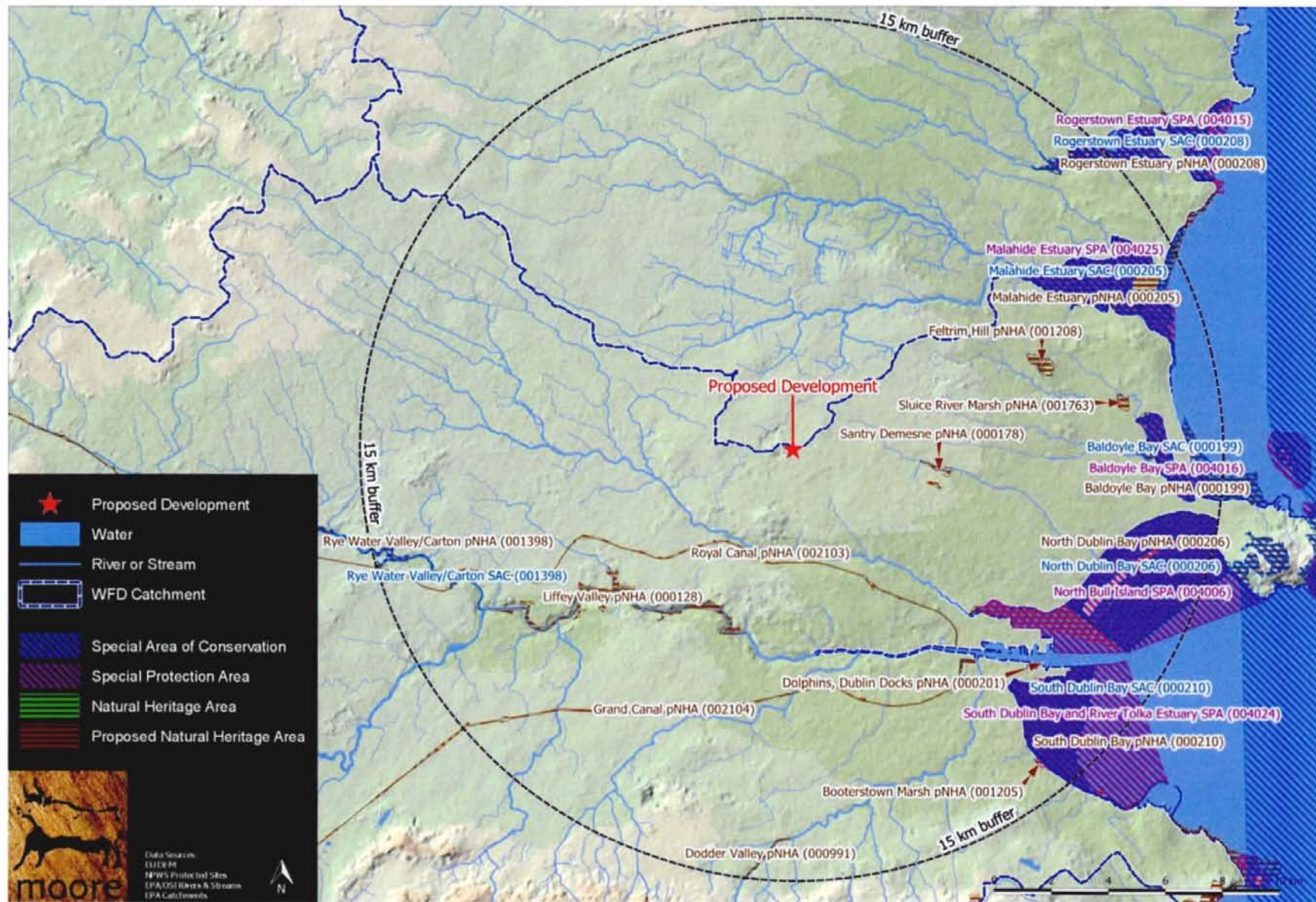


Figure 6. Showing European sites and NHAs/pNHAs within the wider Potential Zone of Influence of the Overall Development.

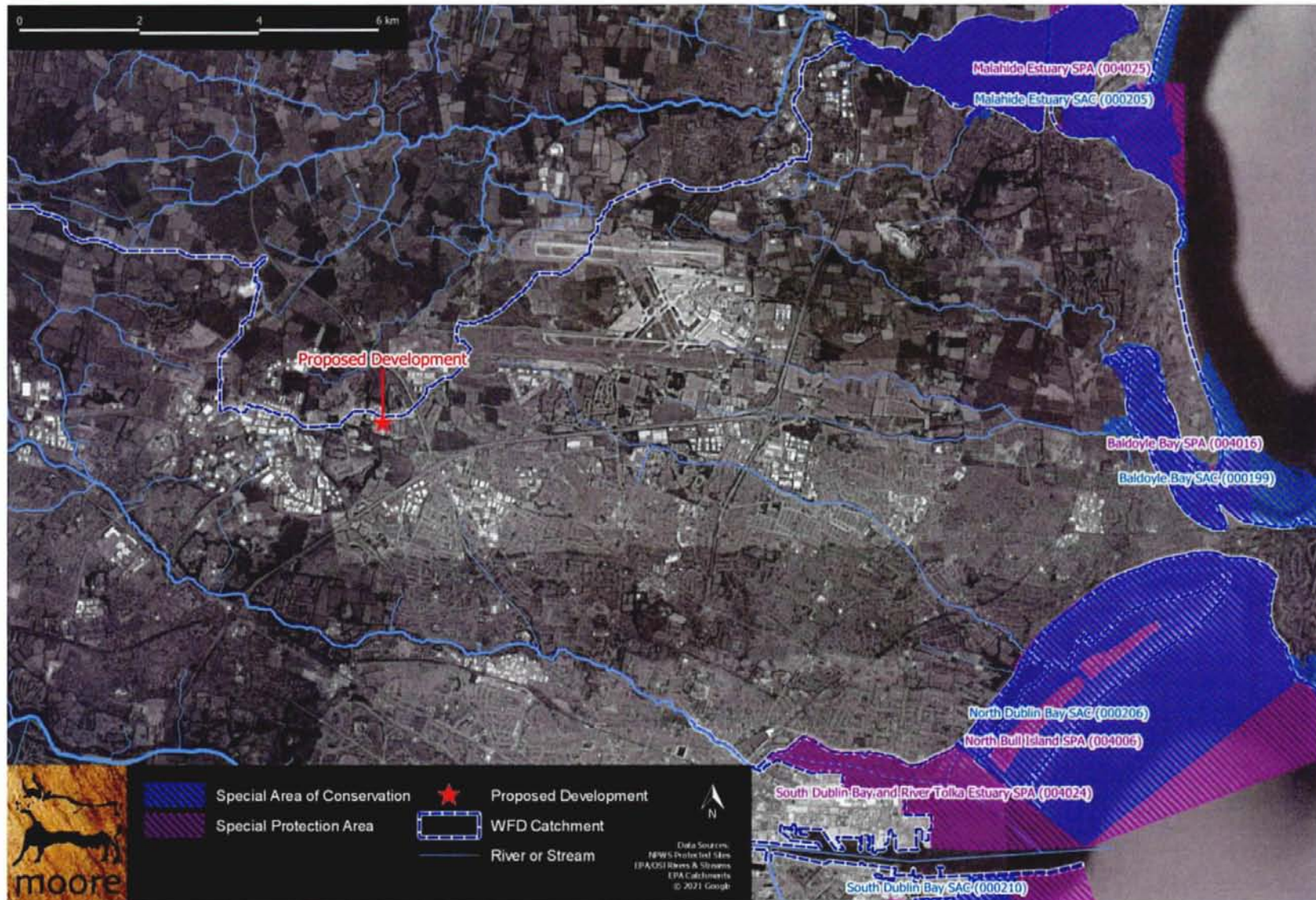


Figure 7. Detailed view of European sites within the nearer Potential Zone of Influence of the Overall Development.

Table 2 Identification of relevant European sites using Source-Pathway-Receptor model and compilation of information QIs and conservation objectives. \*Priority Habitats

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
<p><b>Baldoyle Bay SAC (000199)</b></p> <p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1310 Salicornia and other annuals colonizing mud and sand</p> <p>1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)</p> <p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>NPWS (2012) Conservation Objectives: Baldoyle Bay SAC 000199. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	<p>11.53km to the east of the Overall Development</p>	<p>No</p> <p>There are no pathways or connectivity to the habitats of this site.</p>	<p>N</p>
<p><b>Malahide Estuary SAC (000205)</b></p> <p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1310 Salicornia and other annuals colonising mud and sand</p> <p>1320 <i>Spartina</i> swards (<i>Spartinion maritima</i>)</p> <p>1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)</p> <p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)</p> <p>Including Priority Habitat – Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]</p> <p>NPWS (2013) Conservation Objectives: Malahide Estuary SAC 000205. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	<p>9.53km to the northeast of the Overall Development</p>	<p>Yes</p> <p>There is a very weak and indirect hydrological pathway to Malahide Estuary.</p> <p>The construction stage of the proposed development will entail earth movement and construction practices including the use of cement and hydrocarbons.</p> <p>The use of these potentially polluting substances will be controlled by employing a Construction Environmental Management Plan to avoid effects on the Huntstown Stream and Ward River leading to Malahide Estuary.</p> <p>In the absence of these measures the potential for significant negative effects on water quality in Malahide Estuary is uncertain.</p> <p>A worst case scenario from air emissions was considered whereby the effect of dust on the European sites listed would have a detrimental effect on qualifying habitats or species. However, this scenario is highly unlikely with all European sites located over 8km away. A Technical Note was prepared by AWN Consulting on 03/11/21 and</p>	<p>Y</p>

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
		presented to Fingal County Council which determines that while construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m.	
<p><b>North Dublin Bay SAC (000206)</b></p> <p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1210 Annual vegetation of drift lines</p> <p>1310 Salicornia and other annuals colonising mud and sand</p> <p>1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)</p> <p>1395 Petalwort <i>Petalophyllum ralfsii</i></p> <p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>2110 Embryonic shifting dunes</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)</p> <p>2190 Humid dune slacks</p> <p>Including Priority Habitat – [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes)</p> <p>NPWS (2013) Conservation Objectives: North Dublin Bay SAC 000206. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	10.47km to the southwest of the Overall Development	<p>No</p> <p>There are no pathways or connectivity to the habitats or species of this site.</p>	N
<p><b>Rogerstown Estuary SAC (000208)</b></p> <p>1130 Estuaries</p> <p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1310 Salicornia and other annuals colonising mud and sand</p> <p>1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)</p>	12.63km to the northeast of the Proposed Development	<p>No</p> <p>There are no pathways or connectivity to the habitats of this site.</p>	N



European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
<p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)</p> <p>Including Priority Habitat – Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]</p> <p>NPWS (2013) Conservation Objectives: Rogerstown Estuary SAC 000208. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>			
<p><b>South Dublin Bay SAC (000210)</b></p> <p>Mudflats and sandflats not covered by seawater at low tide [1140]</p> <p>NPWS (2013) Conservation Objectives: South Dublin Bay SAC 000210. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	13.08km to the southeast of the Overall Development	No There are no pathways or connectivity to the habitats of this site.	N
<p><b>Rye Water Valley/Carton SAC (001398)</b></p> <p>1014 Narrow-mouthed Whorl Snail <i>Vertigo angustior</i></p> <p>1016 Desmoulin's Whorl Snail <i>Vertigo moulinsiana</i></p> <p>Including Priority Habitat – [7220] Petrifying springs with tufa formation (<i>Cratoneurion</i>)</p> <p>NPWS (2021) Conservation Objectives: Rye Water Valley/Carton SAC 001398. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.</p>	11.97km to the southwest of the Overall Development	No There are no pathways or connectivity to the habitats of this site.	N
<p><b>North Bull Island SPA (004006)</b></p> <p>A043 Greylag Goose <i>Anser anser</i></p>	10.46km to the southeast of the Overall Development	No There are no pathways or connectivity to the habitats of this site.	N

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
<p>A046 Brent Goose <i>Branta bernicla hrota</i></p> <p>A048 Shelduck <i>Tadorna tadorna</i></p> <p>A056 Shoveler <i>Anas clypeata</i></p> <p>A130 Oystercatcher <i>Haematopus ostralegus</i></p> <p>A137 Ringed Plover <i>Charadrius hiaticula</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p> <p>A143 Knot <i>Calidris canutus</i></p> <p>A149 Dunlin <i>Calidris alpina alpina</i></p> <p>A156 Black-tailed Godwit <i>Limosa limosa</i></p> <p>A162 Redshank <i>Tringa totanus</i></p> <p>A999 Wetlands</p> <p>NPWS (2015) Conservation Objectives: North Bull Island SPA 004006. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>		<p>No, due to distance and the lack of any relevant ex-situ factors of significance to bird species or wetland habitat.</p> <p>It can be noted that the habitat type recorded during fieldwork carried out during the EIAR (17 September 2019 and 2 December 2020) and distance from the coastal SPAs do not present opportunities to support the bird species (predominantly waders) for which the Malahide Estuary or any other SPA is designated.</p> <p>A worst case scenario from air emissions was considered whereby the effect of dust on the European sites listed would have a detrimental effect on qualifying habitats or species. However, this scenario is highly unlikely with all European sites located over 8km away. A Technical Note was prepared by AWN Consulting on 03/11/21 and presented to Fingal County Council which determines that while construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m.</p>	
<p><b>Rogerstown Estuary SPA (004015)</b></p> <p>A043 Greylag Goose <i>Anser anser</i></p> <p>A046 Brent Goose <i>Branta bernicla hrota</i></p> <p>A048 Shelduck <i>Tadorna tadorna</i></p>	<p>13.24km to the northeast of the Overall Development</p>	<p>There are no pathways or connectivity to the habitats of this site.</p> <p>No, due to distance and the lack of any relevant ex-situ factors of significance to bird species or wetland habitat..</p> <p>It can be noted that the habitat type recorded during fieldwork carried out during the EIAR (17 September 2019 and 2 December 2020) and distance from the coastal SPAs do not present opportunities to support the bird species</p>	<p>N</p>

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
<p>A056 Shoveler <i>Anas clypeata</i></p> <p>A130 Oystercatcher <i>Haematopus ostralegus</i></p> <p>A137 Ringed Plover <i>Charadrius hiaticula</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p> <p>A143 Knot <i>Calidris canutus</i></p> <p>A149 Dunlin <i>Calidris alpina alpina</i></p> <p>A156 Black-tailed Godwit <i>Limosa limosa</i></p> <p>A162 Redshank <i>Tringa totanus</i></p> <p>A999 Wetlands</p> <p>NPWS (2013) Conservation Objectives: Rogerstown Estuary SPA 004015. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>		<p>(predominantly waders) for which the Rogerstown Estuary is designated.</p> <p>A worst case scenario from air emissions was considered whereby the effect of dust on the European sites listed would have a detrimental effect on qualifying habitats or species. However, this scenario is highly unlikely with all European sites located over 8km away. A Technical Note was prepared by AWN Consulting on 03/11/21 and presented to Fingal County Council which determines that while construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m.</p>	
<p><b>Baldoyle Bay SPA (004016)</b></p> <p>A046 Brent Goose <i>Branta bernicla hrota</i></p> <p>A048 Shelduck <i>Tadorna tadorna</i></p> <p>A137 Ringed Plover <i>Charadrius hiaticula</i></p> <p>A140 Golden Plover <i>Pluvialis apricaria</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p>	<p>11.58km to the east of the Overall Development</p>	<p>There are no pathways or connectivity to the habitats of this site.</p> <p>No, due to distance and the lack of any relevant ex-situ factors of significance to bird species or wetland habitat.</p> <p>It can be noted that the habitat type recorded during fieldwork carried out during the EIAR (17 September 2019 and 2 December 2020) and distance from the coastal SPAs do not present opportunities to support the bird species (predominantly waders) for which the Baldoyle Bay or any other SPA is designated.</p> <p>A worst case scenario from air emissions was considered whereby the effect of dust on the European sites listed</p>	<p>N</p>

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
<p>A157 Bar-tailed Godwit <i>Limosa lapponica</i></p> <p>A999 Wetlands</p> <p>NPWS (2013) Conservation Objectives: Baldoyle Bay SPA 004016. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>		<p>would have a detrimental effect on qualifying habitats or species. However, this scenario is highly unlikely with all European sites located over 8km away. A Technical Note was prepared by AWN Consulting on 03/11/21 and presented to Fingal County Council which determines that while construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m. .</p>	
<p><b>South Dublin and River Tolka Estuary SPA (004024)</b></p> <p>A043 Greylag Goose <i>Anser anser</i></p> <p>A046 Brent Goose <i>Branta bernicla hrota</i></p> <p>A048 Shelduck <i>Tadorna tadorna</i></p> <p>A056 Shoveler <i>Anas clypeata</i></p> <p>A130 Oystercatcher <i>Haematopus ostralegus</i></p> <p>A137 Ringed Plover <i>Charadrius hiaticula</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p> <p>A143 Knot <i>Calidris canutus</i></p> <p>A149 Dunlin <i>Calidris alpina alpina</i></p> <p>A156 Black-tailed Godwit <i>Limosa limosa</i></p> <p>A162 Redshank <i>Tringa totanus</i></p>	<p>8.08km to the southeast of the Overall Development</p>	<p>There are no pathways or connectivity to the habitats of this site.</p> <p>No, due to distance and the lack of any relevant ex-situ factors of significance to bird species or wetland habitat.</p> <p>It can be noted that the habitat type recorded during fieldwork carried out during the EIAR (17 September 2019 and 2 December 2020) and distance from the coastal SPAs do not present opportunities to support the bird species (predominantly waders) for which the South Dublin and River Tolka Estuary or any other SPA is designated.</p> <p>A worst case scenario from air emissions was considered whereby the effect of dust on the European sites listed would have a detrimental effect on qualifying habitats or species. However, this scenario is highly unlikely with all European sites located over 8km away. A Technical Note was prepared by AWN Consulting on 03/11/21 and presented to Fingal County Council which determines that while construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m.</p>	<p>N</p>

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
<p>A999 Wetlands</p> <p>NPWS (2015) Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>			
<p><b>Malahide Estuary SPA (004025)</b></p> <p>A005 Great Crested Grebe <i>Podiceps cristatus</i></p> <p>A046 Brent Goose <i>Branta bernicla hrota</i></p> <p>A048 Shelduck <i>Tadorna tadorna</i></p> <p>A054 Pintail <i>Anas acuta</i></p> <p>A067 Goldeneye <i>Bucephala clangula</i></p> <p>A069 Red-breasted Merganser <i>Mergus serrator</i></p> <p>A130 Oystercatcher <i>Haematopus ostralegus</i></p> <p>A140 Golden Plover <i>Pluvialis apricaria</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p> <p>A143 Knot <i>Calidris canutus</i></p> <p>A149 Dunlin <i>Calidris alpina alpina</i></p> <p>A156 Black-tailed Godwit <i>Limosa limosa</i></p>	<p>9.57km to the northeast of the Overall Development</p>	<p>Yes</p> <p>There is a very weak and indirect hydrological pathway to Malahide Estuary.</p> <p>The construction stage of the proposed development will entail earth movement and construction practices including the use of cement and hydrocarbons.</p> <p>The use of these potentially polluting substances will be controlled by employing a Construction Environmental Management Plan to avoid effects on the Huntstown Stream and Ward River leading to Malahide Estuary.</p> <p>In the absence of these measures the potential for significant negative effects on water quality in Malahide Estuary is uncertain.</p> <p>It can be noted that the habitat type recorded during fieldwork carried out during the EIAR (17 September 2019 and 2 December 2020) and distance from the coastal SPAs do not present opportunities to support the bird species (predominantly waders) for which the Malahide Estuary is designated.</p> <p>A worst case scenario from air emissions was considered whereby the effect of dust on the European sites listed would have a detrimental effect on qualifying habitats or species. However, this scenario is highly unlikely with all European sites located over 8km away. A Technical Note was prepared by AWN Consulting on 03/11/21 and presented to Fingal County Council which determines that while construction dust tends to be deposited within 350m</p>	<p>Y</p>

European site name & Site code	Location Relative to the Overall Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
A157 Bar-tailed Godwit <i>Limosa lapponica</i> A162 Redshank <i>Tringa totanus</i> A999 Wetlands NPWS (2013) Conservation Objectives: Malahide Estuary SPA 004025. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.		of a construction site, the majority of the deposition occurs within the first 50m.	

## 4.2. Ecological Network Supporting Natura 2000 Sites

A concurrent GIS analysis of the proposed Natural Heritage Areas (pNHA) and designated Natural Heritage Areas (NHA) in terms of their role in supporting the species using Natura 2000 sites was undertaken along with GIS investigation of European sites. It was assumed that these supporting roles mainly related to mobile fauna such as mammals and birds which may use pNHAs and NHAs as “stepping stones” between Natura 2000 sites.

Article 10 of the Habitats Directive and the Habitats Regulations 2011 place a high degree of importance on such non-Natura 2000 areas as features that connect the Natura 2000 network. Features such as ponds, woodlands and important hedgerows were taken into account during the preparation of this AA Screening report .

The NHAs and pNHAs identified in Figure 4 are either located outside the Zone of Influence with the exception of those associated with the Malahide Estuary. The nationally designated Malahide Estuary sites are considered under the higher conservation status as European sites.

## 5. Identification of Potential Impacts & Assessment of Significance

The Overall Development is not directly connected with or necessary to the management of the sites considered in the assessment and therefore potential significant effects must be identified and considered.

### 5.1. Assessment of Likely Significant Effects

It has been established that there is an intermittent weak hydraulic link to the Huntstown Stream depending on flow rates, which eventually leads north to the Ward River and to Malahide Estuary SAC and SPA over 15 river km downstream.

The consideration of all potential direct and indirect impacts that may result in significant effects on the conservation objectives of a European site, taking into account the size and scale of the Overall Development are presented in Table 3.

Table 3 Assessment of Likely Significant Effects.

<b>Identification of all potential direct and indirect impacts that may result in significant effects on the conservation objectives of a European site, taking into account the size and scale of the project.</b>	
<b>Impacts:</b>	<b>Significance of Impacts:</b>
<p><b>Construction phase e.g.</b></p> <p>Vegetation clearance</p> <p>Demolition</p> <p>Surface water runoff from soil excavation/infill/landscaping (including borrow pits)</p> <p>Dust, noise, vibration</p> <p>Lighting disturbance</p> <p>Impact on groundwater/dewatering</p> <p>Storage of excavated/construction materials</p> <p>Access to site</p> <p>Pests</p>	<p>While significant effect from air emissions may be ruled out, there is a very weak and indirect hydrological pathway to Malahide Estuary.</p> <p>The construction stage of the proposed development will entail earth movement and construction practices including the use of cement and hydrocarbons.</p> <p>The use of these potentially polluting substances will be controlled by employing a Construction Environmental Management Plan to avoid effects on the Huntstown Stream and Ward River leading to Malahide Estuary.</p> <p>In the absence of these measures the potential for significant negative effects on water quality in Malahide Estuary is uncertain.</p>
<p><b>Operational phase e.g.</b></p> <p>Direct emission to air and water</p> <p>Surface water runoff containing contaminant or sediment</p> <p>Lighting disturbance</p> <p>Noise/vibration</p> <p>Changes to water/groundwater due to drainage or abstraction</p> <p>Presence of people, vehicles and activities</p> <p>Physical presence of structures (e.g. collision risks)</p> <p>Potential for accidents or incidents</p>	<p>All foul and surface water runoff, once the facility is operational, will be contained on site and discharged to urban drainage systems.</p> <p>There is no real likelihood of any significant effects on European Sites in the wider catchment area.</p> <p>The facility is located at a distance of removal such that there will be no disturbance to qualifying interest species in any European sites.</p>
<b>In-combination/Other</b>	No likely significant in-combination effects are identified in Section 5.2 below.



<b>Describe any likely changes to the European site:</b>	
<p><b>Examples of the type of changes to give consideration to include:</b></p> <p>Reduction or fragmentation of habitat area</p> <p>Disturbance to QI species</p> <p>Habitat or species fragmentation</p> <p>Reduction or fragmentation in species density</p> <p>Changes in key indicators of conservation status value (water quality etc.)</p> <p>Changes to areas of sensitivity or threats to QI</p> <p>Interference with the key relationships that define the structure or ecological function of the site</p> <p>Climate change</p>	<p>The use of potentially polluting substances will be controlled by employing a Construction Management Plan to avoid effects on the Huntstown Stream and Ward River leading to Malahide Estuary.</p> <p>In the absence of these measures the potential for significant negative effects on water quality in Malahide Estuary is uncertain.</p>
<b>Are 'mitigation' measures necessary to reach a conclusion that likely significant effects can be ruled out at screening?</b>	
Yes	Construction Management will be employed to avoid discharge of potentially polluted surface water to the Huntstown Stream. Measures to avoid potential pollution of Malahide Estuary and its associated European sites will be included in a Construction Environmental Management.

## 5.2. Assessment of Potential In-Combination Effects

In-combination effects are changes in the environment that result from numerous human-induced, small-scale alterations. In-combination effects can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials or resource, and second, through the compounding effects as a result of the coming together of two or more effects.

As part of the Screening for an Appropriate Assessment, in addition to the Overall Development, other relevant plans and projects in the area must also be considered at this stage. This step aims to identify at this early stage any possible significant in-combination effects of the Overall Development with other such plans and projects on European sites.

## Assessment of Plans

The planning authority in whose functional area the development is proposed is Fingal County Council. There is potential for “in-combination” effects on water quality in Malahide Estuary from other plans and projects carried out within the functional areas of the Fingal Development Plan 2017-2023 (Fingal County Council, 2017).

Plans and developments within Fingal County must comply with the following policy objectives of the Fingal County Development Plan 2017-2023 relevant to the protection of European sites and the protection of water quality in Malahide Estuary:

### **Objective NH10**

Ensure that the Council takes full account of the requirements of the Habitats and Birds Directives, as they apply both within and without European Sites in the performance of its functions.

### **Objective NH11**

Ensure that the Council, in the performance of its functions, takes full account of the objectives and management practices proposed in any management or related plans for European Sites in and adjacent to Fingal published by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

### **Objective NH15**

Strictly protect areas designated or proposed to be designated as Natura 2000 sites (i.e. Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); also known as European sites) including any areas that may be proposed for designation or designated during the period of this Plan.

### **Objective SW04**

Require the use of sustainable drainage systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques where appropriate, for new development or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.

### **Objective WQ01**

Strive to achieve ‘good status’ in all waterbodies in compliance with the Water Framework Directive, the Eastern River Basin District Management Plan 2009-2015 and the associated Programme of Measures (first cycle) and to cooperate with the development and implementation of the second cycle national River Basin Management Plan 2017-2021.

**Objective WQ04**

Protect existing riverine wetland and coastal habitats and where possible create new habitats to maintain naturally functioning ecosystems whilst ensuring they do not impact negatively on the conservation objectives of any European Sites.

**Objective WT01**

Liaise with and work in conjunction with Irish Water during the lifetime of the plan for the provision, extension and upgrading of waste water collection and treatment systems in all towns and villages of the County to serve existing populations and facilitate sustainable development of the County, in accordance with the requirements of the Settlement Strategy and associated Core Strategy.

**Objective WT02**

Liaise with Irish Water to ensure the provision of wastewater treatment systems in order to ensure compliance with existing licences, EU Water Framework Directive, River Basin Management Plans, the Urban Waste Water Directive and the EU Habitats Directive.

Having regard to the policies and objectives referred to under the relevant development plan, it is concluded that the possibility of any other plans acting in combination with the Overall Development to give rise to significant effects on any European site in, or associated with, Malahide Estuary can be excluded.

**Assessment of Projects**

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data gaps for the area where the Overall Development is located. The database was then queried for developments granted planning permission within 0.5km of the Overall Development within the last three years, these are presented in Table 4 below.

*Table 4. Planning applications granted permission in the vicinity of the Overall Development.*

Planning Ref.	Description of development	Comments
F17A/0436	Revisions to existing Hawk House (Unit 4) granted under F07A/0389.	No potential for in-combination effects given the scale and location of the project.
F17A/0728	The construction of a single storey unit for industrial and/or warehouse use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F17A/0769	Development will consist of the construction of two single storey units for industrial and/or warehousing use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site .
FW18A/0038	Amendments to previously approved application (ref FW14A/0162) which consisted of demolition of existing	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
	2no. two storey semi-detached dwellings, construction of 2 detached dwellings.	
FW18A/0082	The development is a wastewater treatment plant.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F18A/0139	The construction of an extension to internal access road from Maple Avenue with associated works including public lighting and the development of 2 no. plots generally for industrial, warehouse, storage and logistic use.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW18A/0159	Planning Permission is sought for an increase in the annual volume of waste to be imported to the permitted bioenergy plant at Huntstown, North Road, Finglas, Dublin 11. The proposed increase is 9,900 tonnes, which would take the permitted volume from 90,000 tonnes to 99,900 tonnes.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F18A/0683	Permission for a new shed (floor area 180m <sup>2</sup> ) for horticultural related uses and ancillary works including new vehicular entrance.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0015	The development will consist of a Battery Energy Storage System (BESS) which will include up to 9 no. containerised battery storage modules ( up to 14m length, 2.44m wide and 2.9m high) and ancillary equipment including up to: 9 no transformers (2.5m wide and 2.9m high), 7 no. power conditioning unit blocks (8m length and 1.5m wide), 1 no. power conditioning unit block (5m length by 5m wide), 9 no. switchgear units (1.5m length, 1.5m wide and 1.6m high), a sub-station container (4.5m length, 3.0m wide and 3.0m high) and all other associated site development works as required to facilitate the development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0053	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0143	The construction of 2 no. Single-Storey Units for industrial and/or Warehouse use with ancillary Two-Storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0170	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0185	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F19A/0218	Amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0021	The development will consist of storage and logistic facilities comprising yards, warehouses, workshops and ancillary offices at Plots 1, 3, 4, 5, 6, 7, and 9 and amendment to permitted development (Reg. Ref.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.

Planning Ref.	Description of development	Comments
	FW19A/0101 and F18A/0139) at Plot 8 and internal road network at Dublin Inland Port.	
FW20A/0044	The proposed development consists of amendments to Planning Permission F17A/0769 as granted. The amendments are as follows to unit 2: high level building signage to the east and west facing facades along the M2 and R135 respectively.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0045	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted. The amendments relate only to Unit 1 of the permitted development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0097	Fingal County Council. Dublin Port Company intends to apply for planning permission for development and amendments to development permitted under Reg. Ref. F18A/0139 /, ABP Ref. 302361 – 18 as amended.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW21A/0144	The development will consist of the installation of electrical infrastructure between Finglas substation and Huntstown Power Station to facilitate the retirement of existing Electricity Supply Board overhead powerlines and facilitate site clearance for the future development of a data centre and substation (subject to separate planning applications). This will include (i) the installation of approximately three underground cable circuits of 1.2km length (110kV) and one circuit 1.2km length (38kV) and associated underground ducting, joint bays and infrastructure between the existing ESB Finglas substation and an agreed location within Huntstown Power Station (ii) installation of one c.28m double circuit 110 kV cable end tower and one c.17 single circuit 110kV angle mast (iii) removal of 10Nr. existing 110kV timber polesets, 9 Nr. existing 38kV timber polesets, 3 Nr. 38kV lattice steel tower & associated overhead line electrical infrastructure; all associated and ancillary site development, landscaping and construction works, all within the townlands of Johnstown, Huntstown, Coldwinters & Baleskin at Blanchardstown & Finglas, County Dublin. An Environmental Impact Assessment report (EIAR) has been prepared and will be submitted to the Planning Authority with the planning application.	An Appropriate Assessment Screening report submitted with this application found that the proposed development will not have a significant effect on any Natura 2000 site.

The Fingal County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same potential Zone of Influence of the Overall Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the proposed development area and surrounding townlands in which the Overall Development site is located, would be avoided.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Fingal County Development Plan and in compliance with the consenting authority requirement with regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard.

There are no predicted in-combination effects at this stage of the assessment from other projects given that the listed granted applications will have no effect on any European site.

Any new applications for the Proposed Development area will be assessed on a case by case basis *initially* by Fingal County Council which will determine the requirement for AA Screening as per the requirements of Section 177U of the Planning Acts.

In the absence of construction management, the potential impact on the Malahide Estuary SAC and/or the Malahide Estuary SPA is uncertain.

## 6. Conclusion

There will be no direct impacts on the Malahide Estuary European sites and there will be no habitat loss or fragmentation as a result of the Overall Development.

Having considered direct impacts and ruling them out, indirect impacts are then considered.

Potential impacts on or disturbance of SPA bird species can be ruled out given the agricultural habitats of the Overall Development areas being unsuitable for waders and foraging geese and the distance of removal from all SPAs over 8km.

A worst-case scenario may be considered whereby the Overall Development would be the source of a significant detrimental change in water quality in Malahide Estuary either alone or in combination with the other projects or plans listed in Table 4 as a result of indirect pollution via the Huntstown Stream and Ward River, without the application of standard mitigation measures. The effect would have to be considered in terms of changes in water quality which would affect the habitats or food sources of the species for which the Malahide Estuary European sites are designated.

The construction of the site will require the control of potential construction stage pollutants e.g. from elevated suspended solids from the dewatering of the site, the volume and time required is uncertain, and from other sources such as cement or hydrocarbons. In the absence of construction management, the potential impact on the Malahide Estuary SAC and/or the Malahide Estuary SPA is uncertain.

Thus, in line with Departmental Guidance and having regard to ECJ and Irish case law and the 'Precautionary Principle', Stage 2 Appropriate Assessment is required.

## 7. References

Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).

European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

European Commission Environment DG (2002) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission, Brussels.

European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC: Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interests, compensatory measures, overall coherence and opinion of the Commission. European Commission, Brussels.

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European Commission (2021) Guidance document on the strict protection of animal species of Community interest under the Habitats Directive, Brussels 12.10.21.

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NPWS (2022) National Parks and Wildlife Service Metadata available online at <https://www.npws.ie/maps-and-data>

Office-of-the-Planning-Regulator (2021) Appropriate Assessment Screening for Development Management OPR Practice Note PN01. March 2021

**APPENDIX 8.2**  
**BAT SURVEY REPORT**

Prepared by

Eire Ecology

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## BAT SURVEY REPORT

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Proposed Datacentre Development on lands adjacent to  
Huntstown Power Station, North Road, Finglas, Dublin 11.

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APRIL 2021

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APPENDIX A –Site Layout

APPENDIX B – Tree Assessment

APPENDIX C – Ecobat Bat Activity Analysis

# 1 INTRODUCTION

This report details the finding of a bat survey completed to accompany the planning application for two no. data hall buildings arranged over 3 storeys and associated structures and infrastructure include including water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works.

The Proposed Development site is c. 12.9 hectares of greenfield land including two residential properties fronting the R135 and located to the north west of the M50 orbital ring in the townland of Johnstown and Coldwinders, North Road, Finglas, Dublin 11. The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Anaerobic Digestion Plant, to the east by the North Road (R135) and to the west by Huntstown Power Station.

The survey was undertaken in August 2019 and the survey focused on the arable crop fields bordered by mature tree lines and hedgerows. Due to the ongoing Covid-19 restrictions a detailed survey of the 2 no. occupied dwellings located on site has not been undertaken. This report aims to;

- Examine trees on site for their potential to host bat roosts
- Identify species of bats using the site.
- Examine potential feeding and commuting routes.
- Potential impacts of bats by the proposed development.

The surveys undertaken are in line with recommendations in Chapter 10 of the Bat Conservation Trust 'Good Practice Guidelines, 2nd edition, 2012' (BCT Guidelines 2012) and The Irish Wildlife Manual No. 25' (Kelleher, C. & Marnell, F. 2006). The survey was designed and carried out by John Curtin B.Sc. (Ent.). John has over five years' experience of carrying out bat surveys and has completed over 30 surveys during this time. John has also completed

the Bat Conservation Ireland, Bat Detector Workshop and Bat Handling Workshop which are the standard training for the carrying out of bat surveys in Ireland. He follows the Bat Conservation Ireland 'Good Practice Guidelines' (Aughney *et al.*, 2008). In addition, John is an active member of Bat Conservation Ireland, which monitor bat populations in Ireland, and facilitate the education of bat communities to the public.

The site in question refers to arable crop fields bordered by mature treelines and hedgerows.

In order to assess the presence and activity of bats within the proposed development grounds, several surveys were conducted within the site. (See Table 1-1).

**Table 1-1: Surveys completed**

Date	Survey type
14/08/2019	At height prf tree survey
14 <sup>th</sup> to the 15 <sup>th</sup> August 2019	Dusk and dawn bat detector survey
15/08/2019	At height prf tree survey
15 <sup>th</sup> to the 16 <sup>th</sup> August 2019	Dusk and dawn bat detector survey
15 <sup>th</sup> to the 30 <sup>th</sup> of August 2019	Static detector survey

A thorough at height examination of the trees using high powered torch, a Seek Reveal XR FF thermal imaging device and an Ridgid CA-300 Inspection Camera (under Licence No: 137/2018) did not reveal the presence of roosting bats. Night time detector surveys and static monitoring showed bats use the site for feeding purposes. Rarer woodland bats such as *Myotis* species and Brown Long-eared bats do not frequently use the site.

## 2 DESKTOP STUDY

### 2.1 BATS IN IRELAND – LEGISLATIVE PROTECTION

There are two main pieces of legislation which cover wildlife protection in Ireland – the Wildlife Act and the Habitats Regulations. These are outlined below, with particular reference to the protection afforded to bat species in Ireland.

#### The Wildlife Acts 1976 and 2000

The primary pieces of national legislation for the protection of wildlife in Ireland are the Wildlife Act (1976) and the Wildlife [Amendment] Act (2000). All species of bats in Ireland are listed on Schedule 5 of the 1976 Act, and are therefore subject to the provisions of Section 23, which make it an offence to:

- Intentionally kill, injure or take a bat
- Possess or control any live or dead specimen or anything derived from a bat
- Wilfully interfere with any structure or place used for breeding or resting by a bat
- Wilfully interfere with a bat while it is occupying a structure or place which it uses for that purpose

#### The Habitats Regulations 1997-2005

The EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992) seeks to protect rare and vulnerable species and the habitats in which they are commonly found, and requires that appropriate monitoring of populations be undertaken. All bat species found in Ireland are listed under Annex IV of the Directive, while the lesser horseshoe bat is afforded further protection under Annex II. The Habitats Directive has been transposed into Irish law by the European Communities (Natural Habitats) Regulations 1997. All bat species are listed on the First Schedule and Section 23 of the regulations makes it an offence to:

- Deliberately capture or kill a bat
- Deliberately disturb a bat
- Damage or destroy a breeding site or resting place of a bat

Provision is made in the Regulations for the Environment Minister to grant, in strictly specified circumstances set out in that Regulation, a derogation license permitting any of the above activities “where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range”.

## 2.2 SITE LOCATION

The proposed site lies approximately 50m east of the Huntstown power station whilst the R135 borders the site to the East (Grid Ref. E711657/ N741391). The site for the proposed development lies approximately 3.8km from the Royal Canal proposed National Heritage Area (site code: 002103) (see Figure 2-1 below).



**Figure 2-1: Location of proposed development in relation to designated site**



Figure 2-2: Aerial of site

### 2.3 BAT SPECIES RECORDED IN THE SURROUNDING AREA

The NBDC database was consulted for details on bat records held for the site and the surroundings. The database was consulted on the 25/10/2019 for details on historical records from the site, the surrounding 2km (O14A) and the 10km hectad; O14. Results are outlined in Table 2-1. While no bat records were found with the 2km square O14A six of the nine confirmed resident bat species known to occur in Ireland have been recorded within the 10km hectad O14 the subject site resides in. A search for bat roosts found the closest roost to the site located some 4.6km to the east where an unidentified Pipistrelle was recorded from a tree roost. A Leisler's bats, Common and Soprano Pipistrelle roost can be found some 5.2km to the south west while a Pipistrelle roost can be found 6.16km to the south west.

**Table 2-1: Irish bat species recorded in the O14 10km hectad**

Scientific name	Common name	Date of last record	Designation	Distance from subject site
<i>Myotis daubentonii</i>	Daubenton's Bat	24/10/2005	EU Habitats Directive >> Annex IV    Wildlife Acts	2.71km to the NE recorded during road transect
<i>Myotis nattereri</i>	Natterer's Bat	07/03/2006	EU Habitats Directive >> Annex IV    Wildlife Acts	3.65km to the SW on the Tolka River
<i>Nyctalus leisleri</i>	Leisler's Bat	05/06/2012	EU Habitats Directive >> Annex IV    Wildlife Acts	1.51km to the SW recorded during EIA survey
<i>Pipistrellus pipistrellus sensu lato</i>	Pipistrelle	05/06/2012	EU Habitats Directive >> Annex IV    Wildlife Acts	5.42km to the NE recorded during EIA survey
<i>Pipistrellus pygmaeus</i>	Soprano Pipistrelle	05/06/2012	EU Habitats Directive >> Annex IV    Wildlife Acts	1.51km to the SW recorded during EIA survey
<i>Plecotus auritus</i>	Brown Long-eared Bat	16/08/2014	EU Habitats Directive >> Annex IV    Wildlife Acts	1.51km to the SW recorded during EIA survey
<i>Pipistrellus nathusii</i>	Nathusius's Pipistrelle	12/08/2007	EU Habitats Directive >> Annex IV    Wildlife Acts	4.97km to the SW along the Royal Canal



## 3 SURVEY FINDINGS

### 3.1 SURVEY METHODOLOGY

A detailed inspection of the trees was undertaken during daylight hours on the 14<sup>th</sup> and 15<sup>th</sup> of August 2019. The aim was to compile information on actual and potential access points and roosting locations. This was done by searching for evidence of bats including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

### 3.2 SURVEY CONSTRAINTS

Surveys were conducted during August 2019 within the bat active season (May - August).

#### 3.2.1 Habitats on site

The boundary hedgerows and treelines consists of mature and semi mature ash, hawthorn, sycamore. The surrounding lands are well represented with treelines, hedgerows as well as industrial developments. The Huntstown Powerstation located to the east provides considerable light pollution.

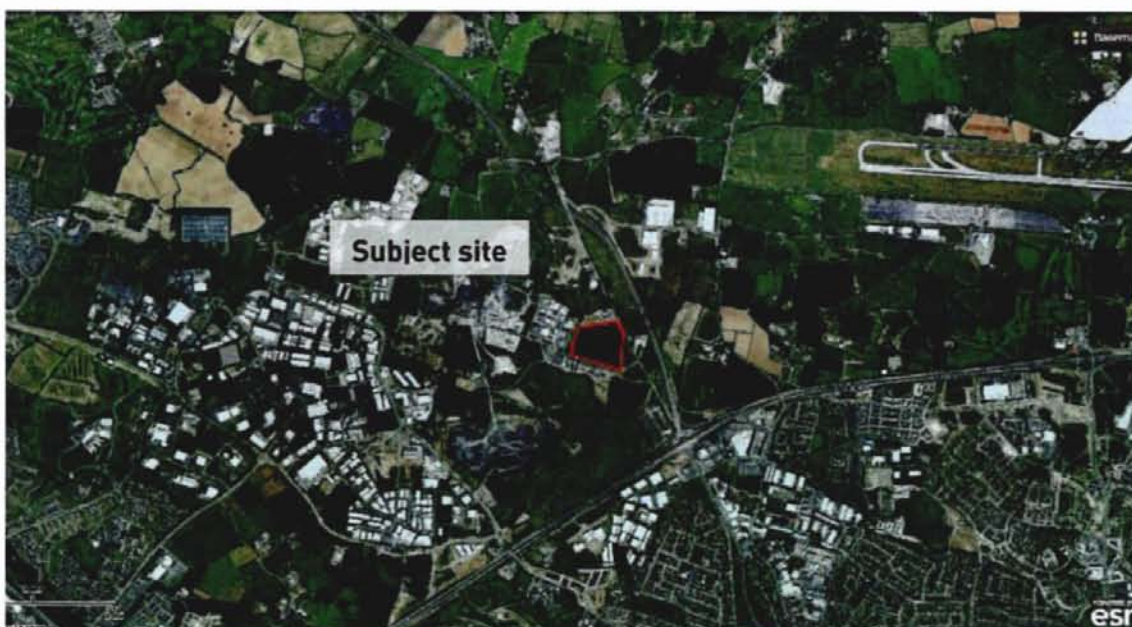


Figure 3-1: Aerial displaying network of treelines and small woodlands surrounding subject site



**Plate 3-1 & Plate 3-2: Treelines within site**



**Plate 3-3: Treeline by western end of site adjacent to mixed woodland**



**Plate 3-4: Light from Huntstown powerstation**

### 3.2.2 Daylight inspection

Several mature and semi-mature trees were found within the site. Given the potential for trees to host bat roosts a full 'at height' potential roost feature (prf) survey was completed on the trees within the site.

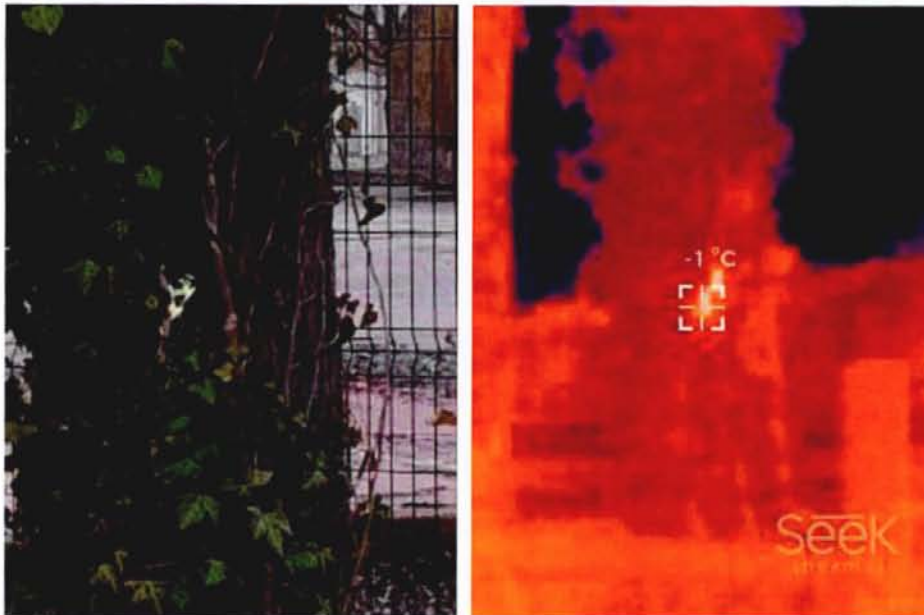
A daytime visual assessment of trees within the proposed development site was undertaken on the 14<sup>th</sup> and 15<sup>th</sup> of August 2019 following adapted guidelines from the following sources;

- Andrews H. (2018) *"Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals"* - *Bat Tree Habitat Key*. Pelagic Publishing
- Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London
- Andrews H. *Surveying Trees for Bat Roosts: Encounter Probability v. Survey Effort* 2015
- Andrews H et al. 2013. *Bat Tree Habitat Key*. AEcol, Bridgwater
- Hundt L. (2012) *Bat Surveys: Good Practice Guidelines*, 2nd edition, Bat Conservation Trust, London
- Kelleher, C. & Marnell, F. (2006) *Bat Mitigation Guidelines for Ireland*. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- National Roads Authority (2005), *Guidelines for the Treatments of Bats Prior to the Construction of National Road Schemes*.

Conditions were dry and sunny. All trees were assessed from ground level using binoculars and by use of telescopic ladders up to 5m in height. Where trees showed some roosting potential a full prf survey was conducted with an arborist climbing the tree. The arborist then conducted full searches of each potential prf feature. Where ivy was present a Seek Reveal XR Fastframe thermal imaging device was used. Thermal imaging cameras are designed to detect heat (infrared radiation) emitted from objects within a defined field of view. The metabolic heat produced by bats and other animals produces a distinct thermal image against a cooler background. In particular circumstances it will produce a thermal plume that escapes from cavities and cracks.

The ability to detect the heat emitted from an object has several advantages as a survey technique. It is not invasive and does not require artificial illumination. It is particularly

advantageous when surveying trees with thick ivy cover which traditionally is difficult to impossible to survey.



**Plate 3-5 & Plate 3-6: Image of led torch placed on tree within site; standard and infrared**

Evidence of bat usage sought during the surveys include:

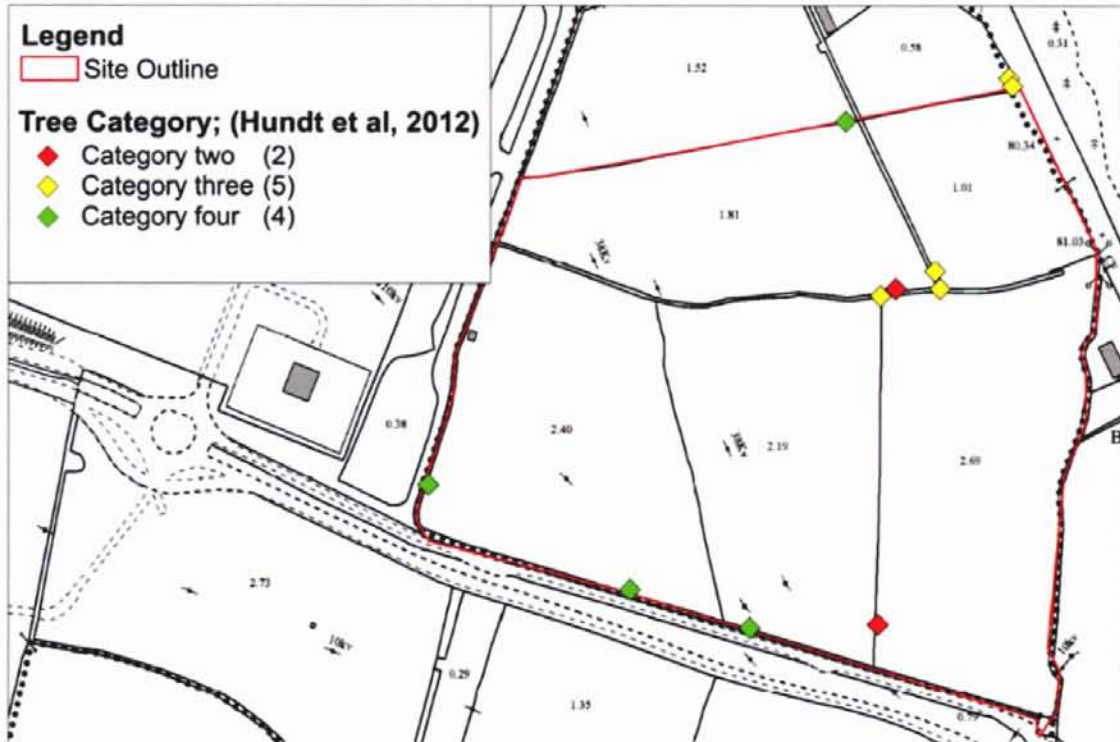
- Bat droppings (these will accumulate under an established roost or under access points);
- Insect remains (under feeding perches);
- Oil (from fur) and urine stains;
- Scratch marks; and
- Bat corpses.

Examples of crevice features include:

- Natural holes;
- Cracks/splits in major limbs;
- Loose bark; and
- Hollows/cavities.

The accompanying arborists report details trees found within and adjacent to the development. Much of these trees had low potential for hosting bat roosts being immature and lacking roost potential features. Appendix B details the findings from the 'at height' survey. Each tree was initially categorised according to Hundt et al, 2012 ranking from 1 (highest potential) to 4 (no potential).

All category 1, 2 or 3 trees were searched at height after which it was re-categorised taking on board the close up examination of each prf (see Figure 3-2).



**Figure 3-2: Concluding category of trees surveyed within the site.**

In summary two mature ash showed definite bat potential but supporting features suitable for use by singleton bats thus was initially ranked 2. Chainsaw cuts, tear outs were visible alongside considerable ivy cover. A branch cut shows lifted bark whilst several pruning cuts were visible.

Several other trees were examined at height however all these trees were reduced to category 3 and 4 after the survey.

### 3.1 BAT DETECTOR SURVEYS

Mobile detector surveys were carried out completing looped transects of the site during the dusk and dawn periods to survey for commuting, feeding and potential roost sites. On the 14<sup>th</sup> the survey commenced at 20:26; half an hour before sunset and continued for three hours. The survey then recommenced two hours before sunrise at 04:07 and continued until sunrise. On the 15<sup>th</sup> surveys started at 20:25 and 04:08. Each contact with a bat was recorded. Where possible, a positive identification to species level was made. Information on the behavior was also recorded where available.

Bat detectors used during the walked surveys were a Wildlife Acoustics Inc. (Massachusetts, USA) Echo Meter EM3 and an EM touch pro 2 which are triggered to record when a bat call is emitted louder than 18dB for 1sec. These detectors uses full spectrum sampling; detecting all frequencies simultaneously, meaning that multiple bat calls can be recorded at the same time.

A contact as shown below describes a bat observed by the surveyor. This contact can range from a commuter passing quickly to a foraging bat circling a feature lasting for several minutes. Some observations contain multiple bats. When several bats of the same species are encountered together they are recorded under the one contact. A separate contact is recorded for each species. A contact finishes when the recorder assumes the bat is no longer present. It is likely that the same bat is recorded in several contacts throughout the night. This survey type cannot estimate abundance of bats, rather activity; the amount of use bats make of an area / feature. The survey followed the guidelines as set out in bat conservation Ireland's 'Bat Survey Guidelines'.

Sunset on the 14<sup>th</sup> of August occurred at 20:56 and sunrise on the 15<sup>th</sup> was at 06:07. A westerly to north-westerly wind of 2.2 to 1.6 m/s was recorded from the start and finish of the dusk survey with increased wind ranging from 3.6 to 2.4 m/s wind value at the start and finish of the dawn survey. Cloud cover ranged from 70% in the evening of the 14<sup>th</sup> to 100% by the end of the dawn survey. The air temperature varied during the night of the survey between 18 degrees at 20:20 to 17.5 degrees Celsius at 23:30. Temperatures during the dawn survey ranged from 14.5 degrees at 04:00 to 14.0 degrees at 06:10. A slight drizzle occurred at 22:57 for five minutes.

On the 15<sup>th</sup> Sunset fell at 20:55 and sunrise on the 16<sup>th</sup> was at 06:08. A southerly wind of 0.6 to 0.9 m/s was recorded from the start and finish of the dusk survey. During the dawn survey southerly winds ranged from 2.3 to 2.8 m/s. Again cloud cover ranged from 70% in the evening of the 15<sup>th</sup> to 100% by the end of the dawn survey. The air temperature varied during the night of the survey between 19.4 degrees at 20:20 to 18.5 degrees Celsius at 23:30. Temperatures during the dawn survey ranged from 14.0 degrees at., 04:00 to 14.6 degrees at 06:10. Drizzle occurred throughout this period somewhat reducing the potential for bat activity.

Overall, these conditions were good for bat survey work baring the dawn survey of the 16<sup>th</sup>.

### 3.1.1 Fixed site recordings made during August

A Song Meter SM3BAT (Wildlife Acoustics, Inc; Massachusetts, USA) 16-bit full spectrum time-expansion recording bat detector was placed within the study area; the townland of Johnstown (Grid Ref. E711702 N741412) on the evening of the 15<sup>th</sup> to the dawn of the 30<sup>th</sup> of August 2019. This static detector was installed according to the guidelines as set out in Bat Conservation Ireland's 'Bat Survey Guidelines.'

The detector was erected within a hedgerow to the centre of the site. The device was set to record from sunset to sunrise and automatically adjusts itself each day. The recorder was thus in position and recording giving a total of 118 hours 13 minutes of recording over the fifteen nights.

Registrations as described below follow the Bat Conservation Trusts definition of a bat pass; 'two or more bat calls in a continuous sequence; each sequence or pass is separated by one second or more in which no calls are recorded. The number of bat passes for each species or species group identified is counted for each' point. (BCT Good Practice Guidelines 2nd Ed 2012).

Weather information is provided by Met Eireann from the weather station located in Dublin Airport. Table 3-1 provides data on sunset weather conditions. Overall these conditions were good for bat activity.

**Table 3-1: Sunset weather data**

Date	Temp	Wind Speed (Mph)	Direction	Rain (mm)
15 / 16 August	17.4	4	SW	0
16 / 17 August	17.3	8	SW	0
17 / 18 August	14.3	10	W	0
18 / 19 August	15.4	8	SSW	0
19 / 20 August	17.2	8	S	0
20 / 21 August	15.5	4	SW	0
21 / 22 August	19.2	15	SW	0.1
22 / 23 August	19	9	SW	0
23 / 24 August	18.1	9	SE	0
24 / 25 August	17.4	12	SSE	0
25 / 26 August	18.3	15	S	0

26 / 27 August	14.3	5	W	0
27 / 28 August	12.8	5	NW	0
28 / 29 August	15.1	8	NW	0
29 / 30 August	15	3	E	0.5

### 3.1.2 Results of survey on the 14<sup>th</sup> of August

The results of the walked transects are shown in Table 3-2, 3-3 and Figure 3-2 below. During the survey, two bat species were identified to species level; Common Pipistrelle (*Pipistrellus pipistrellus*), and Leisler's Bat (*Nyctalus leisleri*). Activity was very low during the survey. Four bats were recorded during the survey with the first recorded at 21:28 some 32 minutes after sunset. Common Pipistrelle typically emerge twenty minutes after sunset thus the appearance of a bat at this time may indicate a bat roost some distance from the site. This record was of a hunting bat located to the western end of the site by the adjacent woodland. Other records were brief recordings. No bats were recorded during the dawn survey. No evidence of roosting activity was noted from any of the trees.

**Table 3-2 Bats recorded during night time dusk detector survey**

Species	Contacts
Common Pipistrelle	1
Leisler's Bat	3
Total Contacts	4

**Table 3-3 Dusk Survey bat contact details**

Contact No	time	x	y	Species
1	21:28	711440	741344	Common Pipistrelle
2	21:46	711651	741466	Leisler's Bat
3	21:36	711453	741299	Leisler's Bat
4	22:50	711918	741397	Leisler's Bat



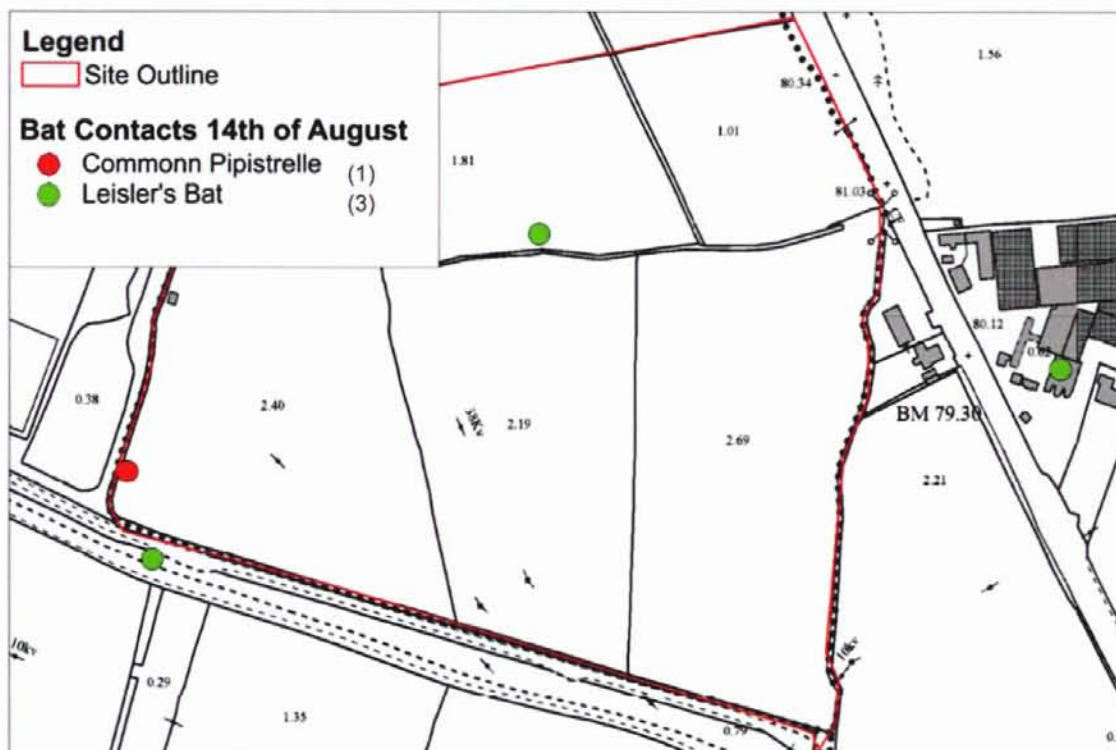


Figure 3-3 Dusk Survey Contact Locations

### 3.1.3 Results of survey on the 15<sup>th</sup> of August

Details of the dawn survey can be found in Tables 3-4, 3-5 and Figure 3-3 below. During the survey, three bat species were identified to species level; Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*) and Leisler's Bat (*Nyctalus leisleri*).

At dusk the surveyor erected a night vision camcorder recording for 70 minutes at the entrance to a prf found on tree number (3a) towards the central hedgerow. No bats were recorded using the prf. Again no bats were recorded during the dawn survey.



Plate 3-7 Night vision camcorder recording

During this survey the majority of activity was noted along the central treeline / hedgerow where a Common Pipistrelle bat was noted hunting. Also recorded here were brief registrations from Soprano Pipistrelle and Leisler's bat. The first bat was recorded at 20:55; a Leisler's bat noted at sunset. This species is the earliest bat to emerge, often noted hunting prior to sunset. Given this recording occurred at sunset it may indicate a roost located relatively closeby. No emerging activity was noted from any of the trees on site. Drizzle during the dawn survey may have reduced bat activity.

**Table 3-4: Bats recorded during night time detector survey S**

Species	Contacts
Soprano Pipistrelle	3
Common Pipistrelle	9
Leisler's Bat	3
<b>Total Contacts</b>	<b>15</b>

**Table 3-5: Contacts 15<sup>th</sup> of August**

Contact No	time	x	y	Species
1	20:55:08	53.41153	6.31983	Leisler's Bat
2	21:14:14	53.41153	6.31983	Leisler's Bat
3	21:23:31	53.41145	6.31974	Common Pipistrelle
4	21:29:06	53.41151	6.31985	Common Pipistrelle
5	21:30:41	53.41147	6.31972	Common Pipistrelle
6	22:55:29	53.41153	6.31983	Common Pipistrelle
7	22:57:34	53.41153	6.31983	Leisler's Bat
8	22:58:04	53.41153	6.31983	Soprano Pipistrelle
9	22:59:41	53.41151	6.31972	Common Pipistrelle
10	22:59:51	53.41154	6.31995	Common Pipistrelle
11	23:00:25	53.41148	6.31984	Common Pipistrelle
12	23:02:44	53.41142	6.31989	Soprano Pipistrelle
13	23:29:22	53.41156	6.31881	Common Pipistrelle
14	23:33:09	53.41122	6.31838	Soprano Pipistrelle
15	23:35:36	53.41085	6.31839	Common Pipistrelle

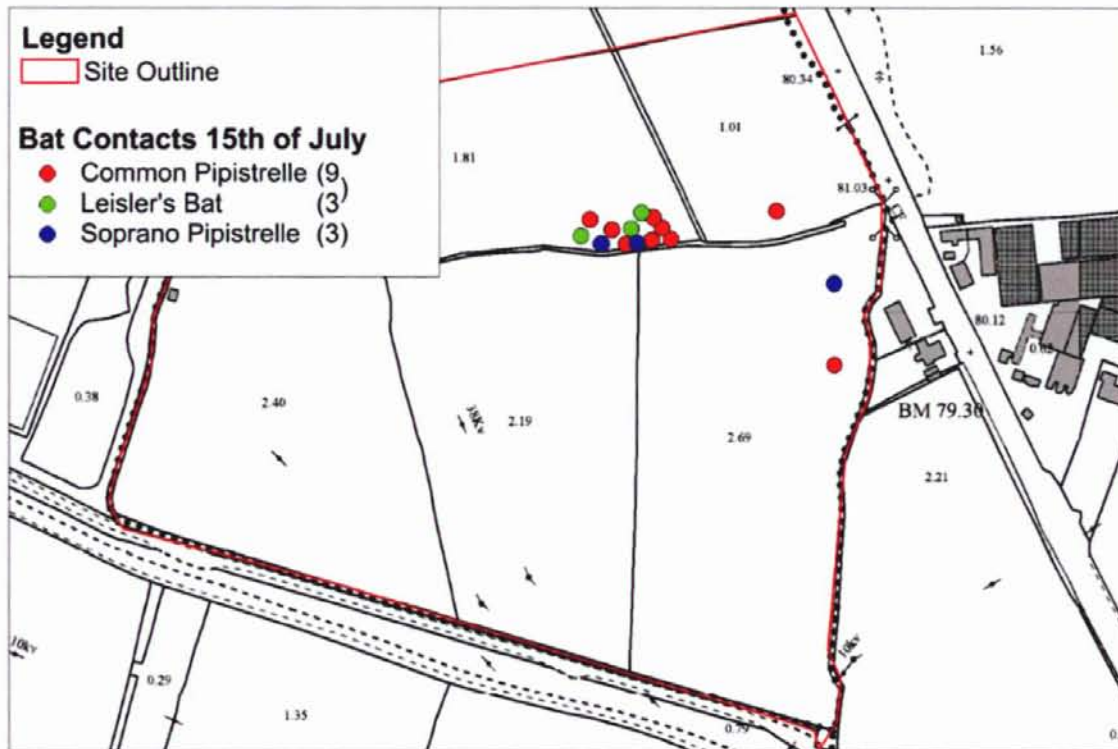


Figure 3-4 Dawn Survey Contact Locations

### 3.1.4 Results of static detector survey

Analysis of recorded registrations was made using Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0. This software identifies many of the calls made by Irish bats. All calls not labelled Soprano or Common Pipistrelle Bats were also manually verified.

The results of the static detector survey are summarised in Table 3-5 and displayed in graph form in Figure 3-4 below. Over the course of fifteen nights a total of 649 registrations were recorded. Several recordings showed multiple bat species in the one recording thus were separated per species. The 25<sup>th</sup>/26<sup>th</sup> of August showed highest activity with 93 recordings. Lowest activity occurred on the first night of recording; the 21<sup>st</sup>/22<sup>nd</sup> of August with 6 registrations recorded.

The most common species recorded was Common Pipistrelle with 324 registrations over the survey period (49.9%). Leisler's was the next most common with 180 (27.7%) followed by Soprano Pipistrelle at 139 (21.4%). Unknown Pipistrelle social calls, Myotis Bat and Nathusius's Pipistrelle were all recorded at low levels with 3, 1 and 2 registrations respectively.

It should be noted that a single bat continuously circling a small stand of trees will produce numerous recordings, thus the amount of registrations cannot quantify abundance, rather activity.

**Table 3-6: Results of the SM3 placement**

Date	Myotis Bat	Leisler's Bat	Common Pipistrelle	Soprano Pipistrelle	Nathusius's Pipistrelle	Pipistrelle Social call	Total
15 / 16 August	1	20	19	16	0	0	56
16 / 17 August	0	7	1	0	0	0	8
17 / 18 August	0	10	1	7	0	0	18
18 / 19 August	0	11	16	9	0	0	36
19 / 20 August	0	10	9	15	0	0	34
20 / 21 August	0	6	3	2	0	0	11
21 / 22 August	0	4	0	2	0	0	6
22 / 23 August	0	21	20	21	0	2	64
23 / 24 August	0	22	31	9	0	0	62
24 / 25 August	0	8	56	17	1	0	82
25 / 26 August	0	22	55	15	1	0	93
26 / 27 August	0	8	44	8	0	0	60
27 / 28 August	0	14	36	6	0	1	57
28 / 29 August	0	8	18	7	0	0	33
29 / 30 August	0	9	15	5	0	0	29

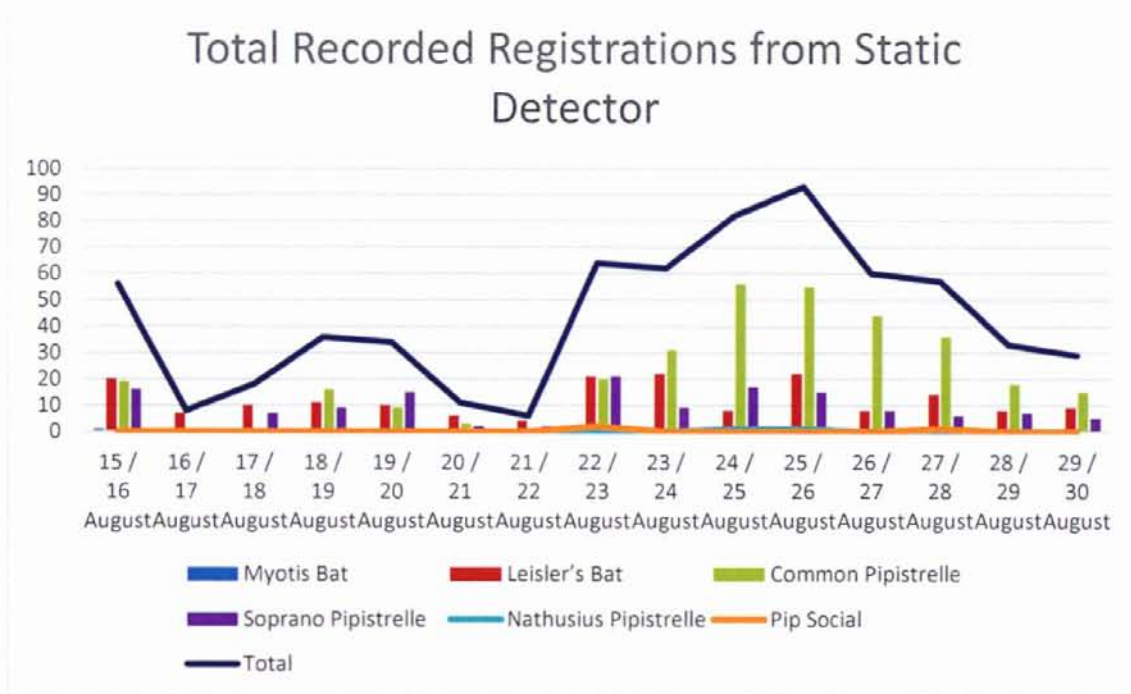


Figure 3-5: Results of static detector

## 4 DISCUSSION

Four species of bat were positively identified during the various bat surveys: Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Leisler's bat (*Nyctalus leisleri*) and Nathusius's Pipistrelle (*Pipistrellus nathusii*).

A single contacts or recording of *Myotis* sp. bats was also made. It can be very difficult to separate the three species of *Myotis* bat that are regularly found in Ireland. This was not identified to species level. Of the two Nathusius's Pipistrelle recordings; one registration had a peak frequency of 39.6kHz whilst the other recording had a peak frequency of 40kHz. Whilst the first recording is likely to be a Nathusius's the second recording lies lower than usual for a Common Pipistrelle (45kHz) whilst somewhat above the typical peak frequency for a Nathusius (39.3 kHz).

Over the fifteen nights the static detector was set recording for a total of 145 hours and 36 minutes or 8736 minutes with 649 registrations logged. This equates to 4.5 bat passes per hour.

Results from the static detector were analysed using Ecobat (University of Exeter); a software package that standardizes and performs interpretation of bat activity data (Summary

displayed in Table 4-1). It compares static detector data with similar datasets set in similar habitats and ranks activity levels taking into account environmental conditions. Results show highest activity was from Common Pipistrelle with 5 nights of high activity and a further 6 nights of medium/high activity. Both Leisler's and Soprano Pipistrelles had medium/high activity for 12 and 8 nights respectively while Nathusius's Pipistrelle and Myotis had low activity.

**Table 4-1 Results of Ecobat Analysis**

Species	Common Name	Nights				
		High	Medium/High	Medium	Low/Medium	Low
<i>Nyctalus leisleri</i>	Leisler's bat	0	12	3	0	0
<i>Pipistrellus pipistrellus</i>	Common Pipistrelle	5	6	1	2	1
<i>Pipistrellus pygmaeus</i>	Soprano Pipistrelle	0	8	4	2	1
<i>Myotis species</i>	-	0	0	0	1	14
<i>Pipistrellus nathusii</i>	Nathusius's Pipistrelle	0	0	0	2	13

The majority of the bat contacts recorded during the bat surveys were of Pipistrelles (72% of static detector and 68% of walked surveys). These results fall in line with what is expected since common and soprano pipistrelle species are the two most commonly encountered in Ireland and they have widespread distributions (although it should also be remembered that they are also amongst the species that produce calls that are the most likely to be captured by bat detectors).

Leisler's Bat utilise a very low qCF call loudest at 23kHz that travels further than any other Irish bat. This is because Leisler's hunt in the open, typically at heights of 20m and need to search large areas for prey. This results in a somewhat over representation of recorded Leisler's Bat calls from detectors.

Highest activity during the walked surveys was recorded to the centre of the site where bats were noted hunting along the treelines on the survey of the 15<sup>th</sup>. On this night a southerly wind was blowing thus this area was sheltered. The previous night with a westerly breeze highest activity occurred along the western hedgerow close to a small area of mixed woodland. This

was the most sheltered area of the site on this night. It is the surveyor's opinion that much of the site will be utilised with locations depending on weather conditions.

No bats were noted during either dawn survey. Although bat activity is typically lower during dawn surveys some activity would typically be expected. An examination of the static detector had similar results over this period with two recordings from the 15<sup>th</sup> compared to

The static detector was in place recording for a total of 145 hours 36 minutes (8,736 minutes) and recorded 649 registrations in this time. This equates to an average rate of 4.5 registrations per hour. For comparison the same detector recorded 88.23 registrations per hour when set on a site along the River Dodder within Dublin city during May 2018.

The lack of recordings from brown long-eared bats, and *Myotis* species demonstrates how the site does not appear to be utilised by rarer woodland species.

## 5 IMPACT ASSESSMENT PRIOR TO MITIGATION

The survey above provides a preliminary study of bat usage of crop fields in the townland of Coldwinters, Co. Dublin.

- Disturbance

Works associated with development or building work are likely to lead to an increase in human presence at the site, extra noise and changes in the site layout and local environment.

- Loss of feeding habitat

The redevelopment of this site involves the removal of treelines and hedgerows that represent landscape features used primarily by Pipistrelle species and Leisler's bats. Activity by Myotis and brown long-eared bat was low. No evidence of commuting bats was noted from the survey. Given the amount of hedgerow features located in the surroundings the loss of the internal treelines and hedgerows will result in a low level permanent reduction of this habitat for local bat populations.

- Loss of potential roosting habitats in trees.

Although no bats were found within the trees on the site it is possible bats will occupy trees prior to feeling. The at height search revealed most of the potential roost features on the trees consist of ivy of low potential. Two trees were ranked category 2; capable of hosting bat roosts for low numbers of bats.

- Loss of potential roosting habitats within houses.

Two unoccupied houses are located within the development footprint. Such structures can have potential for hosting bat roosts.



## 6 MITIGATION AND COMPENSATION

Mitigation measures have been devised under guidance from the Irish Wildlife Manuals, No. 25, (Kelleher & Marnell 2006) and a review of the success of bat boxes in houses (BCT 2006).

### 6.1 RETENTION OF TREES AND SCRUB

Treelines located at the periphery of the site will be retained. Lighting will be restricted closer to these habitats.

- **Feeling of trees**

Trees will be felled from January to February 2020. Any tree ranked category 2 will be re-examined on the day of felling 'at height' in order to ensure no bats are present. Two category 2 trees have been recorded within the site (tag no).

Category 3 trees are defined as 'trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats'. Also included within this category are trees with thick ivy however the ivy root is not thick enough to form mats, thus it is possible but unlikely a single bat may be roosting here. Following the precautionary approach all category 3 trees to be felled within the site the following procedure will be undertaken:

- Tree-felling to be undertaken using heavy plant and chainsaw equipment. Normally trees are pushed over, with a need to excavate and sever roots in some cases. In order to ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly. A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape. Felling works should be overseen by an ecological clerk of works.

All trees ranked category 4 can be felled and removed immediately.

- **Lighting along periphery treelines**

Guidance on lighting has been based on the Bats & Lighting document; (BCI, 2010), the Bats and artificial lighting in the UK Guidance Note 08/18 (BCT, 2018) and Guidelines for consideration of bats in lighting projects. EUROBATS Publication Series No. 8 (Voigt, 2018). Lighting can alter the behaviour of bats and the insects they prey on. Night flying insects can be attracted to lights particularly sources that emit an ultraviolet component or have a high blue spectral content. Whilst some species of bat such as Leisler's and Pipistrelle species can take advantage of this occurrence, other species such as Daubenton's bat and brown long-eared avoid such areas. Lighting can create barriers for bat species both entering roosts and using commuting routes such as rivers, treelined roads and woodland edges. 'Consideration should be given to ensure that dark wildlife corridors remain in the landscape to allow bats and other wildlife to travel safely to and from feeding habitats.'

A study by Emery (Emery, 2008) concluded that shielding and masking of street lights can reduce light spillage by as much as 40%. While internal and external louvers are more effective, the external louvers can reduce light spillage by as much as 97%.

- Bats and artificial lighting in the UK (BCT, 2018) suggest the avoidance of lighting on key habitats and features.
- It is important to maintain Dark Zones for foraging bats in areas where lighting is not necessary. However, where lighting is required, this lighting should be placed at a minimum height using the lowest lux value permitted for health and safety.
- The lighting should be directional on to paths and buildings only with no spillage of light to adjoining habitats. To reduce light spillage from luminaries, lights that are designed not to emit light at angles greater than 70° from the vertical plane should be used. Consequently a flat glass protector is often used to reduce light spillage. Other methods to control light spillage:
  - a) Shields: these can be mounted on lamps to control direction of the light
  - b) Masking: part of the luminaries is painted to block light to control the direction of the light
  - c) Louvers': either as internal or external slates organized in rows or at angles depending on the direction of light control.

- No white light should be permitted as this has the greatest impact on bats. Lighting should be fitted with LED luminaires using warm white colors < than 2700 Kelvins. Luminaires should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Loss of potential roosting habitats within houses.

## 6.2 DEMOLITION OF DWELLINGS

Two unoccupied houses are located within the development footprint. It is recommended that a condition of planning include the conduct of a bat survey examining the potential of these building to host bat roosts. Should bats or their roosts be found a derogation licence will be required before construction works begin.

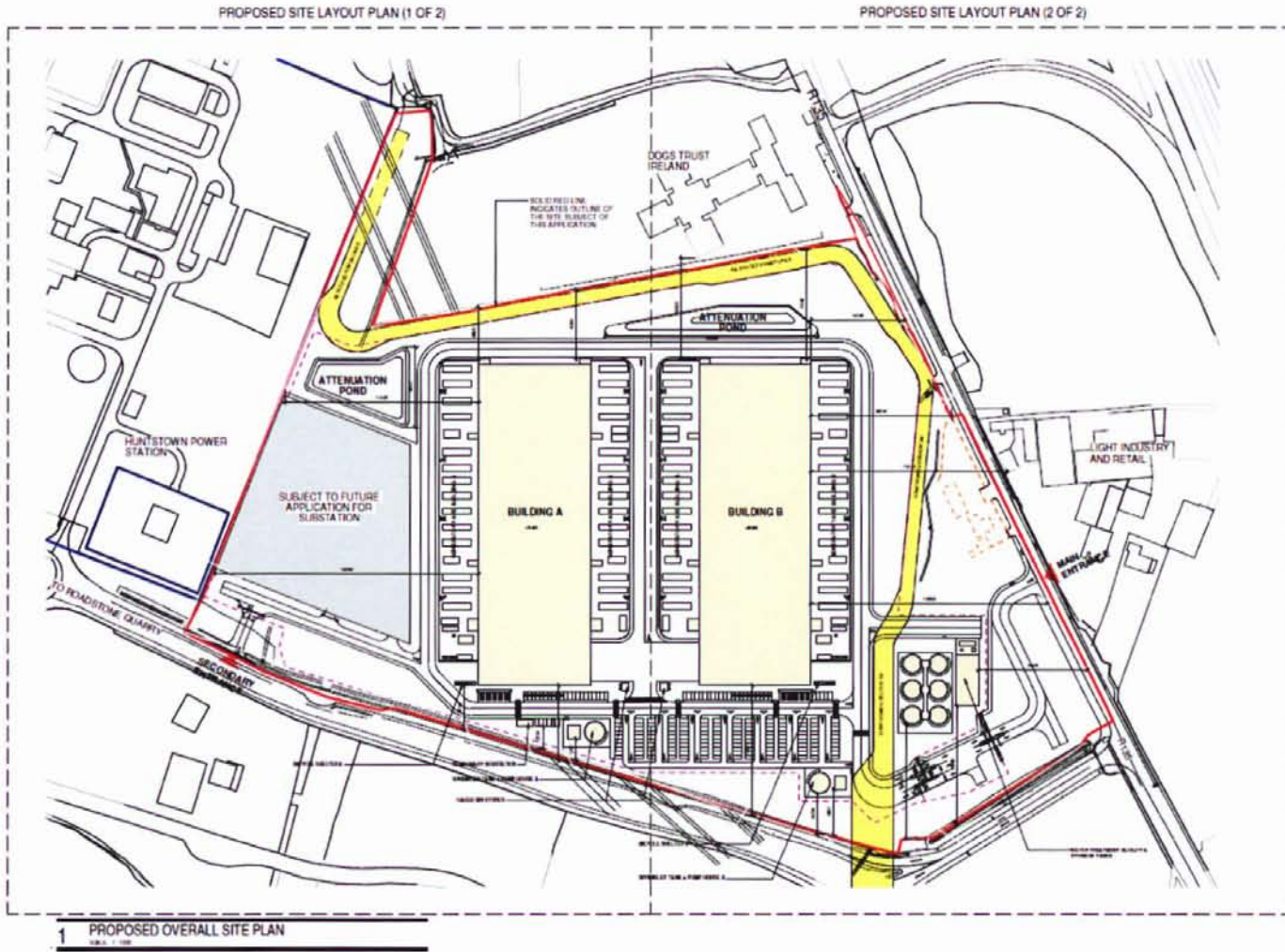
## 7 CONCLUSION

This report details the findings of a bat survey completed as part of a planning application for the constitution of a peaking plant at Coldwinters, Co. Dublin.

The results of the surveys presented above show that although no evidence of roosting bats was found the site is being used by primarily Pipistrelle and Leisler's bats for feeding. Analysis by Ecobat revealed highest activity was from Common Pipistrelle with 5 nights of high activity and a further 6 nights of medium/high activity. Both Leisler's and Soprano Pipistrelles had medium/high activity for 12 and 8 nights respectively while Nathusius's Pipistrelle and Myotis had low activity.

Impacts on bats have been assessed. The overall impact on bats following mitigation is low due to the lack of evidence of roosting bats. Felling of trees will be supervised by an ecological clerk of works who will ensure all trees marked as category 3 will remain on the ground for 48 hours prior to removal. The loss of the internal treelines and hedgerows will have a long term, local negative effect on bats given the loss of these landscape features. The retention of external treelines and the lack of planned lighting here will minimise such losses. As such the overall impacts on bats following mitigation will be low.

# Appendix A – Site Layout



## Appendix B – Tree Assessment

Table 6-1 defines how each tree within the site was categorised according to Bat Conservation Trust 2 ed. (Hundt et al, 2012). Refer to accompanying Arborist tree impact assessment drawing for location of trees with corresponding tag number. Any category 1 or 2 trees require an at height survey. After this survey each tree is re-categorised taking on board the close up examination of each prf.

**Table 7-1 Category description**

Tree Category	Description
1	Trees with multiple, highly suitable features capable of supporting larger roosts
2	Trees with definite bat potential but supporting features suitable for use by singleton bats;
3	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats;
4	Trees have no potential.

PRELIMINARY GROUND LEVEL ROOST ASSESSMENT						
Date: 14 <sup>th</sup> & 15 <sup>th</sup> of August 2019			Survey Title: Project Cirrus			
Surveyor: John Curtin, Rik Pannett			Grid Ref:			
Ref No.	Species / tag No.	Works Required	Comments on Bat Potential	Recommendations	Category	
1a & 1b	Two Ash 711775 741582	Felled??	Thick ivy cover with very low number of prfs. Ivy does not form thick mats. Potential prfs did not lead to good cavities. Ivy searched with thermal. No roost was found.	Follow guidelines for Category 3 trees in recommendations.	3	
2a & 2b	Two ash 711732 741470	Felled	Thick ivy cover with very low number of prfs. Ivy does not form very mats. Potential prfs did not lead to good cavities. Ivy searched with thermal. No roost was found.	Follow guidelines for Category 3 trees in recommendations.	3	
3a &	Two ash 711709 741460	Felled	Eastern tree has knot on main trying travelling c. 30cm. No bats. Also cavity type formation from ivy and trunk c10cm. No signs of bats.	Examine tree immediately prior to felling.	2	

3b		Felled	Western tree has less potential. Contains two double leaders but both clogged with debris. Also has ivy cover. No roost was found.	Follows guidelines for Category 3 trees in recommendations.	3
4	One ash 711680 741557	Felled	Mature tree with some ivy cover. No obvious prfs but ivy is impeding view. Thorough search did not reveal any prf.	No mitigation required.	4
5	One ash 711438 741346	Felled	Mature tree with some ivy cover. No obvious prfs but ivy is impeding view. Thorough search did not reveal any prf. Parallel branch at height despite looking ok from the ground is poor. Ivy cover contains damp debris. No potential.	No mitigation required.	4
6	One ash 711699 741265	Felled	Mature ash. Had some potential features; knot hole, tears and horizontal splits however none were deep. Ivy is quite thick with some sections of root matting formed. These were searched with thermal imaging. No roost was found.	Examine tree immediately prior to felling.	2
7	One sycamore 711555 741285	Felled	Semi mature. Low potential. Has a double ladder that was checked. No potential.	No mitigation required.	4
8	Felled tree 711625 741267	Felled	Circled area may have referred to tree that had since been felled.	No mitigation required.	4

## Appendix C – Ecobat Bat Activity Analysis

Site Name: Coldwinters

John Curtin

28/10/2019

### 7.1.1 Summary

Bat surveys were conducted at Huntstown 1, for 15 nights between 2019-08-15 and 2019-08-29, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 56 passes, and 5 species were recorded.

The reference range dataset was stratified to include:

- Records from any time of year.
- Only records from within 200km<sup>2</sup> of the survey location.
- Records using any make of bat detector.

Table 1

Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
Huntstown 1	<i>Myotis</i>	0	0	0	1	14
Huntstown 1	<i>Nyctalus leisleri</i>	0	12	3	0	0
Huntstown 1	<i>Pipistrellus nathusii</i>	0	0	0	2	13
Huntstown 1	<i>Pipistrellus pipistrellus</i>	5	6	1	2	1
Huntstown 1	<i>Pipistrellus pygmaeus</i>	0	8	4	2	1

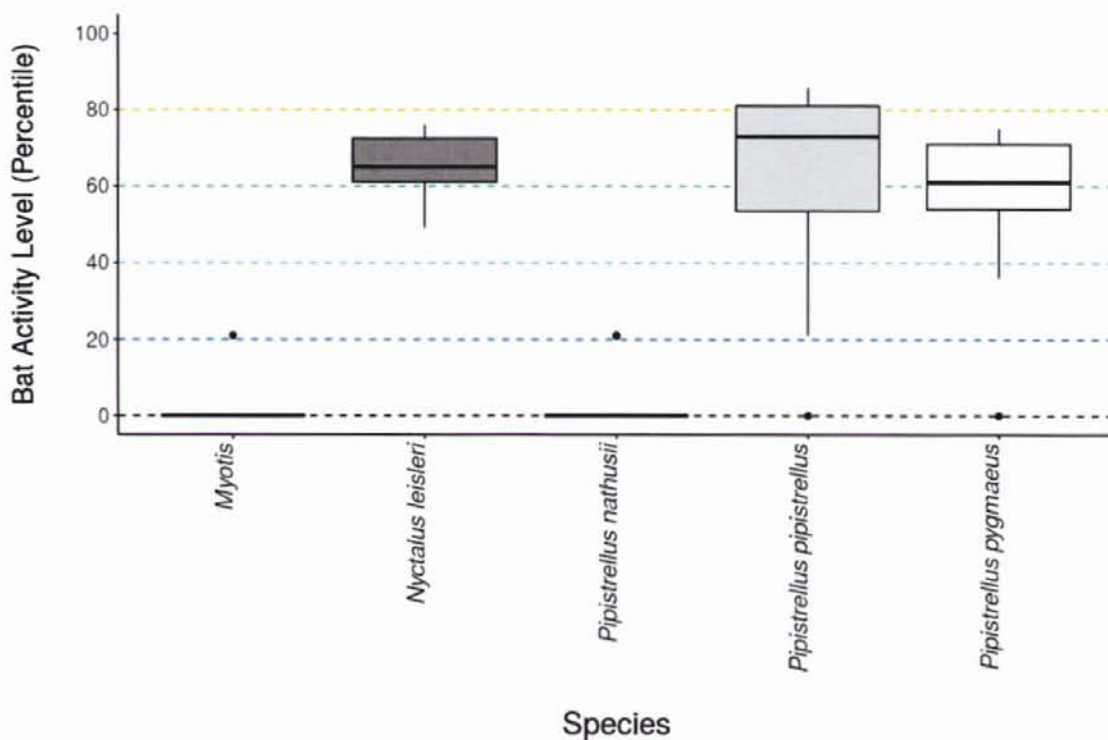


Table 2

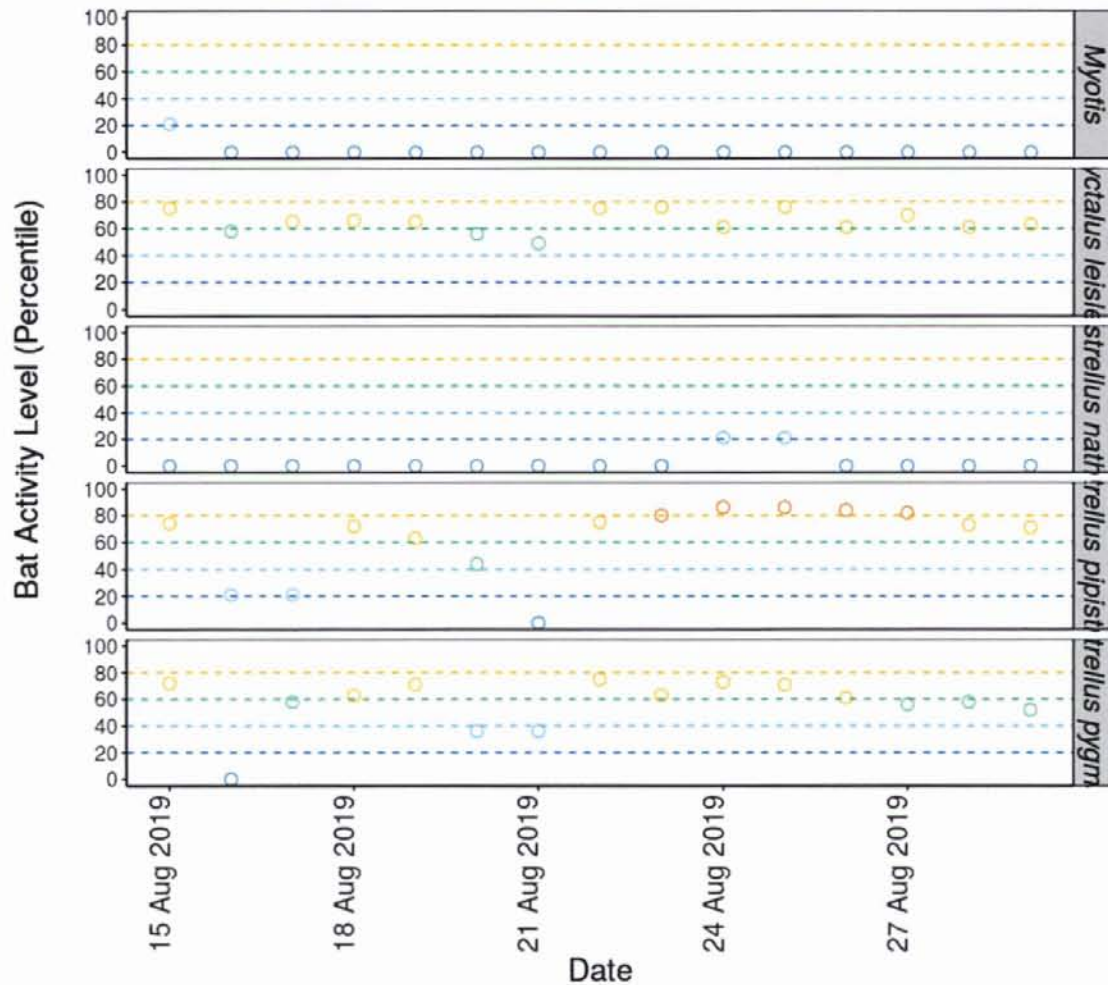
Summary table showing key metrics for each species recorded.

Location	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
Huntstown 1	<i>Myotis</i>	0	0 - 0	21	15	874
Huntstown 1	<i>Nyctalus leisleri</i>	65	61 - 70	76	15	1272
Huntstown 1	<i>Pipistrellus nathusii</i>	0	0 - 0	21	15	391
Huntstown 1	<i>Pipistrellus pipistrellus</i>	73	51.5 - 79.5	86	15	1274
Huntstown 1	<i>Pipistrellus pygmaeus</i>	61	53.5 - 67.5	75	15	1179

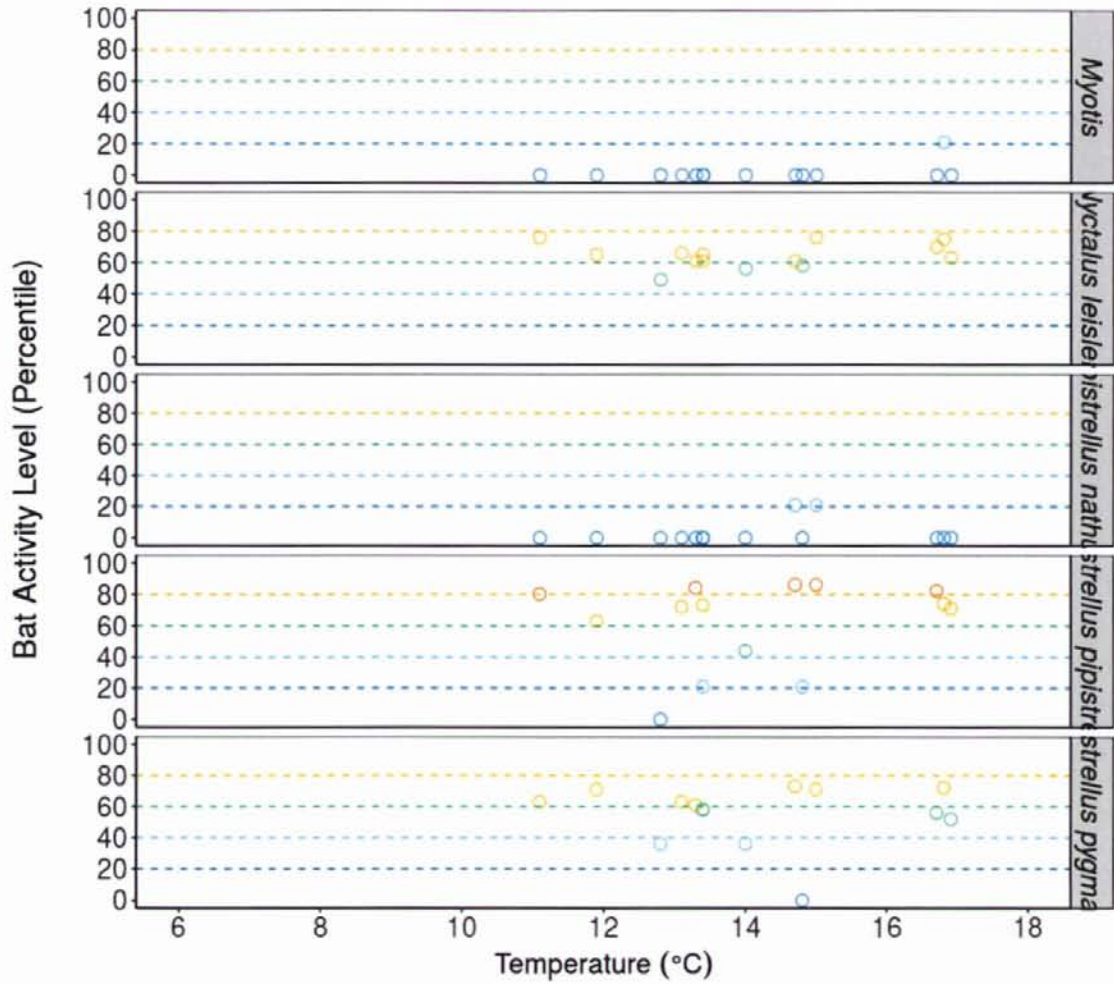
7.1.2 Figures



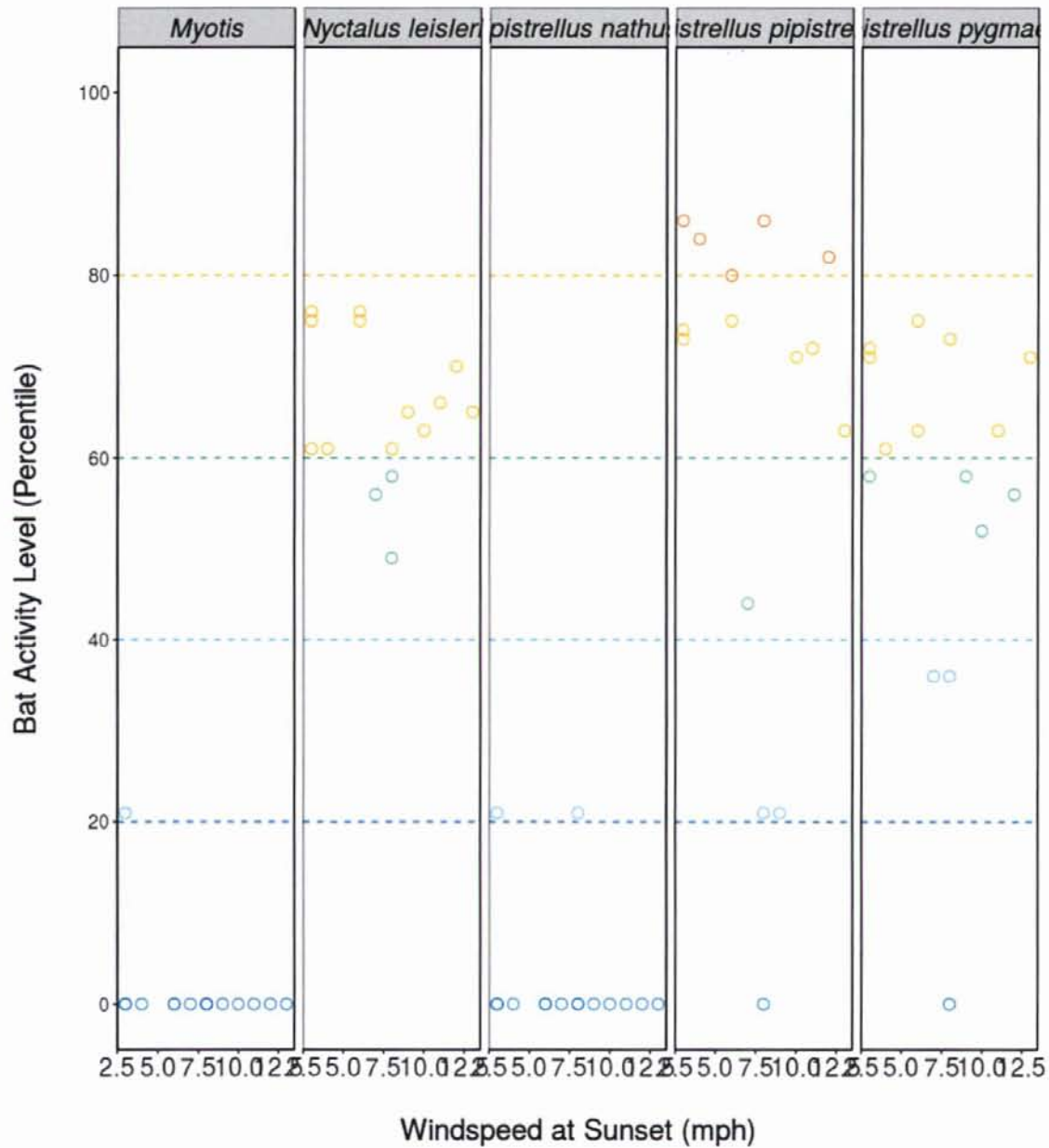
**Figure 1.** The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)



**Figure 2.** The activity level (percentile) of bats recorded across each night of the bat survey, split by species.



**Figure 3.** The relationship between recorded bat activity (percentile) and the temperature at sunset, split by species.



**Figure 4.** The relationship between recorded bat activity (percentile) and the temperature at sunset, split by species.

**APPENDIX 8.3**

**AMPHIBIAN SURVEY**

Prepared by

Triturus Environmental Ltd.

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Amphibian survey for proposed datacentre  
development on lands adjacent to  
Huntstown Power Station, North Road,  
Finglas, Dublin 11.



Prepared by Triturus Environmental Ltd. for

Huntstown Power Company Ltd.

October 2019

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Please cite as: Triturus Environmental Ltd. (2020) Amphibian Survey for proposed datacentre development on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

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# 1. Introduction

## 1.1 Project background

Triturus Environmental Ltd. were contracted by Huntstown Power Company Limited to conduct an amphibian survey at a c. 12.9 hectares site to the north west of the M50 orbital ring in the townland of Johnstown and Coldwinders, North Road, Finglas, Dublin 11, immediately east of Huntstown Power Station (see Figure 1.1 below). The baseline survey would inform the preparation of EIAR reporting for the proposed development of two no. data hall buildings arranged over 3 storeys and associated structures and infrastructure including water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds, sustainable urban drainage measures, underground foul and storm water drainage network, associated landscaping and boundary treatment works.

The preliminary ecological appraisal of the study area (Sands, 2019) specified that there was some suitability for newts and frogs in an onsite drainage ditch network. Considering these findings and historical records of newt within the 10km grid square containing the site it was deemed necessary to conduct an amphibian survey of the area. This was conducted within a drainage ditch network within the existing agricultural field network contained within the site boundary.

## 1.2 Legislative Status

The smooth newt, *Lissotriton vulgaris* (formerly *Triturus vulgaris*), hereafter newt, is a species of carnivorous amphibian that is found throughout continental Europe and is Ireland's only native newt species (King *et al.*, 2011). It must be noted that the non-native alpine newt (*Ichtyosaura alpestris*) was found at one site in Galway during the 2013 Irish Wildlife Trust national smooth newt (Meehan, 2013). However, no more recent data on the species distribution exists on the National Biodiversity Data Centre or Irish Wildlife Trust databases.

The ICUN categorises the species as of least concern, as their populations are stable throughout their range (ICUN 2008), although the loss of suitable terrestrial habitats for overwintering or refuge remains a concern. Newt are protected under the Wildlife Acts (1976 and 2000) and are also listed under Annex III of the Bern Convention. It is an offence to capture or kill a newt in Ireland without a licence.

## 1.3 Amphibians and Ditch Habitats

Typically, amphibians require both aquatic and terrestrial habitats to complete their semi-aquatic life cycle (Dodd and Cade, 1998). The smooth newt life cycle has been shown to have rather complex requirements and they occupy a succession of ecological niches throughout their lives, alternating between aquatic and terrestrial habitats during different life stages (Verrell *et al.*, 1986). For example, adult newt require terrestrial habitats for foraging and overwintering, as well as aquatic habitats for breeding (Fasola and Canova, 1992). Smooth newts have been shown to use a variety of water bodies

during the breeding season including lakes, natural ponds, garden ponds and slow-moving drainage ditches (Meehan, 2013). A mixture of deciduous and coniferous woodland, scrub, unimproved grassland and gardens are considered suitable terrestrial habitat types (Pavingnano *et al.*, 1990, Oldham *et al.*, 2000). Breeding takes place in water during the spring (April and May) but can at times extend into early summer. Although adult newts have been shown to occupy breeding sites for up to four months, breeding is not continuous, most of this time is used by females for oviposition and also males tend to arrive at ponds earlier than females (Verrell and McCabe, 1988). After metamorphosis, juvenile *L. vulgaris* become solely terrestrial, spending several years on land and upon reaching maturity. It has been estimated that newts return to aquatic habitats to breed from around three years of age (Verrell *et al.*, 1986).

Still water ponds and still-water ditches where pH >5, with abundant prey, a diversity of submerged and emergent broadleaved vegetation for egg attachment, which are free of predatory fish are favoured (Beebee, 1985). Running waters such as rivers and fast flowing drainage ditches are generally avoided but populations have been known to occur in very slow flowing drainage ditches with limited riparian overgrowth, incorporated with surrounding terrestrial habitats that provide cover for foraging and hibernation (Kinne, 2006). Occurrence is negatively affected by steep banks and deeper channels or areas which are heavily shaded (Ildos and Ancona, 1994). Mostly, smooth newts will remain relatively close to the breeding areas, as long as the habitat quality immediately surrounding the breeding water body is optimal and has excellent connectivity (Mulkeen *et al.*, 2017).

Anthropogenic water bodies such as drainage ditches have been shown to have limited value for newt occupation. They are typically temporary by nature, depending on depth and are primarily governed by precipitation, evaporation and ground-water exchange (Brooks and Hayashi, 2002). Such conditions can attract predation-sensitive amphibian species including *L. vulgaris* (Loman, 2002) as they typically lack fish and other predatory invertebrates (Herzon and Helenius, 2008). The majority of ditch habitats can be considered of poorer quality amphibians and can function as ecological traps, attractive but not offering long term prospects for a local population due to poor ecological functionality (Suislepp *et al.*, 2011). This is due to the temporary nature of such water bodies which can dry up before tadpole metamorphosis can occur (Dimauro and Hunter, 2002). Previous studies have suggested that although drainage ditches may not be used as breeding areas they may be used by amphibians for hibernation and as ecological corridors for meta population movements (Mazerolle, 2004, Elmberg, 2008). Typically, drainage ditches that are suitable for Irish amphibian populations are rare due to the known intensive management practices in the Irish landscape. Consequentially ditches are subject to regular management i.e. over deepening and widening. They are also subject to eutrophication pressures and sedimentation carried in runoff and may also contain chemical residues from spraying (i.e. herbicides & pesticides) in intensively managed farmland. The resultant conditions are typically poorly suited to amphibians.

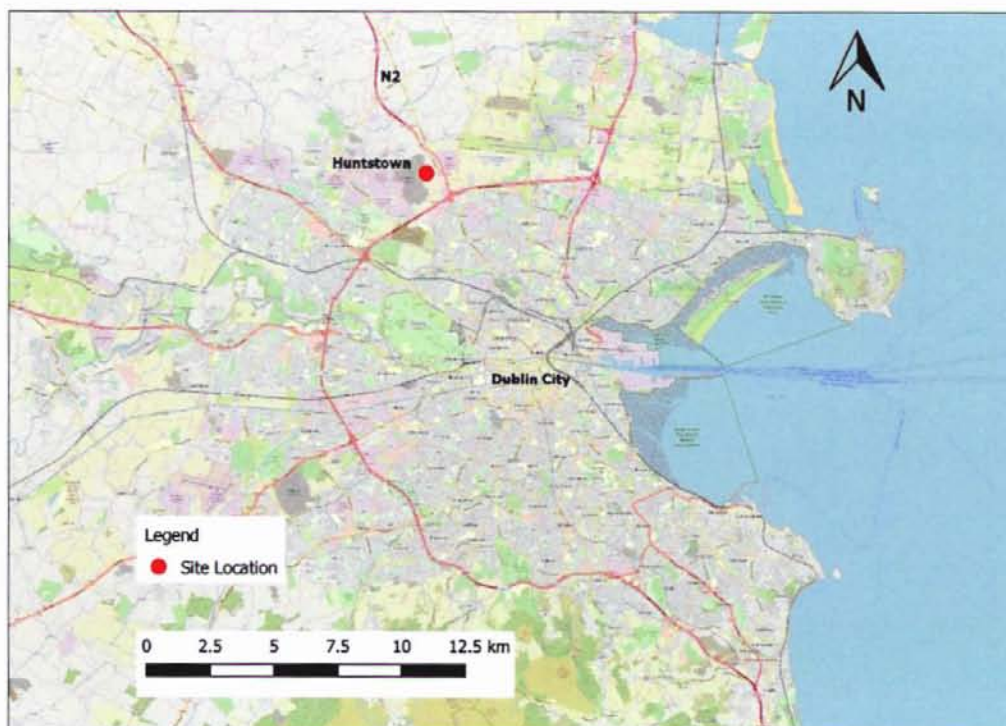


Figure 1.1 Site Location at Huntstown, Dublin

## 2. Methodology

### 2.1 Desktop review

A desktop review of the available data on amphibians for the grid squares containing the Huntstown development was undertaken. These included a review of data records held by the National Biodiversity data Centre (NBDC), accessed on the 2<sup>nd</sup> October 2019. Furthermore, a review of ortho-photography was undertaken to examine the presence of ponds, wetlands and the surface water networks from the Environmental Protection Agency's surface water layers.

### 2.2 Amphibian Survey

According to the Wildlife Acts 1976 to 2012, it is an offence to intentionally kill or injure species listed under the acts or to wilfully interfere with or destroy the breeding site or resting place of a protected wild animal, unless activities are carried out under licence. In this respect, Triturus Environmental Ltd. made an application under Section 23 & 34 of the Wildlife Acts 1976 to 2012 to capture (for measurement/ counts) smooth newt (*Lissotriton vulgaris* L.) and common frog (*Rana temporaria*). Triturus were successfully granted a license (No. C130/2019) and the work was carried out according to license conditions. Survey work was carried out on the 19<sup>th</sup> September 2019 during bright dry conditions.

The primary method used to detect amphibians would be active sampling using a pond net to sweep the margins of the watercourses surveyed. During the September monitoring visit, netting would follow a standardised protocol in order to produce abundance estimates that are comparable across sampling periods and across sites. Elements of best practice used in the UK and Ireland were employed. The UK method for evaluating ponds for selection as Sites of Special Scientific Interest (SSSIs) (Nature Conservancy Council, 1989) was used in particular for searching for newt to establish a CPUE. This protocol uses a sampling effort of fifteen minutes of netting per 50m of pond shoreline. The amphibian survey would also include hand and torch survey of terrestrial refugia to help detect terrestrial amphibian populations.

As per typical license conditions, it is required to make a submission of return on the number of animals caught to the NPWS. If adult newts were recorded, they would be measured and sexed before being returned to where they were found. Where life stages were encountered outside of adults (i.e. juveniles), they would be recorded simply as efts (all frog tadpoles would have matured to frogs by September whereas newt efts are not always fully matured by then). This data would help profile population structure. Should frogs be recorded in the newt surveys, their respective numbers would also be submitted to the NPWS as part of the data return.

### 2.3 Biosecurity protocol

All equipment used was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of disease/ viruses including rana viruses or chytrid fungus. By thoroughly cleaning and disinfecting equipment it helped prevent the spread of invasive invertebrates, plants and other species attaching to equipment immersed in water. The check-clean-dry approach was applied after completion of work. Of particular importance pond nets and waders were dried for 48 hours following survey completion. Should the symptoms of disease in monitored populations be identified, they would be reported to NPWS immediately.

## 3. Results

### 3.1 Site Survey

At the time of survey the drainage ditches surveyed (see Figure 3.1 below) were not found to support ecological conditions favourable to newt or frogs. This was considered given the existing drainage ditch networks running north south and east west were steep sided (between 1 to 2.5m deep) and were heavily shaded with overhanging hedgerow/ treelines. They did not contain water at the time of the survey within the site boundary. The adjoining heavily managed and compacted soils in the adjoining tillage areas provided poor terrestrial habitat for newts. No evidence of newt was found within the study area despite searching terrestrial refugia (deadwood, small boulders, leaf litter etc.).



**Plate 3.1** Searching boulder refugia for terrestrial smooth newt at base of dry drainage channel



**Plate 3.2** Example of intensively managed tillage crops east of Huntstown Power Station

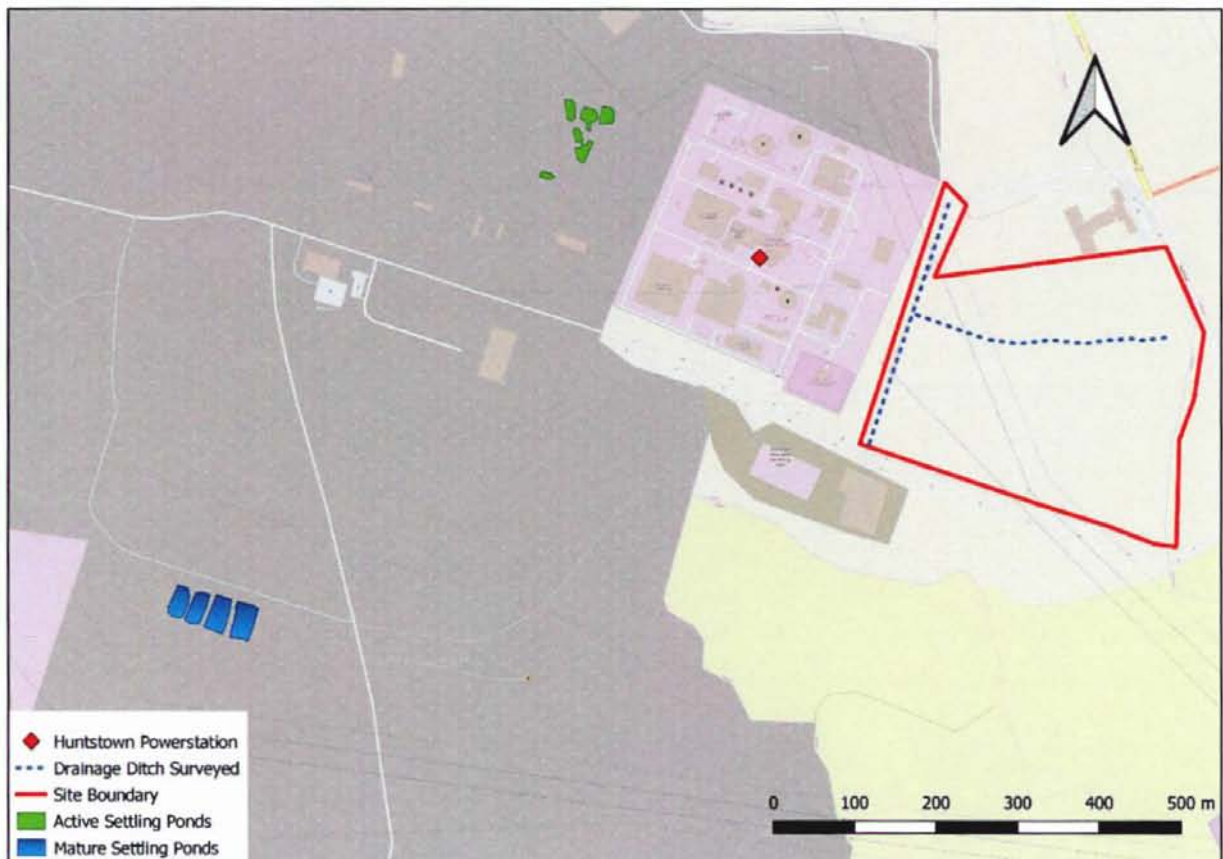
### 3.2 National Biodiversity Data Centre Records

Newt were recorded by Steve Judge in September 2018 at Huntstown Quarry 1km south west of the development area (south of mature quarry settlement ponds; Irish Grid O106, 409). There were no detailed records for common frog on the NBDC database (e.g. 1km grid square resolution) but they are known from the 10km grid square containing the development.

### 3.3 Review of Ortho-photography

Following a negative result for amphibian presence during the site survey, it was deemed necessary to review the ortho-photography for the wider area to establish potential areas of suitable habitat in the wider environment. It was identified that quarry settlement ponds 0.5km west of Huntstown Power station (see Figure 3.1 below) offered some potential for newt (i.e. open water lentic habitat). However, these appeared to be less mature ponds (recently used for suspended solids settlement), than a separate cluster of 4 located 1km to the south west of the development area. These ponds were associated with the Roadstone operated Huntstown Quarry and were also situated immediately

north of the NBDC record for newt (see NBDC records above). At this location 4 disused shallow and ecologically mature settlement ponds were identified on ortho-photography (see Figure 3.1 below). The identified ponds supported visible pondweed growth, were shallow and supported well vegetated margins as visible from ortho-photography, that had recovered well since their historical use as part of quarry operations. These ponds were identified as highly suitable areas for both smooth newt and frog and likely offered breeding and foraging opportunities.



**Figure 3.1** – Location of pond habitats with suitability for smooth newt in the quarry areas west and south west of the study area

## 4. Discussion

The conditions of the surveyed drainage ditch network at the time of the survey (September 2019) were suboptimal for newt or frog as they displayed characteristics inimical to amphibian ecological requirements. The remainder of this discussion focuses on newt but both frog and newt habitat requirements are similar and conditions that support one species can support the other, albeit both species are not always detected at the same site.

A study by Kinne (2006), illustrated that newt prefer to breed in sun exposed still-water ponds and avoid areas which are heavily overgrown and shaded. For these reasons it is considered that the overgrown, shaded nature of the drainage ditch channels surveyed would not provide suitable breeding habitat for newt. Other characteristics such as steep ditch embankments are negatively correlated with newt presence (Ildos and Ancona, 1994). Indeed, the ditches surveyed typically were U-shaped with steep margins that were not considered suitable for amphibians. Although newt can travel up to 500m away from breeding ponds they rarely travel more than 5m from the core breeding area once the surrounding landscape is highly structured in character, thereby offering both shelter and a humid microclimate (Müllner, 2001; Kovar *et al.*, 2009). Although the ditches surveyed may contain standing water during the winter which could offer potential breeding conditions for newt, the distance between known newt habitat e.g. ponds at Huntstown Quarry south west of the study area are considered too far for newts to travel and in combination with likely ecological barriers mean colonisation probability would be poor. Our observations of the surrounding area indicate the intensively managed tillage lands bordering the drainage ditches, active quarry roads and the built land at Huntstown Power station itself, would likely act as an ecological barrier for newt colonisation from meta populations in the wider landscape. For example, a study by (Mulkeen *et al.*, 2017), demonstrated that although newt can utilise semi-natural grassland areas, intensively managed farmland lacks the structural diversity required by newt and such habitats are avoided.

In conclusion, although the ditches surveyed may contain water during the winter, their ephemeral nature mean that water would not persist for long enough to facilitate newt breeding, egg laying, nor for juvenile growth and metamorphosis into adults. Indeed, the presence of pondweeds and other characteristics required for spiral egg attached were absent due to the seasonal nature of the ditches onsite. The surrounding intensively managed tillage landscape within the study area was also unfavourable for amphibians and offered little habitat suitability for movement, foraging and for winter hibernation.



## 5. Recommendations

It is recommended that during the construction phase, native species rich treeline and hedgerows be planted to increase the biodiversity value of the development lands to replace those lost. The creation of wildflower meadows in south facing lands adjoining amenity lawn would increase the biodiversity value of the developed area by attracting pollinators. Where surface water features such as ponds are proposed the margins should be shallow sloping with Geotextile Clay Liner (GCL) favoured over butyl liner. Ponds should be planted with native macrophytes and avoid commercial mixes that have not been screened for their potential biosecurity risks (i.e. high risk non-native invasive species such as parrot's feather (*Myriophyllum aquaticum*), New Zealand pygmyweed (*Crassula helmsii*) and floating pennywort (*Hydrocotyle ranunculoides*) that occur within Dublin city, pers. obs.).

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**APPENDIX 8.4**

**NATURA IMPACT STATEMENT**

Prepared by

Moore Group – Environmental Services



# Natura Impact Statement

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## Huntstown Overall Development: Data Centre and 220 kV Substation

Prepared by: Moore Group – Environmental Services

8 February 2022



On behalf of:

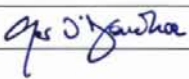
Huntstown Power Company Limited

FINGAL COUNTY COUNCIL  
PLANNING DEPARTMENT

11 FEB 2022

ADDITIONAL INFORMATION  
REGISTRY

<b>Project Proponent</b>	Huntstown Power Company Limited
<b>Project</b>	Huntstown Overall Development: Data Centre and 220 kV Substation
<b>Title</b>	Natura Impact Statement  Huntstown Overall Development: Data Centre and 220 kV Substation

Project Number	19169	Document Ref	19169 Huntstown DSFSS NIS Rev2
Revision	Description	Author	Date
Rev2	Final Edits	G. O'Donohoe 	8 February 2022
<b>Moore Archaeological and Environmental Services Limited</b>			

## Abbreviations

AA	Appropriate Assessment
ABP	An Bord Pleanála
CEMP	Construction Environmental Management Plan
EEC	European Economic Community
EPA	Environmental Protection Agency
EU	European Union
FWPM	Freshwater Pearl Mussel
GIS	Geographical Information System
IW	Irish Water
LAP	Local Area Plan
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
OSI	Ordnance Survey Ireland
pNHA	proposed Natural Heritage Area
SAC	Special Area of Conservation
SPA	Special Protection Area
SuDS	Sustainable Drainage System



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**Appendix 1 Data Centre Outline Construction Environmental Management Plan Prepared by CSEA**

**Appendix 2 220kV Substation Construction Environmental Management Plan Prepared by AECOM**

# 1. Introduction

## 1.1. General Introduction

This Natura Impact Statement (NIS) has been prepared by Moore Group – Environmental Services on behalf of Huntstown Power Company Limited. This NIS report contains information to assist the competent authority in carrying out an in carrying out an Appropriate Assessment (AA) for the purposes of Article 6(3) of the Habitats Directive and section 177V of the Planning and Development Act 2000, as amended, (the “Planning Acts”) in respect of the construction and operation and decommissioning of a Data Storage Facility and 220kV Substation at Huntstown, Co. Dublin (Fingal) (hereafter referred to as the Overall Development).

Where the ‘Data Centre’ or Data Storage Facility is referred to, this refers to FFC Reg Ref. FW21A/0151, lodged by Huntstown Power Company for the construction of 2 no. data centre buildings and associated works, on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

Where the ‘220kV Substation’; is referred to, this includes the lodgement of an application for a Strategic Infrastructural Development to An Bord Pleanála (Reg Ref. SID/03/21) for the construction of a 2 storey 220kV Gas Insulated Switchgear (GIS) substation known as ‘Mooretown’ and associated works on Lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

Where the ‘Overall Development’ is referred to, this relates to the entirety of the project i.e., the Data Centre (and associated works) and the Substation (and associated works).

This NIS informs the Appropriate Assessment process in the determination of any adverse effects on the integrity of European sites, having regard to their conservations objectives and in light of best scientific knowledge. It is necessary that the Project has complies with Article 6 of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (referred to as the Habitats Directive). This is transposed into Irish Law by Part XAB of the Planning and Development Act 2000 as amended and the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. 477) (referred to as the Habitats Regulations). The focus of the assessment is on objectively assessing by reference to the evidence as to whether the Overall Development will adversely affect the integrity of the European sites in light of their conservation objectives.

## 1.2. Legislative Background - The Habitats and Birds Directives

Article 6 of the Habitats Directive is transposed into Irish Law inter alia by the Part XAB of the Planning Acts (section 177U and 177V) governing the requirement to carry out appropriate assessment screening and appropriate assessment, where required, per Section 1.1 above.

The Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) is the main legislative instrument for the protection and conservation of biodiversity in the European Union (EU). Under the Habitats Directive, Member States are obliged to designate Special Areas of Conservation (SACs) which contain habitats or species considered important for protection and conservation in a EU context.

The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds), transposed into Irish law by the Habitats Regulations 2011, is concerned with the long-term protection and management of all wild bird species and their habitats in the EU. Among other things, the Birds Directive requires that Special Protection Areas (SPAs) be established to protect migratory species and species which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

SACs designated under the Habitats Directive and SPAs, designated under the Birds Directive, form a pan-European network of protected sites known as Natura 2000. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs. These sites are also referred to as European sites.

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects likely to have a significant effect on Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out an appropriate assessment if required (Appropriate Assessment (AA)). Article 6(4) establishes requirements in cases of imperative reasons of overriding public interest:

*Article 6(3): "Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to an appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

These obligations in relation to Appropriate Assessment have been implemented in Ireland under Part XAB of the Planning and Development Act 2000, as amended, and in particular Section 177U and Section 177V thereof.

Section 177T(1)(b) and (2) state as follows with regard to a Natura Impact Statement:

*"(b) A Natura impact statement means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a proposed development, on its own or in*

*combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites.”*

*“(2) Without prejudice to the generality of subsection (1), a Natura impact report or a Natura impact statement, as the case may be, shall include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for one or more than one European site in view of the conservation objectives of the site or sites.”*

### 1.3. Methodology

The Commission’s methodological guidance (EC, 2002, 2018, 2021 see Section 1.4 below) promotes a four-stage process to complete the AA and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1 and 2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

**Stage 1 Screening:** This stage examines the likely effects of a project either alone or in combination with other projects upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant. In order to screen out a project, it must be excluded, on the basis of objective information, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

**Stage 2 Appropriate Assessment:** In this stage, there is a consideration of the impact of the project with a view to ascertain whether there will be any adverse effect on the integrity of the Natura 2000 site either alone or in combination with other projects or plans, with respect to the site’s structure and function and its conservation objectives. Additionally, where there are predicted impacts, an assessment of the potential mitigation of those impacts is considered.

**Stage 3 Assessment of Alternative Solutions:** This stage examines alternative ways of implementing the project that, where possible, avoid any adverse impacts on the integrity of the Natura 2000 site.

**Stage 4 Assessment where no alternative solutions exist and where adverse impacts remain:** Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the sites will be necessary.

## 1.4. Guidance

The NIS has been compiled in accordance with guidance contained in the following documents:

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010 rev.).
- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10 & PSSP 2/10.
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001); hereafter referred to as the EC Article 6 Guidance Document.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC Environment Directorate-General, 2000); hereafter referred to as MN2000.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC, 2018).
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EC, 2021).
- Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021).
- Office of the Planning Regulator (OPR) Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021).

## 1.5. Data Sources

Sources of information that were used to collect data on the Natura 2000 network of sites, and the environment within which they are located, are listed below:

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
  - National Parks & Wildlife (NPWS) protected site boundary data;
  - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
  - OSI/Environmental Protection Agency (EPA) rivers and streams, and catchments;
  - Open Street Maps;
  - Digital Elevation Model over Europe (EU-DEM);
  - Google Earth and Bing aerial photography 1995-2022;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from [www.npws.ie](http://www.npws.ie) including:
  - Natura 2000 - Standard Data Form;
  - Conservation Objectives;

- Site Synopses;
- National Biodiversity Data Centre records;
  - Online database of rare, threatened and protected species;
  - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and
- Relevant Development Plans;
  - Fingal County Development Plan 2017 - 2023

## 1.6. Statement of Authority

This report was compiled by Ger O'Donohoe (B.Sc. Applied Aquatic Sciences (GMIT, 1993) & M.Sc. Environmental Sciences (TCD, 1999)) who has over 27 years' experience in environmental impact assessment and has completed numerous reports for Appropriate Assessment Screening and Natura Impact Statements in terrestrial and aquatic habitats.

Engineering, Hydrology and technical data was supplied by AWN Consultants and the Design Team for the Proposed Development and this has been considered for the purposes of preparing this NIS.

## 1.7. Description of the Development

### 1.7.1. Data Centre & Associated Development

The Data Centre development works will include site clearance and preparation, demolition of two residential properties fronting the R135 and the development of two no. data facility buildings (Building DUB40, Building DUB41) arranged over three storeys and associated structures and infrastructure including a water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works.

The 220kV substation compound and subsurface grid connection forms part of a separate Strategic Infrastructure Development (SID) application (ABP Ref: 311528) to An Bord Pleanála (ABP), that is accompanied by an EIAR and an AA Screening report, because ABP (ABP-306723-20) confirmed that the 220kV Substation development falls within the scope of section 182A of the Planning Acts and is 'deemed' strategic infrastructure.

### 1.7.2. Substation and Associated Development

The overall project will comprise of the data centre, as well as a 220kV Substation, which is the subject of an SID application to An Bord Pleanála (ABP Ref. 311528). In order to assess the components of the

overall development, the AA Screening will assess the Substation Project in terms of in combination effects with the Data Centre Project, and the in combination effects of *other* plans and projects.

The 220kV Substation development comprises the construction of a two storey 220 kV Gas Insulated Switchgear (GIS) substation known as 'Mooretown' comprising switchgear floor, cable pit/entry room, generator room, relay room, battery room, workshop, toilet, store room, mess room, hoist space, stair cores and circulation areas (c.2,068 sqm total gross floor area) with an overall height of c.17m located within an overall EirGrid and Customer compound (c.11,231 sqm in area). Lightning electrodes are attached to the roof of the substation building resulting in an overall height of c.20m. The compound includes 4 no. 220/20 kV transformers, 4 no. 20 kV switchgear buildings and 1 no. 20 kV control room buildings (c.5 m high and c. 35.5 sqm in area each), 220 kV series coil (equipment), fire walls (ranging from c.10 m-12.5 m high), lightning finials and monopoles (c.20 m high). The overall compound is surrounded by a c.2.6 m high palisade fence. The 220kV Substation will serve the data centre proposed under concurrent application Reg. Ref. FW21A/0151.

The underground cable (Cable No. 1) will follow a route originating at the proposed Mooretown Substation extending south and then west along the private road connecting the North Road with Huntstown Power Station and Huntstown Quarry. The route terminates at a proposed joint bay on the existing Corduff cable route. The underground cable (Cable No. 2) will follow a route originating at the proposed Mooretown Substation Compound / series coil extending south across the internal road connecting the North Road with Huntstown Power Station and Huntstown Quarry. The route terminates at a proposed joint bay on the existing Finglas cable route. Removal of the redundant sections of the 220 kV Corduff cables and 220 kV Finglas cables serving the existing AIS bay to Huntstown Power Station. The underground cable (Cable No. 3) will follow a route originating at the Mooretown GIS Substation extending south and then west to the adjacent existing ESB Huntstown A AIS station. The route terminates in the ESB Huntstown A AIS Station. The underground cable (Cable No. 4) will follow a route originating at the Mooretown GIS Substation extending south and then west to the adjacent existing Huntstown B AIS station. The route terminates in the ESB Huntstown B AIS Station.

The development includes all associated and ancillary site development and construction works, services provision, drainage works, connections to the substations, all internal road/footpath access routes, landscaping and boundary treatment works, vehicular access onto the private road to the south of the site and provision of 9 no. car parking spaces in the overall compound.

## 1.8. Construction Management

Construction Environmental Management Plans (CEMPs) has been prepared to manage the impacts of construction activities associated with the Overall Development.



The CEMPs set out the principles to be adhered to and outlines measures that will be implemented during the construction of the development to ensure that potential environmental impacts and disturbance will be minimised or eliminated.

It will be the responsibility of the project proponent and contractor employed to update and add (where required) specific control measures relevant to the environmental management plan and procedures, taking into account any conditions imposed on any planning permissions granted. The control measures will be amended by improvement with regards to environmental protection and will take cognisance of additional environmental commitments arising from planning conditions.

The Project Proponent will oversee the process through appointment of the contractor with input from the Project engineer and oversight from the planning and project team. The contractor will be contractually obliged to comply with the CEMP.

Figure 1 shows the Overall Development location (substation and data centre) and Figure 2 shows a detailed view of the Data Centre Development boundary on recent aerial photography. Figure 3 shows the layout of the 220kV Substation Development on recent aerial photography. Figures 4 and 5 show plans of the Data Centre and 220kV Substation development respectively

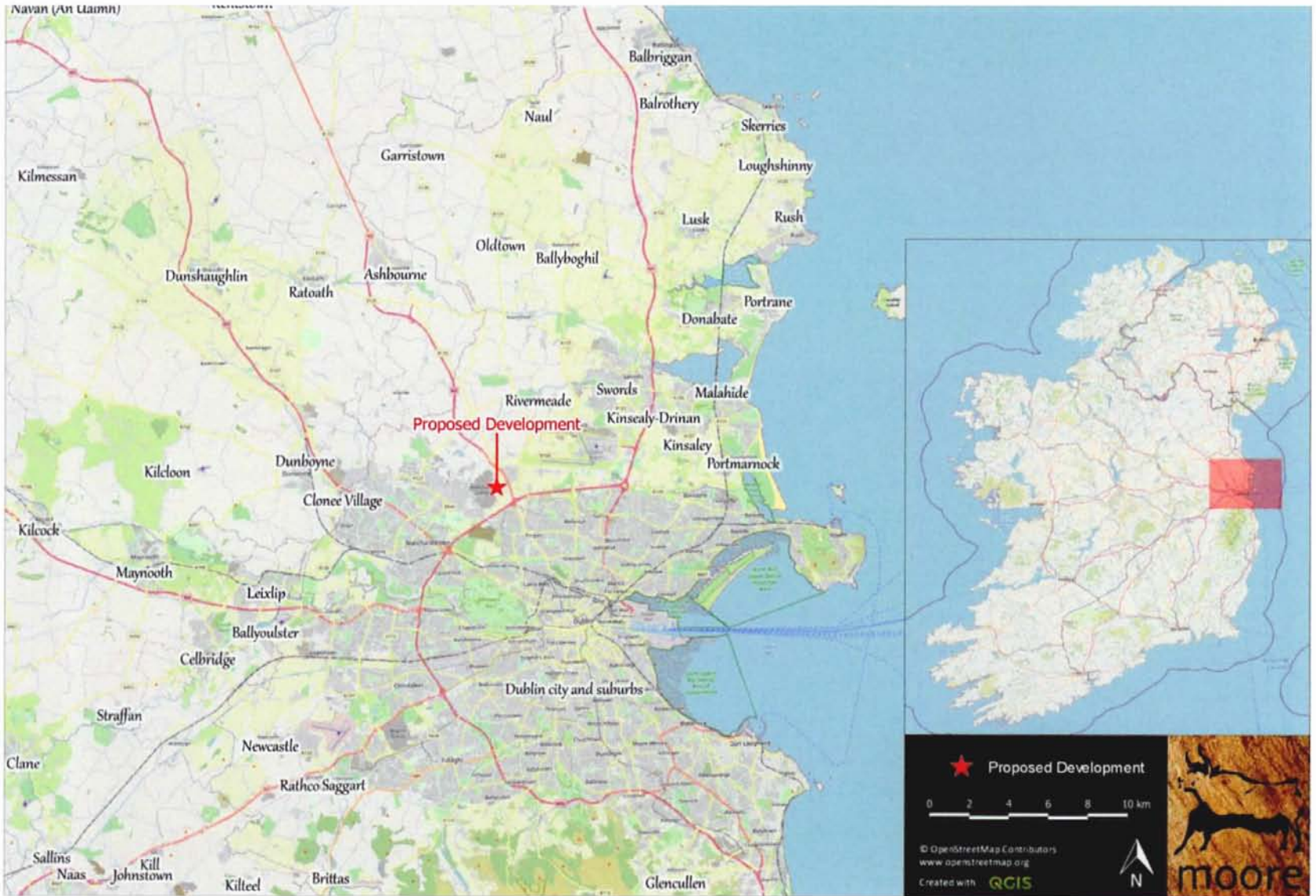


Figure 1. Showing the Overall Development location at Huntstown, Co. Dublin.



Figure 2. Showing the Data Centre Development boundary on recent aerial photography.



Figure 3. Showing the 220kV Substation Development boundary on recent aerial photography.

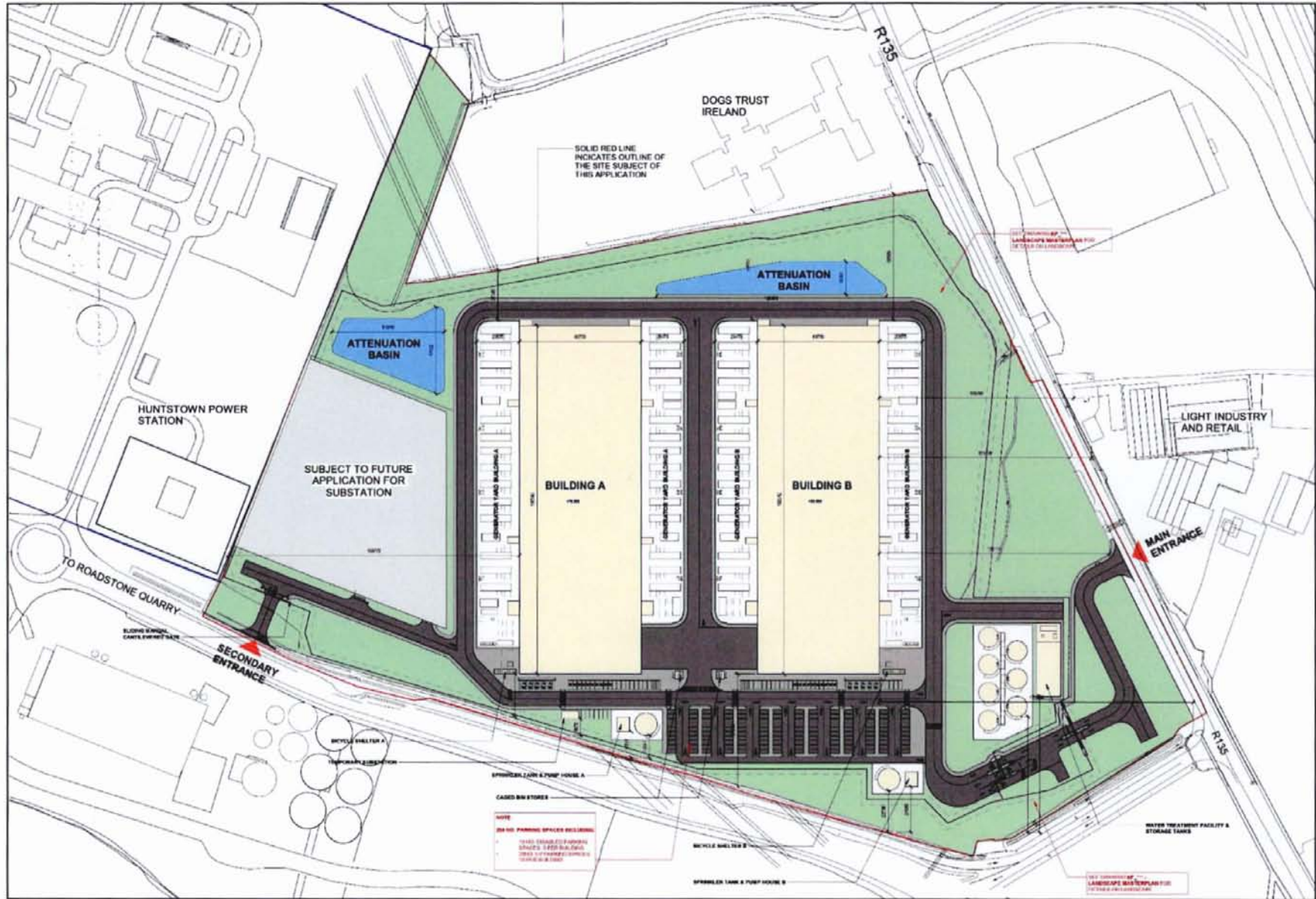


Figure 4. Plan of the Data Centre Development.

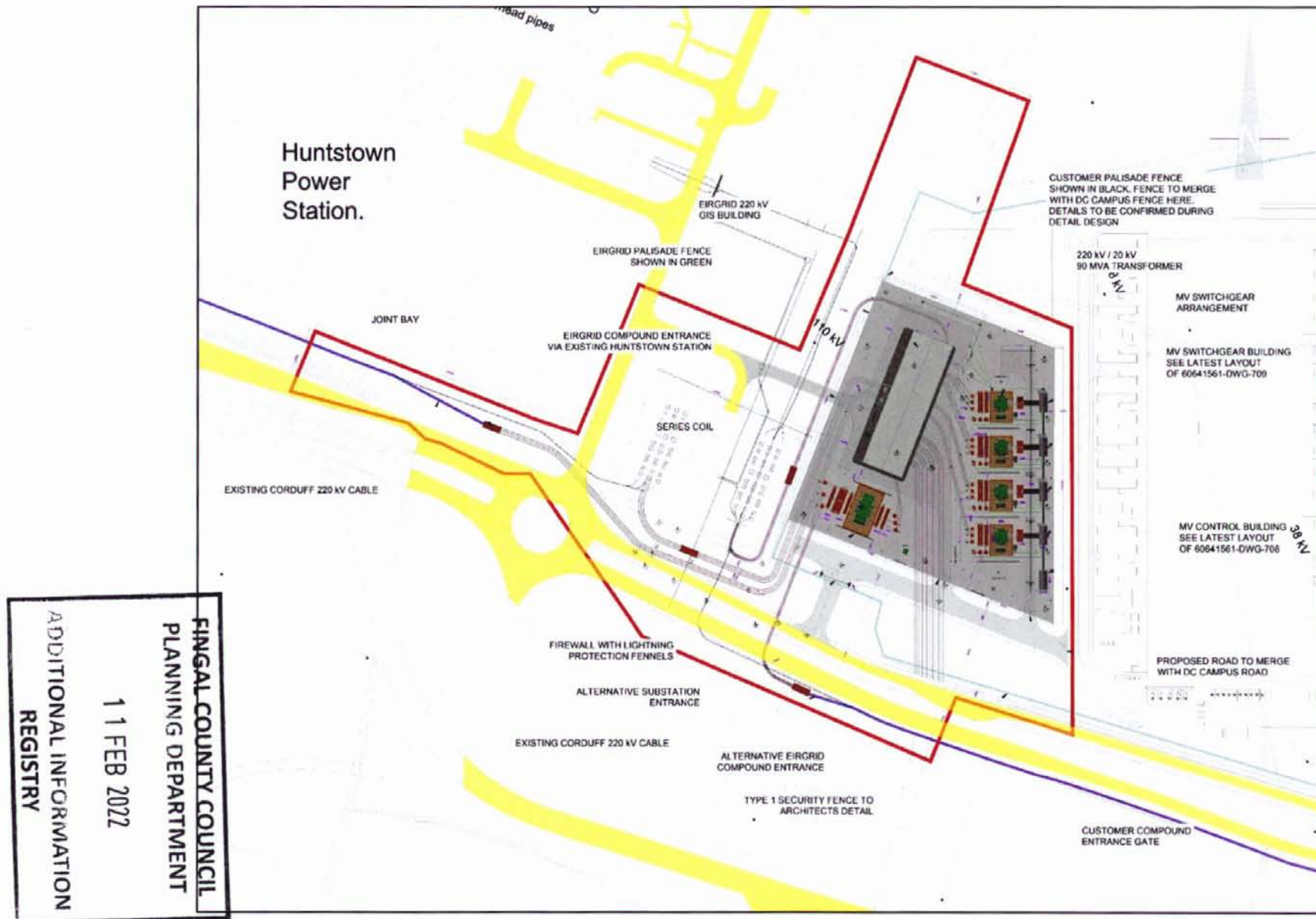


Figure 5. Plan of the 220kV Substation Development.

## 2. Stage 1 – AA Screening

An AA screening has been carried out and a Report for AA Screening presented as part of the planning application.

The potential for source pathway receptor connectivity was firstly identified through GIS interrogation and detailed information was then provided on sites with connectivity. European sites that are located within a potential Zone of Influence of the Overall Development are listed in Table 1 and presented in Figures 6 and 7, below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website ([www.npws.ie](http://www.npws.ie)) on 3 February 2022. This data was interrogated using GIS analysis to provide mapping, distances, locations and pathways to all sites of conservation concern including pNHAs, NHAs and European sites.

*Table 1 European Sites located within the potential Zone of Influence<sup>1</sup> of the Proposed Development.*

Site Code	Site name	Distance (km) <sup>2</sup>
000199	Baldoyle Bay SAC	11.53
000205	Malahide Estuary SAC	9.53
000206	North Dublin Bay SAC	10.47
000208	Rogerstown Estuary SAC	12.63
000210	South Dublin Bay SAC	10.74
001398	Rye Water Valley/Carlton SAC	11.97
004006	North Bull Island SPA	10.46
004015	Rogerstown Estuary SPA	13.24
004016	Baldoyle Bay SPA	11.58
004024	South Dublin Bay and River Tolka Estuary SPA	8.08
004025	Malahide Estuary SPA	9.57

The internal ditches of the Overall Development areas primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter of the Data Centre site. This larger ditch is intermittently hydraulically linked to the Huntstown Stream depending on flow rates, which eventually leads north converging with several other streams to the Ward River c. 6.6km downstream. The Ward River flows northeast to Malahide Estuary SAC and SPA over 15 river km downstream.

<sup>1</sup> All European sites potentially connected irrespective of the nature or scale of the Proposed Development.

<sup>2</sup> Distances indicated are the closest geographical distance between the proposed Project and the European site boundary, as made available by the NPWS.

There is no connectivity or pathways to any other European sites.

Potential source vector pathways were addressed in considering the hydrological connectivity between the Overall Development and the Malahide Estuary SAC and the Malahide Estuary SPA. Were the development to proceed, there would be no direct impact on Malahide Estuary SAC or Malahide Estuary SPA and so potential indirect impacts are then considered.

The potential for indirect significant adverse effects on Malahide Estuary SAC and Malahide Estuary SPA is uncertain in the absence of control of potential pollution on surface water during construction. The Overall Development will require the implementation of measures set out in the Construction Environmental Management Plans to avoid potential impacts on the Huntstown Stream and Ward River leading to Malahide Estuary and it is concluded that in line with Departmental Guidance and having regard to ECJ case law and the 'Precautionary Principle', a Natura Impact Statement be prepared for the purpose of Article 6(3) of the Habitats Directive and Part XAB of the Planning and Development Act, 2000, as amended.

Stage 2 Appropriate Assessment of the Project has been prepared as follows.



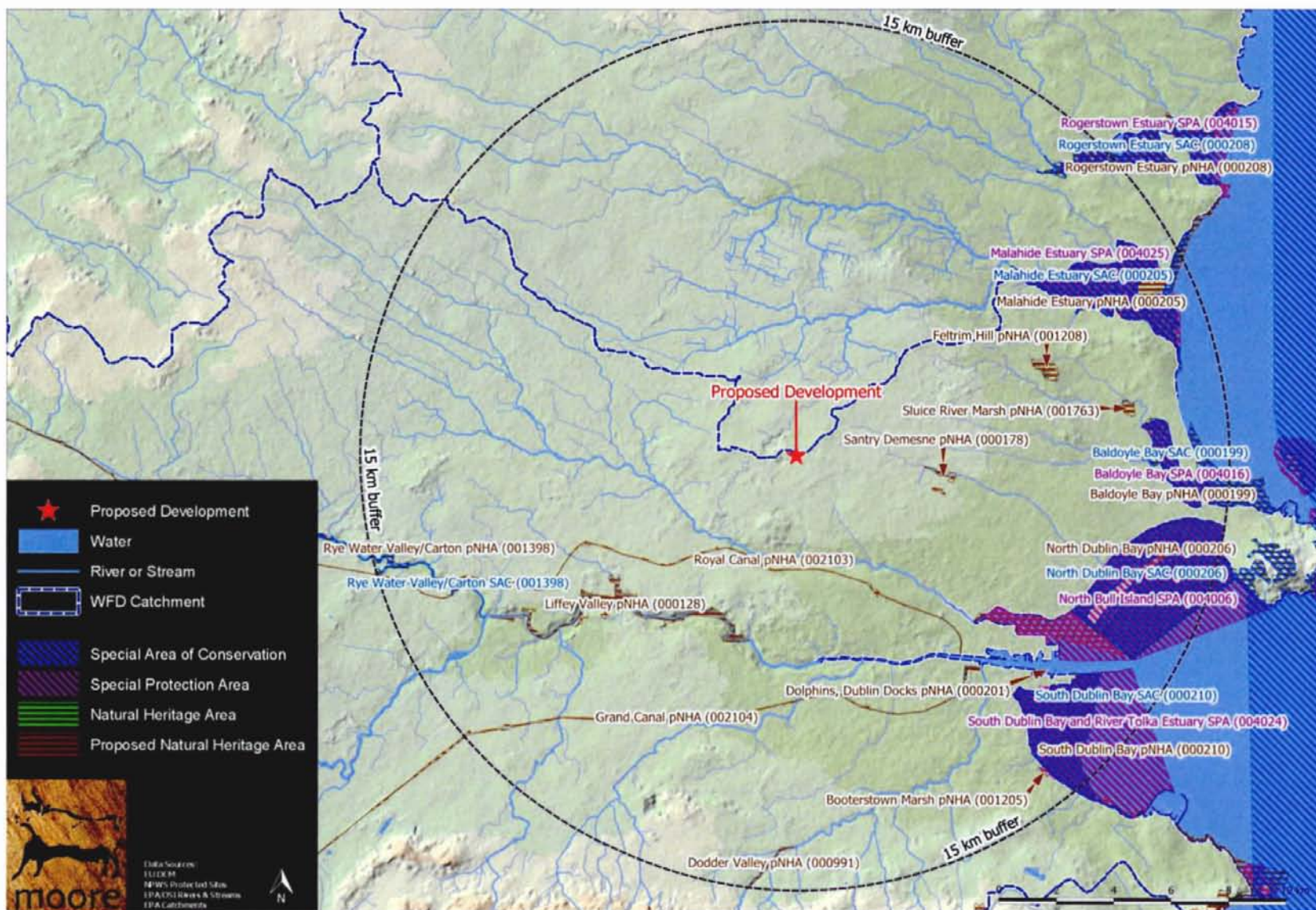


Figure 6. Showing European sites and NHAs/pNHAs in the wider Potential Zone of Influence of the Overall Development.



Figure 7. Detailed view of European sites in the nearer Potential Zone of Influence of the Overall Development

### 3. Stage 2 – Appropriate Assessment

This stage considers whether the Overall Development, alone or in combination with other projects or plans, will have adverse effects on the integrity of a European site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. The Stage 2 Appropriate Assessment comprises a scientific examination of the plan / project and the relevant European site; to identify and characterise any possible implications for the site in view of the site's conservation objectives, structure and function; taking account of in combination effects.

#### 3.1. Description of European Sites Potentially Affected

Potential impacts on the following European site have been identified:

##### 3.1.1. Malahide Estuary SAC (Site code 000205)

*Malahide Estuary is situated immediately north of Malahide and east of Swords in Co. Dublin. It is the estuary of the River Broadmeadow. The site is divided by a railway viaduct which was built in the 1800s. The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (\* = priority; numbers in brackets are Natura 2000 codes):*

*[1140] Tidal Mudflats and Sandflats*

*[1310] Salicornia Mud*

*[1330] Atlantic Salt Meadows*

*[1410] Mediterranean Salt Meadows*

*[2120] Marram Dunes (White Dunes)*

*[2130] Fixed Dunes (Grey Dunes)\**

*The outer part of the estuary is mostly cut off from the sea by a large sand spit, known as 'the island'. The outer estuary drains almost completely at low tide, exposing sand and mud flats. There is a large bed of Eelgrass (Dwarf Eelgrass, *Zostera noltii*, and Narrow-leaved Eelgrass, *Z. angustifolia*) in the north section of the outer estuary, along with Beaked Tasselweed (*Ruppia maritima*) and extensive mats of green algae (*Enteromorpha* spp., *Ulva lactuca*). Common Cord-grass (*Spartina anglica*) is also widespread in this sheltered part of the estuary.*

*The dune spit has a well developed outer dune ridge dominated by Marram Grass (*Ammophila arenaria*). The dry areas of the stabilised dunes have a dense covering of Burnet Rose (*Rosa pimpinellifolia*), Red Fescue (*Festuca rubra*) and species such as Yellow-wort (*Blackstonia perfoliata*), Autumn Gentian (*Gentianella amarella*), Hound's-tongue (*Cynoglossum officinale*), Carline Thistle (*Carlina vulgaris*) and Pyramidal Orchid (*Anacamptis pyramidalis*). Much of the interior of the spit is taken up by a golf course. The inner stony shore has frequent Sea-holly (*Eryngium maritimum*). Well-developed saltmarshes occur at the tip of the spit. Atlantic salt meadow is the principle type and is characterised by species such as*

*Sea-purslane (Halimolobos portulacastris), Sea Aster (Aster tripolium), Thrift (Armeria maritima), Sea Arrowgrass (Triglochin maritima) and Common Saltmarsh-grass (Puccinellia maritima).* Elsewhere in the outer estuary, a small area of Mediterranean salt meadow occurs which is characterised by the presence of *Sea Rush (Juncus maritimus)*. Below the salt marshes there are good examples of pioneering glasswort (*Salicornia* spp.) swards and other annual species, typified by *S. dolichostachya* and Annual Sea-blite (*Suaeda maritima*).

The inner estuary does not drain at low tide apart from the extreme inner part. Here, patches of saltmarsh and salt meadows occur, with *Sea Aster, Sea Plantain (Plantago maritima) and Sea Club-rush (Scirpus maritimus)*. Beaked Tasselweed occurs in one of the channels.

The site includes a fine area of rocky shore south-east of Malahide and extending towards Portmarnock. This represents the only continuous section through the fossiliferous Lower Carboniferous rocks in the Dublin Basin, and is the type locality for several species of fossil coral.

The estuary is an important wintering bird site and holds an internationally important population of Brent Goose and nationally important populations of a further 15 species. Average maximum counts during the 1995/96-1997/98 period were: Brent Goose 1217; Great Crested Grebe 52; Mute Swan 106; Shelduck 471; Pochard 200; Goldeneye 333; Red-breasted Merganser 116; Oystercatcher 1228; Golden Plover 2123; Grey Plover 190; Redshank 454; Wigeon 50; Teal 78; Ringed Plover 106; Knot 858; Dunlin 1474; Greenshank 38; Pintail 53; Black-tailed Godwit 345; Bar-tailed Godwit 99. The high numbers of diving birds reflects the lagoon-type nature of the inner estuary.

The estuary also attracts migrant species such as Ruff, Curlew Sandpiper, Spotted Redshank and Little Stint. Breeding birds of the site include Ringed Plover, Shelduck and Mallard. Up to the 1950s there was a major tern colony at the southern end of the island and the habitat remains suitable for these birds.

The inner part of the estuary is heavily used for water sports. A section of the outer estuary has recently been infilled for a marina and housing development.

This site is a fine example of an estuarine system with all the main habitats represented. The site is important ornithologically, with a population of Brent Goose of international significance.

### 3.1.2. Malahide Estuary SPA (Site code 004025)

Malahide Estuary is situated in north Co. Dublin, between the towns of Malahide and Swords. The site encompasses the estuary, saltmarsh habitats and shallow subtidal areas at the mouth of the estuary. A railway viaduct, built in the 1800s, crosses the site and has led to the inner estuary becoming lagoonal in character and only partly tidal. Much of the outer part of the estuary is well-sheltered from the sea by a large sand spit, known as "The Island". This spit is now mostly converted to golf-course. The outer part empties almost completely at low tide and there are extensive intertidal flats exposed. Substantial stands of eelgrass (both *Zostera noltii* and *Z. angustifolia*) occur in the sheltered part of the outer estuary, along with Tasselweed (*Ruppia maritima*). Green algae, mostly *Ulva* spp., are frequent on the sheltered flats. Common Cord-grass (*Spartina anglica*) is well established in the outer estuary and also

in the innermost part of the site. The intertidal flats support a typical macro-invertebrate fauna, with polychaete worms (*Arenicola marina* and *Hediste diversicolor*), bivalves such as *Cerastoderma edule*, *Macoma balthica* and *Scrobicularia plana*, the small gastropod *Hydrobia ulvae* and the crustacean *Corophium volutator*. Salt marshes, which provide important roosts during high tide, occur in parts of the outer estuary and in the extreme inner part of the inner estuary. These are characterised by such species as Sea Purslane (*Halimione portulacoides*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea Arrowgrass (*Triglochin maritima*) and Common Saltmarsh-grass (*Puccinellia maritima*). The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Great Crested Grebe, Light-bellied Brent Goose, Shelduck, Pintail, Goldeneye, Red-breasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit and Redshank. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

This site is of high importance for wintering waterfowl and supports a particularly good diversity of species. It has internationally important populations of Light-bellied Brent Goose (1,104 individuals or 5% of the all-Ireland total) and Black-tailed Godwit (409 individuals or 2.9% of the all-Ireland total) - figures given here and below are mean peaks for the five winters 1995/96-1999/2000. Furthermore, the site supports nationally important populations of an additional 12 species: Great Crested Grebe (63), Shelduck (439), Pintail (58), Goldeneye (215), Red-breasted Merganser (99), Oystercatcher (1,360), Golden Plover (1,843), Grey Plover (201), Knot (915), Dunlin (1,594), Bar-tailed Godwit (156) and Redshank (581). The high numbers of diving ducks reflects the lagoon-type nature of the inner estuary, and this is one of the few sites in eastern Ireland where substantial numbers of Goldeneye can be found. A range of other species occurs, including Mute Swan (37), Pochard (36), Ringed Plover (86), Lapwing (1,542), Curlew (548), Greenshank (38) and Turnstone (112).

The estuary also attracts other migrant wader species such as Ruff, Curlew Sandpiper, Spotted Redshank and Little Stint. These occur mainly in autumn, though occasionally in spring and winter.

Breeding birds of the site include Ringed Plover, Shelduck and Mallard. Up to the 1950s there was a major tern colony at the southern end of Malahide Island. Grey Herons breed nearby and feed regularly within the site.

Malahide Estuary SPA is a fine example of an estuarine system, providing both feeding and roosting areas for a range of wintering waterfowl. The lagoonal nature of the inner estuary is of particular value as it increases the diversity of birds which occur. The site is of high conservation importance, with internationally important populations of Light-bellied Brent Goose and Black-tailed Godwit, and nationally important populations of a further 12 species. Two of the species which occur regularly (Golden Plover and Bar-tailed Godwit) are listed on Annex I of the E.U. Birds Directive. Malahide Estuary (also known as Broadmeadow Estuary) is a Ramsar Convention site.

## 3.2. Description of the Existing Environment

Habitats were surveyed in accordance with all relevant guidance on the 17 September 2019 and again on 2 December 2020 by conducting a study area walkover covering the main ecological areas identified in the desktop assessment. The first survey date is at the end of the survey period for botanical species but adequate given the improved nature of the farmland and the second date is appropriate for surveying for badgers. A photographic record was made of features of interest.

Signs of mammals such as badgers and otters were searched for while surveying the study areas noting any sights, signs or any activity in the vicinity especially along adjacent boundaries during habitat surveys.

Bat surveys were undertaken by a bat specialist in August 2019 and focused on the arable crop fields bordered by mature tree lines and hedgerows.

A survey of amphibians was undertaken by a Freshwater Specialist on 19 September 2019..

Birds were surveyed using standard transect methodology and signs were recorded where encountered during the field walkover surveys. Signs of Winter Bird usage were assessed during the December 2020 site visit.

### ***Data Centre***

The Data Centre site essentially comprises six fields of farmland in northwest Co. Dublin, five previously used for arable crops and one for silage. The field systems are relatively small and intervening outgrown hedgerows are either low and scrubby or gappy and of locally low value.

The internal ditches primarily drain to ground and, during extended periods of rain, into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter. This larger ditch is intermittently hydraulically linked via the Huntstown Stream depending on flow rates, and eventually leads north converging with several other streams to the Ward River, which flows into northeast to Malahide Estuary over 15 river km downstream.

### ***220 kV Substation***

The 220 kV Substation site essentially comprises two adjacent fields of farmland previously used for arable crops and a portion of the existing developed brownfield site of Huntstown Power Station in northwest Co. Dublin.

The internal ditches primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility. This larger ditch is intermittently hydraulically

linked via the Huntstown Stream depending on flow rates and rainfall, and eventually leads north converging with several other streams to the Ward River, which flows into northeast to Malahide Estuary over 15 river km downstream.

There are no rare or protected habitats recorded in Overall Development area. The site may be considered of Low Ecological Value at a Local level.

None of the Conservation Interests of the Malahide Estuary SAC or Malahide Estuary SPA are located at or adjacent to the Overall Development site.

### 3.3. Conservation Objectives of European Sites

#### 3.3.1. Malahide Estuary SAC (000205)

Specific Conservation Objectives and Target Notes are set by the NPWS (Vers 1; 27<sup>th</sup> May 2013) for the Malahide Estuary SAC (000205) as follows.

##### ***1140 Mudflats and sandflats not covered by seawater at low tide***

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes
Community extent	Hectares	Maintain the extent of the <i>Zostera</i> - dominated community and the <i>Mytilus edulis</i> -dominated community complex, subject to natural processes
Community structure: <i>Zostera</i> density	Shoots/m <sup>2</sup>	Conserve the high quality of the <i>Zostera</i> -dominated community, subject to natural processes
Community structure: <i>Mytilus edulis</i> density	Individuals/m <sup>2</sup>	Conserve the high quality of the <i>Mytilus edulis</i> -dominated community, subject to natural processes
Community distribution	Hectares	Conserve the following community types in a natural condition: Fine sand with oligochaetes, amphipods, bivalves and polychaetes community complex; Estuarine sandy mud with Chironomidae and <i>Hediste diversicolor</i> community complex; and Sand to muddy sand with <i>Peringia ulvae</i> , <i>Tubificoides benedii</i> and <i>Cerastoderma edule</i> community complex

**1310 *Salicornia* and other annuals colonising mud and sand**

To maintain the favourable conservation condition of *Salicornia* and other annuals colonising mud and sand in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary- 1.93ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain, or where necessary restore, natural circulation of sediments and organic matter, without any physical obstructions
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession
Physical structure: flooding regime	Hectares flooded	Maintain natural tidal regime
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated
Vegetation composition: typical species and sub-communities	Percentage cover	Maintain the presence of species-poor communities listed in SMP (McCorry and Ryle, 2009)
Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of common cordgrass ( <i>Spartina anglica</i> ). No new sites for this species and an annual spread of less than 1% where it is already known to occur

**1320 *Spartina* swards (*Spartinion maritimae*)**

*Spartina* swards (*Spartinion maritimae*) was originally listed as a qualifying Annex I habitat for Malahide Estuary SAC due to historical records of two rare forms of cordgrass– small cordgrass (*Spartina maritima*) and Townsend's cordgrass (*S.x townsendii*). However, Preston et al. (2002) considers both



forms to be alien. In addition, all stands of cordgrass in Ireland are now regarded as common cordgrass (*S. anglica*) (McCorry et al., 2003; McCorry and Ryle, 2009). As a consequence, a conservation objective has not been prepared for this habitat. It will therefore not be necessary to assess the likely effects of plans or projects against this Annex I habitat at this site.

### 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary- 25.33 ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain, or where necessary restore, natural circulation of sediments and organic matter, without any physical obstructions
Physical structure: creeks and pans	Occurrence	Allow creek and pan structure to develop, subject to natural processes, including erosion and succession
Physical structure: flooding regime	Hectares flooded	Maintain natural tidal regime
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain the presence of species-poor communities listed in SMP (McCorry and Ryle, 2009)
Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of common cordgrass ( <i>Spartina anglica</i> ), with an annual spread of less than 1% where it is already known to occur

**1410 Mediterranean salt meadows (*Juncetalia maritimi*)**

To maintain the favourable conservation condition of Mediterranean salt meadows (*Juncetalia maritimi*) in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary- 0.64 ha.
Habitat distribution	Occurrence	No decline, subject to natural processes
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession
Physical structure: flooding regime	Hectares flooded	Maintain natural tidal regime
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of subcommunities with characteristic species listed in SMP (McCorry and Ryle, 2009)
Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of common cordgrass ( <i>Spartina anglica</i> ), with an annual spread of less than 1% where it is already known to occur

**2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)**

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary- 1.8 ha.

Habitat distribution	Occurrence	No decline, subject to natural processes
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions
Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats, including transitional zones, subject to natural processes including erosion and succession
Vegetation composition: plant health of dune grasses	Percentage cover	95% of marram grass ( <i>Ammophila arenaria</i> ) and/or lyme-grass ( <i>Leymus arenarius</i> ) should be healthy (i.e. green plant parts above ground and flowering heads present)
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain the presence of species-poor communities dominated by marram grass ( <i>Ammophila arenaria</i> ) and/or lymegrass ( <i>Leymus arenarius</i> )
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover

### 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation ('grey dunes') in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary- 21.42 ha.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes
Physical structure: functionality sediment supply	Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions
Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of subcommunities with typical species listed in Ryle et al. (2009)
Vegetation composition: negative indicator species	Percentage Cover	Negative indicator species (including non-natives) to represent less than 5% cover

Attribute	Measure	Target
species (including <i>Hippophae rhamnoides</i> )		
Vegetation composition: scrub/trees	Percentage Cover	No more than 5% cover or under control

### 3.3.2. Malahide Estuary SPA 004025 – Version 1, 16th Aug 2013

Generic Conservation Objectives and Target Notes are set by the NPWS (Vers 1; 16<sup>th</sup> August 2013) for the Malahide Estuary SPA (004025) as follows.

In the absence of specific conservation objectives, the following generic conservation objectives can be applied to each qualifying species listed.

To maintain the favourable conservation condition of the wetland habitat in Malahide Estuary SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

#### *[Qualifying Bird Species]*

Attribute	Measure	Target
Population trend	Percentage change	Long term population trend stable or increasing
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by redshank, other than that occurring from natural patterns of variation

#### *A99 Wetlands*

To maintain the favourable conservation condition of the wetland habitat in Malahide Estuary SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

Attribute	Measure	Target
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,192 hectares, other than that occurring from natural patterns of variation.

### 3.4. Consideration of Impacts on European Sites

#### 3.4.1. Annex I Habitats Directive Habitats

The qualifying habitats of Malahide Estuary are located over 8km from the Overall Development site and there would be no direct impacts on the Malahide Estuary SAC or the Malahide Estuary SPA and there would be no habitat loss or fragmentation as a result of the Overall Development. Having considered direct impacts and ruling them out, indirect impacts are then considered in terms of source pathway vectors.

Potential impacts on the Malahide Estuary SAC and the Malahide Estuary SPA were considered in terms of hydrological connectivity between the Overall Development and the Huntstown Stream and Ward River and as such these site were screened in for further assessment. There are no pathways or connectivity to other European sites and they were excluded.

A worst-case scenario may arise were the Overall Development to result in a significant detrimental change in water quality in the Huntstown Stream and Ward River either alone or in combination with other projects or plans as a result of indirect pollution, the effect would have to be considered in terms of changes in water quality which would significantly affect the habitats or food sources for which Malahide Estuary SAC and the Malahide Estuary SPA are designated.

While not a Qualifying Interest of the Malahide Estuary European sites, otters have been recorded downstream on the Ward River. The otter (*Lutra lutra*) is listed under Annex II of the EU Habitats Directive and under Annex II of the Berne Convention; it is also a legally protected species under the Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). Otters are found throughout Ireland and tend to occupy linear territories along watercourses and are rarely found far away from water. Records from the NBDC show that otters have been recorded from the main channel of the Ward River with no records from the Huntstown Stream. The drainage ditches in the Overall Development site were surveyed and determined unsuitable habitats for otters. There would be no direct impacts on Otters and so the main concern is with regard to water quality and indirect impacts on water quality and prey species.

#### 3.4.2. Birds Directive Annex I Species

Malahide Estuary SPA is a fine example of an estuarine system, providing both feeding and roosting areas for a range of wintering waterfowl. The lagoonal nature of the inner estuary is of particular value as it increases the diversity of birds which occur. The site is of high conservation importance, with internationally important populations of Light-bellied Brent Goose and Black-tailed Godwit, and nationally important populations of a further 12 species. Two of the species which occur regularly

(Golden Plover and Bar-tailed Godwit) are listed on Annex I of the E.U. Birds Directive. Malahide Estuary (also known as Broadmeadow Estuary) is a Ramsar Convention site.

This site is of high importance for wintering waterfowl and supports a particularly good diversity of species. It has internationally important populations of Light-bellied Brent Goose (1,104 individuals or 5% of the all-Ireland total) and Black-tailed Godwit (409 individuals or 2.9% of the all-Ireland total) - figures given here and below are mean peaks for the five winters 1995/96-1999/2000. Furthermore, the site supports nationally important populations of an additional 12 species: Great Crested Grebe (63), Shelduck (439), Pintail (58), Goldeneye (215), Red-breasted Merganser (99), Oystercatcher (1,360), Golden Plover (1,843), Grey Plover (201), Knot (915), Dunlin (1,594), Bar-tailed Godwit (156) and Redshank (581). The high numbers of diving ducks reflects the lagoon-type nature of the inner estuary, and this is one of the few sites in eastern Ireland where substantial numbers of Goldeneye can be found.

The Appropriate Assessment Screening process found that noted that the habitat type recorded during fieldwork and distance from the coastal SPAs do not present opportunities to support the bird species (predominantly waders) for which the Malahide Estuary SPA (c. 8.67km) is designated.

The main concern for Wintering birds and their supporting wetland habitats is with regard to water quality and indirect impacts on water quality and prey species which inhabit the sand and mudflats.

### 3.4.3. Ecological Network Supporting Natura 2000 Sites

A concurrent GIS analysis of the proposed Natural Heritage Areas (pNHA) and designated Natural Heritage Areas (NHA) in terms of their role in supporting the species using Natura 2000 sites was undertaken along with GIS investigation of European sites. It was assumed that these supporting roles mainly related to mobile fauna such as mammals and birds which may use pNHAs and NHAs as "stepping stones" between Natura 2000 sites.

Article 10 of the Habitats Directive and the Habitats Regulations 2011 place a high degree of importance on such non-Natura 2000 areas as features that connect the Natura 2000 network. Features such as ponds, woodlands and important hedgerows were taken into account during the preparation of this NIS.

The NHAs and pNHAs identified in Figure 4 are either located outside the Zone of Influence with the exception of those associated with the Malahide Estuary. The nationally designated Malahide Estuary sites are considered under the higher conservation status as European sites.

#### 3.4.4. Potential Impacts on European Sites

The Overall Development is not directly connected with or necessary to the management of the European sites considered in the assessment and therefore potential downstream impacts must be identified and considered.

The qualifying habitats of Malahide Estuary are located over 8km from the Overall Development site and there will be no direct impacts on the Malahide Estuary SAC or SPA designated habitats as a result of the Overall Development. Direct impact refers to physical impacts defined in the Departmental Guidance as 'Loss of habitat area' and/or 'Habitat Fragmentation'. Having established this, the assessment emphasis is placed on potential indirect and cumulative impacts.

The potential for impact is considered whereby the Overall Development would result in a significant detrimental change in water quality either alone or in combination with other projects or plans as a result of indirect pollution of surface water. The effect would have to be considered in terms of changes in water quality which would affect the habitats or species for which Malahide Estuary SAC and SPA are designated. This is assessed by firstly establishing the pathways by which impacts could occur and then reviewing the design measures included which will avoid these impacts and then by also looking at the potential in-combination effects which will be assessed in Sections 3.6 and 3.7 later in this report.

### 3.5. Impacts on the Qualifying Interests of European Sites

#### 3.5.1. Direct Impacts

There will be no direct impacts on the Malahide Estuary SAC or SPA as a result of the construction, operation or decommissioning of the Overall Development. Direct impact refers to physical impacts defined in the Departmental Guidance as 'Loss of habitat area' and/or 'Habitat Fragmentation'. There are no direct impacts identified which may affect the Annexed habitats or species of the SAC. The Overall Development will have **no impacts** upon the integrity or the site structure of the Malahide Estuary SAC or SPA.

Having established this, the assessment emphasis is placed on potential indirect and cumulative impacts.

The primary consideration in terms of source-vector-pathways for indirect impacts relates to surface water and potential indirect impacts on hydrologically linked habitats and aquatic species.

### 3.5.2. Indirect Impacts

The potential for impact is considered whereby the Overall Development would result in a significant detrimental change in water quality either alone or in combination with other projects or plans as a result of indirect pollution of surface water. The effect would have to be considered in terms of changes in water quality which would affect the habitats or species for which the Malahide Estuary SAC and SPA are designated.

#### Consideration of impacts on Surface Water During Construction

The likelihood of impacts on hydrologically connected environmental sites is extremely low given the intermittent connection between the drainage on the Overall Development site and the Huntstown Stream and will be avoided by construction management.

Accidental spillages and contaminated runoff and will be avoided by construction management measures are set out in the Construction Environmental Management Plans (CEMP). Management measures will include appropriate site-specific measures from the CIRIA Report C532 Control of Water Pollution from Construction Sites.

The CEMP will include a reference to the EIA Report and this NIS which establishes the connectivity of the Huntstown Stream and Ward River and Malahide Estuary and the requirement for avoidance in terms of both direct and indirect construction activity, e.g. machinery will not enter any water course and construction management will avoid indirect pollution of all water courses. More detailed measures are set out in Section 3.6 below.

#### Consideration of impacts on Surface Water During Operation

##### Data Centre

The Data Centre development includes the storage of 29 no. emergency generators (per data hall) and diesel fuel belly-tanks. However, it is noted (in the EIAR Chapter 7 – Hydrology) that any accidental discharge will more likely impact stormwater drainage due to the hardstand and drainage infrastructure proposed which include 2 no. hydrocarbon interceptors.

Generator yard passes through hydrocarbon interceptor prior to connection to the onsite drainage networks. Hydrocarbon interceptors will be installed as part of the SuDS measures to capture any potential oil or hydrocarbon contamination prior to discharge into the attenuation system on site. This together with hardstand cover will minimise the potential for any impact to the watercourses receptors.

An environmental management plan will apply to the overall development during the operational phase incorporating mitigation measures and emergency response measures.



### Emergency Response Procedures

There will be a comprehensive emergency response procedures and standard operating procedures to respond to an onsite fuel spillage. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and standard operating procedures.

### Environmental Procedures

During operation the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer. The following containment measures are included within the design to reduce potential for environmental impact. There will be comprehensive emergency response procedures and standard operating procedures to respond to chemical spillage all types. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and standard operating procedures.

### Fuel Storage

The provision of spill kit facilities and training of operatives in use of same; should be undertaken at the operational stage in order to manage any leaks from fuel storage and vehicles resulting in soil and/or groundwater quality impacts:

The storage of fuel oil for the emergency generators will be restricted to the generator yard, the bulk fuel tanks and belly tanks will be bunded, and the over ground delivery pipeline double lined. The final design for the diesel storage will either be contained within a bunded area or self-bunded in line with the requirements of the *Guidance to Storage and Transfer of Materials for Scheduled Activities* (EPA, 2005).

### Storm Water & Foul Sewer Drainage

The Overall Development will provide a significant improvement to the local drainage catchment as it is proposed to provide full attenuation for increase in hardstand area in compliance with the requirements of the Greater Dublin Strategic Drainage Study. A number of measures will be put in place to minimise the likelihood of any spills entering the water environment to include the design of the car park, fitting of refuelling areas with hydrocarbon interceptors and on-site speed restrictions.

It is proposed to ultimately discharge surface water from the Overall Development, post attenuation and outflow restrictions into the existing local drainage.

With regarding to the culverted ditch, the OPW Guidelines requires culverts to be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100 year flow without significantly changing the hydraulic characteristics of the watercourse.

### 220 kV Substation

During operation there is no requirement for bulk fuels or chemical storage, no requirement for discharge to ground and no requirement for abstraction of groundwater.

The design includes hardstand cover across the site and 2 no. full retention interceptors prior to discharge into the attenuation system. Therefore, the risk of accidental discharge has been adequately addressed through design.

Petrol interceptors will be installed as part of the SuDS measures to capture any potential oil or hydrocarbon contamination prior to discharge into the attenuation system on site. This together with hardstand cover will minimise the potential for any impact to the hydrological environment.

### Emergency Response Procedures

ESB Networks has an Environmental Safety and Health Management System (EMS) which will be implemented at the 220 kV Substation development during operations. An environmental management plan will apply to the overall development during the operational phase incorporating mitigation measures and emergency response measures.

There will be comprehensive emergency response procedures and standard operating procedures to respond to an onsite fuel spillage. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and standard operating procedures.

### Environmental Procedures

During operation the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer. The following containment measures are included within the design to reduce potential for environmental impact. There will be comprehensive emergency response procedures and standard operating procedures to respond to chemical spillage all types. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and standard operating procedures.

### Spill Kit Facilities

The provision of spill kit facilities and training of operatives in use of same; should be undertaken at the operational stage in order to manage any leaks from fuel storage and vehicles resulting in surface water quality impacts.

### Storm Water & Foul Sewer Drainage

The Overall Development will provide full attenuation for increase in hardstand area in compliance with the requirements of the Greater Dublin Strategic Drainage Study. A number of measures will be put in place to minimise the likelihood of any spills entering the water environment to include the design of the car park, fitting of refuelling areas with hydrocarbon interceptors and on-site speed restrictions.

It is proposed to ultimately discharge surface water from the Overall Development, post attenuation and outflow restrictions into the existing local drainage.

## 3.6. Mitigation Measures

### 3.6.1. Data Centre

A Construction Environment Management Plan (CEMP) has been prepared by Clifton Scannell Emerson Associates for the Data Centre development and is included with the EIAR planning documentation (and as Appendix 1).

All mitigation measures outlined therein will be implemented, as well as any additional measures required pursuant to planning conditions which may be imposed. The final contractors CEMP with which they will be obliged to contractually comply, will set out the overarching vision of how the construction of the Data Centre development will be managed in a safe and organised manner by the Contractor. The CEMP will be a live document and it will go through a number of iterations before works commence and during the works. The CEMP sets out requirements and standards which must be met during the construction stage and includes the relevant mitigation measures outlined in the EIA Report and this NIS.

As a minimum, the CEMP will be formulated in accordance with best international practice including but not limited to:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532) Construction Industry Research and Information Association;
- CIRIA (2002) Control of water pollution from construction sites: guidance for consultants and contractors (SPI56) Construction Industry Research and Information Association

- CIRIA (2005), *Environmental Good Practice on Site* (C650); Construction Industry Research and Information Association
- BPGCS005, Oil Storage Guidelines;
- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- CIRIA 697, The SUDS Manual, 2007; and
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004.

### **Surface Water Runoff**

As there is potential for run-off to enter current stormwater systems and indirectly discharge to a watercourse, mitigations will be put in place to manage run-off during the construction phase.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts.

Should any discharge of construction water be required during the construction phase, discharge will be to foul sewer. Pre-treatment and silt reduction measures on site will include a combination of silt fencing, settlement measures (silt traps, 20 m buffer zone between machinery and watercourses, refuelling of machinery off site) and hydrocarbon interceptors.

Any minor ingress of groundwater and collected rainfall in the excavation will be pumped out during construction. It is estimated that the inflow rate of groundwater will be low and limited to the northeast of the site. It is therefore proposed that the water be discharged via the existing stormwater sewer network. Extensive monitoring will be adopted to ensure that the water is of sufficient quality to discharge to the sewer. The use of slit traps and an oil interceptor (if required) will be adopted if the monitoring indicates the requirements for the same with no silt or contaminated water permitted to discharge to the sewer. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavations are kept relatively dry. Due to the very low permeability of the Dublin Boulder Clay and the relative shallow nature for excavations, infiltration to the underlying aquifer is not anticipated.

Run-off water containing silt will be contained on site via settlement tanks and treated to ensure adequate silt removal. Silt reduction measures on site will include a combination of silt fencing and settlement measures (silt traps, silt sacks and settlement tanks/ponds).

The temporary storage of soil will be carefully managed. Stockpiles will be tightly compacted to reduce runoff and graded to aid in runoff collection. This will prevent any potential negative impact on the stormwater drainage and the material will be stored away from any surface water drains. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust.

Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations. Soil from works will be stored away from existing drainage features to remove any potential impact.

Weather conditions will be considered when planning construction activities to minimise the risk of run-off from the site and the suitable distance of topsoil piles from surface water drains will be maintained.

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas. Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

#### **Fuel and Chemical Handling**

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area (or where possible off the site) which will be away from surface water gulleys or drains. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as "Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001) will be complied with.

Where feasible, all ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

In the case of drummed fuel or other chemical which may be used during construction, containers should be stored in a dedicated internally bunded chemical storage cabinet and labelled clearly to allow appropriate remedial action in the event of a spillage.

Emergency response procedures are outlined in the CEMP. All personnel working on the site will be suitably trained in the implementation of the procedures.

#### **Soil Removal and Compaction**

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. The material will be stored away from any surface water drains

(see Surface Water Run-off section above). Movement of material will be minimised to reduce degradation of soil structure and generation of dust.

All excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.

Site investigations carried out at the Overall Development site in 2020 (Refer to Chapter 6) found no residual contamination on site. Nonetheless, all excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.

### 3.6.2. 220kV Substation

A Construction Environment Management Plan (CEMP) has been prepared by AECOM for the 220 kV Substation development and is included with the EIAR planning documentation (and as Appendix 2). All mitigation measures outlined therein will be implemented, as well as any additional measures required pursuant to planning conditions which may be imposed. The final contractors CEMP with which they will be obliged to contractually comply, will set out the overarching vision of how the construction of the 220 kV Substation development will be managed in a safe and organised manner by the Contractor. The CEMP will be a live document and it will go through a number of iterations before works commence and during the works. The CEMP sets out requirements and standards which must be met during the construction stage and includes the relevant mitigation measures outlined in the EIA Report and this NIS.

As a minimum, the CEMP will be formulated in accordance with best international practice including but not limited to:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532) Construction Industry Research and Information Association;
- CIRIA (2002) Control of water pollution from construction sites: guidance for consultants and contractors (SPI56) Construction Industry Research and Information Association
- CIRIA (2005), *Environmental Good Practice on Site* (C650); Construction Industry Research and Information Association
- BPGCS005, Oil Storage Guidelines;

- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- CIRIA 697, The SUDS Manual, 2007; and
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004.

### **Surface Water Runoff**

As there is potential for run-off to enter current stormwater systems and indirectly discharge to a watercourse, mitigations will be put in place to manage run-off during the construction phase.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts.

Should any discharge of construction water be required during the construction phase, discharge will be to foul sewer. Pre-treatment and silt reduction measures on the construction site will include a combination of silt fencing, settlement measures (silt or sediment traps, 20 m buffer zone between machinery and watercourses, refuelling of machinery off site) and hydrocarbon interceptors.

Any minor ingress of groundwater and collected rainfall in the excavation will be pumped out during construction. It is estimated that the inflow rate of groundwater will be low and limited to the northeast of the 220 kV Substation site. It is therefore proposed that the water be discharged via the existing stormwater sewer network. Extensive monitoring will be adopted to ensure that the water is of sufficient quality to discharge to the sewer. The use of silt traps and an oil interceptor (if required) will be adopted if the monitoring indicates the requirements for the same with no silt or contaminated water permitted to discharge to the sewer. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavations are kept relatively dry. Due to the very low permeability of the Dublin Boulder Clay and the relative shallow nature for excavations, infiltration to the underlying aquifer is not anticipated.

Run-off water containing silt will be contained on site via settlement tanks and treated to ensure adequate silt removal. Silt reduction measures on site will include a combination of silt fencing and settlement measures (silt traps, silt sacks and settlement tanks/ponds).

The temporary storage of soil will be carefully managed. Stockpiles will be tightly compacted to reduce runoff and graded to aid in runoff collection. This will prevent any potential negative impact on the stormwater drainage and the material will be stored away from any surface water drains. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust. Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations. Soil from works will be stored away from existing drainage features to remove any potential impact.

Weather conditions will be considered when planning construction activities to minimise the risk of run-off from the site and the suitable distance of topsoil piles from surface water drains will be maintained.

#### **Fuel and Chemical Handling**

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas. Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area (or where possible off the site) which will be away from surface water gulleys or drains. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as "Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001) will be complied with.

Where feasible all ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

In the case of drummed fuel or other chemical which may be used during construction, containers should be stored in a dedicated internally bunded chemical storage cabinet and labelled clearly to allow appropriate remedial action in the event of a spillage.

Emergency response procedures will be outlined in the detailed CEMP. All personnel working on the site will be suitably trained in the implementation of the procedures.

#### **Soil Removal and Compaction**

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. The material will be stored away from any surface water drains (see Surface Water Run-off section above). Movement of material will be minimised to reduce degradation of soil structure and generation of dust. These measures associated with the construction phase are best practice measures, and are in no way included to avoid or reduce any potential harmful effects to any European sites.



All excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.

Site investigations carried out at the Overall Development site in 2020 found no residual contamination on site. Nonetheless, all excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.

### 3.7. Assessment of In-Combination Effects

As part of the preparation of this NIS, other relevant projects and plans in the Zone of Influence must also be considered. This step aims to identify at this early stage any possible significant in-combination or cumulative effects / impacts of the proposed development with other such plans and projects on the Natura 2000 site.

#### Assessment of Plans

The planning authority in whose functional area the development is proposed is Fingal County Council. There is potential for “in-combination” effects on water quality in Malahide Estuary from other plans and projects carried out within the functional areas of the Fingal Development Plan 2017-2023 (Fingal County Council, 2017).

Plans and developments within Fingal County must comply with the following policy objectives of the Fingal County Development Plan 2017-2023 relevant to the protection of European sites and the protection of water quality in Malahide Estuary:

#### **Objective NH10**

Ensure that the Council takes full account of the requirements of the Habitats and Birds Directives, as they apply both within and without European Sites in the performance of its functions.

**Objective NH11**

Ensure that the Council, in the performance of its functions, takes full account of the objectives and management practices proposed in any management or related plans for European Sites in and adjacent to Fingal published by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

**Objective NH15**

Strictly protect areas designated or proposed to be designated as Natura 2000 sites (i.e. Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); also known as European sites) including any areas that may be proposed for designation or designated during the period of this Plan.

**Objective SW04**

Require the use of sustainable drainage systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques where appropriate, for new development or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.

**Objective WQ01**

Strive to achieve 'good status' in all waterbodies in compliance with the Water Framework Directive, the Eastern River Basin District Management Plan 2009-2015 and the associated Programme of Measures (first cycle) and to cooperate with the development and implementation of the second cycle national River Basin Management Plan 2017-2021.

**Objective WQ04**

Protect existing riverine wetland and coastal habitats and where possible create new habitats to maintain naturally functioning ecosystems whilst ensuring they do not impact negatively on the conservation objectives of any European Sites.

**Objective WT01**

Liaise with and work in conjunction with Irish Water during the lifetime of the plan for the provision, extension and upgrading of waste water collection and treatment systems in all towns and villages of the County to serve existing populations and facilitate sustainable development of the County, in accordance with the requirements of the Settlement Strategy and associated Core Strategy.

## Objective WT02

Liaise with Irish Water to ensure the provision of wastewater treatment systems in order to ensure compliance with existing licences, EU Water Framework Directive, River Basin Management Plans, the Urban Waste Water Directive and the EU Habitats Directive.

Having regard to the policies and objectives referred to under the relevant development plan, it is concluded that the possibility of any other plans acting in combination with the Overall Development to give rise to significant effects on any European site in, or associated with, Malahide Estuary can be excluded.

## Assessment of Projects

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data gaps for the area where the Overall Development is located. The database was then queried for developments granted planning permission within 0.5km of the Overall Development within the last three years, these are presented in Table 2 below.

*Table 2. Planning applications granted permission in the vicinity of the Overall Development.*

Planning Ref.	Description of development	Comments
F17A/0436	Revisions to existing Hawk House (Unit 4) granted under F07A/0389.	No potential for in-combination effects given the scale and location of the project.
F17A/0728	The construction of a single storey unit for industrial and/or warehouse use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F17A/0769	Development will consist of the construction of two single storey units for industrial and/or warehousing use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site .
FW18A/0038	Amendments to previously approved application (ref FW14A/0162) which consisted of demolition of existing 2no. two storey semi-detached dwellings, construction of 2 detached dwellings.	No potential for in-combination effects given the scale and location of the project.
FW18A/0082	The development is a wastewater treatment plant.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F18A/0139	The construction of an extension to internal access road from Maple Avenue with associated works including public lighting and the development of 2 no. plots generally for industrial, warehouse, storage and logistic use.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW18A/0159	Planning Permission is sought for an increase in the annual volume of waste to be imported to the permitted bioenergy plant at Huntstown, North Road, Finglas, Dublin 11. The proposed increase is 9,900 tonnes, which	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.

Planning Ref.	Description of development	Comments
	would take the permitted volume from 90,000 tonnes to 99,900 tonnes.	
F18A/0683	Permission for a new shed (floor area 180m <sup>2</sup> ) for horticultural related uses and ancillary works including new vehicular entrance.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0015	The development will consist of a Battery Energy Storage System (BESS) which will include up to 9 no. containerised battery storage modules ( up to 14m length, 2.44m wide and 2.9m high) and ancillary equipment including up to: 9 no transformers (2.5m wide and 2.9m high), 7 no. power conditioning unit blocks (8m length and 1.5m wide), 1 no. power conditioning unit block (5m length by 5m wide), 9 no. switchgear units (1.5m length, 1.5m wide and 1.6m high), a sub-station container (4.5m length, 3.0m wide and 3.0m high) and all other associated site development works as required to facilitate the development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0053	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0143	The construction of 2 no. Single-Storey Units for industrial and/or Warehouse use with ancillary Two-Storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0170	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW19A/0185	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
F19A/0218	Amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0021	The development will consist of storage and logistic facilities comprising yards, warehouses, workshops and ancillary offices at Plots 1, 3, 4, 5, 6, 7, and 9 and amendment to permitted development (Reg. Ref. FW19A/0101 and F18A/0139) at Plot 8 and internal road network at Dublin Inland Port.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0044	The proposed development consists of amendments to Planning Permission F17A/0769 as granted. The amendments are as follows to unit 2: high level building signage to the east and west facing facades along the M2 and R135 respectively.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0045	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted. The amendments relate only to Unit 1 of the permitted development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site.
FW20A/0097	Fingal County Council. Dublin Port Company intends to apply for planning permission for development and	The Appropriate Assessment Screening report with this application found that the proposed

Planning Ref.	Description of development	Comments
	amendments to development permitted under Reg. Ref. F18A/0139 /, ABP Ref. 302361 – 18 as amended.	development will not have a significant effect on any Natura 2000 site.
FW21A/0144	The development will consist of the installation of electrical infrastructure between Finglas substation and Huntstown Power Station to facilitate the retirement of existing Electricity Supply Board overhead powerlines and facilitate site clearance for the future development of a data centre and substation (subject to separate planning applications). This will include (i) the installation of approximately three underground cable circuits of 1.2km length (110kV) and one circuit 1.2km length (38kV) and associated underground ducting, joint bays and infrastructure between the existing ESB Finglas substation and an agreed location within Huntstown Power Station (ii) installation of one c.28m double circuit 110 kV cable end tower and one c.17 single circuit 110kV angle mast (iii) removal of 10Nr. existing 110kV timber polesets, 9 Nr. existing 38kV timber polesets, 3 Nr. 38kV lattice steel tower & associated overhead line electrical infrastructure; all associated and ancillary site development, landscaping and construction works, all within the townlands of Johnstown, Huntstown, Coldwinters & Baleskin at Blanchardstown & Finglas, County Dublin. An Environmental Impact Assessment report (EIAR) has been prepared and will be submitted to the Planning Authority with the planning application.	An Appropriate Assessment Screening report submitted with this application found that the proposed development will not have a significant effect on any Natura 2000 site.

The Fingal County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same potential Zone of Influence of the Overall Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the Overall Development area and surrounding townlands in which the Overall Development site is located, would be avoided.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the consenting authority requirement with regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard.

There are no predicted in-combination effects given that it is predicted that the Overall Development will have no effect on any European site, after standard mitigation measures outlined above are applied.

Any new applications for the Proposed Development area will be assessed on a case by case basis *initially* by Fingal County Council which will determine the requirement for AA Screening and AA, where appropriate.

## 4. Natura Impact Statement & Conclusion

This NIS has considered and assessed the predicted impacts arising from the Overall Development and found that with the implementation of appropriate mitigation measures specifically with regard to surface water, during construction, there will be no adverse effects on the integrity of the Malahide Estuary SAC or Malahide Estuary SPA.

It is the conclusion of this NIS, on the basis of the best scientific knowledge available, and with the implementation of the mitigation and restriction measures set out under Section 3.6. that the possibility of any adverse effects on the integrity of the European Sites considered in this NIS (having regard to their conservation objectives) arising from the Overall Development, either alone or in combination with other plans or projects, can be excluded beyond reasonable scientific doubt.

## 5. References

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NPWS (2019) The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

NPWS (2022) National Parks and Wildlife Service Metadata available online at <https://www.npws.ie/maps-and-data>

Office-of-the-Planning-Regulator (2021) Appropriate Assessment Screening for Development Management OPR Practice Note PN01. March 2021

## **APPENDICES**

**Appendix 1 Data Centre Outline Construction Environmental Management Plan Prepared by CSEA**

**Appendix 2 220kV Substation Construction Environmental Management Plan Prepared by AECOM**



**Appendix 1**

**Data Centre Outline Construction Environmental Management Plan**

**Prepared by CSEA**



**Clifton Scannell Emerson**  
Associates

# Outline Construction Environmental Management Plan

## Huntstown Data Centre Facility

**energia**  
group

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Client: Huntstown Power Company  
Ltd.

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Date: 5<sup>th</sup> March 2021

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Job Number: 20\_099

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Civil  
Engineering

Structural  
Engineering

Transport  
Engineering

Environmental  
Engineering

Project  
Management

Health  
and Safety

CONSULTING ENGINEERS



## Document Control Sheet

Project Name: Huntstown Data Centre Facility  
Project Number: 20\_099  
Report Title: Outline Construction Environmental Management Plan  
Filename: 20\_099-CSE-00-XX-RP-C-004

Issue No.	Issue Status	Date	Prepared by	Checked by
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1.3	DRAFT	25/07/2021	PM	CD
1.4	FINAL	04/08/2021	PM	CD

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## 1 INTRODUCTION

This Outline Construction Environmental Management Plan (CEMP) has been prepared by Clifton Scannell Emerson Associates (CSEA) on behalf of Huntstown Power Company Ltd. in support of a planning application to Fingal County Council for planning permission for the proposed development of a greenfield site of approximately 13.3 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

This Outline CEMP defines the approach to environmental management at the site during the construction phase. It provides a basis for achieving and implementing the construction related mitigation measures identified in the Environmental Impact Assessment Report (EIAR) and promotes best environmental on-site practices for the duration of the construction phase.

The outline CEMP provides a framework from which a final CMP (Construction Management Plan) will be developed to avoid, minimise or mitigate any construction effects on the environment prior to commencement on site.

The contractor will prepare specific method statements, which should identify perceived risks to the environment and detail mitigation measures to be employed which will negate the risk to the environment.

The main issues that have been considered within this document are as follows;

- Description of works;
- Construction programme and phasing;
- Site logistics;
- Workforce;
- Public relations and community liaison;
- Construction traffic and access; and
- Safety, health and environmental management.

Preparation of the final CEMP should comply with the Mitigation Measures presented in the EIAR and all additional measures, as outlined in the decision of the Planning Authority, may be added to following consultation with relevant consultees in preparation of specific method statements prior to commencement of works.

## 2 DESCRIPTION OF THE PROJECT

### 2.1 Subject Site Characteristics

The subject site is located to the north west of the M50 orbital ring in the townland of Huntstown, North Road, Finglas, Dublin 11. The overall site extends to over 13.3 ha. of mainly greenfield (agricultural) lands located within the administrative area of Fingal County Council (Blanchardstown Division).

The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Anaerobic Digestion Plant, to the east by the North Road (R135) and two residential properties fronting the R135 which form part of the subject site and to the west by Huntstown Power Station.

A number of large logistics warehouse parks are located to the north east of the site including Dublin Airport Logistics Park and Vantage Business Park, Coldwinters, granted under Ref. F17A/0769 and further amended under Refs. FW19A/0053 and FW20A/0044. Several small scale commercial and service uses are scattered along the frontages of the R135 including: a garden centre; veterinary clinic and car repair facility.

The greenfield site is free from development. The topography of the site falls slightly in an east west direction (77.5AOD - 79.5AOD). An archaeological feature is identified south of the northern site boundary. A series of hedgerows are located throughout the site including the site perimeter. There are no known protected structures on site, nor is the site located within an architectural conservation area.

A drainage ditch located on the western site boundary separates the subject site from the adjoining Huntstown Power Plant. A set of 110kv and 38kv overhead lines traverse the site in a north - south direction connecting to the Finglas 220Kv substation complex to the south east of the site. The overhead lines are subject of the separate planning application which proposes the undergrounding of lines and removal of lattice towers and polesets to facilitate future development the site.

The subject site is highly accessible to the national road network and is located less than 1km from the M50/N2 interchange and approximately 0.1km from the Coldwinters exit on the N2. The site is directly accessible from the R135 via a service road to the south leading to Huntstown Quarry and Power Station.

The subject site is identified in Figure 2.1 overleaf.



Figure 2.1: Aerial View showing the site outlined in red.

## 2.2 Description of Characteristics of the Proposed Development

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Fig 2.2 below.

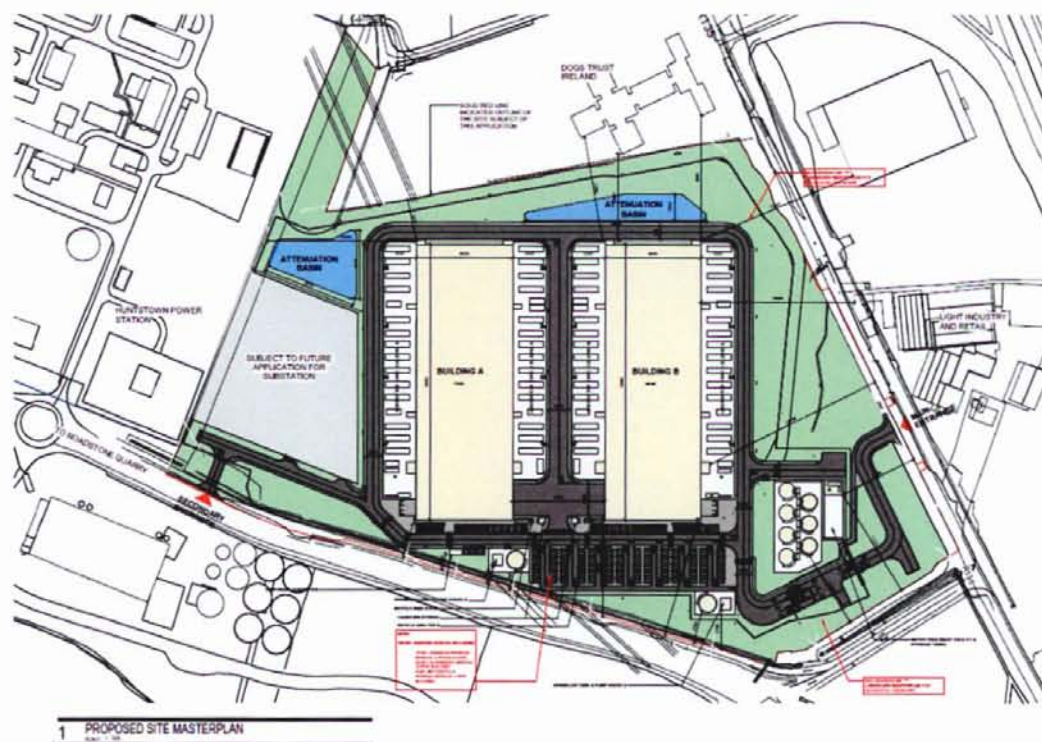


Figure 2.2 – Proposed Site Masterplan

The proposed development is described as follows:

Huntstown Power Company Limited intend to apply for a 10 year permission for development at this site of c.13.3ha on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11. The development will consist of the following:

- Demolition of 2 no. existing residential dwellings and ancillary structures to the east of the site (c.344sqm total floor area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;
- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m<sup>3</sup> and c.6.35m high), 2 no. sprinkler tanks (c.670m<sup>3</sup> each and c.7.2m high) with 2 no. pump houses each (c.40sqm c. 6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing up to c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no. bicycle spaces, 208 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.



### 3 CONSTRUCTION PROGRAMME AND PHASING

The Proposed Development will be built on a phased basis to meet customer demand with the following estimated timelines. Note that a construction overlap period is assumed for the two buildings, such that first building developed will be in its final fit out phase when the second building is at peak construction.

#### **Proposed Development/Construction of the First Building:**

- Construction Start – Q3 2021
- Commence Operation of first data storage room – Q1 2024
- Full Operation – Q1 2025

#### **Indicative Development/Construction of the Second Building:**

- Construction Start – Q1 2024
- Commence Operation of first data storage room – Q4 2026
- Full Operation – Q4 2027

#### **HV Substation:**

- Construction Start – TBC\* (subject to separate SID application)
- Construction Complete – TBC\* (subject to separate SID application)

\*Subject to Grant of Planning it is assumed that construction will run in parallel to the First Building being developed.

#### **Site Preparation**

It is proposed that the accesses and haul roads for vehicles, the contractors' compound and fencing will be established for the proposed development utilising the existing entrance from the R135 road as the primary construction entrance for this development.

The construction compound will facilitate office, portable sanitary facilities, equipment storage, parking etc. for contractors. It will be used for the duration of the works.

The primary activities that will be required during the site preparation phase for the development will be site clearance, excavations and levelling of the site to the necessary base level for construction, surveying and setting out for structures and any rerouting of services/connections to services.

A combination of excavators, trucks and other soil shifting plant will commence the main site clearance and levelling aspects.

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## **Building Construction Works**

### *Foundations and Structure*

Following the completion of site clearance and levelling, all structures will require foundations to the structural engineers specifications. Building structures will comprise of standard structural steel frames.

It is anticipated that foundations will require moderate scale excavations. Local minor dewatering may be required during excavation works and groundworks.

### *Levelling/Cut and Fill*

It is predicted that the majority of the cut material generated during site preparation/levelling (6,306 m<sup>3</sup>) will be reused to form landscaping berms on site. In addition, topsoil (29,311m<sup>3</sup>) will also be stripped from the site and may also be used in the landscaping berms.

Circa 81,929m<sup>3</sup> fill will be required to facilitate construction of the proposed roads, car parks, buildings and landscaping berms. It is assumed that the majority (but not all) of the topsoil/cut material will be re-used on site with some export required with final estimates to be refined at a later date.

Contractors will be required to submit and adhere to a method statement (including the necessary risk assessments) and indicating the extent of the areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.

Any temporary storage of spoil required will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc.

### *Building Envelopes and Finishes*

The outer finishing of the building envelopes are intended to be of a high quality and appearance as per the architects drawings.

### *Roads, Services and Landscaping*

Sections of the internal road system will be completed as part of the Building A permitted development as detailed on the architects phasing drawings.

Landscaping will be undertaken in accordance with the landscape plan for the proposed development.

## 4 EXCAVATION

### 4.1 *Archaeological and Architectural Heritage*

An archaeo-geophysical survey followed by a preliminary programme of archaeological testing has been undertaken for the site. These studies identified the probable remains of an oval enclosure with a possible entranceway to the south. Within the enclosure are numerous responses and trends, most likely representing the remains of pits and ditches. To the east of the enclosure is another curvilinear ditch-type response and numerous trends, suggesting a possible outer ditch and associated field system. External to the enclosure ditch, one curvilinear feature and eight linear features were identified that may be related to an outer enclosure and associated field system. An isolated pit, possibly unrelated to the activity associated with the enclosure, was identified c. 50m to the southeast of the main area of activity. The composition of the fill of this pit was similar to that found in burnt mound activity. No evidence of an associated burnt mound was identified, so it is possible that this feature had a "pot boiler" type function.

A further, more detailed programme of pre-development archaeological testing and the subsequent excavation of features, deposits or structures identified (under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht) is currently being undertaken by AMS Ltd. to fully assess the potential for archaeological remains across the development site.

Archaeological excavation and preservation by record of features, deposits or structured identified is recommended, under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. This covers the archaeological features encountered to date and potential further archaeological features encountered during the programme of further testing. Further detail is provided within Chapter 12 of the Environmental Impact Assessment Report (EIAR) submitted with this application.

### 4.2 *Ground Condition*

Ground works will be required to clear the site and to facilitate construction of building foundations, access roads, the installation of utilities and landscaping. The Land, Soils, Geology & Hydrogeology Chapter of the EIAR (Chapter 6) details the existing ground conditions at the site and provides a summary of the anticipated stratigraphy of the soil beneath the site.

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services and landscaping will require 81,929 m<sup>3</sup> of fill material. Some existing topsoil/cut material may be able to be re-used as fill or as topsoil in landscaped areas with estimates to be refined at a later date.

Any surplus material that requires removal from site for offsite reuse, recovery and/or disposal and any potentially contaminated material (in the unlikely event that it is encountered), should be segregated, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous* using the *HazWasteOnline* application (or similar approved classification method). If the material is to be disposed of to landfill, it will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* and landfill specific criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.

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**Clifton Scannell Emerson**  
Associates

The surplus soils and stones may be suitable for acceptance at either inert or non-hazardous soil recovery facilities/landfills in Ireland or, in the event of hazardous material being encountered, be transported for treatment/recovery or exported abroad for disposal in suitable facilities.

## **5 SITE LOGISTICS**

### **5.1 Site Establishment and Security**

The site office and welfare facilities will be situated on site at an agreed location within the site boundary.

All of the sub-contractors as well as the main contractor and project managers will occupy offices in the same area. The site parking for staff, contractors and visitors will also be located in this area. It is proposed to provide 200 spaces on site for parking with up to 500 no. offsite parking spaces being made available at a suitable location such as the Dublin Airport Authority Surface Car Parks (subject to separate agreement). Allowing for a car occupancy of 1.5 average this provides parking for 1,050.

### **5.2 Consents and Licences**

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. These will include, but are not limited to:

- Site notices;
- Construction commencement notices; and
- Licence to connect to existing utilities and mains sewers, where required.
- Road opening licences.

### **5.3 Service and Utilities**

Welfare facilities (canteens, toilets etc.) will be available within the construction compound on site. Temporary connections to the existing estate services in the existing estate road will be utilised to provide service and utilities subject to relevant applications and approvals.

### **5.4 Material Handling and Storage**

Key materials will include, steel structure, concrete, cladding, ducting and piping. A 'Just in Time' delivery system will operate to minimise storage of materials, the quantities of which are unknown at this stage.

Where possible it is proposed to source general construction materials from the surrounding area to minimise transportation distances.

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles in a secure compound area within the contractors' compound on site. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications) to prevent spillage.

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries/trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway.

The majority of construction waste materials generated will be soil from excavation works. Soil requiring removal offsite will be removed from site regularly to ensure there is minimal need for stockpiling.

## **5.5 Visitor Management**

Visitors will only be allowed to enter the main site compound at the eastern boundary of the site from the R135 Road or via designated pedestrian access gates. A dedicated, secured footpath to the security office is established at the gate for registration and obtaining PPE prior to entering the site. A log will be maintained by security to control access to the site. Visitors will be required to attend a site-specific induction to allow access to the site unless being accompanied by an inducted member of the site team.

Visitors will then be taken by an inducted member of the construction team to the required area of the site.

## **5.6 Site Working Hours**

Construction of the proposed development would take place over a period of approximately 75 months from the commencement of construction for site development works.

Majority of works are to be done off-road within the site boundary, with the exception of service connections which will be done under licence from the Local Authority and Utility providers.

During the off-road section of works, construction staffing personnel will arrive prior to 07.00am to mitigate against traffic peak. Site development and building works shall be carried out only between the hours of 08.00 to 19.00 Mondays to Fridays inclusive, between 08.00 to 14.00 on Saturdays.

Deviation from these times will only be allowed in exceptional circumstances where prior written approval has been received from Fingal County Council. Such approval may be given subject to conditions pertaining to the particular circumstances being set by Fingal County Council.

## **5.7 Employment and Management Workforce**

Construction traffic would consist of the following:

- Private vehicles belonging to site construction staff;
- Private vehicles belonging to site security staff;
- Occasional Private vehicles belonging to professional staff (i.e. design team, utility companies);
- Construction material delivery;  
and
- Excavation plant and dumper trucks used for site development works.

It is anticipated that the worst case construction traffic impact for the proposed development would occur in Q4 2022, when Building A is at peak construction.

Construction traffic has been estimated using data obtained from a similar data centre facility development that used a similar construction methodology to the current development. The following construction data has been used to estimate peak daily construction traffic:

- Average construction staff for one data centre facility: 600;
- Peak construction staff for one data centre facility: 1,050;
- Average cars/ day for one data centre facility: 400 with max 200 on site – shared with Sub-Station Development. Construction of the latter managed to ensure they do not peak at the same time;

- Peak cars/day for one data centre facility: 700.
- Peak HGVs/day for one data centre facility: 110; and
- Peak LGVs/ day for one data centre facility: 30.

All employees working on the site will be required to have a Safe Pass Card (or similar approved Construction Health & Safety card), manual handling training and the necessary certificates to operate machinery, as required. The details of training required, records maintained, and induction procedures will be outlined in the Main Contractor's Health and Safety Plan(s).

## 6 CONSTRUCTION TRAFFIC AND SITE ACCESS

During construction of the proposed development, construction traffic will travel to and from the site via the construction site access located on the east section of the site. It is expected that the origins and destinations of construction traffic will continue to match the distribution of traffic currently using the surrounding road network with the majority of construction traffic via the N2 National Road. As noted in Section 5.1 a total of 500 car parking spaces will be provided off-site at the Dublin Airport Authority Surface Car Parks (subject to agreement) or other suitable location in order to minimise traffic movements to and from the site.

The following measures will be put in place during the construction works:

- The contractor will be required to provide wheel cleaning facilities, and regular cleaning of the main access road;
- Temporary car parking facilities for the construction workforce will be provided within the site and the surface of the car park will be prepared and finished to a standard sufficient to avoid mud spillage onto adjoining roads;
- Monitoring and control of construction traffic will be ongoing during construction works. Construction Traffic Management will minimise movements during peak hours.
- Construction Traffic routes minimising traffic impact on surrounding residential development will be used by construction vehicles.
- Provide off-site car parking in Dublin Airport Authority Surface Car Parks.

### **Traffic Queueing**

Material deliveries and collections from site will be planned, scheduled and staggered to avoid any unnecessary build-up of construction works related traffic.

### **Site Hoarding and Security Fencing**

Security fencing will be established around the site compound.

Site access will be restricted by dedicated security personnel who will check all incoming and outgoing vehicles and workers.



## 7 SAFETY, HEALTH AND ENVIRONMENTAL CONSIDERATIONS DURING CONSTRUCTION WORKS

The appointed main contractor will be required to prepare a Construction Health & Safety Plan which will be put in place prior to commencement of the works. At a minimum, this plan will include:

- *Construction Health & Safety training requirements;*
- *Induction procedures;*
- *Emergency protocols; and*
- *Details of welfare facilities.*

### 7.1 Air Quality

This section describes the site policy with regard to dust management and the specific mitigation measures which will be put in place during construction works. The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following measures have been formulated by drawing on best practice guidance from Ireland, the UK and the US, such as:

- 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014);
- 'Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings' (The Scottish Office, 1996);
- 'Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance' (UK Office of Deputy Prime Minister, 2002);
- 'Controlling Particles, Vapours & Noise Pollution From Construction Sites' (BRE, 2003);
- 'Fugitive Dust Technical Information Document for the Best Available Control Measures' (USEPA, 1997); and
- 'Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition' (periodically updated) (USEPA, 1986).

#### Site Management

The site activities will be undertaken with due consideration of the surrounding environment and the close proximity of sensitive receptors such as watercourses, residents and pedestrians. Dust management during the construction phase will be the most important aspect in terms of minimising the impacts of the project on the surrounding air quality. The following measures will also be implemented to ensure impacts are minimised:

- Complaint registers will be kept detailing all telephone calls and letters of complaint received in connection with construction activities, together with details of any remedial actions carried out;
- Equipment and vehicles used on site will be in good condition such that emissions from diesel engines etc. are not excessive; and
- Pre-start checks will be carried out on equipment to ensure they are operating efficiently and that emission controls installed as part of the equipment are functional.

#### Dust Control Measures

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design, planning and effective control strategies. The siting of construction activities and the limiting of stockpiling will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust

nuisance. In addition, good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures quickly before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (UK Office of Deputy Prime Minister (2002), BRE (2003)). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent will monitor the contractors' performance to ensure that the proposed mitigation measures are implemented, and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board will also include head/regional office contact details;
- Community engagement shall be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein; and
- The procedures put in place will be reviewed at regular intervals and monitoring conducted and recorded by the principal contractor. It is recommended that reviews are conducted on a monthly basis as a minimum.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

### **Site Roads**

Site access routes (particularly unpaved routes) can be a significant source of fugitive dust from construction sites if control measures are not in place. The most effective means of suppressing dust

emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25% to 80%.

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles;
- Bowzers will be available during periods of dry weather throughout the construction period. Research shown found that the effect of surface watering is to reduce dust emissions by 50%. The bowser will operate during dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible; and
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

### **Land Clearing/Earth Moving**

Land clearing/earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

The movement of truck containing materials with a potential for dust generation to an off-site location will be enclosed or covered.

### **Stockpiling**

The location and moisture content of rubble stockpiles are important factors which determine their potential for dust emissions. The following measures will be put in place:

- Overburden material will be protected from exposure to wind by storing the material in sheltered parts of the site, where possible stockpiles should be located downwind of sensitive receptors;
- Regular watering will take place during dry/windy periods to ensure the moisture content is high enough to increase the stability of the soil and suppress dust;
- There will be no storage of soil along the cable route; and
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

### **Site Traffic on Public Roads**

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash; and
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.

### **General**

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory management of dust by the construction contractor.

The key features with respect of dust control will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

## **7.2 Ecology**

The proposed development will have a neutral imperceptible effect on designated sites within the zone of impact of the development site. The proposed development is located in an area of low ecological value and as such predicted to have a neutral imperceptible effect on biodiversity. A full assessment of the ecology has been undertaken and is included in chapter 8 of the EIAR.

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March 1<sup>st</sup> to August 31<sup>st</sup>. If this cannot be enforced then the site will be surveyed for the presence of nesting birds and/or nests prior to cutting and if none are recorded the vegetation may be removed within 48 hours.

Mature trees, which are to be removed, shall be felled in the period early September to late October, or early November, in order to avoid the disturbance of any roosting bats as per Transport Infrastructure Ireland (TII and formerly the National Roads Authority) guidelines (NRA 2006a and 2006b). Tree felling shall be completed by Mid-November at the latest because bats roosting in trees are vulnerable to disturbance during their hibernation period (November – April). Ivy-covered trees, once felled, shall be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight.

A bat specialist will survey the trees to be felled for roosting bats prior to felling and will provide detailed measures for any roosts found at that time.

The mature trees that are to be removed, should, due to the passage of time, again be surveyed for bat presence by a suitably experienced specialist on the day of felling. If several bats are found within any one tree, that specific tree should be left in-situ while an application for a derogation licence is made to the National Parks and Wildlife Service to allow its legal removal.

The trees identified as having potential for use by bats should be felled carefully to avoid hard shocks which may injure any bats within. Large mature trees with bat roosting potential such as those onsite should essentially be felled by gradual dismantling by tree surgeons. Care should be taken when removing larger branches as removal of loads may cause cracks or crevices to close, crushing any animals within. Such cracks should be wedged open prior to load removal. If single bats are found during tree felling operations, they should be transferred to the previously erected bat boxes onsite (see below).

Loss of linear habitats within and surrounding the site will be partially compensated for by the provision of alternative linear habitats around the site boundary to ensure connectivity with surrounding ecological

corridors. It is predicted that there would be a loss of c. 730m of internal hedgerow and that c. 1.7 km of hedgerow would be retained and conserved in situ.

In order to minimise the extent of light spill onto perimeter habitats, all lights that are pole mounted will be directional and/or cowled to ensure that light is directed downward and inwards. Lights will be programmed or otherwise to be off unless required.

### **7.3 Noise and Vibration**

Noise impacts arising from earthworks and construction activities have the potential to cause annoyance or nuisance to local residents in the area.

The earthworks will generate typical construction activity related noise and vibration sources from use of a variety of plant and machinery such as rock breakers (where required), excavators, lifting equipment, dumper trucks, compressors and generators.

The noise limits to be applied for the duration of the infrastructure works are those specified in the B Category of BS 5228. This has been discussed as part of the EIAR – Chapter 10, Noise and Vibration and all relevant mitigation measures are to be implemented.

It should be noted the Contractor shall liaise with the operators of the Dog's Trust site to the north in order to manage impacts during the construction phase.

Vibration limits to be applied for the infrastructure works are those specified in BS 5228 – code of practice for noise and vibration control on construction and open sites. This has been discussed as part of the EIAR – Chapter 10, Noise and Vibration and all relevant mitigation measures are to be implemented.

Any noise complaints related to activities at the site will be logged and investigated and, where required, measures taken to ameliorate the source of the noise complaint.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. excavation close to a property, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

All works on site shall comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities.

In general, the contractor shall implement the following mitigation measures during the proposed infrastructure works:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul roads well maintained and avoid steep gradients.
- Minimise drop height of materials.
- Start-up plant sequentially rather than all together

More specifically the Contractor shall ensure that:

- In accordance with "Best Practicable Means", plant and activities to be employed on site are reviewed to ensure that they are the quietest available for the required purpose.
  - Where required, improved sound reduction methods are used e.g. enclosures.
-

- Site equipment is located away from noise sensitive areas, as much as physically possible.
- Regular and effective maintenance by trained personnel is carried out to reduce noise and / or vibration from plant and machinery.
- Hours are limited during which site activities likely to create high levels of noise and vibration are carried out.
- A site representative responsible for matters relating to noise and vibration will be appointed prior to construction on site.

Reference Chapter 10 of the EIAR for further guidance on the management of noise and vibration.

## **7.4 Waste Management**

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment.

Chapter 15 of EIA Report contains a detailed description of waste management relating to construction of the proposed development. A site-specific Construction and Demolition Waste Management Plan is included as Appendix 15.1 of the EIA Report. The C&D Waste Management Plan has been prepared in accordance with the Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG & NCDWC, 2006). This C&D Waste Management Plan will be refined and updated in advance of the works to ensure best practice is followed in the management of waste from the proposed development.

Adherence to the C&D Waste Management Plan prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2011 as amended 7, associated Regulations 7, the Litter Pollution Act of 1997 as amended 8 and the Eastern-Midlands Region Waste Management Plan 2015 – 2021 9, and achieve optimum levels of waste reduction, re-use and recycling.

The following mitigation measures will be implemented during the construction phase:

- Building materials will be chosen with an aim to 'design out waste';
- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery – it is anticipated that the following waste types, at a minimum, will be segregated:
  - Concrete rubble (including ceramics, tiles and bricks);
  - Plasterboard;
  - Metals;
  - Glass; and
  - Timber.
- Left over materials (e.g. timber off-cuts, broken concrete blocks/bricks) and any suitable construction materials shall be re-used on-site, where possible;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site;
- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably banded areas, where required);

- A waste manager will be appointed by the main contractor(s) to ensure effective management of waste during the excavation and construction works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered where possible to avoid material designated for disposal;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licenced facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

The management of all hazardous waste materials, if they occur, shall be coordinated in liaison with Health and Safety Management.

#### **7.4.1 Waste Minimisation**

Waste minimisation measures proposed are summarised as follows:

- Materials will be ordered on an 'as needed' basis to prevent over supply;
- Materials will be correctly stored and handled to minimise the generation of damaged materials;
- Materials will be ordered in appropriate sequence to minimise materials stored on site; and
- Sub-contractors will be responsible for similarly managing their wastes.

All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste.

#### **7.4.2 Waste Storage**

A dedicated and secure compound containing bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities are to be stored, is to be established within permitted site compound.

Waste materials generated will be segregated on at the site compound, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

The site construction manager will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

#### **7.4.3 Responsibility**

It will be the responsibility of the construction manager to ensure that a written record of all quantities and natures of wastes removed from the site are maintained on-site in a waste file (in hardcopy or electronically).

It is the responsibility of the project manager or his/her delegate that all contracted waste haulage drivers hold an appropriate waste collection permit for the transport of waste loads and that all waste materials are delivered to an appropriately licenced or permitted waste facility in compliance with the relevant Regulations.

The contractor, as part of regular site inspection audits, will determine the effectiveness of the waste management strategy and will assist the project manager in determining the best methods for waste minimisation, reduction, re-use, recycling and disposal as the construction phase progresses and waste materials are generated.

Prior to commencement of the excavation and construction activity and removal of any waste off-site, details of the proposed destination of each waste material will be provided to the local authority.

## **7.5 Surface Water Management**

Run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations (up to 3m) during and after heavy rainfall events to ensure that the trenches are kept relatively dry.

Mitigation measures that will be put in place during the construction phase to ensure protection of surface waterbodies are detailed in Section 7.6.2 of Chapter 7 (Hydrology) of the EIA Report.

These measures are in compliance with the following relevant CIRIA guidance documents:

- CIRIA, (2001), *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532)* Construction Industry Research and Information Association;
- CIRIA (2002) *Control of water pollution from construction sites: guidance for consultants and contractors (SP156)* Construction Industry Research and Information Association;
- CIRIA (2005), *Environmental Good Practice on Site (C650)*; Construction Industry Research and Information Association;
- BPGCS005, *Oil Storage Guidelines*;
- Eastern Regional Fisheries Board, (2006), *Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*;
- CIRIA 697 (2007), *The SUDS Manual*; and
- *UK Pollution Prevention Guidelines, (PPG)* UK Environment Agency, 2004.



## 8 SUMMARY

This Outline CEMP sets out the overall management strategy for construction works for the proposed development.

The Outline CEMP aims to ensure the management of construction activity is carried out in a planned, structured and considerate manner which minimises the impacts of the works on the local environment, residents and commercial activities in the vicinity of the site. Due to the nature of construction works, there may be unforeseen events which occur at the site and the project team will actively manage any changes and discuss with the relevant authorities, where required. The Outline CEMP will form a basis for the CEMP to be developed by the Contractor. The CEMP will form a live document which will be updated as and when required.

The project team are committed to ensuring that the construction activities to be carried out are pro-actively managed to minimise potential impacts.

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**Appendix 2**

**220kV Substation Construction Environmental Management Plan**

**Prepared by AECOM**

# Construction Environmental Management Plan

Mooretown 220 kV Substation  
Huntstown Power Company Limited  
60641561-REP-740

14 September 2021

### Quality information

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# 1 Introduction

This Outline Construction Environmental Management Plan (CEMP) has been prepared by AECOM on behalf of Huntstown Power Company Limited in support of a planning application to An Bord Pleanála (ABP). The substation development is a new 220kV GIS electrical substation and associated grid connection. The substation development is located on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

This Outline CEMP sets out the approach to environmental management, environmental work practices and management responsibilities at the site during the construction phase. The primary aim of a CEMP is to reduce the effects from construction on the environment by avoiding, minimising, or mitigating any construction effects on the environment, and to promote best environmental on-site practices for the duration of the construction phase.

The Outline CEMP would form part of the Contract Documents for the construction stage. In this context, the values and information presented herein is subject to change and refinement through the selection of the contractor and the delivery of the proposed development, and in line with planning conditions and any surveys and reports produced for the proposed development.

This Outline CEMP will be further refined and expanded upon by the appointed contractor (hereafter referred to as the Contractor) into a full Contractor CEMP should the substation development receive planning permission. The elements contained within this Outline CEMP will be included in the Contractor's CEMP, which will be prepared prior to construction by the Contractor and approved by the appropriate planning authority. The Contractor's CEMP should be treated as a live document requiring regular review and revision throughout the lifecycle of the substation development and would be subject to amendment as and when additional content becomes available.

The outline CEMP and the final Contractors CEMP will provide a basis for achieving and implementing construction related mitigation measures as outlined within a number of documents produced for the substation development. Preparation of the Contractors CEMP should comply with the Schedule of Mitigation Measures presented in the Environmental Impact Assessment Report (EIAR) produced for the substation development, any planning conditions that may result following the planning process, any additional mitigation measures outlined within standalone environmental reports produced for the substation development and the adjoining data centre.

In addition to the Contractors CEMP, the Contractor will prepare specific method statements, which should identify perceived risks to the environment and detail mitigation measures to be employed which will negate the risk to the environment.

At the end of the construction phase, the Contractor will prepare a Handover Environmental Management Plan (HEMP) that will contain essential environmental information needed by the bodies responsible for the future maintenance and operation of the asset.

## 1.1 Scope

The main issues that have been considered within this document include.

- Environmental Management
- Construction Works
- Site Logistics
- Construction Traffic and Site Access
- Safety, Health and Environmental Considerations including:
  - Air Quality and Climate
  - Ecology
  - Noise and Vibration
  - Archaeology and Architectural Heritage
  - Land and Soils
  - Water
  - Waste Management

## 2 Description of the Project

The development by Huntstown Power Company Limited located at Huntstown, Co. Dublin involves the construction of a new electrical substation and associated grid connection (known as Mooretown Substation), which will serve the site including the proposed data storage facility development once completed, as well as any future development on the wider landholding.

The substation development consists of the following:

- A new 2 story 220 kV Gas Insulated Switchgear (GIS) substation constructed to EirGrid standards, comprising cable pit/entry room, generator room, relay room, battery room, workshop, toilet, storeroom, mess room, hoist space, stair cores and circulation areas.
- The rerouting, of 220 kV feeder cables from Huntstown 1 & 2 to the new 220 kV GIS.
- The rerouting, of 220 kV feeder cables to Finglas 220 kV and Corduff 220 kV.
- The installation of 4 x 220 kV circuits to feed the data centre transformers and the installation of 4 x 220 / 20 or 33 kV transformers, to feed the data centre.
- All associated and ancillary site development and construction works, services provision, drainage works, connections to the substations, all internal road/footpath access routes, landscaping and boundary treatment works, vehicular access onto the private road to the south of the site and provision of car parking spaces in the substation compound.

The compound includes 4 no. 220 kV/mv transformers, 5 no. mv switchgear/control buildings, series coil, 4 no. cable trenches, fire walls, and lightning monopoles. The compound is surrounded by a c. 2.6 m high palisade fence and EirGrid post and rail fence (approximately 1.4m high).

One of the underground cables will follow a route originating at the proposed Mooretown Substation extending south and then west along a private road connecting the North Road with Huntstown Power Station and Huntstown Quarry. The route terminates at a proposed joint bay on the existing Cloghran cable route.

The second underground cable will follow a route originating at the proposed Mooretown Substation Compound/series coil extending south along the internal road connecting the North Road with Huntstown Power Station and Huntstown Quarry. The route terminates at a proposed joint bay on the existing Finglas cable route. The development also includes the removal of the 220 kV Corduff cables and 220 kV Finglas cables serving the existing AIS building to Huntstown Power Station.

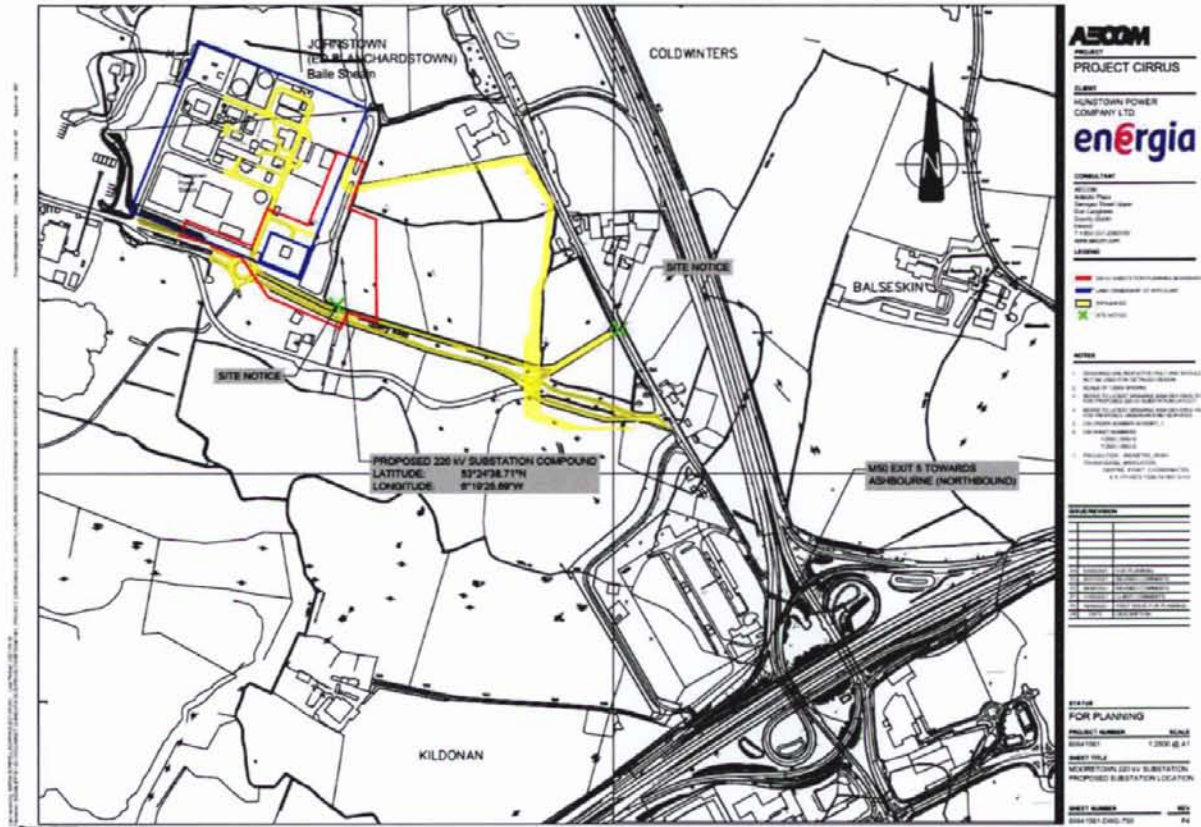


Figure 2-1 Location of the substation development showing the planning boundary (red)

## 3 Resources

Several surveys have been carried out for the adjoining data centre which also included the lands upon which the substation will be constructed (should planning permission be granted). These surveys and the mitigation outlined within (where relevant) should be adhered to by the Contractor and incorporated into the Contractors CEMP. Surveys carried out included but were not limited to

- Landscape Works and Maintenance Specification
- Amphibian survey Prepared by Triturus Environmental Ltd.
- Tree Survey Report prepared by Rik Pannett - Arboriculture Consultant
- Bat Survey Report prepared by Eire Ecology
- Geophysical Survey Report prepared by J. M. Leigh Surveys Ltd.
- Archaeological Assessment prepared by IAC

An EIAR has also been produced for the substation development and the mitigation measure outlined within will be included within the Contractors CEMP by the Contractor.

## 4 Environmental Management

### 4.1 Roles and Responsibilities

The key contractor team roles and responsibilities common to most sites are outlined in Table 4-1. These roles are indicative only and will be updated by the Contractor in the Contractor CEMP.

**Table 4-1 Key Contractor Team Roles and Responsibilities (indicative)**

Role	Responsibilities
Contractor's Project Director	<ul style="list-style-type: none"><li>▪ Assign specific environmental duties to competent members of the Contractor's Team.</li><li>▪ Identify the environmental training needs of personnel under their control and arrange appropriate training programmes and ensure records are being maintained.</li><li>▪ Ensure that significant environmental aspects identified for the Project are managed.</li><li>▪ Promote the continual improvement of environmental performance</li></ul>
CEMP Coordinator (CEMPC)	<ul style="list-style-type: none"><li>▪ Develop, maintain, and audit the CEMP (and supporting documents/plans) to ensure all aspects, impacts and statutory requirements etc. are reflected in the CEMP.</li><li>▪ Develop and implement a programme of regular Project environmental inspections, monitoring, recording, and reporting by the Environmental Site Representative(s) in accordance with procedures set out in the CEMP.</li><li>▪ Ensure that the works are constructed in line with the CEMP.</li><li>▪ Liaise with statutory authorities.</li><li>▪ Attend regular construction meetings to ensure environmental issues are discussed and addressed by the Contractor's Team.</li><li>▪ Liaise with relevant authorities/environmental bodies and the local community as required.</li><li>▪ Comply with duties under relevant legislation and company procedures in relation to environmental incident investigation and reporting.</li><li>▪ Provide support and training to the workforce with regard to understanding environmental aspects, impacts, regulatory requirements, best practice, constraints, and methods of working.</li><li>▪ Nominate the Environmental Site Representative(s).</li><li>▪ Appoint environmental specialists as required.</li></ul>

Role	Responsibilities
Contractor's Project Manager	<ul style="list-style-type: none"> <li>▪ Ensure identified environmental specialists are in attendance on-site as required by the CEMP.</li> <li>▪ Review non-conformance reports provided by the Environmental Site Representative(s) to identify any underlying issues or patterns to identify suitable ameliorative measures</li> </ul>
Site Manager	<ul style="list-style-type: none"> <li>▪ Ensure that the CEMP is produced, maintained, implemented, and distributed to all relevant parties.</li> <li>▪ Provide an on-call 24hr resource as a first point of contact for environmental issues/incidents.</li> <li>▪ Monitor the completion of corrective actions by the Site Manager and act as required to expedite completion.</li> <li>▪ Provide regular reports to the GCC on environmental performance, including details of any identified incidents or non-conformances and corrective actions.</li> <li>▪ Ensure that all personnel for whom they are responsible are aware of the CEMP and implement the relevant requirements.</li> <li>▪ Evaluate the competence of all subcontractors and suppliers and ensure that they are made aware of and comply with the CEMP and associated procedures.</li> <li>▪ Establish a consultation and communication system with all relevant stakeholders and interested parties associated with the Project, including employees, partners, sub-contractors, designers and third parties, etc., where relevant.</li> </ul>
Environmental Specialists (i.e. Ecological Clerk of Works (ECoW)	<ul style="list-style-type: none"> <li>▪ Attend site as required to monitor the protection of asset in accordance with the requirements of relevant legislation, the Environmental Impact Assessment Report (EIAR) mitigation measures or mitigation contained within standalone environmental reports produced for the proposed development, the construction contract and the CEMP.</li> <li>▪ Identify potential risks to wildlife and develop suitable control measures.</li> <li>▪ Provide status reports and updates to the Environmental Site Representative(s) in the completion of their activities.</li> </ul>

## 4.2 Complaints

A Complaints Register for internal communication and for receiving, documenting, and responding to environmental complaints from external parties will be established and will be maintained. When a

complaint is received (telephone calls and letters of complaint etc.), the following information must be taken as a minimum:

- Date and time of the complaint are recorded
- Name of complainant (if provided)
- Nature of complaint

A record of and details of the remedial actions carried out will also be documented. All complaints received from external sources and incidents must be reported to the Environmental Co-ordinator and the appropriate site personnel (e.g. Senior Management). Complaints must be dealt with in a timely manner and reported to the client.

### 4.3 Monitoring and Inspections

Environmental focused monitoring and inspection activities will be carried out throughout the lifetime of the project. The frequency of these monitoring and inspection activities will be agreed in advance of construction with the client and would be in line with planning conditions. Additional monitoring and inspection will take place outside of the agreed frequency where an incident occurs or where activities that can have a significant environmental impact are occurring.

Regular site inspections will be undertaken by the Contractor's CEMPC/Environmental Site Representative to monitor compliance with the CEMP and record inspection results. It is anticipated that a daily visual check and a detailed weekly check will be carried out and these records will be available to Fingal County Council (FCC) upon request.

During construction phase the following monitoring measures will be considered:

- Regular inspection of surface water run-off and sediments controls e.g. silt traps will be carried during the construction phase
- Soil sampling to confirm disposal options for excavated soils in order to avoid contaminated run-off
- Regular inspection of construction/mitigation measures will be undertaken e.g. concrete pouring, refuelling etc
- Dust Monitoring and monitoring of dust control measures
- Noise and vibration monitoring and monitoring of noise and vibration control measures
- Surface water monitoring (if required)
- General Housekeeping

### 4.4 Environmental Auditing

Planned and documented audits (including waste and environmental audits) aimed at evaluating the performance of the project will be carried out. The frequency of the audits will be agreed in advance with the client but would be as a minimum as outlined below:

- Weekly site walkover with results presented at the Contractors' regular meetings with the client
- Quarterly waste audit of all waste types and records would be available for review upon request
- The CEMP will be reviewed and audited every 6 months and updated in line with current guidance and legislation
- Dedicated waste audits shall be carried out at a frequency agreed in advance with the client.

# 5 Construction Works

Information on the construction programme is to be added by the Contractor to the Contractors CEMP. This information was not available at the time of preparing the Outline CEMP. It is anticipated the construction programme would be approximately 24 months.

A number of construction activities with general information have been included below however these are to be reviewed and updated by the Contractor prior to construction.

## 5.1 Site Preparation

This section is to be updated by the Contractor once additional information becomes available.

It is proposed that access to the substation development will be from the R135 via a private road into Huntstown Power Station. Fencing and hoarding will be established around the site boundary prior to construction.

The primary activities required during the site preparation phase for the development will be site clearance, excavations, and levelling of the site to the necessary base level for construction, surveying and setting out for structures and any rerouting of services/connections to services.

A combination of excavators, trucks and other soil shifting plant will commence the main site clearance and levelling aspects.

## 5.2 Building Construction Works

This section is to be updated by the Contractor once additional information becomes available. A number of construction activities with general information have been included below however these are to be reviewed and updated by the Contractor prior to construction.

### 5.2.1 Foundations and Structure

The preliminary design incorporates reinforced concrete bases for a 110 kV grid layout. The final base requirements will be designed in accordance with EirGrid functional specifications upon completion of the final electrical design. Transformer bases are to be designed in accordance with SSE specifications.

Following the completion of site clearance and levelling, all structures will require foundations to the structural engineers' specifications. Foundations works will require excavations and local minor dewatering may be required during excavation works and groundworks.

### 5.2.2 Levelling/Cut and Fill

Information on the cut and fill requirements for the Proposed Development are included in Table 5-1. This includes quantities for earthworks such as topsoil strip, quantities for structural infill and quantities for concrete requirements. Importation of fill will only be sourced from suppliers which comply with vetting requirements.

Any temporary storage of spoil will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc. Further information is contained within Sections 8.6, 8.10 and 8.11

Contractors will be required to submit and adhere to a method statement (including the necessary risk assessments) and indicating the extent of the areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.

**Table 5-1. GIS Substation Cut and Fill Requirements (Excluding Customer Compound)**

Cut and Fill Information	m3 / Te
<b>Earthworks</b>	
Mound removal to reduced level 77.7 m AD	8780 m3
Topsoil strip (retain 10% for nominal landscape around the site – remainder removed offsite.) average depth 0.3 m	1490 m3
<b>Infill</b>	
Structural Infill former burn imported stone	950 m3
Structural fill formation to underside of roads/slabs	1670 m3
Roads/Hard standings imported black top and concrete surfaces	1487 m3
Concrete for GIS Substation (foundations and other concrete structures)	640 m3
Concrete for Drainage	120 m3
Concrete Roads & hard standings /other	160 m3
Concrete for Tx base	120 m3
Reinforcement in concrete	145 Te
Structural steel Substation buildings (Does not include equipment and support weights)	244 Te
<b>Total</b>	15896 Te (Average loads 20Te = 795)

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### 5.2.3 Roads, Services and Landscaping

The internal road system will be completed as per the details on the architects/designer's drawings. A temporary hardstanding road will be provided from the main entrance gates to the construction compound along the same route as the permanent internal access road.

Surveys of the public roads will be required before the commencement of works and at various stages of use. Allowances shall be made for repairs and maintenance during the works and upon completion.

A landscape report was produced for the wider data centre development. Landscaping of the Proposed Development will be implemented upon the completion of construction. This section should be updated by the Contractor when more information on landscaping requirements become available.





# 6 Site Logistics

Information on site logistics is to be added/updated by the Contractor to the Contractors CEMP. A number of headings with general information have been included below however these are to be reviewed and updated by the Contractor prior to construction.

## 6.1 Site Establishment and Site Security

The contractors' compound and associated parking will indicatively be located in proximity to the site entrance. The construction compound is likely to include offices and meeting rooms, portable sanitary facilities, equipment storage, changing and drying facilities etc. for contractors and will be used for the duration of the works.

Materials will be stored near their final position on site and the delivery of materials will follow a just in time approach, therefore a dedicated laydown area is not anticipated.

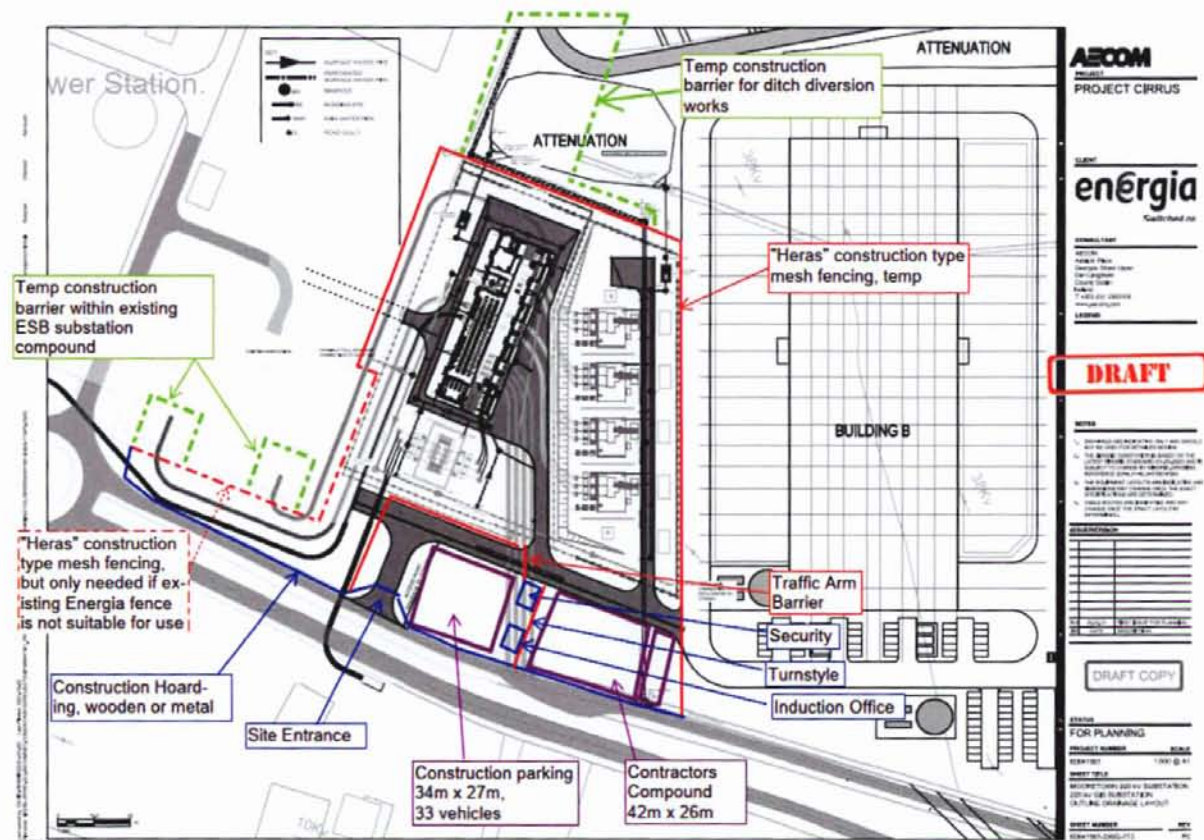


Figure 6-1 Location for the site offices and materials compound (to be added by the contractor)

The Contractor will be responsible for site security for the duration of the works. The main site access area will be manned by security personnel during site opening hours. The need for and nature of out of hours security cover will be determined by the Contractor and its insurer. The need for periodic night-time security patrols or monitored PTZ CCTV will be evaluated by the Contractor.

Contractors responsibilities for site security will include

- ensuring restricted access is maintained to the works
- managing a site induction process/badging for construction staff and visitors
- monitoring and recording all deliveries to site and all materials/waste taken off site
- monitoring the integrity of the temporary construction fencing along the site perimeter boundary

Temporary construction lighting will be provided in the site entrance area, contractors compound and construction vehicle parking area for the purposes of security and safety.

Site security will be located adjacent to the site entrance.

## 6.2 Consents and Licences

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. It will be the responsibility of the Contractor to ensure all consents and licences required are in place prior to the start of construction.

These will include, but are not limited to:

- Site notices
- Construction commencement notices
- Licence to connect to existing utilities and mains sewers, where required
- Abstraction and/or discharge licenses
- Road opening/closure licences.

## 6.3 Service and Utilities

Welfare facilities (canteens, toilets etc.) will be available within the construction compound on site.

The Contractor will require a water source for the duration of the construction works. A temporary connection for water supply from Irish Water will not be requested. Instead a combination of tankered water and bottled water will be used. Water will be required for Contractor welfare facilities and construction activities.

Wastewater generated at the welfare facilities in the construction compound will be managed by means of a temporary sealed storage tank, with all wastewater being tankered off-site to an appropriately licensed facility for disposal.

## 6.4 Material Handling and Storage

A 'Just in Time' delivery system will operate to minimise storage of materials, the quantities of which are unknown at this stage. Where possible it is proposed to source general construction materials from the surrounding area to minimise transportation distances.

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles in a secure compound area within the contractors' compound on site. Liquid materials will be stored within temporary bunded areas, double skinned tanks or bunded containers (all bunds will conform to standard bunding specifications - BS EN 1992-3:2006) to prevent spillage.

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries/trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway.

## 6.5 Visitor Management

Visitors will be required to attend a site-specific induction to allow access to the site unless they are attending a site meeting in which case, they will be accompanied by an inducted member of the construction management team who will guide them.

## 6.6 Site Working Hours

Site working hours are to be updated by the Contractor in line with the EIAR and planning conditions.

On-site construction works shall be permitted to take place between 08:00hrs and 18:00hrs Monday to Friday and between 08:00hrs and 13:00hrs on Saturdays or as directed by FCC.

Working outside these hours will only take place in exceptional circumstances and under prior agreement with FCC.

No works shall take place on Sundays or Bank Holidays. In exceptional cases, FCC may permit works to proceed outside the above times/days. This will be subject to the written agreement of the Council prior to such works proceeding. Locations of works that are anticipated to be outside normal working hours will be defined and confirmed.

## 6.7 Employment and Management Workforce

Construction traffic would likely consist of the following:

- Private vehicles belonging to site construction and security staff
- Occasional private vehicles belonging to professional staff (i.e. design team, utility companies)
- Construction material delivery
- Excavation plant and dumper trucks used for site development works

All employees working on the site will be required to have a Safe Pass Card (or similar approved Construction Health & Safety card), manual handling training and the necessary certificates to operate machinery, as required. The details of training required, records maintained, and induction procedures will be outlined in the Contractor's Health and Safety Plan(s) and will be communicated to all site personnel.

All construction personnel will undergo a site safety induction upon their arrival on site. Once the induction is complete, construction personnel will be issued with a swipe card that will allow them to access the main compound and the site. All construction personnel will also be issued with a helmet sticker identifying that they have been inducted on the site and a name sticker will be required to be displayed on safety helmets so staff or security can identify workers by name.

Arrival of personnel to site on foot or bicycle is not planned for due to absence of footpaths, bus routes and cycle lanes in this industrial location.

# 7 Construction Traffic and Site Access

Information on traffic and site access is to be added by the Contractor to the Contractors CEMP. A number of headings are included below however these are to be reviewed and updated by the Contractor when additional information on the substation development becomes available.

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measure outlined within the traffic chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractor CEMP.

A Construction Site Traffic Management Plan (CSTMP) will be developed by the Contractor to identify hazards and to ensure appropriate controls are applied so that the movement of construction vehicles and pedestrians within the construction site itself are managed and coordinated.

## 7.1 Site Access

During construction of the substation development, construction traffic will travel to and from the site via the construction site access located off the R135.

Site access will be restricted by dedicated security personnel who will check all incoming and outgoing vehicles and workers. Site security will indicatively be located adjacent to the site entrance. Pedestrian access to the site will be via a turn-style located in the construction vehicle parking area that will be controlled by magnetic lock activated by the swipe card issued after induction.

Arrival of personnel to site on foot or bicycle is not planned for due to absence of footpaths, bus routes and cycle lanes in this industrial location.

The Contractor will be responsible to ensure that in particular emergency response services can identify the substation development site entrance as quickly as possible, without confusing the construction entrance with that of the data centre project.

The following measures will be put in place during the construction works:

- The Contractor will be required to provide a method of wheel cleaning prior to trucks etc. leaving site, and regular cleaning of the main access road
- Temporary car parking facilities for the construction workforce will be provided within the site and the surface of the car park will be prepared and finished to a standard sufficient to avoid mud spillage onto adjoining roads
- Monitoring and control of construction traffic will be ongoing during construction works. Construction Traffic Management will minimise movements during peak hours
- Construction Traffic routes minimising traffic impact on surrounding residential development will be used by construction vehicles.

## 7.2 Traffic Queueing

Material deliveries and collections from site will be planned, scheduled, and staggered to avoid any unnecessary build-up of construction works related traffic. Materials will be stored near their final position on site and the delivery of materials will follow a just in time approach, therefore a dedicated laydown area is not anticipated.

## 7.3 Site Hoarding and Security Fencing

Temporary construction and security fencing will be established. Temporary hoarding 2.4 m high will be erected along the southern boundary of the substation development site. Hoarding materials of construction and foundation type will be selected by the Contractor.

The hoarding will include the stepped back main site entrance gate. Hoarding, if timber, will be painted in Contractors company colour scheme and be fitted with header and kicker trimming panels. Hoarding will include site safety signage and should be kept in good condition at all times.

Temporary "Heras" type fencing 2.0 m high will be erected along the data centre construction site boundary to the east and north. Tarpaulin/netting should be fitted to the fence line where required for screening purposes. Approximately half of the existing fence along the site's western boundary will be removed to facilitate HV cable work and replaced with temporary "Heras" type fencing 2.0 m high. The remainder of the existing fence along the site's western boundary will be utilized as a construction boundary where possible.

All fence lines should be inspected regularly, maintained and if required remedial works carried out.

# 8 Safety, Health and Environmental Considerations During Construction Works

The Contractor will comply with the mitigation measures outlined within the EIAR produced for the substation development, will take account of any planning conditions upon grant of permission for the substation development, will comply with any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre and any other reports carried out throughout the construction phase. It is always the responsibility of the Contractor to demonstrate full compliance with all of the environmental controls/mitigation associated with the substation development.

The appointed Contractor will be required to prepare a Construction Health & Safety Plan which will be put in place prior to commencement of the works. At a minimum, this plan will include:

- Construction Health & Safety training requirements
  - Induction procedures
- Emergency protocols
- Details of welfare facilities

## 8.1 Emergency Response and Environmental Training

All personnel working on the project will attend a site induction. Personnel attending such an induction will complete the site Induction Record acknowledging attendance and confirming that they understand and agree to comply with the requirements of the site. Copies of all certificates of competency, licences and other qualifications as deemed necessary by the Contractor will be copied and documented. The environmental induction will run concurrently with safety awareness training.

Induction will include:

- Overview of the goals and objectives of the Environmental Policy and CEMP
- Awareness in relation to the environmental risk associated with the substation development and methods of avoiding environmental risks as identified within the schedule of mitigation measures of the EIAR, mitigation measures as outlined with the individual chapters of the EIAR, mitigation as identified within standalone environmental reports for the substation development, and the planning conditions
- Awareness of roles and individual responsibilities and environmental constraints to specific jobs
- Location of and sensitivity of Special Area of Conservations, Special Protection Areas, protected monuments, structures etc.
- Location of habitats and species to be protected during construction, how activities may affect them and methods necessary to avoid impacts, controls to minimise noise and the importance of pollution prevention measures to protect nearby watercourses and sensitive receptors including residential properties

## 8.2 Daily Pre-Work Briefings

All supervisors are required to carry out daily briefings at the commencement of each shift to ensure environmental issues specific to the work being performed are being addressed. All personnel involved with site works must be briefed and sign onto the daily briefing form prior to commencing activities.

## 8.3 Toolbox Training

Toolbox talks may be conducted prior to the start of specific work elements where there is a substantial environmental risk or when required to reinforce ongoing environmental issues. Any tool box talk training conducted will ensure that relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern.

## 8.4 Project Management Meetings

Meetings will be held to discuss the program and any ongoing environmental and safety concerns or issues which may have arisen in the upcoming works. Minutes of these meetings will be documented.

Personnel and sub-contractors working on environmentally sensitive sites will be provided with environmental training to achieve a level of awareness and competence appropriate to their assigned activities. Targeted environmental awareness training may be provided to individuals or groups of workers with a specific authority or responsibility for environmental management or those undertaking an activity with a high risk of environmental impact.

This training will generally be prepared and delivered by the CEMPC or delegate prior to undertaking the works. Environmental Training will be recorded, and the records will be available for inspection upon request.

The below table summarises the environmental training that will likely be required to be undertaken as a minimum as part of the project.

**Table 8-1 Summary of Training Requirements**

Training	Target	Frequency	Record
Site Induction	All site personnel	Prior to working on-site	Induction Record Form
Daily Pre-working Briefings	All site personnel	Prior to commencing daily works	
Toolbox Talk	Personnel relevant to the topic	As required	Toolbox Record Form
Project Management meeting	Project Managers, Engineers and Site Supervisor	Monthly	Meeting Minutes Record
Environmental Training	Personnel relevant to the activity	Quarterly or more frequently as required	Training Attendance Form
Environmental Bulletin	All company and Project personnel	As required	Environmental Bulletin Form

## 8.5 Concrete works

No on-site concrete batching will be carried out at the site. Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. When concrete is delivered to site, only the chute of the delivery truck will be cleaned before leaving the site. Concrete trucks will be washed out fully at the batching plant.

To limit potential impacts of concrete and lime:

- Ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water/storm water to the underlying subsoil, groundwater, or surrounding ditches etc.
- The pouring of concrete will take place within a designated area using a geosynthetic material protected to prevent concrete runoff into the soil/groundwater media
- Only the chute of the delivery truck will be cleaned before leaving the site. This will be carried out in a carefully managed designated onsite wash out area. Washout should occur into a lined skip to be in good condition (or similar). The container should not overflow or leak and should be easily accessible to vehicles. The containers must be checked and emptied at a frequency equivalent to the volume of concrete being used and no runoff should leave the washout location. The area must be clearly marked and must be located away from storm drain inlets, open drainage facilities & watercourses.
- No wash-down of chutes during the construction works will be carried out at the site within 10 meters of an existing surface water drainage point. Washouts will only be allowed to take place in designated areas with an impervious surface.

## 8.6 Accidental Spills and Leaks

- No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks will be kept in the material storage area in suitable containers and will be appropriately banded as required. Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in designated areas of the site, where possible, which will be kept away from surface water drains.
- Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release during refuelling. Training will be given to appropriate site workers in how to manage a spill event.
- The following mitigation measures will be taken at the construction site in order to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts:
  - Refuelling will be undertaken off site where possible
  - Where mobile fuel bowsers are used the following measures will be taken
  - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use
  - The pump or valve will be fitted with a lock and will be secured when not in use
  - All bowsers must carry a spill kit
  - Operatives must have spill response training
  - Portable generators or similar fuel containing equipment will be placed on suitable drip trays

## 8.7 Air Quality and Climate

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measure outlined within the air quality and climate chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractors CEMP.

All site activities will be carried out with due consideration of air quality at the surrounding environment and sensitive receptors. There will be a Duty of Care on the Contractor to ensure that dust-raising activities are located away from sensitive receptors wherever possible, such as ditches, watercourses, residential dwellings, pedestrians, and nesting birds as much as feasibly possible and duration kept to a minimum when in proximity to a receptor/activity.

The Contractor will be required to implement measures to minimise the amount of dust and emissions (including odour) produced during the construction of the substation development. Several general and specific mitigation measures will be implemented during the construction phase. These are discussed in the below sections.

It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions and mitigation measures herein.

### 8.7.1 General Measures

The following general measures will be implemented during the construction phase:

- The Contractor will pro-actively control fugitive dust to ensure the prevention of significant emissions.
- The name and contact details of a person to contact regarding air quality and dust issues will be displayed on the site boundary, this notice board will also include head/regional office contact details.
- Works will be planned to consider the location of sensitive receptors, sensitive core activities associated with operation of other businesses, local topography, wind direction and any potential sources of pollution.
- Details of air quality complaints and remediation will be added to the Complaint Registers that will be kept by the Contractor throughout the duration of the construction phase
- Equipment and vehicles used on site will be in good condition such that emissions from diesel engines etc. are not excessive.
- Pre-start checks will be carried out on equipment to ensure they are operating efficiently and that emission controls installed as part of the equipment are functional.
- Dust deposition levels will be monitored on a regular basis in order to assess the impact that site activities may have on the local ambient air quality. A limit value of 350 mg/m<sup>2</sup>/day will be used in comparison with recorded values.
- Community engagement shall be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses.
- The Contractors will produce specification of a site policy on dust and will identify the site management responsibilities for dust issues, this will include the development of a documented system for managing site practices with regard to dust control and the regular monitoring and assessment of the performance of the site in terms of dust management and suppression.
- At all times, the procedures put in place will be strictly monitored and assessed.



## 8.7.2 Dust Control Measures

Good design, planning and effective control strategies should be implemented across the site to reduce dust becoming airborne at source. All construction activities will take note of the location of sensitive receptors and prevailing wind directions to minimise the potential for significant dust nuisance. As the prevailing wind is predominantly westerly to south-westerly, locating construction compounds and storage piles downwind (to the east or north-east) of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors. Stockpiling will be limited on site.

Good site management practices will be implemented on site and will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures in a timely and effective manner before the potential for nuisance occurs. The following measures will be taken to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent will monitor the contractors' performance to ensure that all proposed mitigation measures relating to the substation development and the wider site are implemented and adhered to, to ensure dust impacts and nuisance are minimised
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions
- Visual inspections will be undertaken regularly by the Contractor when dust-raising activities are occurring. Inspections should consider prevailing meteorological conditions, and results will be recorded and maintained
- Measures to minimise the amount of dust produced might include, dampening haul roads and stockpiles, keeping roads clean and using covers to minimise dust blow from haulage vehicles. Appropriate measures should reflect the nature of the construction activity as well as ameliorating conditions. Possible methods of reducing and controlling dust emissions during construction are listed in Table 8-2 and detailed further in sub-sections below.
- The dust minimisation measures will be reviewed at regular intervals and monitoring conducted and recorded by the principal contractor during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed, and satisfactory procedures implemented to rectify the problem.

**Table 8-2 Possible Dust Control Measures**

Operation	Dust Control Measure
Drilling	<ul style="list-style-type: none"> <li>▪ Use dust-extraction equipment such as filters, on exhaust air emissions from drill rigs</li> </ul>
Loading/Unloading	<ul style="list-style-type: none"> <li>▪ Reduce drop heights wherever practicable</li> <li>▪ Protect activities from wind</li> </ul>
Material storage	<ul style="list-style-type: none"> <li>▪ Dampen material.</li> <li>▪ Protect from wind and store under cover.</li> <li>▪ Screen material to remove dusty fractions prior to external storage.</li> </ul>
Overburden handling	<ul style="list-style-type: none"> <li>▪ Protect exposed material from wind (by keeping material within voids or protecting them by topographical features)</li> <li>▪ Spray exposed surfaces of mounds regularly to maintain surface moisture unless mound surface has formed a crust after rainfall or is grassed</li> <li>▪ Minimise handling.</li> </ul>
Soil handling and storage	<ul style="list-style-type: none"> <li>▪ Restrict the duration of the activity. Seal and seed storage mound surfaces as soon as is practical.</li> <li>▪ Protect surfaces from winds until disturbed areas are sealed and stable.</li> <li>▪ Materials stockpiles on site shall be designed so as to minimise dust generation by wind erosion (i.e. no steep-sided stockpiles or mounds or those that have sharp changes in shape), covered securely, or damped down or suitably treated to prevent the emission of dust.</li> </ul>

## Operation

## Dust Control Measure

Operation	Dust Control Measure
	<ul style="list-style-type: none"><li>▪ Stockpiles and mounds shall be located away from the site boundary, sensitive receptors, watercourses and surface drains, ditches and sited to consider the predominant wind direction.</li><li>▪ Avoid double handling of material</li></ul>
Transport by vehicle within and off-site	<ul style="list-style-type: none"><li>▪ Restrict vehicle speed.</li><li>▪ Water unsurfaced roads and paved roads.</li><li>▪ Wheel or body wash at an appropriate distance from site entrance. This should always be within the site, and the roadway from the washing facility to the road shall be hard-surfaced.</li><li>▪ Load and unload in areas protected from wind.</li><li>▪ Minimise drop heights.</li><li>▪ Sheet or cover loaded vehicles.</li><li>▪ Use water sprays/spray curtains to moisten material.</li><li>▪ Sweep/wash paved roads.</li><li>▪ Use paved roads where practicable.</li></ul>

The key features with respect to control of dust will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

### 8.7.3 Land Clearing/Earthworks

Land clearing/earthworks during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering will be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided
- The movement of truck containing materials with a potential for dust generation to an off-site location will be enclosed or covered.
- Exposed earthworks will be kept damp to prevent airborne dust emissions. Should this not be possible, windbreaks will be used to minimise the potential for dust generated by wind erosion
- Dust generation will be minimised from earthworks by sealing or seeding of surfaces to stabilise them as soon as possible

### 8.7.4 Stockpiling

The location and moisture content of stockpiles are important factors which determine their potential for dust emissions. The following measures will be put in place:

- Stockpiles/overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site, and designed to minimise dust generation by wind.
- Stockpiles, mounds, and construction materials will be located away from the site boundary, sensitive receptors, watercourses, surface drains and ditches, sited to consider the predominant wind direction, and maintained at suitable heights.

- Regular watering of stockpiles/overburden material will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency.
- Stockpiled materials that are likely to remain undisturbed for a significant duration will be vegetated or covered while long-term stockpiles can be seeded, re-vegetated or turfed to stabilise surfaces.
- Drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment will be minimised. Where drop heights are greater than 2 m, suitable dust suppression measures will be utilised to control dust emissions.
- Where feasible, hoarding will be erected around site boundaries to prevent larger particles from impacting on nearby sensitive receptors.
- Double handling of material will be avoided wherever reasonably practicable.
- The site will be regularly inspected by the Contractor for spillages of dusty or potentially dusty materials and procedures will be in place for prompt clearance of any such spillage. The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions

### 8.7.5 Site Traffic on Public Roads

Site access routes and movement of construction trucks along site roads (particularly unpaved routes) can be a significant source of fugitive dust from construction sites if control measures are not in place. Spillage and blow-off of debris, aggregates and fine material onto public roads can occur during the construction phase of project. This will be reduced to a minimum by employing the following measures:

- Haul routes and plant will be situated and operated away from sensitive receptors and sensitive core activities associated with operation of other businesses (where possible).
- A speed restriction of 20 km/hr (or as set out within the EIAR) will be applied as an effective control measure for dust for on-site vehicles. Any unsurfaced roads will be restricted to essential site traffic only.
- Bowers or suitable watering equipment will be available during periods of dry weather throughout the construction period.
- Haul roads will be dampened down using water, spraying will be repeated regularly and frequently during warm and sunny weather/sustained dry periods throughout the construction period to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use. Access gates to the site will be located at least 10 m from sensitive receptors where possible.
- All trucks will be inspected prior to leaving site and excess mud removed where required.
- Public roads outside the site will be regularly inspected for cleanliness as a minimum on a daily basis and cleaned as necessary.
- A road sweeper will be present onsite to clean the site's hard standing areas and the public roads in the vicinity of the site to remove mud and aggregate materials from their surface. Following sweeping of road network material will be disposed of to a licensed waste facility.
- Vehicles delivering or collecting material with potential for dust emissions will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- At the main site traffic exits, a wheel wash facility will be installed. All trucks leaving the site must pass through the wheel wash.

The following should be adhered to by all vehicles and plant on site:

- The engines of all vehicles and plant on-site should not be left running unnecessarily (i.e. idling) to minimise exhaust emissions (and noise).
- Vehicles and plant will adhere to applicable emissions standards.

- Plant, equipment, and emission control apparatus will be selected to minimise the engine exhaust emissions, taking into consideration economic constraints and practicability.
- Vehicles and plant will be in good working order and certified where applicable, with servicing completed in line with manufacturer's recommendations. Records of servicing will be maintained, and visual checks carried out to ensure that black smoke is not emitted at times other than at ignition.
- The use of diesel or petrol-powered generators will be minimised, with mains electricity or battery powered equipment used as an alternative (where feasible).
- Exhausts will be directed away from the ground to minimise risk of re-suspension of ground dust.

## 8.8 Ecology

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measure outlined within the biodiversity/ecology chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractor CEMP.

### 8.8.1 General Measures

General mitigation measure to be adhered to during the construction phase include:

- The Contractor will implement, comply with and include within the Contractors CEMP, ecological mitigation measures described in standalone environmental reports included with the planning package, mitigation as set out within the EIAR for the substation and wider site, any mitigation identified within ecological pre-construction reports, any measures required as a condition of planning consent, and any updated or new supplementary environmental reports made available to the Contractor throughout the life of the construction phase of the substation development.
- Works should be planned to take account of the location of identified sensitive ecological receptors and any seasonal restrictions and/or surveys that are required prior to construction works commencing. It is the responsibility of the Contractor to ensure these are carried out and in a timely manner.
- Any external lighting installed to facilitate night-time working or security lighting on the site should be kept to a minimum of that required for security, health and safety purposes and should be positioned and directed in such a manner as to minimise impacts on adjacent areas outside the site boundary and areas where sensitive ecological receptors occur.
- Any temporary construction lighting should be reviewed by an ecologist to determine its potential to disturb nesting birds or roosting bats.
- As birds and bats are mobile, additional nests or roosts could become established within the construction site during construction works. A 'watching brief' must be maintained by the Contractor throughout the construction period. If any nesting birds or roosting bats are encountered during works or if it is suspected that protected fauna may be utilising the construction site, the Contractor will cease works in the area immediately and consult an appropriately qualified Ecologist.
- All site clearance works will comply with current legislative requirements and best practice
- All fuels, chemicals, liquid and solid waste will be stored at the construction compound in areas bunded in accordance with established best practice guidelines and an adequate number of spill kits will be available at all time in key works areas and within compounds
- The Contractor will produce a water and sediment management plan, providing for means to ensure that surface water run-off is controlled such that no silt or other pollutants enter local water courses or drains

## 8.8.2 Fauna

### 8.8.2.1 Badger

This section is to be completed by the Contractor within the CEMP in line with recommendations made as part of any pre-construction surveys (should they occur), any mitigation measures outlined within the EIAR for the substation and wider site, and in line with any conditions upon grant of permission for the substation development. As badgers are mobile species and could establish in the area further surveys may be required where earthworks or construction starts more than 12 months after the badger surveys for the Proposed Development occurred.

### 8.8.2.2 Bats

All trees will be monitored for bats and breeding birds by a suitably qualified ecologists prior to felling or delimiting.

#### 8.8.2.2.1 Trees

- Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March 1st to August 31st. If this cannot be enforced, then the site will be surveyed for the presence of nesting birds and/or nests prior to cutting and if none are recorded the vegetation may be removed within 48 hours of the survey.
- Mature trees, which are to be removed, shall be felled in the period early September to late October, in order to avoid the disturbance of any roosting bats as per Transport Infrastructure Ireland (TII and formerly the National Roads Authority) guidelines. Tree felling shall be completed by Mid-November at the latest because bats roosting in trees are vulnerable to disturbance during their hibernation period (November – April). Ivy-covered trees, once felled, shall be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight.
- Any mature trees that are to be removed, should, due to the passage of time, again be surveyed for bat presence by a suitably experienced specialist on the day of felling. If several bats are found within any one tree, that specific tree should be left in-situ while an application for a derogation licence is made to the National Parks and Wildlife Service to allow its legal removal.
- The trees identified as having potential for use by bats should be felled carefully to avoid hard shocks which may injure any bats within. Large mature trees with bat roosting potential such as those onsite should essentially be felled by gradual dismantling by tree surgeons. Care should be taken when removing larger branches as removal of loads may cause cracks or crevices to close, crushing any animals within. Such cracks should be wedged open prior to load removal. If single bats are found during tree felling operations, they should be transferred to previously erected bat boxes onsite.
- Following the precautionary approach all category 3 trees to be felled within the site will follow the procedure set out within the bat survey carried out for the wider development site
  - Tree-felling to be undertaken using heavy plant and chainsaw equipment. Normally trees are pushed over, with a need to excavate and sever roots in some cases. To ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly. A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape. Felling works be overseen by an ecological clerk of works.
  - All category ranked category 4 can be felled and removed.
  - Felling of trees will be supervised by an ecological clerk of works.

**Table 8-3 Category Description**

<b>Tree Category</b>	<b>Description</b>
Category 1	<i>Trees with multiple, high suitability features capable of supporting larger roosts</i>
Category 2	<i>Trees with definite bat potential but supporting features suitable for use by singleton bats</i>
Category 3	<i>Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats. Also included within this category are trees with thick ivy however the ivy root is not thick enough to form mats, thus it is possible but unlikely a single bat may be roosting here</i>
Category 4	<i>Trees have no potential</i>

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### 8.8.2.2 Lighting

There is a risk of indirect impacts on foraging bats, and on potential roost features in the surrounding area should any new lighting be directed towards the boundaries of the site.

Any temporary construction lighting shall be reviewed by an ecologist to determine its potential to disturb fauna such as nesting birds or roosting bats.

Construction lighting will be designed so as to be sensitive to the potential presence of bats and should adhere to the following guidance:

- Bats & Lighting: Guidance Notes for Planners, engineers, architects, and developers (Bat Conservation Trust, 2010);
- Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2011);
- Bats and Lighting in the UK - Bats and the Built Environment Series (Bat Conservation Trust UK, January 2008).

### 8.8.2.3 Birds

This section is to be completed by the Contractor within the CEMP in line with recommendations made as part of any pre-construction surveys, any mitigation measures outlined within the EIAR for the substation and wider site, and in line with any conditions upon grant of permission for the substation development.

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March 1st to August 31st. If this cannot be enforced, then the site will be surveyed for the presence of nesting birds and/or nests prior to cutting and if none are recorded the vegetation may be removed within 48 hours.

Disturbance impacts are to be minimised insofar as possible. This will be achieved by limiting areas of clearance, limiting working times in sensitive areas, and avoiding the use of noisy plant or equipment such as pumps, generators, or chainsaws.

## 8.8.3 Trees and Shrub

It will be necessary to complete the tree works as detailed in the tree survey schedule conducted by Rik Pannett (2019), Arboriculture Consultant. All tree work must comply with BS 3998:2010 'Recommendations for Tree Work' or other appropriate current industry standards.

Based on the outcome of the tree survey carried out at the site by Rik Pannett (2019), three areas of hedgerow containing a number of trees are recommended for protection during any proposed development works. The Tree Protection Plan (TPP: appendix 4 of Rik Pannett (2019)) shows the indicative position of the Root Protection Area (RPA) for trees and hedgerows with a retention priority.

The RPA (as described in BS5837: 2012 sec. 3.7) represents the minimum area around each tree in which the ground should remain largely undisturbed and is shown as orange dashed lines on the TPP.

The RPA will require physical protection with fencing which should be constructed on site before any access to the site or development work begins.

Where any construction works need to take place within the RPA of retained trees, special care must be taken to minimise compaction and to prevent root damage to these trees. Temporary ground protection such as track matting should be installed close to the RPAs of retained trees.

Where roads, parking bays and pathways are constructed within the RPAs of retained trees, it should be possible to utilise alternative construction methods using no dig construction in the root protection area of these trees. It is recommended that a porous surfacing is utilised for roadways for soil gases to exchange.

Recommendations for tree protection and details of tree related operations should be sought following the drawing of detailed plans by using a site specific Arboricultural Method Statement (AMS).

### 8.8.4 Invasive Species

Should any recommendations relating to invasive species be included with the EIAR for the substation this section should be updated by the contractor to reflect the findings of the EIAR.

No invasive species have been identified on site however should any invasive species be identified on site, the area should be cordoned off, no access to the area allowed, and an invasive species contractor should be contacted immediately to advise on treatment, containment and removal. If an invasive species is identified on site an invasive species management plan and biosecurity measures would likely be required.

All site personnel should be aware of the potential to find invasive species on site and should be aware of what procedures to follow should an invasive species be identified on site.

## 8.9 Noise and Vibration

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measure outlined within the noise and vibration chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractor CEMP.

Noise impacts arising from earthworks and construction activities have the potential to cause annoyance or nuisance to local residents in the area.

The earthworks will generate typical noise and vibration sources from use of a variety of plant and machinery such as rock breakers (where required), excavators, lifting equipment, dumper trucks, compressors, and generators.

### 8.9.1 General Measures

- The Contractor will be responsible compliance with any prescribed noise and vibration levels and for the implementation of noise and vibration mitigation onsite related to construction activities
- A site representative and designated noise liaison responsible for matters relating to noise and vibration will be appointed prior to construction on site. Any complaints should be logged, investigated, and followed up in a prompt fashion and, where required, measures taken to ameliorate the source of the noise complaint. In addition, prior to particularly noisy construction activity, e.g. excavation close to a property, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works

- The site representative and designated noise liaison will also liaise with environmental advisors, relevant authorities/environmental bodies and the local community as required with respect to noise and vibration impacts during the construction phase
- The Contractor will highlight through method statements and/or risk assessment specific activities that will create significant noise and vibration levels. Contractors will demonstrate how they will mitigate/manage these emissions
- Stationary noise sources will be located as far away as possible from residential noise sensitive receptors
- Site staff will be informed about the need to minimise noise and will be supervised to ensure compliance with the noise control measures adopted
- All works on site will comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities. In general, the Contractor will implement the following mitigation measures during the proposed infrastructure works:
  - Avoid unnecessary revving of engines and switch off equipment when not required
  - Keep internal haul roads well maintained and avoid steep gradients
  - Minimise drop height of materials
  - Start-up plant sequentially rather than all together
- More specifically the Contractor will ensure that:
  - In accordance with "Best Practicable Means", plant and activities to be employed on site are reviewed to ensure that they are the quietest available for the required purpose
  - Where required, improved sound reduction methods are used e.g. enclosures
  - Site equipment is located away from noise sensitive areas, as much as physically possible
  - Regular and effective maintenance by trained personnel is carried out to reduce noise and/or vibration from plant and machinery
  - Hours are limited during which site activities likely to create high levels of noise and vibration are carried out

## 8.9.2 Noise Limits

The noise limits to be applied for the duration of the infrastructure works will be those specified either within the EIAR, those outlined within any planning conditions upon grant of permission for the substation development or if not identified within the EIAR or planning conditions those identified in agreement with the planning authority. The Contractor will include details of the noise limits within the Contractors CEMP. An example of possible noise limits are set out below:

- Noise limits as specified in the B Category of BS 5228, which would be applied at the nearest sensitive receptor.
  - Night (23:00-07:00) = 50dB
  - Evening (19:00-23:00) = 60dB
  - Day (07:00-19:00) = 70dB
  - At the commercial property = 75dB

The total noise (LAeq) which should not be exceeded during daytime is therefore 70dB. Vibration limits likely to be applied for the infrastructure works are those specified in the TII document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, Revision 1, 2004). These limits are outlined below:

- Allowable Vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of;



- Less than 10Hz - 8mm/s
- 10 to 50 Hz – 12.5mm/s
- 50 to 100 Hz (and above) - 20mm/s

### 8.9.3 Noise Monitoring

External noise and vibration monitoring will be undertaken at locations on the site boundary closest to sensitive locations. It is considered that it will be appropriate to amend the monitoring program as the works progress. Accordingly, monitors may be added, removed, or relocated as necessary.

- The noise monitoring terminals should provide the following at minimum:
  - Logging at hourly intervals
  - Daily CIC automated calibrations

Vibration monitoring terminals should continually log vibration levels using the Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions, in accordance with BS ISO 4866: 2010: Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures.

The mounting of the transducer to the vibrating structure, by way of resin fixings only, will need to comply with BS EN ISO 5348: 1998: Mechanical vibration and shock – Mechanical mounting of accelerometers. In summary, the following ideal mounting conditions apply:

- The transducer and its mountings should be as rigid as possible
- The mounting surfaces should be as clean and flat as possible
- Simple symmetric mountings are best
- The mass of the mounting should be small in comparison to that of the structure under test

## 8.10 Archaeological and Architectural Heritage

An archaeo-geophysical survey followed by a preliminary programme of archaeological testing has been undertaken for the site. These studies identified the probable remains of an oval enclosure with a possible entranceway to the south. Within the enclosure are numerous responses and trends, most likely representing the remains of pits and ditches. These features are outside of the boundary of the proposed development currently being assessed.

A further, more detailed programme of pre-development archaeological testing and the subsequent excavation of features, deposits or structures identified (under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht) is currently being undertaken by AMS Ltd to fully assess the potential for archaeological remains across the development site.

Archaeological excavation and preservation by record of features, deposits or structured identified is recommended, under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. This covers the archaeological features encountered to date and potential further archaeological features encountered during the programme of further testing. Further detail is provided within Chapter 12 of the Environmental Impact Assessment Report (EIAR) submitted with this application.

### 8.10.1 General Measures

This section is to be completed by the Contractor within the CEMP in line with recommendations made as part of any surveys carried out for the substation development and the wider site, any mitigation measures outlined within the EIAR for the substation and wider site, and in line with any conditions upon grant of permission for the substation development. A Precautionary Working Method Statement should be prepared for the site to identify the procedure to be followed should unexpected finds occur during construction

## 8.11 Land and Soils

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measure outlined within the land and soils chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractor CEMP.

### 8.11.1 General Measures

- The Contractor will develop a Soil Management Plan (SMP) outlining its proposal for the management and reuse of excavated materials from the site, where permitted in accordance with the relevant legislation, and provided that the reuse meets the engineering requirements for material used within the works. In addition, where the Contractor proposes to maximise the reuse of excavated soil in order to minimise the generation of waste, it will set out how it proposes to manage and document this reuse to the satisfaction of the relevant authority or its representatives
- Where dewatering is required to facilitate excavations, a risk assessment should be undertaken to determine the risk to sensitive receptors. Where an unacceptable risk is identified, suitable mitigation will be put in place, such as sheet piling of excavations and monitoring of groundwater levels

In order to prevent spillages to ground of fuels, and to prevent any consequent soil quality impacts, it will be necessary to adopt mitigation measures during the construction phase, which include:

- Designating a bunded storage area at the contractor's compound for all oils, solvents and chemicals used during construction. Oil and fuel storage tank design will be bunded to a volume of not less than the greater of 110% of the capacity of the largest tank or drum within the bunded area, or 25% of the total volume of the substance which could be stored within the bunded area, with impermeable bases within each contractor's storage area as required. Drainage from the bunded area will be diverted for collection and safe disposal
- All containers within storage areas will be clearly labelled so that appropriate remedial action can be taken in the event of a spillage. When moving drums from the bunded storage area to locations within the site a suitably sized spill pallet will be used for containing any spillages during transit
- Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. Spill kit facilities will be provided at the fuelling areas in order to provide for accidental releases or spillages in and around the area. Any used spill kit materials will be disposed of using a licenced hazardous waste contractor in accordance with relevant legislation
- Where mobile fuel bowsers are used on site, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double skinned tank. Any flexible pipe tap or valve will be fitted with a lock where it leaves the container and locked shut when not in use. The pump or valve will be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training
- The Contractor will develop procedures and contingency plans to deal with emergency accidental spills and leaks

To limit potential impacts associated with the use of natural resources throughout the course of the substation development the following will apply:

- The source of backfill material will be vetted for environmental management status, regulatory and legal compliance status
- Backfill material will only be sourced from suppliers which comply with vetting requirements
- Periodic reviews of the backfill supplier's license will be undertaken
- In the event recycled aggregate is used as backfill, chemical testing will be undertaken to confirm that it is 'clean'

## 8.11.2 Ground Conditions

This section is to be completed by the Contractor within the CEMP in line with recommendations made as part of any pre-construction surveys, any mitigation measures outlined within the EIAR for the substation and wider site, and in line with any conditions upon grant of permission for the substation development.

Ground works will be required to clear the site and to facilitate construction of building foundations, access roads, the installation of utilities and landscaping.

Any surplus material that requires removal from site for offsite reuse, recovery and/or disposal and any potentially contaminated material if encountered on site, should be segregated, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous' using the HazWasteOnline application (or similar approved classification method). If the material is to be disposed of to landfill, it will then need to be classified as clean, inert, non-hazardous, or hazardous in accordance with the EC Council Decision 2003/33/EC and landfill specific criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.

Surplus soils and stones may be suitable for acceptance at either inert or non-hazardous soil recovery facilities/landfills in Ireland or, in the event of hazardous material being encountered, be transported for treatment/recovery, or exported abroad for disposal in suitable facilities.

This section should be read in conjunction with Section 8.5 Cultural Heritage as it contains additional important information relating to excavations.

## 8.11.3 Stockpiles

Stockpiles will be kept as low as possible and will not exceed 1.5 metres in height. The running of machinery over stockpiles should be minimised and stockpiles should not be compacted. Soil should be loosely dumped and shaped to shed water. Stockpiles will be located on dry, free draining ground, not subject to temporary standing water. If water ponds against the stockpile, temporary drains will be put in place to relieve it.

Topsoil stockpiles will not be covered or contaminated by subsoil, rock, rubble, remains of trees, site debris, fuel, or chemical pollution. Any contaminated soil stripped from the site will be stockpiled separately and labelled, contaminated soil will not be incorporated into 'clean' stockpiles. Where space is short, or where there is any risk of contamination or of topsoil and subsoil stockpiles intermingling, the topsoil stockpile will be surrounded with a temporary fence.

Temporary yards or hardstanding's, or any area where fuel or chemicals are stored will not drain towards topsoil stockpiles.

Also see Section 8.11 water for further information on stockpiles.

## 8.12 Water

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measures outlined within the water chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractor CEMP.

A large drainage ditch occurs along the boundary of the site. The drainage ditch is hydrologically connected to the Ward River and the Malahide Estuary SAC and SPA. Where ditches are being diverted as part of the substation development mitigation measures will be required to ensure there are no impacts to streams or downstream European sites. Any licences required for the works should be sought by the Contractor prior to construction.

## 8.12.1 General Measures

The following mitigation and general control measures should be followed as a minimum to ensure no significant adverse direct and indirect effects on the environment arise from the substation development.

- The Contractor will develop an emergency response plan including a spill response procedure to be followed in the event of spills and leaks
- Materials and equipment to implement the Contractors spill response and control plan must be available adjacent to all ditches where works are occurring (for example, spill kits, booms). These should be in clearly marked response points, which can be accessed by all staff. They must be checked on a daily basis to ensure that all required materials are in place. All staff on site must be aware of these items and be trained on procedures to implement in the case of a spill. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation
- All water runoff from designated refuelling areas will be channelled to an oil interceptor or an alternative treatment system prior to discharge
- Drip trays will be used under mobile plant and machinery
- Refuelling operations should not occur near ditches
- Refuelling of vehicles will only to be carried out at designated refuelling areas using appropriate funnels or fuel nozzles and in adequately bunded areas
- Leaking or empty fuel drums will be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor

### 8.12.1.1 Managing Runoff and Silty Water

The following mitigation measures should be followed as a minimum to ensure no significant adverse direct and indirect effects on the environment arise from runoff associated with the substation development:

- Run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, will be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation
- Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. All run-off will be prevented from directly entering any water courses as no construction will be undertaken directly adjacent to open water.
- No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavation is kept relatively dry.
- Surface water discharge from the site will be managed and controlled for the duration of the construction works until the permanently attenuated surface water drainage system of the proposed site is complete. A temporary drainage system shall be installed prior to the commencement of the construction works to collect surface water runoff by the site during construction.
- Excavations will only remain open for limited time periods to reduce groundwater and surface water ingress and water containing silt will be passed through a settlement tank or adequate filtration system prior to discharge. A discharge consent will be obtained as necessary for disposal of water arising from pumping (if any) or such water may be disposed of as construction site run off where appropriate.
- Ditches and watercourses (if applicable) will be clearly identified on site and shown on method statements and site plans. Construction compounds will be located away from these areas

- Any temporary storage of spoil, hardcore, crushed concrete or similar material will be stored as far as possible from any surface water drains and also stored in receptacles where possible. In order to minimise the risk of contamination, the stockpiled material will be removed off-site as soon as possible. Surface water drain gratings in areas near or close to where stockpiles are located will be covered by appropriate durable polyurethane covers or similar.
- There will be no direct pumping of silty water from the works to any watercourse. Sediment entrapment facilities will be installed to reduce sediment discharges to downstream properties and receiving waters. All run-off leaving a disturbed area should pass through a sediment entrapment facility before it exits the site and flows downstream for example straw bales, silt fencing, silt barriers and diversion dams. It will be the Contractors responsibility to ensure all the necessary consents are in place prior to construction and complied with throughout construction

A range of measures will be implemented to reduce runoff from stockpiles. The measures will differ based on the location and constituents of stockpiles, but will include the following

- Stockpiling of excavated material will be managed such that the potential contamination of down slope natural drainage systems is mitigated and minimised
- Stockpiles will be kept to a minimum, to control erosion areas of exposed ground. Stockpiles will be minimised to reduce silty runoff and located well away from, ditches, drains, watercourses (if applicable) and dewatering points
- Consideration will be given to groundwater level and ground saturation to prevent excessive overland flow and associated scouring and mobilisation of suspended solids. Areas to be stripped will be kept to a minimum and phased during the construction phase to reduce the amount of land exposed
- Creation of bunded stockpile areas, silt fences, cut-off ditches and silt traps will be implemented as required.

CIRIA guidance documents detailing control measures include:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532) Construction Industry Research and Information Association
- CIRIA (2002) Control of water pollution from construction sites: guidance for consultants and contractors (SPI56) Construction Industry Research and Information Association
- CIRIA (2005), Environmental Good Practice on Site (C650); Construction Industry Research and Information Association
- BPGCS005, Oil Storage Guidelines
- CIRIA 697 (2007), The SUDS Manual
- UK Pollution Prevention Guidelines, (PPG) UK Environment Agency, 2004

## 8.13 House Keeping

Good housekeeping is an important part of good environmental practice and helps to maintain a more efficient and safer site. The site should be tidy, secure, and have clear access routes that are well signposted. The appearance of a tidy, well-managed site can reduce the likelihood of theft, vandalism, complaints and/or specific hazards that could affect the safe operation of the other businesses in the area, such as bird hazards and wind-blown litter.

As outlined in the fourth edition of CIRIA's 'Environmental good practice on site guide' (C741), when considering good housekeeping, the Contractor will implement the following steps:

- Adequately plan the site with designated areas of materials and waste storage
- Segregate and label different types of waste as it is produced and arrange frequent removal
- Keep the site tidy and clean
- Ensure that no wind-blown litter or debris leaves the site, use covered skips to prevent wind-blown litter
- Keep hoarding tidy – repair and repaint when necessary, removing any fly posting or graffiti
- Keep haul routes clean from site derived materials
- Keep roads free from mud by using a road sweeper
- Ensure site is secure.

## 8.14 Waste Management

All mitigation measures outlined within this Outline CEMP are to be updated by the Contractor to include all mitigation measure outlined within the waste chapter of the EIAR produced for the substation development and to take account of any planning conditions upon grant of permission for the substation development. In addition, any further mitigation measures outlined within standalone environmental reports produced for the substation or adjoint data centre should also be detailed within the Contractor CEMP.

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment. A site-specific Construction and Demolition Waste Management Plan has been prepared for the substation development and will be employed to ensure sustainable and effective waste management throughout the excavation and construction phases of the project.

Adherence to the C&D WMP prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2011 as amended, associated Regulations, the Litter Pollution Act of 1997-2009 as amended and the Eastern-Midlands Region Waste Management Plan 2015 – 2021, and that it will achieve optimum levels of waste reduction, re-use and recycling. Draft Best Practice Guidelines for the Preparation of Resource Management Plans for Construction & Demolition Projects have been produced by the EPA and are currently open for public consultation.

A site-specific Construction and Demolition Waste Management Plan (WMP) is included as Appendix 15.1 of the EIAR for the Substation.

## 8.14.1 General Measures

- The C&D WMP will be refined and updated throughout the lifetime of the works to ensure best practice is followed in the management of waste from the substation development. The WMP will apply to all works carried out by the Contractor and any subcontractors under its control. In preparing the plan, the Contractor will consider any measures set out in any planning consent document, the relevant legislation, and industry best practice. In developing the plan, the Contractor will also consider the requirements of FCC.
- The Contractor will establish a system for the management of wastes in accordance with the Waste Management Hierarchy. This hierarchy outlines that waste prevention and minimisation are the first priority in managing wastes, followed by waste reuse and recycling. Disposal of waste will only be considered as a last resort. The hierarchy is:
  - Prevention
  - Minimisation
  - Reuse
  - Recycling
  - Disposal

Typical waste materials that will be generated from the construction works will include:

- Soil and stones
- Concrete, bricks, tiles, and ceramics
- Wood, glass, and plastics
- Metals
- Gypsum-based construction material
- Paper and cardboard
- Mixed C&D waste
- Chemicals (solvents, paints, adhesives, detergents etc.)

The management of all hazardous waste materials, if they occur, will be coordinated in liaison with Health and Safety Management.

## 8.14.2 Waste Minimisation

Waste minimisation measures proposed are summarised as follows (and are described in more detail in the C&D WMP):

- Materials will be ordered on an 'as needed' basis to prevent over supply
- Materials will be correctly stored and handled to minimise the generation of damaged materials
- Materials will be ordered in appropriate sequence to minimise materials stored on site
- A waste tracking log will be established
- Sub-contractors will be responsible for similarly managing their wastes
- All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste

### 8.14.3 Waste Storage

A dedicated and secure area will be located within the site compound. The area will contain bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities are to be stored.

Waste materials generated will be segregated at the site compound, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

The site construction manager will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

### 8.14.4 Waste Identification and Classification

- The Contractor will establish a procedure to identify and classify all waste arising at the site in accordance with the List of Waste (LoW) Code.
- The Contractor will ensure that the waste materials generated during the works are clearly identified as either hazardous or non-hazardous wastes, with reference to the guidance from the Environmental Protection Agency where required and will establish designated waste storage areas for the different types of waste that may arise.
- For each waste stream identified by the Contractor, and for each additional waste stream that may arise during the works, the Contractor will identify the following:
  - The appropriate LoW Code
  - A suitable waste collection contractor in possession of a valid Waste Collection Permit for the collection of the particular waste within Dublin
  - The waste recovery or disposal site, including the transfer station where the waste may be transferred to upon leaving the site in possession of a valid Waste Facility Permit or Waste License, as appropriate
  - The recovery or disposal method for the waste
- Only contractors in possession of a valid Waste Collection Permit will collect wastes from the site. The contractor responsible for the waste will ensure that the Waste Collection Contractor:
  - Is permitted to collect the particular waste
  - Is permitted to collect waste within Dublin
  - Uses a waste collection vehicle identified on the Waste Collection Permit
  - Transfers the waste to a licenced waste facility identified on the Waste Collection Permit
- The Contractor will ensure the following information is available upon request:
  - Transfer notes for controlled waste and consignment notes for hazardous waste must include an accurate description of the type, quantity, and containment of waste; Standard Industrial Classification; the LoW Code; and details of the waste carrier, who must be licensed
  - Sufficient information must be provided to ensure that the waste disposal operator is aware of the potential hazards of the substance
  - The Trade Contractor should also ensure that returns for consignment notes are collected and retained
  - All documentation must be retained for a minimum of two years for transfer notes and three years for consignment notes and be available for inspection
- The logistics contractor and all trade contractors removing waste directly from site must provide the following documentation:



- Waste forecast
- Licence documentation for all waste carriers removing waste and for all waste destinations receiving waste (to be approved before use)
- Recycling rates from facilities being used
- Waste consignment notes (for a minimum of three years) for all hazardous waste. These must include the following:
  - Consignment note code
  - Details of the site that the hazardous waste is removed from
  - Details of waste disposal site
  - Waste producer details if different to site details
  - Description of the waste (written description, LoW code and SIC number)
  - Details of process that has generated this waste
  - Specific details of the waste- quantity, chemical/biological components, physical form, and hazardous properties Any special handling requirements
  - Signature of consignor once completed
- Waste transfer notes (for a minimum of two years) for all non-hazardous waste. These must include the following and should be reported:
  - Accurate description of the waste type (written description, LoW code and SIC number)
  - Quantity and containment of waste
  - Location, time, and date of the waste transfer
  - Names of both persons involved in the waste transfer
  - Details of the waste carrier and facility, both must be licensed
  - Waste carrier's registration number

The Contractor will advise the local county council or its representatives in advance if it proposes to act as the Waste Collection Contractor, subject to agreement. In the event that the Contractor acts as the Waste Collection Contractor, it will ensure that it has the relevant Waste Collection Permit(s) in place prior to commencement of the Project.

#### **8.14.4.1 Waste Documentation**

The Contractor will develop a Waste Documentation System within the overall documentation system for the works. The documentation to be maintained in relation to wastes includes the following (where applicable):

- The names of the agent(s) and the transporter(s) of the wastes
- The name(s) of the person(s) responsible for the ultimate recovery or disposal of the wastes
- The ultimate destination(s) of the wastes
- Written confirmation of the acceptance and recovery or disposal of any hazardous waste consignments
- The tonnages and LoW Code for the waste materials
- Details of any rejected consignments
- The Waste Transfer Forms for hazardous wastes transferred from the site
- The Transfrontier Shipment of Waste forms for hazardous wastes transferred abroad
- The Certificates of Recycling, Reuse or Disposal for all wastes transferred from the site
- The results of any analysis conducted on wastes

- The results of any analysis conducted on excavated soil

The Contractor will provide a report of all waste arising at the site to include the information set out above. Information on the management of waste at the site will be made available to the Client or its representatives upon request. The original documentation relating to the management of waste will be maintained at the site.

Waste audits and monitoring will be carried out at regular intervals through the construction phase of the substation development.

### 8.14.5 Responsibility

It will be the responsibility of the construction manager to ensure that a written record of all quantities and natures of wastes removed from the site are maintained on-site in a waste file (in hardcopy or electronically).

It is the responsibility of the project manager or his/her delegate that all contracted waste haulage drivers hold an appropriate waste collection permit for the transport of waste loads and that all waste materials are delivered to an appropriately licenced or permitted waste facility in compliance with the relevant Regulations.

The Contractor, as part of regular site inspection audits, will determine the effectiveness of the waste management strategy and will assist the project manager in determining the best methods for waste minimisation, reduction, re-use, recycling and disposal as the construction phase progresses and waste materials are generated.

Prior to commencement of the excavation and construction activity and removal of any waste off-site, details of the proposed destination of each waste material will be provided to FCC, along with waste collection permit numbers.

## 9 Summary

This Outline CEMP sets out the overall management strategy for construction works for the substation development.

The Outline CEMP aims to ensure the management of construction activity is carried out in a planned, structured, and considerate manner which minimises the impacts of the works on the local environment, residents, and commercial activities in the vicinity of the site. Due to the nature of construction works, there may be unforeseen events which occur at the site and the project team will actively manage any changes and discuss with the relevant authorities, where required.

The project team are committed to ensuring that the construction activities to be carried out are pro-actively managed to minimise potential impacts.

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**APPENDIX 9.2**  
**DESCRIPTION OF AERMET**  
**PREPARED BY AWN CONSULTING LTD.**

AERMOD incorporates a meteorological pre-processor AERMET. AERMET allows AERMOD to account for changes in the plume behaviour with height. AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness ( $z_0$ ), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. A morning sounding from a representative upper air station, latitude, longitude, time zone, and wind speed threshold are also required.

Two files are produced by AERMET for input to the AERMOD dispersion model. The surface file contains observed and calculated surface variables, one record per hour. The profile file contains the observations made at each level of a meteorological tower, if available, or the one-level observations taken from other representative data, one record level per hour.

From the surface characteristics (i.e. surface roughness, albedo and amount of moisture available (Bowen Ratio)) AERMET calculates several boundary layer parameters that are important in the evolution of the boundary layer, which, in turn, influences the dispersion of pollutants. These parameters include the surface friction velocity, which is a measure of the vertical transport of horizontal momentum; the sensible heat flux, which is the vertical transport of heat to/from the surface; the Monin-Obukhov length which is a stability parameter relating the surface friction velocity to the sensible heat flux; the daytime mixed layer height; the nocturnal surface layer height and the convective velocity scale which combines the daytime mixed layer height and the sensible heat flux. These parameters all depend on the underlying surface.

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g. urban, cultivated land etc.) and vary with seasons and wind direction. The assessment of appropriate land-use types was carried out in line with USEPA recommendations.

#### *Surface roughness*

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on an upwind area-weighted average of the land use within the sector, by using the eight land use categories outlined by the USEPA. The inverse-distance weighted surface roughness length derived from the land use classification within a radius of 1km from Dublin Airport Meteorological Station is shown in Table A9.1.

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter <sup>Note 1</sup>
340-100	100% Urban	1.000	1.000	1.000	1.000
100-340	100% Grassland	0.050	0.100	0.010	0.010

<sup>Note 1</sup> Winter defined as periods when surfaces covered permanently by snow whereas autumn is defined as periods when freezing conditions are common, deciduous trees are leafless and no snow is present (Iqbal (1983)). Thus for the current location autumn more accurately defines "winter" conditions in Ireland.

**Table A9.1** Surface Roughness based on an inverse distance weighted average of the land use within a 1km radius of Dublin Airport Meteorological Station.

### Albedo

Noon-time albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. A 10 km x 10 km square area is drawn around the meteorological station to determine the albedo based on a simple average for the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10km from Dublin Airport Meteorological Station is shown in Table A9.2.

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter <sup>Note 1</sup>
2% Water, 49% Urban, 31% Grassland, 19% Cultivated Land	0.152	0.173	0.185	0.185

<sup>Note 1</sup> For the current location autumn more accurately defines "winter" conditions in Ireland.

**Table A9.2** Albedo based on a simple average of the land use within a 10km x 10km grid centred on Dublin Airport Meteorological Station.

### Bowen Ratio

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. A 10 km x 10 km square area is drawn around the meteorological station to determine the Bowen Ratio based on geometric mean of the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10 km from Dublin Airport Meteorological Station is shown in Table A9.3.

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter <sup>Note 1</sup>
2% Water, 49% Urban, 31% Grassland, 19% Cultivated Land	0.628	1.23	1.36	1.36

<sup>Note 1</sup> For the current location autumn more accurately defines "winter" conditions in Ireland.

**Table A9.3** Bowen Ratio based on a geometric mean of the land use within a 10km x 10km grid centred on Dublin Airport Meteorological Station.

**APPENDIX 9.3**

**OPERATIONAL PHASE CUMULATIVE IMPACT ASSESSMENT**

**PREPARED BY AWN CONSULTING LTD**

The cumulative impact scenario assessed the combined operational phase impact of Buildings A and B as outlined in this chapter as well as the nearby Huntstown Power Station.

Cumulative Impact Assessment (USEPA Methodology)

The NO<sub>2</sub> modelling results at the worst-case location at and beyond the site boundary are detailed in Table A9.4 based on the USEPA methodology (USEPA, 2011). This scenario involved the emergency operation of 56 no. back-up diesel generators associated with Building A and Building B for 100 hours per year as well as considering worst-case scheduled testing for all 56 no. back-up generators on site in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The results indicate that the ambient ground level concentrations are within the relevant air quality standards for NO<sub>2</sub>. For the worst-case year modelled, emissions from all back-up generators lead to an ambient NO<sub>2</sub> concentration (including background) which is 59% of the maximum ambient 1-hour limit value (measured as a 99.8<sup>th</sup> percentile) and 81% of the annual limit value at the worst-case off-site receptor.

In conclusion, the results of the cumulative impact scenario are in compliance with the relevant ambient air quality limit values at all locations at or beyond the site boundary. This results in a **long-term, slight, negative** impact to air quality.

Pollutant / Year	Background Concentration (µg/m <sup>3</sup> )	Averaging Period	Process Contribution NO <sub>2</sub> (µg/m <sup>3</sup> )	Predicted Environmental Concentration NO <sub>2</sub> (µg/m <sup>3</sup> )	Limit Value (µg/m <sup>3</sup> ) Note 1
NO <sub>2</sub> / 2015	30	99.8th%ile of 1-Hr Means	81.2	111.2	200
	15	Annual mean	15.5	30.5	40
NO <sub>2</sub> / 2016	30	99.8th%ile of 1-Hr Means	80.0	110.0	200
	15	Annual mean	14.6	29.6	40
NO <sub>2</sub> / 2017	30	99.8th%ile of 1-Hr Means	86.9	116.9	200
	15	Annual mean	17.2	32.2	40
NO <sub>2</sub> / 2018	30	99.8th%ile of 1-Hr Means	82.0	112.0	200
	15	Annual mean	14.2	29.2	40
NO <sub>2</sub> / 2019	30	99.8th%ile of 1-Hr Means	88.1	118.1	200
	15	Annual mean	15.2	30.2	40

**Table A9.4** NO<sub>2</sub> Dispersion Model Results – Cumulative Scenario



Cumulative Impact Assessment (UK Environment Agency Methodology)

The methodology, based on considering the statistical likelihood of an exceedance of the NO<sub>2</sub> hourly limit value assuming a hypergeometric distribution, has been undertaken at the worst-case residential receptor for the Cumulative Impact Scenario. This scenario involved the emergency operation of 56 no. back-up generators on the site for Buildings A and B in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined as outlined in Table A9.5. The results have been compared to the 98<sup>th</sup> percentile confidence level to indicate if an exceedance is likely at various operational hours for the back-up diesel generators. The results indicate that in the worst-case year, the emergency generators for the Cumulative Scenario can operate for up to 33 hours per year before there is a likelihood of an exceedance of the ambient air quality standard (at a 98<sup>th</sup> percentile confidence level). However, the UK guidance recommends that there should be no running time restrictions placed on back-up generators which provide power on site only during an emergency power outage.

Pollutant / Meteorological Year	Hours of operation (Hours) (98 <sup>th</sup> ile) Allowed Prior To Exceedance Of Limit Value	UK Guidance – Probability Value = 0.02 (98 <sup>th</sup> ile) <sup>Note 1</sup>
NO <sub>2</sub> / 2015	40	0.02
NO <sub>2</sub> / 2016	40	
NO <sub>2</sub> / 2017	33	
NO <sub>2</sub> / 2018	43	
NO <sub>2</sub> / 2019	39	

<sup>Note 1</sup> Guidance Outlined In UK EA publication "Diesel Generator Short-term NO<sub>2</sub> Impact Assessment" (EA, 2016)  
**Table A9.5** Hypergeometric Statistical Results at Worst-case Residential Receptor – NO<sub>2</sub> Cumulative Impact Scenario

**APPENDIX 9.3**

**OPERATIONAL PHASE CUMULATIVE IMPACT ASSESSMENT**

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The cumulative impact scenario assessed the combined operational phase impact of Buildings A and B as outlined in this chapter as well as the nearby Huntstown Power Station.

Cumulative Impact Assessment (USEPA Methodology)

The NO<sub>2</sub> modelling results at the worst-case location at and beyond the site boundary are detailed in Table A9.4 based on the USEPA methodology (USEPA, 2011). This scenario involved the emergency operation of 56 no. back-up diesel generators associated with Building A and Building B for 100 hours per year as well as considering worst-case scheduled testing for all 56 no. back-up generators on site in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The results indicate that the ambient ground level concentrations are within the relevant air quality standards for NO<sub>2</sub>. For the worst-case year modelled, emissions from all back-up generators lead to an ambient NO<sub>2</sub> concentration (including background) which is 59% of the maximum ambient 1-hour limit value (measured as a 99.8<sup>th</sup> percentile) and 81% of the annual limit value at the worst-case off-site receptor.

In conclusion, the results of the cumulative impact scenario are in compliance with the relevant ambient air quality limit values at all locations at or beyond the site boundary. This results in a **long-term, slight, negative** impact to air quality.

Pollutant / Year	Background Concentration (µg/m <sup>3</sup> )	Averaging Period	Process Contribution NO <sub>2</sub> (µg/m <sup>3</sup> )	Predicted Environmental Concentration NO <sub>2</sub> (µg/m <sup>3</sup> )	Limit Value (µg/m <sup>3</sup> ) Note 1
NO <sub>2</sub> / 2015	30	99.8th%ile of 1-Hr Means	81.2	111.2	200
	15	Annual mean	15.5	30.5	40
NO <sub>2</sub> / 2016	30	99.8th%ile of 1-Hr Means	80.0	110.0	200
	15	Annual mean	14.6	29.6	40
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	15	Annual mean	17.2	32.2	40
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	15	Annual mean	15.2	30.2	40

**Table A9.4** NO<sub>2</sub> Dispersion Model Results – Cumulative Scenario

Cumulative Impact Assessment (UK Environment Agency Methodology)

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The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined as outlined in Table A9.5. The results have been compared to the 98<sup>th</sup> percentile confidence level to indicate if an exceedance is likely at various operational hours for the back-up diesel generators. The results indicate that in the worst-case year, the emergency generators for the Cumulative Scenario can operate for up to 33 hours per year before there is a likelihood of an exceedance of the ambient air quality standard (at a 98<sup>th</sup> percentile confidence level). However, the UK guidance recommends that there should be no running time restrictions placed on back-up generators which provide power on site only during an emergency power outage.

Pollutant / Meteorological Year	Hours of operation (Hours) (98 <sup>th</sup> ile) Allowed Prior To Exceedance Of Limit Value	UK Guidance – Probability Value = 0.02 (98 <sup>th</sup> ile) <sup>Note 1</sup>
NO <sub>2</sub> / 2015	40	0.02
NO <sub>2</sub> / 2016	40	
NO <sub>2</sub> / 2017	33	
NO <sub>2</sub> / 2018	43	
NO <sub>2</sub> / 2019	39	

<sup>Note 1</sup> Guidance Outlined In UK EA publication "Diesel Generator Short-term NO<sub>2</sub> Impact Assessment" (EA, 2016)  
**Table A9.5** Hypergeometric Statistical Results at Worst-case Residential Receptor – NO<sub>2</sub> Cumulative Impact Scenario

**APPENDIX 10.1**

**GLOSSARY OF ACOUSTIC TERMINOLOGY**

**PREPARED BY AWN CONSULTING LIMITED**

<b>ambient noise</b>	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
<b>background noise</b>	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ( $L_{AF90,T}$ ).
<b>broadband</b>	Sounds that contain energy distributed across a wide range of frequencies.
<b>dB</b>	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micropascals (20 $\mu$ Pa).
<b>dB <math>L_{pA}</math></b>	An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'-weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
<b>Hertz (Hz)</b>	The unit of sound frequency in cycles per second.
<b>impulsive noise</b>	A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.
<b><math>L_{Aeq,T}</math></b>	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the $L_{Aeq}$ value is to either the $L_{AF10}$ or $L_{AF90}$ value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
<b><math>L_{AFN}</math></b>	The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.
<b><math>L_{AFmax}</math></b>	is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).
<b><math>L_{Ar,T}</math></b>	The Rated Noise Level, equal to the $L_{Aeq}$ during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.
<b><math>L_{AF90}</math></b>	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
<b><math>L_{AT}(DW)</math></b>	equivalent continuous downwind sound pressure level.
<b><math>L_{rT}(DW)</math></b>	equivalent continuous downwind octave-band sound pressure level.
<b><math>L_{day}</math></b>	$L_{day}$ is the average noise level during the daytime period of 07:00hrs to 19:00hrs
<b><math>L_{night}</math></b>	$L_{night}$ is the average noise level during the night-time period of 23:00hrs to 07:00hrs.

<b>low frequency noise</b>	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
<b>noise</b>	Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.
<b>noise sensitive location</b>	NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
<b>octave band</b>	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
<b>rating level</b>	See $L_{A,T}$ .
<b>sound power level</b>	The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per $m^2$ where: $L_w = 10 \text{Log} \frac{P}{P_0} \text{ dB}$ <p>Where: <math>p</math> is the rms value of sound power in Watts; and <math>P_0</math> is 1 pW.</p>
<b>sound pressure level</b>	The sound pressure level at a point is defined as: $L_p = 20 \text{Log} \frac{P}{P_0} \text{ dB}$ <p>Where: <math>p</math> is the rms value of sound power in pascals; and <math>P_0</math> is <math>2 \times 10^{-5}</math> Pa.</p>
<b>specific noise level</b>	A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is a more precise definition as follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval ( $L_{Aeq,T}$ )'.
<b>tonal</b>	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.
<b><math>1/3</math> octave analysis</b>	Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one-third of an octave each.

**APPENDIX 10.2**

**BASELINE NOISE MONITORING SURVEY**

**PREPARED BY AWN CONSULTING LIMITED**



An environmental noise survey has been conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*. Specific details are set out below.

### 10.2.1 Survey Details

#### Dates & Times of Survey

Unattended monitoring was carried out at Locations A, B and C between 10:00hrs on 28 August 2019 to 15:00hrs on 4 September 2019. Unattended monitoring was carried out at Location D between 13:00hrs on 13 November 2019 to 13:30hrs on 20 November 2019.

#### Instrumentation

The noise measurements were performed using a Rion N52 Sound Level Analyzers. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

#### Measurement Locations

Figure 10.2.1 details the approximate location of the measurement positions.

#### Methodology

Measurements were conducted at the boundary location noted above. Sample periods for the noise measurements were typically 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis if required. Survey personnel noted the primary noise sources contributing to noise build-up.

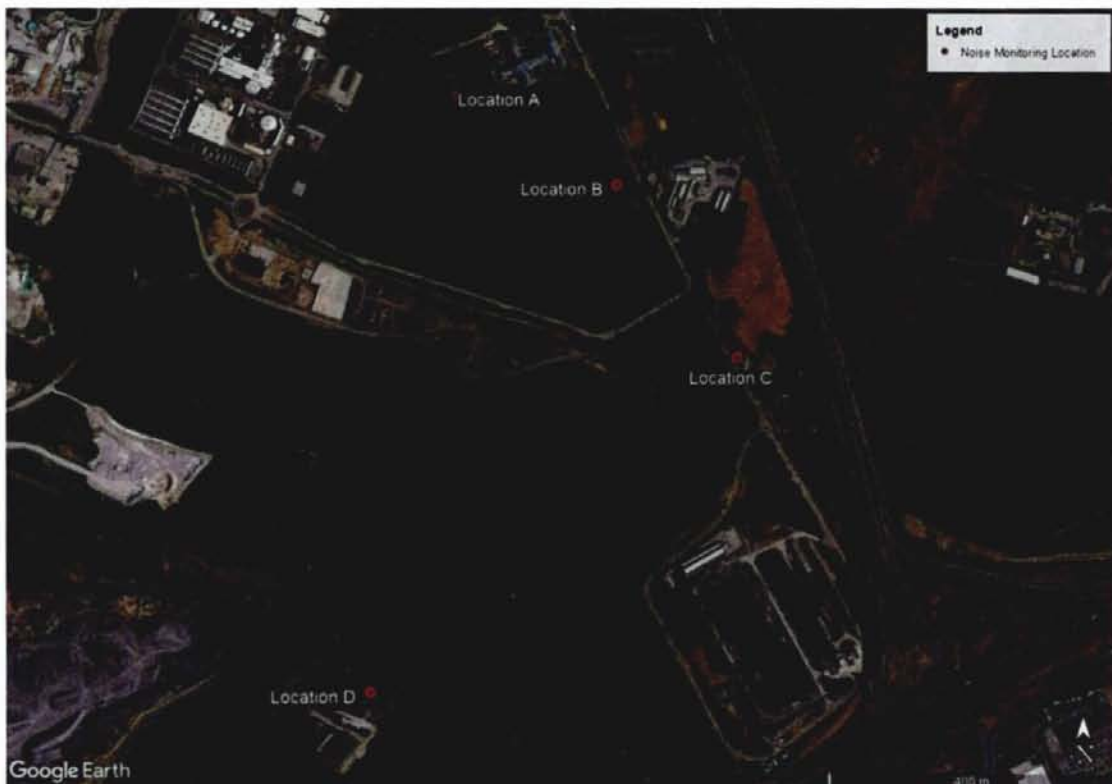


Figure 10.2.1 Noise Survey Locations (Source: Google Maps)

## 10.2.2 Survey Results

Table 10.2.1 reviews the noise levels measured of the current survey period reviewed at the various locations identified.

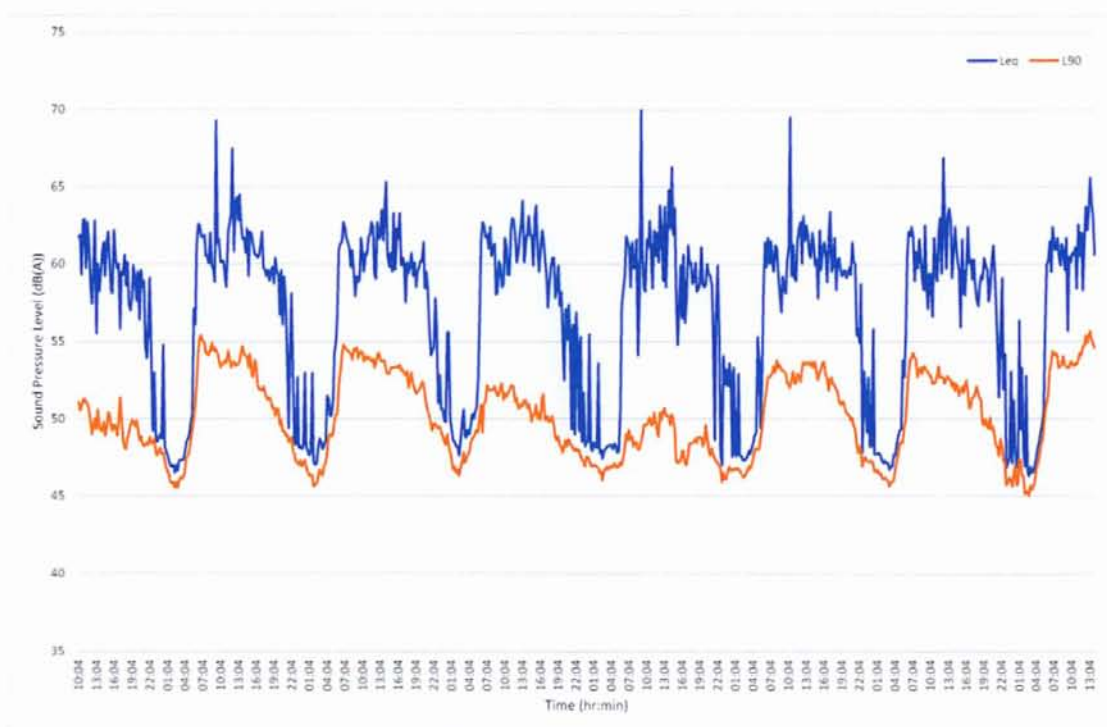
Location	Period	Average Measured Noise Level over Survey Period	
		$L_{Aeq,T}$	$L_{A90,T}$
A	Day (07:00 – 19:00hrs)	61	52
	Evening (19:00 – 23:00hrs)	58	49
	Night (23:00 to 07:00hrs)	55	48
B	Day (07:00 – 19:00hrs)	61	54
	Evening (19:00 – 23:00hrs)	57	50
	Night (23:00 to 07:00hrs)	54	48
C	Day (07:00 – 19:00hrs)	62	56
	Evening (19:00 – 23:00hrs)	59	53
	Night (23:00 to 07:00hrs)	55	48
D	Day (07:00 – 19:00hrs)	59	55
	Evening (19:00 – 23:00hrs)	58	54
	Night (23:00 to 07:00hrs)	54	49

**Table 10.2.1** Review of Measured Noise Levels

Background noise levels at the selected noise monitoring locations during night-time periods ranged from 48 to 49dB  $L_{A90,8hrs}$  based on the survey data to hand.

### Location A

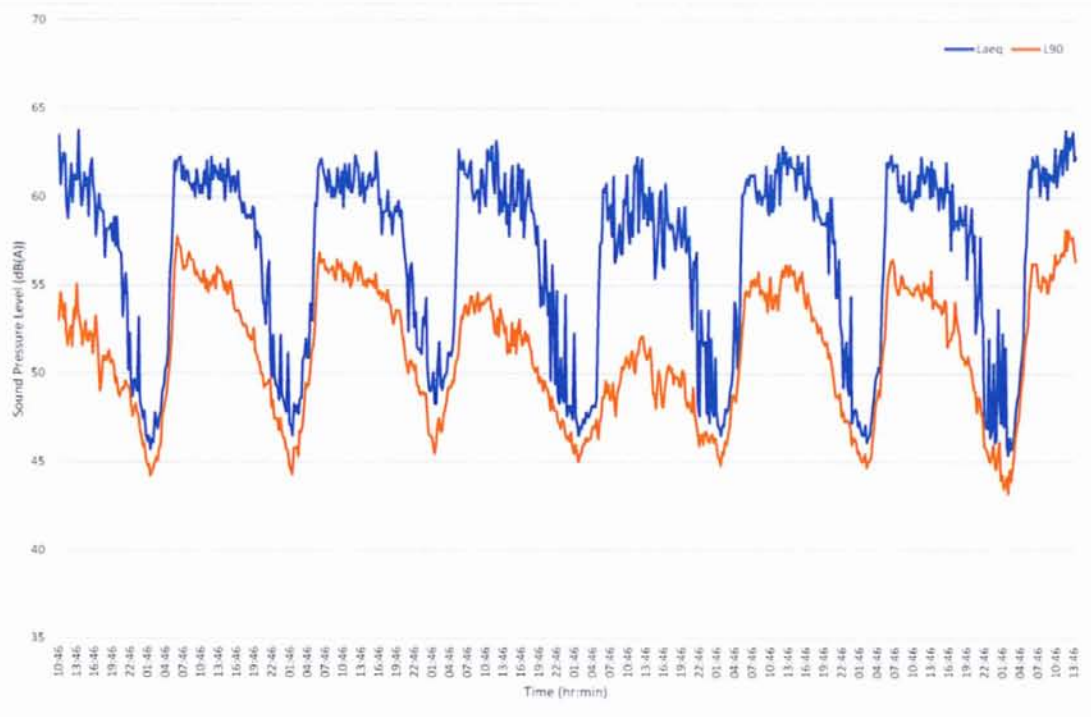
Figure 10.2.2 presents a diurnal profile of ambient (i.e.  $L_{Aeq}$ ) and background (i.e.  $L_{A90}$ ) noise levels measured at Location A over the duration of the survey.



**Figure 10.2.2** Review of Ambient and Background Measurements at Location A

### Location B

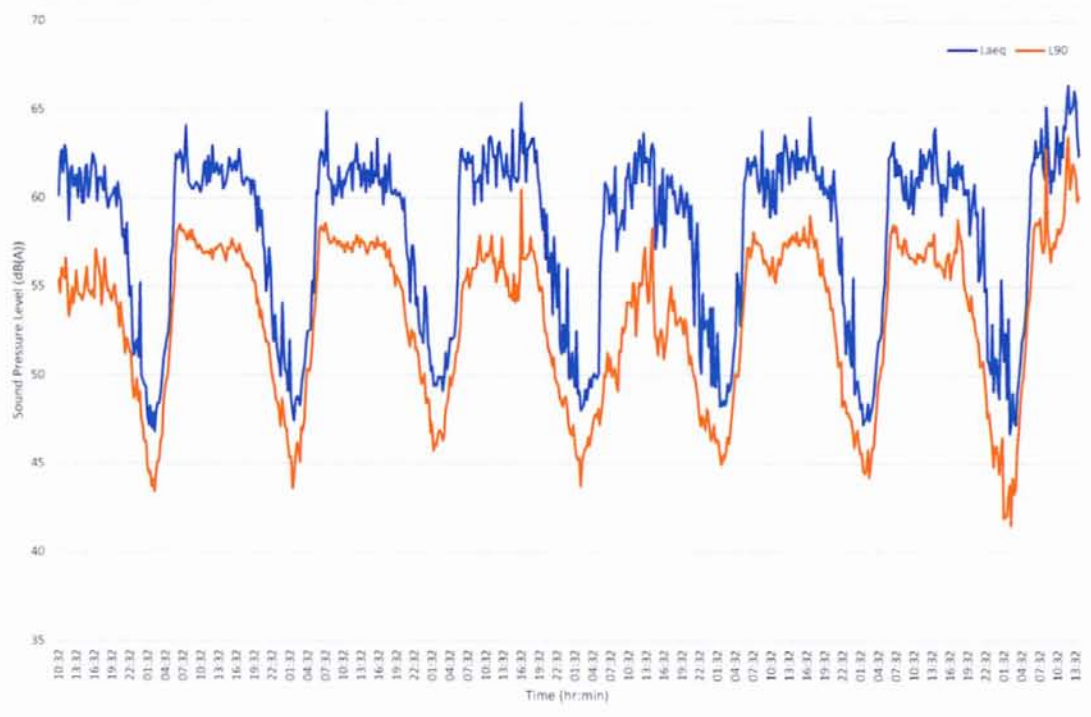
Figure 10.2.3 presents a diurnal profile of ambient (i.e.  $L_{Aeq}$ ) and background (i.e.  $L_{A90}$ ) noise levels measured at Location B over the duration of the survey.



**Figure 10.2.3** Review of Ambient and Background Measurements at Location B

### Location C

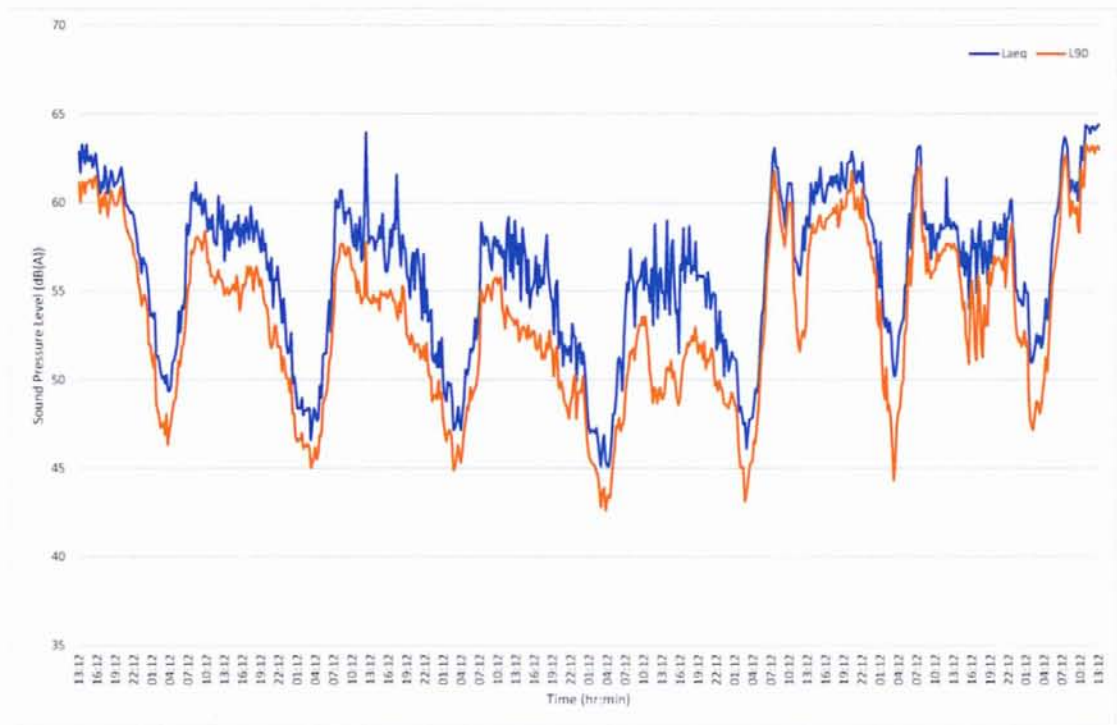
Figure 10.2.4 presents a diurnal profile of ambient (i.e.  $L_{Aeq}$ ) and background (i.e.  $L_{A90}$ ) noise levels measured at Location C over the duration of the survey.



**Figure 10.2.4** Review of Ambient and Background Measurements at Location C

**Location D**

Figure 10.2.5 presents a diurnal profile of ambient (i.e.  $L_{Aeq}$ ) and background (i.e.  $L_{A90}$ ) noise levels measured at Location D over the duration of the survey.



**Figure 10.2.5** Review of Ambient and Background Measurements at Location D

APPENDIX 10.3

NOISE MODELLING DETAILS & ASSUMPTIONS

PREPARED BY AWN CONSULTING LIMITED

FINGAL COUNTY COUNCIL  
PLANNING DEPARTMENT  
11 FEB 2022  
ADDITIONAL INFORMATION  
REGISTRY

## Noise Model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the proposed building. This section discusses the methodology behind the noise modelling process.

### DGMR iNoise

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, DGMR iNoise, calculates noise levels in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

DGMR iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels ( $L_{WA}$ );
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

### Brief Description of ISO9613-2: 1996

ISO9613-2:1996 calculates the noise level based on each of the factors discussed previously. However, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level,  $L_{AT}(DW)$ , for the following conditions:

- wind direction at an angle of  $\pm 45^\circ$  to the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and;
- wind speed between approximately  $1\text{ms}^{-1}$  and  $5\text{ms}^{-1}$ , measured at a height of 3m to 11m above the ground.

The equations and calculations also hold for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear calm nights.

The basic formula for calculating  $L_{AT}(DW)$  from any point source at any receiver location is given by:

$$L_{rT}(DW) = L_W + D_c - A \quad \text{Eqn. A}$$

Where:

$L_{rT}(DW)$  is an octave band centre frequency component of  $L_{AT}(DW)$  in dB relative to  $2 \times 10^{-5}\text{Pa}$ ;

$L_W$  is the octave band sound power of the point source;

$D_c$  is the directivity correction for the point source;

$A$  is the octave band attenuation that occurs during propagation, namely attenuation due to geometric divergence, atmospheric absorption, ground effect, barriers and miscellaneous other effects.

The estimated accuracy associated with this methodology is shown in Table 10.3.1 below:

**Table 10.3.1** Estimated Accuracy for Broadband Noise of  $L_{AT}(DW)$

Height, $h^*$	Distance, $d^\dagger$	
	$0 < d < 100m$	$100m < d < 1,000m$
$0 < h < 5m$	$\pm 3dB$	$\pm 3dB$
$5m < h < 30m$	$\pm 1dB$	$\pm 3dB$

\*  $h$  is the mean height of the source and receiver.  $\dagger d$  is the mean distance between the source and receiver. N.B. These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

## Input Data and Assumptions

The noise model has been constructed using data from various source as follows:

<i>Site Layout</i>	The general site layout has been obtained from the drawings forwarded by HJL Architects.
<i>Local Area</i>	The location of noise sensitive locations has been obtained from a combination of site drawings provided by HJL Architects and others obtained from Ordnance Survey Ireland (OSI).
<i>Heights</i>	The heights of buildings on site have been obtained from site drawings forwarded by HJL Architects. Off-site buildings have been assumed to be 8m high for houses with the exception of industrial buildings where a default height of 15m has been assumed.
<i>Contours</i>	Site ground contours/heights have been obtained from site drawings forwarded by HJL Architects where available.

The final critical aspect of the noise model development is the inclusion of the various plant noise sources. Details are presented in the following section.

## Source Sound Power Data

The noise modelling completed indicates the following limits in relation to various items of plant associated with the overall site development. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site (including any system regenerated noise).

**Table 10.3.2**  $L_w$  levels Utilised in Noise Model

Source	$L_w$ - Octave Band Centre Frequency								dB (A)
	63	125	250	500	1k	2k	4k	8k	
AHU Intake <sup>Note A</sup>	58	63	63	57	51	48	43	35	59
Generator Intake <sup>Note B</sup>	95	94	84	84	85	77	71	64	88
Generator Rear <sup>Note B</sup>	101	96	87	86	84	82	79	79	90
Generator Stack <sup>Note C</sup>	111	98	79	67	60	57	57	60	86
Generator Roof <sup>Note B</sup>	98	97	91	92	89	84	76	74	93
Generator Sides <sup>Note B</sup>	100	99	93	93	91	86	78	76	95
Generator Exhaust <sup>Note B</sup>	104	96	85	79	74	67	71	76	85
Generator Intake <sup>Note D</sup>	106	98	81	56	46	44	44	56	85
Generator Rear <sup>Note D</sup>	104	98	82	64	55	52	52	66	84
Generator Stack <sup>Note D</sup>	111	98	79	67	60	57	57	60	86
Generator Sides & Roof <sup>Note D</sup>	105	97	92	83	78	78	78	75	89
Transformers (x4) <sup>Note E</sup>	--	--	--	--	95	--	--	--	95
Series Coil <sup>Note E</sup>	--	--	--	--	105	--	--	--	105

Note A Per m<sup>2</sup> of louvre opening.

Note B Assuming generator housing dimensions of 17m (L) x 4m (W) x 4m (H). Data based on data supplied in relation to proposed unit.

Note C Additional attenuation due to 20m stack and additional bends assumed.

Note D Associated with waste water treatment plant and administration areas.

Note E Assessed to consider cumulative impact of adjacent sub station development.

Figure 10.3.1 presents a 3D render of the developed site noise model for the current proposals.



Figure 10.3.1 Images of Developed Noise Model – View of Site

### Modelling Calculation Parameters<sup>1</sup>

Prediction calculations for plant noise have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

Ground attenuation factors of 1.0 have been assumed. No metrological corrections were assumed for the calculations. The atmospheric attenuation outlined in Table 10.3.3 has been assumed for all calculations.

Table 10.3.3 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

<sup>1</sup> See Appendix 10.5 for further discussion of calculation parameters.



**APPENDIX 10.4**

**INDICATIVE CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN**

**PREPARED BY AWN CONSULTING LIMITED**

This Noise and Vibration Management Plan (NVMP) details a 'Best Practice' approach to dealing with potential noise and vibration emissions during the construction phase of the development. The Plan should be adopted by all contractors and sub-contractors involved in construction activities on the site. The Site Manager should ensure that adequate instruction is provided to contractors regarding the noise and vibration control measures contained within this document.

The environmental impact assessment (EIA) Report conducted for the construction activity has highlighted that the construction noise and vibration levels can be controlled to within the adopted criteria. However, mitigation measures should be implemented, where necessary, in order to control impacts to nearby sensitive areas within acceptable levels.

Nearby sensitive properties in the vicinity of the Proposed Development are summarised in Figure 10.5.1 below:



Figure 10.5.1 Sensitive Receptors

Table 10.4.1 Review of Assessment Locations

Ref.	Description
NSL01	Private residence / office located to the south east of the development site along the R135
NSL02	Private residence / office located to the south east of the development site along the R135
NSL03	Private residence / office located to the south east of the development site along the R135
NSL04	Assumed to be a private residence located on the far side of the R135 beyond the eastern boundary of the site.
NSL05	Nearest façade of the Dogs Trust centre located on the far side of the northern boundary of the development site. This location is understood to be the kennel and administration areas associated with the site.
NSL06	Private staff residences located on the Dog's Trust site.
NSL07	Assumed to be a private residence located on the far side of the R135 beyond the eastern boundary of the site.
NSL08	Nearest residential location to the south of the site at some 640m distance.

## Construction Noise Criteria

As referenced in the EIA Report prepared for the Proposed Development, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*<sup>2</sup> which indicates the following criteria and hours of operation.

**Table 10.4.2** Construction Noise Limit Values

Days and Times	Noise Levels (dB re. 2x10 <sup>-5</sup> Pa)	
	L <sub>Aeq</sub> (1hr)	L <sub>Amax</sub>
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00hrs to 13:00hrs	65	75

Note \* Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

## Construction Vibration Criteria

It is recommended in this EIA Report that vibration from construction activities to off-site residences be limited to the values set out in Table 10.4.3. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

**Table 10.4.3** Construction Vibration Limit Values

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

## Hours of Work

The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays. However, weekday evening works may also be required from time to time.

Weekday evening activities should be significantly reduced and generally only involve internal activities and concrete pouring which will be required during certain phases of the development. As a result, noise emissions from evening activities are expected to be significantly lower than for other general daytime activities.

## Best Practice Guidelines for the Control of Noise & Vibration

BS5228 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening;

<sup>2</sup> *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004, Transport Infrastructure Ireland*

- hours of work;
- liaison with the public, and;
- monitoring.

Detailed comment is offered on these items in the following paragraphs. Noise and vibration control measures that will be considered include the selection of suitable plant, enclosures and screens around noise sources, limiting the hours of work and monitoring.

#### *Selection of Quiet Plant*

This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

#### *General Comments on Noise Control at Source*

If replacing a noisy item of plant is not a viable or practical option, consideration should be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS5228 states that "*as far as reasonably practicable sources of significant noise should be enclosed*". In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures will also be used to screen operatives using hand tools and will be moved around site as necessary.

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. As with Ireland's Environmental Protection Act legislation, we propose that the concept of "*best available techniques not entailing excessive cost*" (BATNEEC) be adopted. Furthermore, proposed noise control techniques should be evaluated in light of their potential effect on occupational safety etc.

BS5228 makes a number of recommendations in relation to "use and siting of equipment". These are all directly relevant and hence are reproduced in full. These recommendations will be adopted on site.

*"Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas. Special care will be necessary when work has to be carried out at night.*

*Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.*

*Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.*

*Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.*

*Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.*

*Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material."*

All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

### *Screening*

Typically, screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen should be bent around the source. The height of any screen should be such that there is no direct line of sight between the source and the receiver.

BS5228 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 7 kg/m<sup>2</sup> will give adequate sound insulation performance.

In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances, materials such as topsoil or aggregate can provide a degree of noise screening if placed between the source and the receiver.

### *Vibration*

The vibration from construction activities will be limited to the values set out in Table 2. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%.

### *Liaison with the Public*

The Contractor will provide proactive community relations and will notify the public and sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The Contractor

will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. rock breaking, piling, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

#### *Noise Monitoring*

During the construction phase consideration should be given to noise monitoring at the nearest sensitive locations.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

#### *Vibration Monitoring*

During the construction phase consideration should be given to vibration monitoring at the nearest sensitive locations.

Vibration monitoring should be conducted in accordance with BS7385-1 (1990) *Evaluation and measurement for vibration in buildings — Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings* or BS6841 (1987) *Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock*.

The mounting of the transducer to the vibrating structure should comply with BS ISO 5348:1998 *Mechanical vibration and shock – Mechanical mounting of accelerometers*. In summary, the following ideal mounting conditions apply:

- the transducer and its mountings are as rigid as possible;
- the mounting surfaces should be as clean and flat as possible;
- simple symmetric mountings are best, and;
- the mass of the mounting should be small in comparison to that of the structure under test.

In general, the transducer will be fixed to the floor of a building or concrete base on the ground using expansion bolts. In instances where the vibration monitor will be placed outside of a building a flat and level concrete base with dimensions of approximately 1m x 1m x 0.1m will be required.

**APPENDIX 10.5**  
**NOISE MODEL PARAMETERS**  
**PREPARED BY AWN CONSULTING LIMITED**

Prediction calculations for noise emissions have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

**Directivity Factor:** The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measured in a down wind direction, corresponding to the worst-case propagation conditions and needs no further adjustment.

**Ground Effect:** Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation) Our predictions have been carried out using various source height specific to each plant item, a receiver heights of 1.6m for single storey properties and 4m for double. An assumed ground factor of G = 1.0 has been applied off site. Noise contours presented in the assessment have been predicted to a height of 4m in all instances. For construction noise predictions have been made at a level of 1.6m as these activities will not occur at night.

**Geometrical Divergence** This term relates to the spherical spreading in the free-field from a point sound source resulting in attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log (\text{distance from source in meters}) + 11$$

**Atmospheric Absorption** Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. In these predictions a temperature of 10°C and a relative humidity of 70% have been used, which give relatively low levels of atmosphere attenuation and corresponding worst case noise predictions.

**Table 10.5.1** Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

**Barrier Attenuation** The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.



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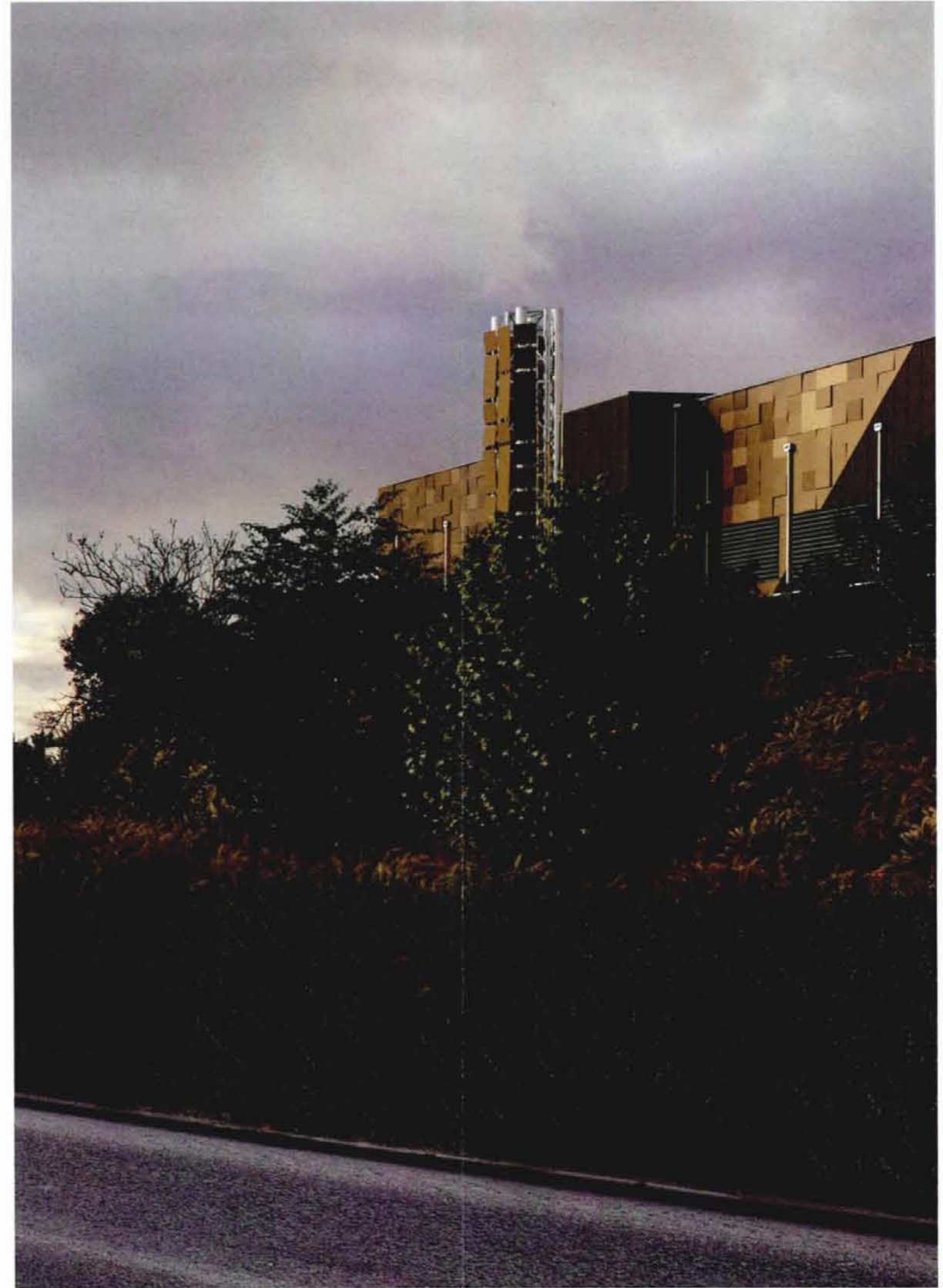
**APPENDIX 11.1**  
**PHOTOMONTAGE VIEWS**

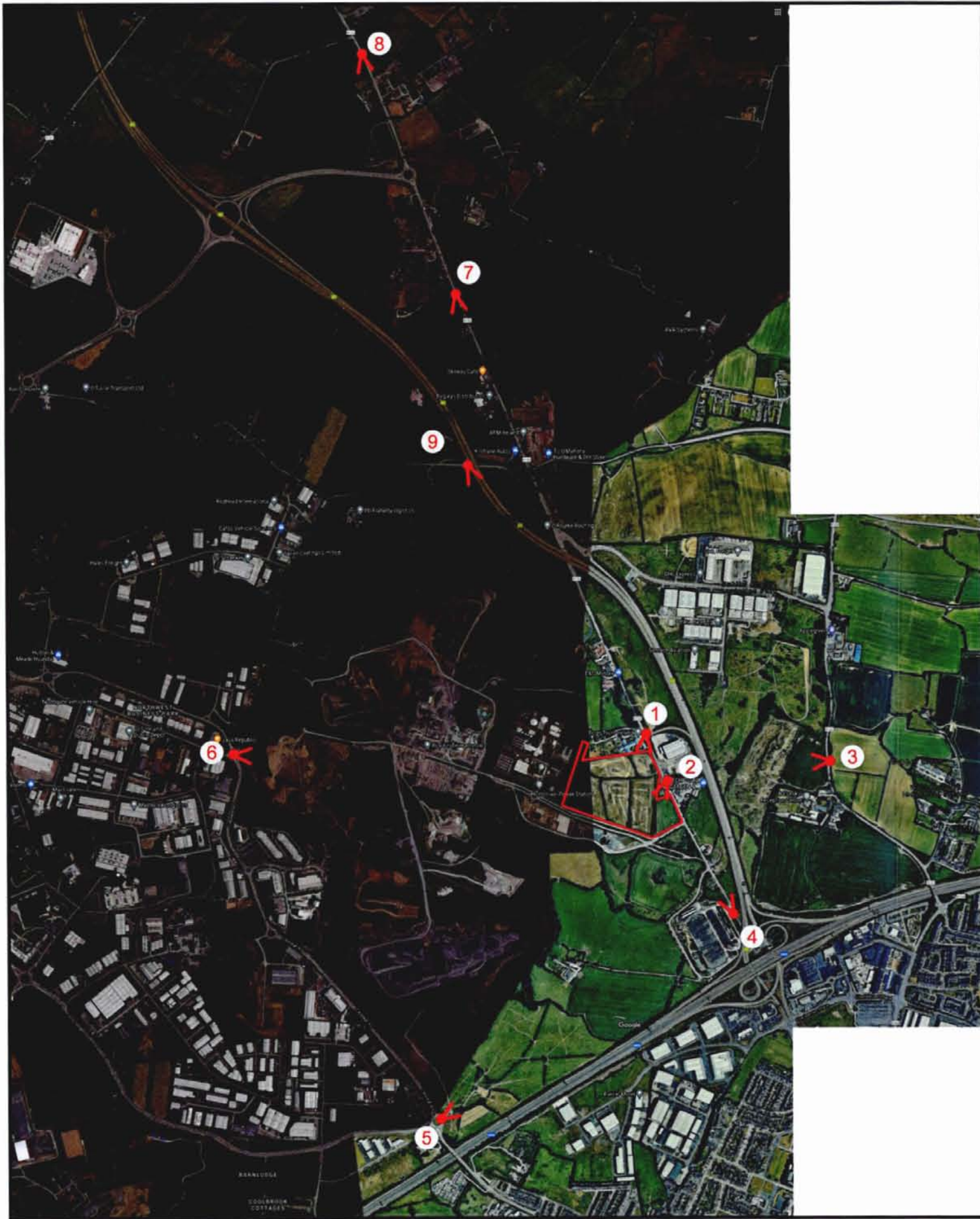
Prepared by  
Digital Dimensions

# Huntstown Data Centre

## Method Statement - Photo-montage production.

1. Photographs are taken from locations as advised by client with a full frame SLR digital camera and prime lens. The photographs are taken horizontally with a survey level attached to the camera. The photographic positions are marked (for later surveying), the height of the camera and the focal length of the image recorded.
2. In each photograph, a minimum of 3no. visible fixed points are marked for surveying. These are control points for model alignment within the photograph. All surveying is carried out by a qualified topographical surveyor using Total Station / GPS devices.
3. The photographic positions and the control points are geographically surveyed and this survey is tied in to the site topographical survey supplied by the Architect / client.
4. The buildings are accurately modelled in 3D cad software from cad drawings supplied by the Architect. Material finishes are applied to the 3D model and scene element are place like trees and planting to represent the proposed landscaping.
5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.
6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.
7. In the event of the development not being visible, the roof line of the development will be outlined in red if re-quested.
8. The document contains:
  - a) Site location map with view locations plotted.
  - b) Photo-montage sheet with existing or proposed conditions.
  - c) Reference information including field of view/focal length, range to site / development, date of photograph.





FINGAL COUNTY COUNCIL  
PLANNING DEPARTMENT  
11 FEB 2022  
ADDITIONAL INFORMATION  
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Location Map

Project: Huntstown Data Centre



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	04-02-2021	74°	24mm	72m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Planning Submission	04-02-2021	74°	24mm	72m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Planning Submission F.I.	04-02-2021	74°	24mm	72m	Canon EOS 5DS



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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Planning Submission	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS





Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Planning Submission F.I.	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	04-02-2021	74°	24mm	711m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed	04-02-2021	74°	24mm	711m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Planning Submission F.I.	04-02-2021	74°	24mm	711m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	04-02-2021	74°	24mm	468m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed	04-02-2021	74°	24mm	468m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green



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 REGISTRY

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Planning Submission F.I.	04-02-2021	74°	24mm	468m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Existing	04-02-2021	74°	24mm	1414m	Canon EOS 5DS





Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	04-02-2021	74°	24mm	1414m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Existing	04-02-2021	74°	24mm	1361m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Proposed	04-02-2021	74°	24mm	1361m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Existing	04-02-2021	74°	24mm	2171m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Proposed	04-02-2021	74°	24mm	2171m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green



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 11 FEB 2022  
 ADDITIONAL INFORMATION  
 REGISTRY

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8 Existing	04-02-2021	74°	24mm	3188m	Canon EOS 5DS



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8 Proposed	04-02-2021	74°	24mm	3188m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9 Existing	04-02-2021	74°	24mm	1355m	Canon EOS 5DS





Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9 Proposed	04-02-2021	74°	24mm	1355m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

**APPENDIX 11.2**  
**ARBORICULTURAL REPORT**

Prepared by  
C&G Arboriculture

**Arboricultural Report  
BS5837:2012 Trees in Relation to  
Design, Demolition and Construction  
-Recommendations**

**Proposed Site:** Huntstown, Dublin  
**Client:** Energia

**Job Reference:** Project Cirrus  
**Prepared by:** Rik Pannett, C&G Arboriculture  
**Date:** 21<sup>st</sup> July 2021

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- 1. Tree Survey Schedule
- 2. Key to Tree Survey Schedule Criteria & Headings
- 3. BS5837: 2012 Cascade Chart for Tree Categorisation
- 4. Tree Constraints Plan
- 5. Tree Protection Plan

## 1.0 Terms of Reference

**1.1** Rik Pannett was retained by AWN Consulting on behalf of Energia, to undertake a pre-development tree survey at Huntstown, Dublin D11 in accordance with British Standards 'Trees in relation to design, demolition & construction – Recommendations (BS 5837:2012). The surveyed trees are located within the parameters and adjacent to the proposed site.

**1.2** All trees have been inspected from ground level only. No climbing inspections or below ground investigations have been undertaken. Should a more detailed inspection be deemed appropriate, this will be covered under recommendations. Trees are dynamic living organisms, whose health and condition can be subject to rapid change, depending upon external and internal factors. The conclusions and recommendations contained in this report relate to the trees only at the time of inspection, and do not constitute a tree risk assessment report.

**1.3** An initial tree survey and visual assessment was undertaken in November 2019 by Rik Pannett. An additional tree survey was undertaken in November 2020 to update the original findings, and to survey another field adjacent to the original site. A further visual assessment was made in July 2021.

**1.4** The objective of this survey was to gather information regarding the location of trees and hedgerows on the site and how these may be impacted by construction and development of the site. The survey will detail any constraints to the proposed development. An arboricultural impact assessment addresses the likely impact of the proposed development on trees within and adjacent to the site. Recommendations for the protection of trees during construction work is based on BS 5837: 2012. An arboricultural method statement is included to provide guidance in relation to tree protection during construction.

## 2.0 Survey Methodology

**2.1** Unless otherwise stated tree inspections have been undertaken from ground level using non-invasive techniques only. The survey concentrated primarily on the significant trees within and adjacent to the proposed development site.

**2.2** All trees, groups of trees, and hedgerows surveyed have been given a number prefixed by the letters T, G, and H respectively and were assessed using the 'Cascade chart for tree quality assessment' as described in Table 1 of the BS 5837:2012. Where accessible, trees were physically tagged with an individually numbered tag. The locations of trees, groups of trees and hedgerows on, and adjacent to the site are shown on the Tree Constraints Plan (TCP Appendix 4)

**2.3** Tree species, height, stem diameter and crown spread were recorded for significant trees within the site, some of which may be considered to be a constraint on development based on information supplied by the client. In accordance with BS 5837: 2012 'Trees in relation to design, demolition and construction - Recommendations', only trees with a stem diameter of 75mm or greater were surveyed. As per section 4.4.2.3, trees forming obvious groups were assessed as such.

**2.4** The findings of the survey are given in tabular form in Appendix 1. A full explanation of the survey headings is given in Appendix 2.

**2.5** No assessment of the soil has taken place as part of this report. The BS 5837:2012 states that a soil assessment should be carried out by a competent person to establish the structure, clay content and potential volume for change of the soil. A survey of this nature is considered outside the scope of this arboricultural assessment. An arboricultural method statement is included to provide guidance in relation to tree protection during construction. For guidance on soil structure in relation to construction, advice should be sought from a Structural Engineer.



Fig 1. Shelter belt, South-Eastern corner



Fig 2. Hedgerow including ash T7

### 3.0 Site Overview

**3.1** The survey area comprises broadly level arable land bordered and intersected by drainage ditches (Fig 4) adjoined by hedgerows of varying character. There are a number of native hedgerows (Fig 2), comprising an overstorey of Ash (*Fraxinus excelsior*), Wych Elm (*Ulmus glabra*) and Sycamore (*Acer pseudoplatanus*), with an understorey of Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), and Elder (*Sambucus nigra*). Bramble

(*Rubus fruticosus*), Dog Rose (*Rosa canina*) and Ivy (*Hedera helix*) proliferate in the understorey, and the Ivy climbs high into the crowns of the overstorey trees., There is a shelter belt of Birch (Fig 1) (*Betula pendula*), Beech (*Fagus sylvatica*), and Rowan (*Sorbus aucuparia*) to the South-East, and to the South-West lies another shelter belt of Scots Pine (*Pinus sylvestris*), Oak (*Quercus petraea*), Beech, and Ash. The northern boundary is a hedgerow adjacent to arable land and to The Dogs Trust facility. The eastern extent is bordered by a public road and two dwelling houses. The southern boundary is a roadway which leads to Huntstown Power Station and Huntstown Quarry. The western boundary is adjacent to the Huntstown Power Station campus.

**3.2** The development proposals are for a data centre and a substation which will require significant works to the entirety of the site.

#### 4.0 Limitations and scope of survey report

**4.1** The site was originally surveyed in winter and again in summer. Most of the overstorey trees within the hedgerows are covered in ivy from ground level, far into the crowns. Ivy obscures visibility of the crown and stem and potentially prevents observation of gross structural defects and fungal fruiting bodies if present. This survey does not constitute a tree safety inspection, however, where obvious defects were observed they have been noted.

#### 5.0 Summary of Findings & Conclusions

**5.1** A total of 45 trees or groups of trees as well as 17 hedgerows have been surveyed. A breakdown of the numbers of trees in each retention category is shown in the table below as per BS 5837:2012:

	Category A	Category B	Category C	Category U
Trees	0	0	36	0
Groups	0	5	4	0
Hedgerows	0	0	17	0

**5.2** Category A trees are of high quality and there should be a general presumption for retention of these trees.

**5.3** Category B trees are of moderate quality. It is likely that most Category B trees should be retained and regarded as a constraint to development. Some Category B trees, particularly smaller individuals are of insufficient value to impose significant design constraints and removal of such trees can be justified in order to promote good design (usually on the basis that mitigation is provided elsewhere on the site in the form of high quality new planting).

**5.4** Category C trees are of low quality. They should not impose significant constraints to design layout, and if necessary can defensibly be removed in order to facilitate good design. If Category C trees can be satisfactorily retained within the proposed layout, then consideration should be given for this.

**5.5** Category U trees are unsuitable for retention, usually in such a condition that they cannot realistically be retained as living trees and should be removed for reasons of sound arboricultural practice.

## **6.0 Arboricultural Impact Assessment**

**6.1** Based on the proposed site layout drawings supplied, the arboricultural impact of the proposed development was assessed as follows:

### **6.2 Data Centre:**

Many of the trees, tree groups and hedgerows are implicated by the current proposal for development. Several trees and hedgerows included in the survey offer little or no sustainability due to the scale and extent of the proposed works (refer to appendix 5: TPP). The trees and hedgerows intersecting the interior of the site will all need to be removed, whereas some of the boundary trees (T004; T005; T008-T016; T038; G039-G043) and hedgerows (H1-H3; H5; H7-H9; H14) can be satisfactorily retained within the design proposals.

### **6.3 Substation:**

The semi-mature shelter belt (G045) at the South-West of the site, adjacent Huntstown power station campus needs to be removed to accommodate construction of the proposed substation and ancillary services, as does a section of the hedgerow (H15) and the trees therein (T018-T021).

### **6.4 Replanting:**

There is limited visibility of the site from public roads. The trees are generally of small stature (Fig 4), and as such they offer minimal visual importance. The planned replanting of a wide variety of native trees and hedgerows will mitigate losses sustained during the development of the site as well as mitigating expected future losses due to ash dieback. The impact on retained trees, tree groups and hedgerows will be minimal if the development plans are carefully implemented according to the arboricultural method statement.

### **6.5 Tree Constraints Plan**

Refer to Tree Constraints Plan (TCP) for location of trees and hedgerows (Appendix 3). The TCP has been produced as a basis for the assessment of the constraints imposed by existing trees on the proposed design.



## 6.6 Tree Protection Plan

The Tree Protection Plan (TPP: appendix 5) shows the indicative position of the Root Protection Area (RPA) for trees and hedgerows with a retention priority. The RPA (as described in BS5837: 2012 sec. 3.7) represents the minimum area around each tree in which the ground should remain largely undisturbed and is shown as a pink line on the TPP (refer to Tree Survey Data: appendix 1 for accurate RPA radiuses). Hedgerows close to construction should be protected at least 1 metre from the canopy edge. Tree and hedgerow protection zones are shown as an orange line on the TPP.



Fig 3. Drainage ditch



Fig 4. Ash, typical of many on site

## 7.0 Arboricultural Method Statement

The arboricultural method statement provides information about how to protect trees and hedgerows, their crowns, stems and root systems during the construction process. The stages described below should be used as reference by the main contractor in order to prepare a site-specific method statement for the construction works. The method statement is to be used in conjunction with the TPP which details the extent of root protection areas.

### 7.1 Stage 1: Pre-construction stage

The developer will appoint an Arboriculturist who will oversee tree protection measures for the duration of the project. The arboriculturist will make regular site visits to ensure continued compliance, as well as to respond to project specific issues as they arise.

### 7.2 Tree work

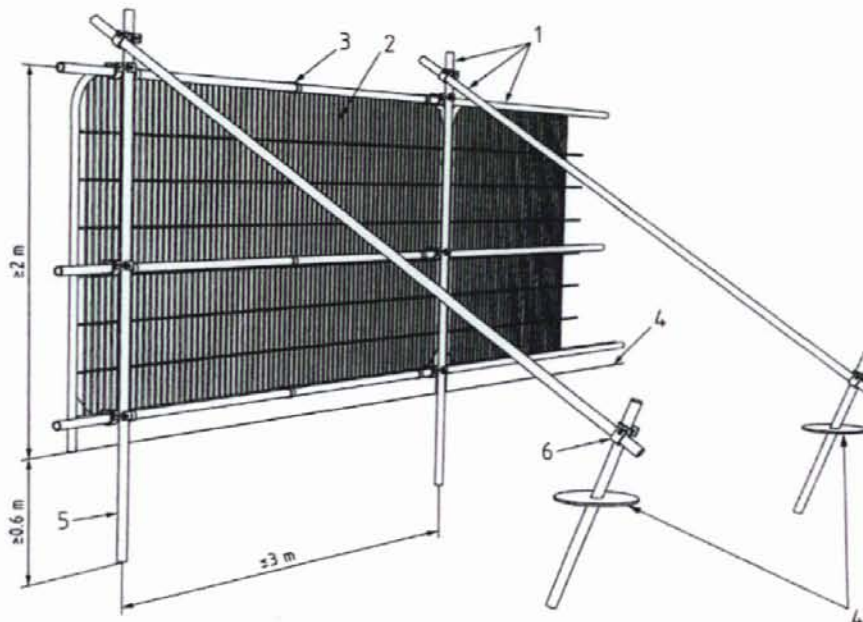
The developer will appoint a qualified arborist to undertake pruning and felling works as

specified in the tree survey recommendations (Appendix 1). All works carried out must conform to BS3998: 2010 Tree Work. Recommendations. Any damage caused to a tree during the construction phase should be reported immediately to the site manager so that inspection and/or remedial works can be undertaken.

### 7.3 Protective fencing

On completion of the tree works, protective fencing should be erected where required, as specified in the tree protection plan, in accordance with BS5837:2012 (fig. 5). Fencing is intended as a precaution to prevent accidental damage to the rooting area of retained trees. Hedgerows, and trees remote from construction can be protected using a lower specification of barrier such as Euromesh (fig. 6). The positioning of any fencing at the edge of the RPA is shown in the TPP as a pink line.

- Erection of protective fencing should be completed before any materials or construction machinery are brought onto site and before any construction works commence.
- Signage (fig. 7) indicating 'tree protection area, no construction access' or similar must be affixed to the protective fencing.
- Fencing is not to be removed or repositioned without approval of the project arboriculturist.



#### Key

- 1 Standard scaffold poles
- 2 Heavy gauge 2m tall, galvanised tube & welded mesh infill panels
- 3 Panels secured to uprights & cross members with wire ties
- 4 Ground level
- 5 Uprights driven into the ground until secure (minimum depth 0.6m)
- 6 Standard scaffold clamps

Fig. 5: Protective barrier specifications



Fig. 6: Euromesh type fencing



Fig. 7: signage to be affixed to fencing

#### 7.4 Ground protection for construction access routes

Where construction or temporary construction access is considered necessary within the RPA, the alignment of the protective barrier may be set back, under supervision of the project arboriculturist.

Temporary ground protection within the RPA must be capable of supporting the load of any persons or traffic using the site without affecting or compacting the underlying soil.

The ground protection must comprise one of the following or similar, as described in BS5837:2012:

- For pedestrian movement, single thickness scaffold board should be laid on top of 100mm of woodchip laid on top of a geotextile membrane.
- For plant up to gross weight of 2 t, interlinked boards must be laid over a compression resistant layer such as woodchip to 150mm, over a geotextile membrane.
- For construction traffic over 2 t gross weight a proprietary system or pre-cast concrete slabs must be installed, in conjunction with arboricultural advice.

In all instances, the objective is to prevent soil compaction where possible, which can occur from the passage of a single vehicle, especially in wet conditions.

#### 7.5 Installation of hard surfacing in proximity to trees

Construction of hard surfaces can impact the surface roots of nearby trees and prevent soil gases exchanging if porousness and load spreading is not incorporated into the design.

In order to prevent root damage, excavation, soil stripping or grading must not be conducted within the RPA of retained trees and hedgerows. Hard surfaces will need to be installed using a 'no dig' method of construction, using a cellular confinement system.

Three cardinal principles apply when avoiding damage to trees during construction:

- Roots must not be severed.
- Soil must not be compacted.
- Oxygen and water must be able to diffuse into the soil beneath the engineered surface.

Construction of hard surfaces will incorporate a cellular no-dig solution such as Cellweb tree root protection (fig. 8) which will ensure that loads placed upon it are laterally dissipated rather than being transferred to the soil and root systems below ground.

The walls of the cellular structure are perforated and must be combined with the infill of clean angular stone, preferably of a single size (20-40mm) which will enable the passage of water and oxygen to the tree roots, ensuring their continued functioning and health.

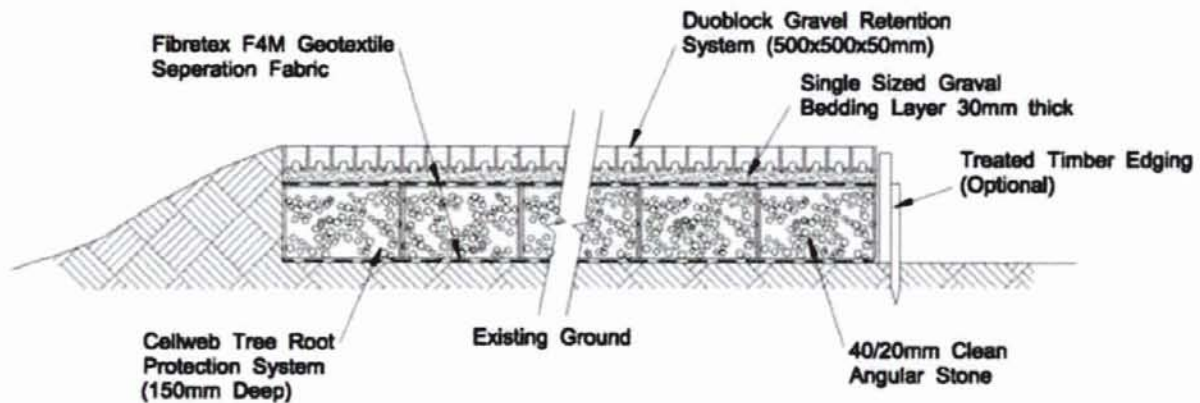


Fig. 8: example of cellular no dig construction method.

### 7.6 Installation of underground Services

Installation of underground cabling must comply with the National Joint Utilities Group (NJUG) 'Guidelines for the planning, installation, and maintenance of utility services in proximity to trees' and with BS 5837:2012. The excavation of open trenches by machine is unacceptable within the RPA of any of the retained trees, and wherever possible, services should be routed outside of any retained trees RPA. Where this is not possible cables should be routed together in a common duct and any inspection chambers sited outside the RPA.

Acceptable techniques for the laying of services are:

- Trenchless- by use of thrust boring or similar techniques. The pit excavations for starting and receiving the machinery should be located outside of the RPA. To avoid root damage, the mole should run at a depth of at least 600mm. Use of external lubricants on the mole other than water should be avoided.
- Broken trench- by using hand dug trench sections together with trenchless techniques. It should be limited to practical access and installation around or below the roots. The trench must be dug by hand and only be long enough to allow access for linking to the next section. The open sections should be kept as short as possible.
- Continuous trench- the trench is excavated by hand and retains as many roots as possible. The surface layer is removed carefully and hand digging of the trench takes place. No roots over 2.5cm diameter or clumps of smaller roots (including fibrous) should be severed. The bark surrounding the roots must be maintained. Cutting of roots over 2.5cm diameter should be performed under supervision of the project Arboriculturalist. If roots have to be cut, a sharp tool (defined as spade, narrow spade, fork, breaker bar, secateurs, handsaw, hand trowel) should be used.

Roots, and in particular fine roots, are vulnerable to desiccation on exposure to air. The roots are at greatest risk when there are rapid fluctuations in the air temperature around them. It is vitally important that the roots are covered with sacking whilst the trench is open.

### **7.7 Pre-commencement site meeting**

Prior to commencement of construction works, a pre-commencement site meeting and contractor briefing will occur. Tree protection barriers are to be inspected by the project arboriculturist, and any additional protection measures to be agreed. Scope of future inspections and monitoring to be agreed between the site manager and project arboriculturist.

### **7.8 Landscape works**

New planting of trees and hedgerows shall be undertaken in accordance with BS5837:2012 and supervised by the project arboriculturist or landscape architect. The existing ground levels within the RPA must be retained and not subjected to compaction or alteration. Manual tools should be used where possible for planting within RPAs in order to minimise root disturbance and damage.

### **7.9 Stage 2: Construction Works stage**

#### **7.10 Protective fencing**

During the construction phase, protective fencing must be kept in place, remain upright and rigid as intended, and checked daily for any damage. The fencing must remain in place, and not be removed until all site works are completed.

#### **7.11 Excavations**

Excavation works can commence once the protective fence line is in place. In advance of excavation, the project manager, site foreman and project arboriculturist will identify and determine the extent of the impact of the proposed works and identify any additional mitigation measures to protect retained trees and hedgerows.

The project arboriculturist will supervise the pruning of roots which are exposed and damaged during excavation works. The excavated face is to be covered with soil in order to prevent drying out and death of further root material.

#### **7.12 Working within RPAs**

If any works are to take place within the RPA, the project arboriculturist must be informed so that mitigation measures are agreed upon to limit impact on root, stem and crown of tree.

#### **7.13 Site considerations**

Throughout the development stages the following must be observed:

- No materials, chemicals, machinery or vehicles are to be stored within the RPA.
- No materials are to be rested against the trunk of trees.
- Burning of rubbish is not permitted within 10m of RPA or hedgerows. Wind direction should be factored when locating a fire, and it must not be unattended.

- Attaching items to any part of a tree is not permitted.
- Washing of machinery, concrete, diesel or other contaminants are not to be discharged within 10m of RPA or hedgerows.
- Any damage caused to protective fencing, ground protection, or retained trees must be reported to the site manager without delay.
- The area around trees enclosed by protective fencing must be considered a construction exclusion zone.

### **7.14 Stage 3: Post Construction Works stage**

On completion of construction works, retained trees are to be re-examined by the project arborist in order to identify any additional remedial works required to ensure tree health and site safety.

## **8.0 Recommendations**

### **8.1 Ash Dieback Overview**

Ash dieback is a fungal disease affecting the common ash tree (*Fraxinus excelsior*), as well as other *Fraxinus* species. Ash dieback has been present in Europe since the 1990s and is now widespread in Ireland. Ash is one of the dominant hedgerow and woodland trees in Ireland, and it has great visual and cultural importance, as well as being an important habitat for hundreds of species.

Ash growing in open locations, such as hedgerows, may deteriorate slowly, and some trees with few symptoms might survive for many years. A small proportion of ash will have a genetic tolerance, and these will stand out as healthy specimens among the population.

In order to minimise impact on the existing ecosystem, and for the possibility of securing any healthy Ash populations present, I am recommending the retention of Ash trees where possible on the site since 'lower levels of intervention may be appropriate where conserving environmental benefits is the (...) objective' (forestry commission, 2020).

## **9.0 Statutory Obligations**

I am currently unaware if any trees at the site are protected by a Tree Preservation Order (TPO) or by virtue of being located within a Conservation Area. I have not been instructed to establish the TPO status of trees with the Local Planning Authority. If any trees are subject to TPOs then consent should be sought from the relevant Local Authority prior to commencement of any works.

Rik Pannett, C&G Arboriculture.

## 10.0 Bibliography

Forestry Commission. (2019) *Managing ash trees affected by ash dieback: operations note 46a*: Available at: <https://www.gov.uk/government/publications/managing-ash-trees-affected-by-ash-dieback-operations-note-46a> (Accessed 20th June 2021)

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
G007	Common Ash (Fraxinus excelsior)	Group	Height (m): 10 3 stems, diam(mm): 500, 400, 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:7 E:4 S:6 W:5	Multi stemmed trees growing from bank of drainage ditch	C2	Radius: 9.1m. Area: 260 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove trees to facilitate construction.
G029	Common Ash (Fraxinus excelsior)	Group	Height (m): 9 Stem Diam (mm): 300 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:3 E:4 S:5 W:3	Group of 3 trees, ash dieback present.	C2	Area: same as Group - 73 sq m.	Other Reference: Physiological Cond: Poor Structural Cond: Fair	Remove tree.
G039	Silver Birch (Betula pendula)	Group	Height (m): 8 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:2 W:2	Group of birch, with understorey of dogwood, guelder rose, rowan and beech.	C2	Area: same as Group - 99 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Fair	Pre construction: Phased thinning to remove damaged and suppressed trees.  During construction: Protect trees with protective barriers - as shown on plans.  Post construction: No action required.
G040	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 8 stems, diam(mm): 80 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:2 E:5 S:2 W:5	Group of birch growing on bank, with beech, dogwood, guelder rose, lilac and rowan.	C2	Area: same as Group - 68 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Phased thinning to remove damaged and suppressed trees.  During construction: Protect trees with protective barriers - as shown on plans.  Post construction: No action required.



Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
G041	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 8 stems, diam(mm): 80 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:2 W:2	trees forming a shelter belt; growing on bank adjacent existing roadway	B2	Area: same as Group - 46 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Thin to remove suppressed and damaged trees.  During construction: Protect trees with protective barriers - as shown on plans.  Post construction: No action required.
G042	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 7 stems, diam(mm): 80 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:2 E:2 S:3 W:3	trees forming a section of shelter belt; growing on bank adjacent existing roadway	B2	Area: same as Group - 106 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: thin to remove suppressed and damaged trees.  During construction: Protect trees with protective barriers - as shown on plans.  Post construction: No action required.
G043	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 7 stems, diam(mm): 100 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:2 S:3 W:3	trees forming a shelter belt; growing on bank adjacent existing roadway, comprising birch, beech, rowan, dogwood and guelder rose.	B2	Area: same as Group - 115 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Thin to remove damaged and suppressed trees.  During construction: Protect trees with protective barriers - as shown on plans.  Post construction: No action required.
G044	Silver Lime (Tilia tomentosa)	Group	Height (m): 5 Life Stage: Semi Mature Rem. Contrib.: 30+ Years	N:1 E:1 S:1 W:1	13 silver lime	C	Area: same as Group - 163 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: No action required.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
G045	Common Ash (Fraxinus excelsior) Pedunculate Oak (Quercus robur) Scots Pine (Pinus sylvestris) Common Beech (Fagus sylvatica)	Group	Height (m): 10 Life Stage: Semi Mature Rem. Contrib.: 20+ Years		Shelter belt approximately 80mx30m.	C2	Area: same as Group - 3464 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove trees to facilitate construction.
H1	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Common Ash (Fraxinus excelsior) Wych Elm (Ulmus glabra)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble and ivy, with ash and dead wych elm.	C2	Area: same as Hedge - 1738 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: No action required.  Post construction: No action required.
H2	Not identified (Not identified)	Hedge	Height (m): 5 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sparse hedge, hawthorn and elder to 5 metres and sections of bramble.	C2	Area: same as Hedge - 1636 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H3	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble and ivy	C2	Area: same as Hedge - 615 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.
H4	Common Hawthorn Blackthorn Elder	Hedge	Height (m): 4 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, elder, bramble and ivy	C2	Area: same as Hedge - 729 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H5	Blackthorn (Prunus spinosa) Elder (Sambucus nigra) Common Hawthorn (Crataegus monogyna)	Hedge	Height (m): 3 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Roadside hedge, comprising hawthorn, blackthorn and elder.	C	Area: same as Hedge - 801 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.
H6	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Common Ash (Fraxinus excelsior)	Hedge	Height (m): 8 Life Stage: Early Mature Rem. Contrib.: 10+ Years		Sprawling unmanaged agricultural hedge, 10 metres deep in sections, adjacent dwelling houses on east, comprising mainly hawthorn, blackthorn, ash, bramble and ivy	C2	Area: same as Hedge - 4245 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow, retaining sections adjacent dwelling houses.
H6 section retain	Not identified (Not identified)	Hedge	As above		As Above	NotRecorded	None - no Retention Category specified.	Other Reference: Physiological Cond: Structural Cond:	Retain Section as per TPP

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H7	Common Beech (Fagus sylvatica) Common Hawthorn (Crataegus monogyna)	Hedge	Height (m): 7 Life Stage: Semi Mature Rem. Contrib.: 10+ Years		Beech and hawthorn hedge, planted adjacent dwelling.	C2	Area: same as Hedge - 440 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Remove hedgerow.
H8	Common Hawthorn (Crataegus monogyna) Sycamore (Acer pseudoplatanus)	Hedge	Height (m): 2 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Hedgerow bordering road, Hawthorn and sycamore.	C2	Area: same as Hedge - 1206 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: Remove section for site access.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.
H8 section removal	Not identified (Not identified)	hedge	As above		As above	NotRecorded	None - no Retention Category specified.	Other Reference: Physiological Cond: Structural Cond:	Remove section as per TPP
H9	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Common Ash (Fraxinus excelsior)	Hedge	Height (m): 5 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble, dog rose and ivy	C2	Area: same as Hedge - 655 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.
H10	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 7 Life Stage: Early Mature Rem. Contrib.: <10 years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble, dog rose and ivy	C2	Area: same as Hedge - 2403 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H11	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Wych Elm (Ulmus glabra) Common Ash (Fraxinus excelsior)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, wych elm, ash, dog rose, bramble and ivy	C2	Area: same as Hedge - 577 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Remove hedgerow.
H12	Common Hawthorn Blackthorn Elder	Hedge	Height (m): 7 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, elder, dog rose, bramble and ivy	C2	Area: same as Hedge - 1587 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H13	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 10+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, dog rose, bramble and ivy	C2	Area: same as Hedge - 1723 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H14	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Roadside agricultural hedge, unmanaged in sections, comprising mainly hawthorn, blackthorn, bramble, dog rose and ivy	C2	Area: same as Hedge - 1832 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.
H15	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Elder (Sambucus nigra)	Hedge	Height (m): 7 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling, unmanaged agricultural hedge, comprising hawthorn, blackthorn, elder, dog rose, bramble and ivy.	C2	Area: same as Hedge - 1597 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H16	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		sprawling agricultural hedge, comprising hawthorn and blackthorn.	C2	Area: same as Hedge - 774 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H17	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 5 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling hedge, mainly blackthorn, hawthorn, bramble and ivy.	C2	Area: same as Hedge - 247 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
T001	Common Ash (Fraxinus excelsior)	Tree	Height (m): 9 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:4 S:3 W:4	Multi stemmed tree growing from bank of drainage ditch	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Structural Cond:	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.
T002	Common Ash (Fraxinus excelsior)	Tree 7 stems	Height (m): 9 7 stems, diam(mm): 90, 90, 90, 90, 80, 100, 100 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:2 E:5 S:6 W:3	Multi stemmed tree adjacent to drainage ditch	C2	Radius: 2.9m. Area: 26 sq m.	Other Reference: Physiological Cond: Fair Structural Cond:	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T003	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:3 E:3 S:3 W:3	Ivy suppressing crown; multi stemmed tree growing from bank of drainage ditch	C2	Radius: 3.8m. Area: 45 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T004	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Stem Diam (mm): 640 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:6 E:2 S:3 W:4	Ivy in crown, growing from bank, dead wood on branch tips, has been pruned on south to accommodate overhead cables.	C2	Radius: 7.7m. Area: 186 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T005	Common Ash (Fraxinus excelsior)	Tree 3 stems	Height (m): 8 3 stems, diam(mm): 80, 80, 80 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:3 E:2 S:1 W:3	Ivy in crown, growing from bank of ditch,	C2	Radius: 1.7m. Area: 9 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect hedgerow with protective barriers - as shown on plans.  Post construction: No action required.
T006	Common Ash (Fraxinus excelsior)	Tree	Height (m): 13 Stem Diam (mm): 800 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:5 S:5 W:5	Ivy climbing far into crown. dead stem present.	C2	Radius: 9.6m. Area: 290 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T008	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 8 2 stems, diam(mm): 300, 200 Life Stage: Semi Mature Rem. Contrib.: 10+ Years	N:3 E:3 S:2 W:3	Ivy in crown, growing from bank of drainage ditch.	C	Radius: 4.3m. Area: 58 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T009	Sycamore (Acer pseudoplatanus)	Tree	Height (m): 9 Stem Diam (mm): 300 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:4 E:3 S:2 W:3	Ivy suppressing crown; growing from bank of drainage ditch	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T010	Wych Elm (Ulmus glabra)	Tree	Height (m): 6 Stem Diam (mm): 200 Life Stage: Semi Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:2	Ivy present in crown.	C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Structural Cond:	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T011	Sycamore (Acer pseudoplatanus)	Tree	Height (m): 7 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:3	Ivy present, growing from drainage ditch.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T012	Sycamore (Acer pseudoplatanus)	Tree	Height (m): 6 Stem Diam (mm): 200 Life Stage: Semi Mature Rem. Contrib.: 30+ Years	N:3 E:2 S:2 W:3		C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.



Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T013	Wych Elm ( <i>Ulmus glabra</i> )	Tree 2 stems	Height (m): 7 2 stems, diam(mm): 300, 200 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:4	Ivy in crown	C2	Radius: 4.3m. Area: 58 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T014	Sycamore ( <i>Acer pseudoplatanus</i> )	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:4 E:4 S:4 W:4	growing from bank of drainage ditch.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T015	Wych Elm ( <i>Ulmus glabra</i> )	Tree	Height (m): 8 Stem Diam (mm): 200 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:3	Growing from bank of drainage ditch.	C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T016	Common Ash ( <i>Fraxinus excelsior</i> )	Tree 3 stems	Height (m): 13 3 stems, diam(mm): 400, 300, 300 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:6 E:6 S:4 W:6	Multi stemmed tree, spreading habit, ivy present.	C2	Radius: 7.0m. Area: 154 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T017	Common Ash (Fraxinus excelsior)	Tree	Height (m): 15 Stem Diam (mm): 500 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:2 S:2 W:3	Ivy in crown, storm damage to leader, growing from bank of ditch.	C	Radius: 6.0m. Area: 113 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T018	Common Ash (Fraxinus excelsior)	Tree	Height (m): 12 Stem Diam (mm): 500 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:4 S:4 W:4	Ivy dominating crown.	C2	Radius: 6.0m. Area: 113 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T019	Common Ash (Fraxinus excelsior)	Tree 3 stems	Height (m): 14 3 stems, diam(mm): 300, 200, 300 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:6 E:6 S:5 W:6	Ivy in crown, growing from bank of drainage ditch.	C2	Radius: 5.6m. Area: 99 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T020	Wych Elm (Ulmus glabra)	Tree 2 stems	Height (m): 8 2 stems, diam(mm): 200, 200 Life Stage: Semi Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:3	Growing from bank of ditch, twisting growth habit.	C2	Radius: 3.4m. Area: 36 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T021	Sycamore (Acer pseudoplatanus)	Tree 2 stems	Height (m): 9 2 stems, diam(mm): 300, 200 Life Stage: Semi Mature Rem. Contrib.: 20+ Years	N:5 E:3 S:3 W:3	growing from bank of drainage ditch.	C2	Radius: 4.3m. Area: 58 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T022	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 12 2 stems, diam(mm): 400, 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:5 S:4 W:5	ivy dominating crown, bare twigs on branch tips.	C2	Radius: 6.8m. Area: 145 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T023	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 9 2 stems, diam(mm): 200, 200 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:3 S:3 W:3	ivy in crown.	C2	Radius: 3.4m. Area: 40 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T024	Common Ash (Fraxinus excelsior)	Tree	Height (m): 12 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:4 E:1 S:5 W:4	Early dieback, ivy dominating crown.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T025	Common Ash (Fraxinus excelsior)	Tree	Height (m): 13 Stem Diam (mm): 600 Life Stage: Early Mature Rem. Contrib.: <10 years	N:4 E:6 S:3 W:6	Ivy in crown, cavity in stem at 2m on north. Early dieback.	C2	Radius: 7.2m. Area: 163 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T026	Common Ash (Fraxinus excelsior)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: <10 years	N:3 E:3 S:3 W:3	Ivy in crown.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T027	Wych Elm (Ulmus glabra)	Tree	Height (m): 9 Life Stage: Early Mature Rem. Contrib.: <10 years	N:2 E:2 S:3 W:2	Elm disease present throughout crown.	C2	Area: same as Group - 40 sq m.	Other Reference: Physiological Cond: Poor Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T028	Common Ash (Fraxinus excelsior)	Tree	Height (m): 8 Stem Diam (mm): 300 Life Stage: Semi Mature Rem. Contrib.: <10 years	N:3 E:4 S:3 W:4	Ivy dominating crown. dieback present.	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T030	Common Ash (Fraxinus excelsior)	Tree	Height (m): 9 Stem Diam (mm): 300 Life Stage: Semi Mature Rem. Contrib.: <10 years	N:3 E:2 S:2 W:3	Ivy present throughout crown.	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T031	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Stem Diam (mm): 300 Life Stage: Early Mature Rem. Contrib.: <10 years	N:5 E:3 S:5 W:4	Ivy dominating crown.	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T032	Common Ash (Fraxinus excelsior)	Tree	Height (m): 7 Stem Diam (mm): 200 Life Stage: Early Mature Rem. Contrib.: <10 years	N:4 E:3 S:4 W:3	Ivy in crown. Early dieback.	C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Poor Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T033	Common Ash (Fraxinus excelsior)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: <10 years	N:4 E:4 S:4 W:4	Growing from bank, ivy spreading far into crown. Early dieback.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T034	Common Ash (Fraxinus excelsior)	Tree	Height (m): 14 Stem Diam (mm): 700 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:4 E:6 S:4 W:5	Ivy far into crown, Early dieback.	C	Radius: 8.4m. Area: 222 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T035	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 10 2 stems, diam(mm): 200, 200 Life Stage: Semi Mature Rem. Contrib.: 10+ Years	N:3 E:3 S:3 W:3	Growing from drainage ditch.	C2	Radius: 3.4m. Area: 36 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T036	Common Ash (Fraxinus excelsior)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:2 E:4 S:4 W:2	dead branch tips. early dieback.	C	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.
T037	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: <10 years	N:1 E:4 S:8 W:4	Sprawling growth habit, suppressed by neighbouring tree.	C	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T038	Sycamore (Acer pseudoplatanus)	Tree 7 stems	Height (m): 10 7 stems, diam(mm): 100, 100, 100, 100, 100, 100, 100 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:4 E:4 S:3 W:3	Multi stemmed tree, densely ivy covered.	C2	Radius: 3.2m. Area: 32 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Fair	Pre construction: No action required.  During construction: Protect with protective barriers - as shown on plans.  Post construction: No action required.

## Key to Tree Survey Schedule Criteria & Headings

<b>Tree No.</b>	This number identifies the trees & corresponds with the provided plans.
<b>Species</b>	The common name is given for each tree.
<b>Height</b>	Estimated in metres.
<b>Stem Diameter</b>	Measured at 1.5m above ground level, recorded in millimetres.
<b>Number of Stems</b>	Recorded from ground level or base of tree.
<b>Crown Spread</b>	Estimated in metres & given at cardinal compass points.
<b>Age</b>	Refers to the age of the individual tree & recorded as: Y = Young; SM = Semi-mature; EM = Early-mature; M = Mature; OM = Over-mature; V = Veteran; D = Dead
<b>General Observations</b>	Comments relating to trees' previous & possible future management.
<b>Recommended Works</b>	To mitigate issues with the trees' condition & vitality or as part of pre-development works.
<b>ERC (Estimated Remaining Contribution)</b>	Estimated by subtracting the current age from the life expectancy of a tree in same location & condition. Each tree is given a retention category according to BS 5837: 2012: <10 years; 10+; 20+; 40+
<b>Retention Category</b>	Based upon the categories in Table 1 of BS 5827: 2012 regarding tree quality assessment and suitability for retention.
<b>RPA</b>	Root protection area measured in metres from centre of tree.



## Cascade Chart for Tree Quality Assessment

TREES UNSUITABLE FOR RETENTION				
Category and Definition	Criteria			Identification on Plan
<p><b>Category U</b> Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.</p>	<ul style="list-style-type: none"> <li>Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other Category U trees (eg, where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning).</li> <li>Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline.</li> <li>Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality.</li> </ul> <p><i>NOTE: Category U trees can have existing or potential conservation value which it might be desirable to preserve; see 4.5.7.</i></p>			
TREES TO BE CONSIDERED FOR RETENTION				
Category and Definition	Criteria			Identification on Plan
	1. Mainly arboricultural qualities	2. Mainly landscape qualities	3. Mainly cultural values, including conservation	
<p><b>Category A</b> Trees of high quality with an estimated remaining life expectancy of at least 40 years.</p>	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (eg, the dominant and/or principal trees within an avenue.	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features.	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e, veteran trees or wood-pasture).	
<p><b>Category B</b> Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.</p>	Trees that might be included in category A, but are downgraded because of impaired condition (eg, presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation.	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality.	Trees with material conservation or other cultural value.	
<p><b>Category C</b> Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm.</p>	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories.	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value, and/or trees offering low or only temporary/transient landscape benefits.	Trees with no material conservation or other cultural value.	



**CONTRACTOR:**  
Rik Pannett : Consultant Arborist  
Retained by Energia

**LEGEND**

Root Protection Area  
Actual Crown Spread  
Tag Number - Category Grade








**CATEGORY GRADE**  
 CATEGORY UJ —  
 CATEGORY A —  
 CATEGORY B —  
 CATEGORY C —

T032 - C2

DRAWING No	RP-007	
REV SUFFIX	REVISION DETAILS	DATE

STATUS	DRAWN BY	DATE	SCALE	ENG CHECK	DATE
	WD	23/07/21	1:2000	RP	23/07/21
PROJECT		HUNTSTOWN			SHEET SIZE
DRAWING TITLE		TREE CONSTRAINTS PLAN			<b>A3</b>



<b>CONTRACTOR:</b>  Rik Pannett : Consultant Arborist Retained by Energia	<b>REMOVAL AREA</b>  Road Protection Area  Actual Crown Spread Tag Number : Category Grade	<b>LEGEND</b> <b>CATEGORY GRADE</b> CATEGORY U  CATEGORY A  CATEGORY B  CATEGORY C  TREE PROTECTION 	DRAWING No RP-008	STATUS [ ]	DRAWN BY WD	DATE 23/07/21	SCALE 1:2000	ENG CHECK RP	DATE 23/07/21
			REV SUFFIX [ ]	REVISION DETAILS [ ]	DATE [ ]	PROJECT HUNTSTOWN		SHEET SIZE A3	
			DRAWING TITLE TREE PROTECTION PLAN						

**APPENDIX 12.1**  
**RECORDED ARCHAEOLOGICAL MONUMENTS**  
**PREPARED BY CRDS LTD.**

Recorded Archaeological Monuments located within c. 1.5km of the Proposed Development are listed below (source Sites and Monuments Record for Co. Dublin, [www.archaeology.ie](http://www.archaeology.ie)).

**DU014-006001-**

**Class:** Ringfort - unclassified  
**Townland:** NEWTOWN (Coolock By., Finglas ED)  
**Description:** Was formerly located on a slight rise in undulating tillage. Now within Dublin Airport Logistics Park. Marked on OS historical maps, the site was levelled in 1953 (NMI Correspondence). Prior to its destruction it comprised a roughly circular area (diam. c. 90m) enclosed by a bank (H c. 2m) with external fosse and a low external counterscarp bank. There was an entrance causeway in the south (NMI Correspondence 3 September 1952). A series of aerial photographs taken after site destruction (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) shows detailed cropmark evidence for two distinct building phases on the site. A roughly circular enclosure (diam. c. 45m) with field system attached to the W (DU014-006002-) appears to pre-date the ringfort levelled in 1953 (Stout and Stout 1992, 5-14).  
Test excavation (Licence no. 05E0236) was undertaken in advance of the industrial park development. A strategy of open area testing was adopted to find the extent of remains. A total of 33 features were identified including human remain, pits, postholes, stakeholes, hearths and large ditch features. The testing confirmed the presence of large ditches illustrated on the OS maps in the form of two enclosing ditches and a bank between. The burials, aligned east-west, are located to the north east quadrant of the ditches cut into its fill indicating a later deposition. The burials and eastern quadrant of the site was preserved in situ under the carpark of DHL. The western quadrant of the ringfort was covered in terram and stone. Now within wasteland. Drop of c.1m down to stone. No indication of significance of the site.

**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 22 January 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-006002-**

**Class:** Ringfort - unclassified  
**Townland:** NEWTOWN (Coolock By., Finglas ED)  
**Description:** Located on wasteland within the Dublin Airport Logistics Park. Previously a golf course. A series of aerial photographs taken after site destruction (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) shows detailed cropmark evidence for two distinct building phases on the site. A roughly circular enclosure (diam. c. 45m) with field system attached to the west appears to pre-date the ringfort (DU014-006001-) levelled in 1953 (Stout and Stout 1992, 5-14).

**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
Scheduled for inclusion in the next revision of the RMP

**DU014-012001-**

**Class:** Church  
**Townland:** KILSHANE  
**Description:** On the 1st edition OS 6-inch (1842 ) there is a field named 'Church Field' and an area identified as the 'Old Burying Ground' outlined in the N end of the same field. Other than this placename there is no supporting documentary evidence for a church at this location. The area has been extensively quarried. Not visible at ground level.

**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker

- Date of upload:** 22 January 2015  
Not scheduled for inclusion in the next revision of the RMP
- DU014-012002-**  
**Class:** Burial ground  
**Townland:** KILSHANE  
**Description:** On the 1st edition OS 6-inch map (1842) there is an area identified as the 'Old Burying Ground' outlined in the N end of this field. The area has been extensively quarried. Not visible at ground level.  
**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 22 January 2015  
Not scheduled for inclusion in the next revision of the RMP
- DU014-012003-**  
**Class:** Ritual site - holy well  
**Townland:** KILSHANE  
**Description:** The 1st edition OS 6-inch map (1842) marks the site 'Church Well'. In 1958 it was being used for domestic purposes and not considered to be a holy well (Ó Danachair 1958, 76). It has been removed by quarrying.  
**Compiled by:** Geraldine Stout  
**Date of upload:** 26 August 2011  
Not scheduled for inclusion in the next revision of the RMP  
**References:** Ó Danachair, C. 1958 The holy wells of county Dublin. Reportorium Novum 2, 68-87; 2, No. 2 The holy wells of County Dublin: A supplementary list, 233-5.
- DU014-013----**  
**Class:** Castle - motte and bailey  
**Townland:** NEWTOWN (Coolock By., Finglas ED)  
**Description:** Situated in a field next to the N2. Prior to its destruction in 1952 this site comprised a circular platform (diam. 28m; H 3m) which was enclosed around the base by a wide fosse. This flat-topped platform was further enclosed by an oval earthwork or bailey (dims. 100m E-W; 70m N-S; NMI IA 245/1952). The site is visible as a soilmark on an aerial photograph taken in 1971 (FSI 2.4154/4) and on colour vertical photograph (OS 8/Flight 31, 7616 see Healy 1975, 26). A cropmark showing oval enclosure with the faint traces of a smaller oval enclosure within is visible on digital globe aerial view created on the 9 June 2016 The site was subject to geophysical survey and test excavation (Licence no. 04E0807). The geophysical survey concluded there were extensive archaeological remains present including the enclosing fosse and internal features of a motte and bailey. Text excavation confirmed the presence of archaeological remains (the fosse measures 5m in width). A burnt mound was also identified.  
**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 22 January 2015  
Scheduled for inclusion in the next revision of the RMP
- DU014-015----**  
**Class:** Ring-ditch  
**Townland:** COLDWINTERS (Castleknock By.)  
**Description:** Located in pasture (formerly the green of a golf course) between the Dublin-Ashbourne Road and the N2. A circular cropmark (diam. c. 15m) visible on an aerial photograph (CUCAP, BDQ 66). Not visible at ground level.  
**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 22 January 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-016----**

**Class:** Enclosure  
**Townland:** COLDWINTERS (Castleknock By.)  
**Description:** An aerial photograph (CUCAP, BDQ 66) shows cropmark evidence for a circular, single-ditched enclosure (diam. c. 45m). It had been truncated by field boundaries in the east and was formerly incorporated into a golf course. The site was subject to test excavation (Licence no. 05E0236) but not identified (Tierney, 2005). Not visible at ground level.

**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 22 January 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-017----**

**Class:** Enclosure  
**Townland:** DUBBER  
**Description:** Situated in a low-lying area under tillage. A curvilinear earthwork is shown on the 1st edition OS 6-inch map (1837). This may have been part of an enclosure. Not visible at ground level.

**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 22 January 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-047----**

**Class:** Inn  
**Townland:** DUBBER  
**Description:** The OS 6-inch map shows the Old Red Lion. It is mentioned in the Finglas, County Dublin, Vestry Books for the year 1675 (1916, 33). Site within overgrown uneven pasture beside road. No visible remains.

**Compiled by:** Geraldine Stout  
**Updated by:** Christine Baker  
**Date of upload:** 23 January 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-102----**

**Class:** Enclosure  
**Townland:** BALSESKIN  
**Description:** A large circular enclosure visible as a crop mark on an aerial photograph (SMR file; pers. comm. T. Condit). Relatively low lying field north of M50 and west of N2. No visible remains.

**Compiled by:** David O'Connor  
**Updated by:** Christine Baker  
**Date of upload:** 25 January 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-122001-**

**Class:** Enclosure  
**Townland:** KILDONAN  
**Description:** This monument was subject to geophysical survey (Licence no. 09R195) and test excavation (Licence no. 10E0462) as part of the proposed Metro West development. A sub rectangular enclosure (35m x 25m.) was identified on the geophysical survey and confirmed through test excavation. Two postholes were located either side of the ditch (0.55m wide and 0.25m deep) suggesting the possibility of a palisade. Two corn-drying kilns (DU014-122002-; DU014-122003) are situated at the S of the enclosure (O'Donovan 2010, 18).

**Compiled by:** Christine Baker  
**Date of upload:** 6 February 2015  
Scheduled for inclusion in the next revision of the RMP

**DU014-122002-****Class:** Kiln - corn-drying**Townland:** KILDONAN**Description:** This monument was subject to geophysical survey (Licence no. 09R195) and test excavation (Licence no. 10E0462) as part of the proposed Metro West development. A comma-shaped corn-drying kiln and the probable flue of a second corn-drying kiln were located to the S of an enclosure (DU014-122001-). The former (2.1m wide and 0.51m deep) contained three fills (O'Donovan 2010, 17).**Compiled by:** Christine Baker**Date of upload:** 6 February 2015

Scheduled for inclusion in the next revision of the RMP



**APPENDIX 12.2**  
**RECORDED ARCHAEOLOGICAL FINDS**  
**PREPARED BY CRDS LTD.**

The recorded archaeological finds from the study area are listed below, all noted in the National Museum of Ireland files, Kildare Street, Dublin 2, in local journals, or in other published catalogues of prehistoric material: Raftery (1983), Eogan (1965; 1983; 1994), Harbison (1968; 1969a; 1969b) and the Irish Stone Axe Project Database. The Heritage Maps website ([www.heritagemaps.ie](http://www.heritagemaps.ie)) was also assessed. The following townlands were assessed: Baleskin, Coldwinters, Dubber, Grange, Huntstown, Kildonan, Kilshane and Newtown.

**List of finds**

<b>Reg no.</b>	<b>Location</b>	<b>Description</b>
NMI 1956:182	Newtown	Stone lamp (portion of)

**APPENDIX 12.3**  
**EXCAVATIONS**  
**PREPARED BY CRDS LTD.**

The excavation bulletin website ([www.excavations.ie](http://www.excavations.ie)) was consulted to identify previous excavations that have been carried out within the study area. This database contains summary accounts of excavations carried out in Ireland from 1970 to 2019. The following townlands were assessed: Baleskin, Coldwinters, Dubber, Grange, Huntstown, Kildonan, Kilshane and Newtown.

**1988:18 - Kilshane, Dublin**

**County:** Dublin  
**Site name:** Kilshane  
**SMR No.:** N/A  
**Licence number:** —  
**Author:** Margaret Gowen, 5 St Catherine  
**Site type:** Christian Cemetery  
**ITM:** E 710408m, N 742789m  
**Lat, Lon:** 53.423648, -6.338816

**Description:**

This site lies on flat, low lying land about half a mile to the west of the N2 near St Margaret's in a townland which already has two recorded cemetery sites.

**The Remains**

The site was discovered when topsoil removal uncovered the remains of several skeletons and areas of disturbed bone. Excavation revealed the remains of 123 individuals, many of whom were children and adolescents. There was no enclosing element, though a linear ditch which appeared to be an old field boundary was revealed at the north of the excavated area.

No historic references have yet been found for this site but a more detailed study of the documentary sources may yield some information on it.

**The Burials**

Burial occurred on a c.21m stretch of the pipeline corridor and only on the western side of the area excavated which was a 8m wide strip running beneath the spoilheap of topsoil and probably beyond the western limit of the pipeline corridor. The area to the east was intensively trenched and no further burials were located. There was thus a dramatic density of burial in the small area excavated as many as 3-4 individuals, one on top of the other in places).

While the burials were aligned east-west, in the Christian mode, the burial alignment was far more haphazard than had been noted on the other sites investigated during the same pipeline campaign. Some of the bodies appeared to have been buried either in rigor mortis or in a very hurried manner, as some were crouched, folded or lying to one or other side and there appeared to be little regard in many cases for the position of the hands. The remains of at least ten infants/young children occurred among those excavated.

In general the bone was remarkably well preserved, even in the case of the infants. This may indicate that the cemetery is of relatively recent date, perhaps dating back to the Famine Period. However, the presence of stones around and under the heads of some individuals, and the presence of 'pillowstones' may indicate a rather earlier date for the site.

**Other Features**

Two, apparently agricultural, ditches/drains were revealed, one to the south and one to the north of the excavated area. The fill of the northernmost feature, a linear ditch 5m wide where excavated (crossed diagonally) and 1m deep, which crossed the pipeline corridor in a north west/south east direction, contained animal bone and shell. This feature appeared to be an old field boundary or open drain and could be traced as a depression crossing the field through which the pipeline corridor passed in this area.

The second feature, a land drain 1m wide with a fill of stones at the base, ran north/south at the eastern limit of the site, lying outside the burial area.

**Finds**

The only finds retrieved were a plain blue glass bead and a fragment of a large tanged iron knife of relatively modern appearance.

**1999:253 - KILSHANE, Dublin**

**County:** Dublin  
**Site name:** KILSHANE  
**SMR No.:** SMR 14:48  
**Licence number:** 99E0220  
**Author:** Malachy Conway for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower,

Glenageary, Co. Dublin.

**Site type:** Unenclosed cemetery  
**ITM:** E 710408m, N 742789m  
**Lat, Lon:** 53.423648, -6.338816

**Description:**

An assessment and subsequent monitoring (see No. 161 above) of topsoil removal were undertaken at Kilshane, Co. Dublin, as part of the reinforcement of the Brownsbarn to Ballough Gas Pipeline (formerly known as the Northeastern Pipelines, Phases I and II). The name Kilshane contains the element 'Kil', or Cill, signifying a church, while the second element is less certain, but in at least one other instance (in County Limerick) a church site called Cill Senaig has been anglicised as Kilshane. That being the case, the County Dublin site may well represent the church of Senach.

The site, first discovered on removal of topsoil during the Phase II pipeline operation in 1988, is in a flat, low-lying area c. 0.5 miles to the west of the N2, near St Margaret's. During Phase II pipeline operations an unenclosed cemetery comprising 123 individuals was revealed over a 21m stretch of the pipeline corridor (see report by Margaret Gowen in Excavations 1988, 17). Consequent to this discovery, the site was included in the SMR by the National Monuments and Historic Properties Service.

The new reinforcement pipeline corridor runs parallel to the existing and archaeologically resolved area of 1988 and thereby encroached the SMR constraint area for the cemetery site. Geophysical survey of the proposed corridor was undertaken before the assessment.

In summary, the assessment revealed one feature of archaeological potential, and no further features or finds were revealed during subsequent monitoring of topsoil-stripping before pipe-laying.

Magnetic gradiometry and electrical soil-resistivity surveys were undertaken at the site. The former technique indicated strong ferrous (iron) interference within the western area of the survey grid, along with two anomalies representing possible ditch features. One these anomalies is just beyond the disturbance zone caused by the existing gas pipe and is almost certainly ditch F140 revealed in the NEP II 1988 operation. Various clusters of small anomalies were also discerned, along with regular linear-trending anomalies, suggesting changes in the underlying geology. The resistivity survey revealed a number of low-resistance linear trends, which coincide with the magnetic anomalies, indicating possible ditches. However, the majority of the resistivity responses appeared to reflect natural variations in resistance values across the site, especially along the western edge of the survey grid, which would suggest disturbance from the pipe and 1988 construction. The same may also be said of a number of linear trends in the north-eastern corner of the survey grid, which equate with plough action or other modern disturbances.

Four test-trenches were excavated across the proposed 30m wayleave realignment corridor. The trenches were directly east of the area excavated and resolved in 1988. The position of the trenches was largely determined by the anomalous responses from the geophysical survey carried out before the assessment.

Trenches 1 and 2 were conjoined in T-shaped plan, with Trench 1 orientated north-west/south-east and Trench 2 set perpendicular to its centre and extending away in a south-west direction. The position of Trench 1 was determined by the double-ditch-like response from the geophysical survey, which correlates with a ditch excavated at the eastern limit of the 1988 NEP II pipeline corridor and which appeared to mark the eastern boundary of the cemetery. The position of Trench 2 was also determined by geophysical responses, in this case a number of roughly west-east-lying linear anomalies. Trenches 3 and 4 were conjoined in T-shaped plan, as with Trenches 1 and 2, and were positioned south of these. Only a few limited anomalous responses were detected in the southern portion of the survey grid, and the position of Trenches 3 and 4 was largely designed to test a number of these responses as well as to examine areas that failed to give a response.

Trench 1 was positioned 112m from the eastern field boundary and measured 22m by 2m. Removal of topsoil 0.25-0.3m deep revealed two modern drainage features between 0.4 and

0.5m wide and cut directly into subsoil, which in this area was brown, sandy clay containing frequent stones. The eastern half of the test-trench was completely devoid of features and was characterised by grey clay subsoil with less stone than on the western side.

Trench 2, 29m by 2.1m, was conjoined with Trench 1. Several roughly north-west/south-east-aligned features, mostly natural, were revealed on removal of topsoil. Only one item of archaeological significance was revealed, a west-east linear feature, which extended beyond the western limit of the test-trench. The feature, initially defined by several longitudinally set stones, was characterised by a roughly linear spread of dark soil containing charcoal and numerous (apparently heat-shattered) angular stones. The feature, which survived in the trench in a truncated form, was up to 1.9m long by at most 0.75m wide and at its deepest point, the west section, was found to be up to 0.15m deep. A single fragment of iron slag was recovered from the fill of the feature at the western section. The east end of the feature was rounded in plan and delimited by iron staining in the subsoil. It was significantly shallower than the western end and contained a thin lens of grey clay flecked with charcoal, overlying and partially cutting into the brown clay subsoil at this point. The western section of the feature comprised charcoal-flecked, grey clay overlying a deposit of orange, friable ash and a basal deposit of soil charcoal. None of the stones either within or forming the limits of the feature were found to be burnt. It was estimated that the feature could extend, at most, only a further 0.3m beyond the western section face, which was confirmed during later monitoring. In attempting to date this feature, and also taking into account that some possible fragments of bone were associated with the uppermost fill deposit, it would seem that the feature is fairly late, possibly after AD 1700.

The excavation of Trenches 3 and 4 failed to reveal deposits, features or finds of archaeological significance. A simple sequence of topsoil, between 0.25m and 0.3m deep, was found to overlie either yellow/brown clay or grey boulder clay.

No further features were revealed during topsoil removal of the pipeline corridor in late July 1999. The solitary archaeological feature, revealed in Trench 2, appears to be an isolated linear feature, which in the absence of clearly datable finds would appear to be post-17th-century in date.

#### **1999:269 - NEWTOWN LINK ROAD, ST MARGARET S, Dublin**

**County:** Dublin  
**Site name:** NEWTOWN LINK ROAD, ST MARGARET'S  
**SMR No.:** N/A  
**Licence number:** 99E0028  
**Author:** Claire Walsh, Archaeological Projects Ltd, 25A Eaton Square, Terenure, Dublin 6W.  
**Site type:** Cultivation furrows  
**ITM:** E 711927m, N 741825m  
**Lat, Lon:** 53.414662, -6.316320  
**Description:**

A second phase of monitoring of topsoil-stripping was undertaken from 10 to 12 March 1999. The area to be stripped lay outside and to the north of the area that had previously been studied archaeologically for the construction of the new road. The area had to be stripped to allow the laying of a drainage pipe leading from the road north to the stream that flows north-eastwards just east of Connaberry Motte and for the construction of a paddock.

As this area lay outside the study area and was close to Connaberry Motte and Dunsoghly Castle, the topsoil was removed using a toothless grading bucket. A series of cultivation furrows was uncovered. They were aligned roughly north-south and were regularly spaced, 3m apart. They varied from less than 55m wide and from 20mm or less to 60mm wide. They were only visible where they cut into subsoil and did not survive in the north-west side of the stripped area, owing to the stony nature of the underlying subsoil there. The furrows were filled with grey, loamy silt, and no finds were retrieved from any of them. However, several sherds of medieval pottery (North Leinster cooking wares and wheel-thrown Dublin wares) were uncovered from the topsoil that overlay them.

The furrows are the remains of ridge-and-furrow cultivation, which is probably of medieval date. The proximity of the site to both the Connaberry Motte and to Dunsoghly Castle means that the cultivation system could have been used by the occupants of either site.

**2001:430 - Huntstown, Dublin**

**County:** Dublin  
**Site name:** Huntstown  
**SMR No.:** N/A  
**Licence number:** 01E1108  
**Author:** Fintan Walsh, Irish Archaeological Consultancy Ltd, 8 Dungar Terrace, Dun Laoghaire, Co. Dublin.

**Site type:** No archaeological significance  
**ITM:** E 704752m, N 740351m  
**Lat, Lon:** 53.402896, -6.424686

**Description:**

A monitoring brief was undertaken in advance of the expansion of an existing quarry at Huntstown, Finglas, Co. Dublin. The area of topsoil-stripping was c. 10–12 acres. Nothing of archaeological significance was noted throughout all subsurface works within the development area.

**2001:456 - Newtown, Dublin**

**County:** Dublin  
**Site name:** Newtown  
**SMR No.:** SMR 14:13  
**Licence number:** 01E1214  
**Author:** Fiona Rooney, Archaeological Consultancy Ltd, Ballydavid South, Athenry, Co. Galway.

**Site type:** Site of motte and bailey  
**ITM:** E 713092m, N 725187m  
**Lat, Lon:** 53.264960, -6.304733

**Description:**

An assessment of a proposed development in the townland of Newtown, Kilshane, Co. Dublin, found that one monument, the site of a possible motte and bailey, was located within its boundary. The site was visited in 1952 by a representative from the National Museum of Ireland, prior to its demolition. It was recorded as a circular platform 28m in diameter and 3m in height. The base of the flat-topped platform was enclosed by a wide ditch, which was in turn enclosed by an oval earthwork (100m by 70m). At present the site is only visible as a soil-mark on aerial photographs. Consequently, monitoring of ground disturbance at the site was recommended by the assessment.

Seven test-pits were excavated. No features or artefacts of archaeological significance were revealed. The trenches excavated were small in comparison to the area of the proposed development. Consequently, while no archaeological features were encountered, it is possible that such features do exist, particularly in the vicinity of the motte and bailey site in the north.

**2002:0636 - Newtown, Dublin**

**County:** Dublin  
**Site name:** Newtown  
**SMR No.:** SMR 14:13  
**Licence number:** 01E1214 ext.  
**Author:** Martin Fitzpatrick, Arch. Consultancy Ltd, Ballydavid South, Athenry, Co. Galway.

**Site type:** Near motte and bailey  
**ITM:** E 713092m, N 725187m  
**Lat, Lon:** 53.264960, -6.304733

**Description:**

Testing was recommended to assess the potential impact on archaeological remains in the area of the proposed development at Newtown, Kilshane, and to establish a buffer zone around the motte and bailey situated in a field proposed for development. During 2001 seven test-pits were excavated by Fiona Rooney; no features or artefacts of archaeological significance were revealed (Excavations 2001, No. 456).

Nineteen test-trenches were mechanically excavated. The soil profiles in the trenches were fairly uniform, and any changes recorded appear to have been the result of varying topography as opposed to anthropogenic factors. The ground was generally drier, and the

bedrock closer to the surface, in areas where the ground was higher than the surrounding area. The softer dark material and sand recognised in the trenches to the west of the field were a result of the ground being low lying and close to the stream that forms the western boundary of the field. A notable feature of all trenches was the lack of finds from the topsoil, apart from some fragments of black earthenware, blue-patterned delft and glass.

A number of features were recognised. A ditch, 2.45m wide, running north-west/south-east was noted at the base of Trench 13, with a small fragment of brown glass in its fill. An old field drain that was cut into the subsoil and disturbed by two relatively modern field drains was revealed in Trench 16. A small fragment of brown earthenware was noted in the upper part of the fill mixed between the large stones. Two flint nodules were found in the fill at the base of the cut. A linear cropmark could be seen running approximately east-west across the field, and a large ditch was recognised in Trench 17 where this cropmark crossed the trench. This feature may be associated with an old field boundary marked on the OS maps or may represent the ditch for a large drainage pipe. At the base of Trench 10 a small modern post-hole and a circular pit containing wood fragments were revealed.

Nothing of archaeological significance was noted. The area south of Trenches 1 and 13 and west of Trench 12 can be said to have been resolved; however, the area north of Trenches 1 and 13 and east of Trench 12 has not been resolved. This line should represent the limit of the buffer zone surrounding the monument.

#### **2003:475 - Test Area 1, Coldwinters, Dublin**

**County:** Dublin  
**Site name:** Test Area 1, Coldwinters  
**SMR No.:** N/A  
**Licence number:** 02E1353 ext.  
**Author:** Neil O'Flanagan, 3 Manor Street, Stoneybatter, Dublin 7.  
**Site type:** No archaeological significance  
**ITM:** E 711901m, N 741580m  
**Lat, Lon:** 53.412467, -6.316798

#### **Description:**

The excavation of engineering test-pits on the N2 Improvement Scheme was monitored in September and October 2003. No archaeological features were exposed.

#### **2003:476 - Coldwinters, Dublin**

**County:** Dublin  
**Site name:** Coldwinters  
**SMR No.:** N/A  
**Licence number:** 03E1450  
**Author:** Laurence McGowan, 27 Lindenwood Park, Foyle Springs, Derry, for Judith Carroll Network  
**Site type:** No archaeological significance  
**ITM:** E 711901m, N 741580m  
**Lat, Lon:** 53.412467, -6.316798

#### **Description:**

This work was undertaken as part of a programme of testing, ahead of the proposed realignment of the N2 Finglas to Ashbourne carriageway. The area investigated lies between Chainage points 500 and 900 on the proposed road, and encompasses roughly 30% of the area designated as Testing Area 1. The remainder of the area is in land currently occupied by St Margaret's Golf Course and will be tested later. The area was tested by means of a machine-excavated central trench with perpendicular offsets located on either side at 20m intervals.

A single oval pit, measuring 0.9m by 0.4m by 0.13m deep (maximum), was uncovered. It contained a single dark-brown, silty clay fill with frequent charcoal inclusions. An additional area, approximately 5m by 7m, was opened surrounding this feature but failed to produce any further evidence of activity from any period.

#### **2004:0612 - KILSHANE, Dublin**

**County:** Dublin  
**Site name:** KILSHANE  
**SMR No.:** N/A



**Licence number:** 03E1359 ext.  
**Author:** Dermot G. Moore, for Cultural Resource Development Services Ltd, Unit 4, Dundrum  
Business Park, Dundrum, Dublin 14.  
**Site type:** Neolithic segmented enclosure, Early Bronze Age activity  
**ITM:** E 710927m, N 742924m  
**Lat, Lon:** 53.424752, -6.330966

**Description:**

This excavation was undertaken as part of the archaeological mitigation in advance of the N2 Finglas-Ashbourne road scheme (Appendix II). A geophysical survey was carried out by GSB Prospection in 2002, which recorded a number of possible archaeological features in Testing Area 5 (GS 2 Area 25). Pre-development testing subsequently carried out by David Bonner in October 2003 (03E1359) exposed a small number of archaeological deposits, interpreted as a ditch and ditch-like feature containing burnt stone, both undated. The licence was transferred to Dermot G. Moore in March 2004 and, from 15 March to 22 July 2004, excavation of Site 5 was carried out by a team of 43 archaeologists.

Site 5, which comprised three distinct areas, Sites 5a, 5b and 5c, was situated on a gently undulating gravel ridge associated with tributaries of the Ward River and was located in a large irregular-shaped field bordered by the Kilshane road to the south and the N2 to the east. Open drains and hedgerows formed of mature hedge plants and trees bounded the area of the site to the north and west. A commercial glasshouse was located on the north-western side of the enclosure. Site 5a was situated atop this ridge at 80.53-81.3m OD, while Site 5b was situated north of Site 5a at 80.3m OD. Site 5c, situated north-west of Site 5a, lies at 81.04m OD.

Initially, two areas were topsoil-stripped in February 2004 (consisting of a total of 199m<sup>2</sup>) around the area of a possible ditch/gully feature (later designated Site 5a) and a linear feature (designated Site 5b) identified during the testing phase in October 2003. The topsoil-stripping was carried out using a tracked mechanical digger equipped with a 2m-wide toothless ditching bucket. Upon commencing investigation of these features, it became obvious that the area of Site 5a was considerably greater in extent. A further programme of topsoil-stripping was therefore initiated, which expanded the Site 5a stripped area to 1335m<sup>2</sup>. This included the excavation of two geological test-trenches to determine the nature of the natural boulder clay and gravel deposits into which most of the archaeological deposits were cut. While the excavation was ongoing, the commercial glasshouse was demolished and the underlying topsoil stripped, adding a further 3500m<sup>2</sup> to the opened area. A number of extensions to Site 5a were also added, as well as expansion of the area opened at Site 5b and a series of test-trenches to the west of Site 5a.

The main enclosure ditch on Site 5a was excavated in a series of fourteen box sections, ranging in length from 2.4m to 11.25m, to determine the structure and sequence of the ditch deposits and method of construction. Longitudinal sections were also cut through a number of the baulks to determine the sequence of deposition of individual deposits within identified ditch segments and to define an entranceway. The smaller causewayed ditch uncovered in Site 5c was also excavated by box section.

A detailed excavation strategy was put in place to retrieve as much information as possible from the enclosure ditch and its fills, especially the animal bone layer, due to the quality of preservation and the uniqueness of such a deposit from an Irish prehistoric site. All archaeological features interior and exterior to the enclosure were excavated, in addition to a number of geological features that were investigated to determine their archaeological potential.

The natural deposits defined on the site consisted of three types. The first was glacial gravel clay of unknown depth consisting of firm mixed grey/brown gritty gravel with frequent small stone and pebble inclusions. Ice wedges were identified within this deposit where exposed in the excavated ditch sections. Overlying this was a deposit of frequent angular and sub-angular stones and cobbles (of limestone/greywacke) within compacted mixed brown/grey silty clay with a depth of 0.2-0.35m, which occurred predominantly in the interior of Site 5a and to the west-north-west of the excavated area. This deposit appears to have become exposed due to a combination of natural erosion of the slight ridge on which the enclosure is set and plough action over the years.

Overlying this substantial deposit of stone was a mixed deposit of firm pale-grey/orange coarse sand gravel. This deposit occurred predominantly at the northern and southern limits of the excavated area and was cut by the enclosure ditch and a number of features,

especially in the northern portion of the site. This deposit appears to represent the 'B' horizon material of the overlying topsoil. In addition to the main geological deposits, a smaller series of deposits was identified during the period of excavation consisting of the remains of decomposed siltstones and calcareous rocks, while others were simply irregular depressions in the natural filled with yellow/yellow-brown sands and fine gravels.

#### Site 5a

The earliest activity is defined by the construction and infilling of a large ditched enclosure dating to mid-Neolithic times. The enclosure was almost egg-shaped, coming to a notable point (the 'apex') in the north. Once the limits were defined prior to excavation, it was noted that the shape of the ditch was very irregular and the reason for this became apparent during the excavation. The ditch had been excavated in a series of interconnecting regular and irregular segments.

The overall plan of the ditch shows that its long axis was aligned north-west/south-east and that it had maximum external dimensions of 45m northwest/south-east by 34m. The width of the ditch varied around its circumference (1.9-3.8m) and enclosed an area 38.5m north-west/south-east by 27.5m, totalling c. 850m<sup>2</sup>. The western side of the ditch bowed inwards, off line with the rest of the ditch, which followed a gentle curve north to south. However, there were sharp turns noted, particularly at three locations: the apex, the south-east and the south-west. This is quite probably due to the method of construction of the ditch.

The average length of a segment was 8.9m, the shortest being 6m and the longest c. 13m. The segments were interconnecting and were probably dug by different work groups. The alteration in direction of the line of the ditch at the apex and in other segments may be due to inaccurate ditch digging between the different work groups. This would also add to the suggestion that the segments were dug at different times.

During the excavation, the segments were primarily defined by changes in direction of the ditch and slight changes in height where the segments connected. The profile of the ditch, especially the individual ditch segments, varied from gentle U-shaped to V-shaped (generally, wide U-shaped profile in the centre of the segments and V-shaped at the ends).

In plan, some of the segments appeared to have considerable breaks between them but in most this can be seen as the remains/evidence of the segment terminals, which were sloping rather than vertical-sided terminals. Tentative evidence for the method of ditch excavation is shown by the presence of portions of antler tines in some of the ditch fills, although as yet only one was recognised from primary fill deposits.

Soon after the ditch was cut, it began to silt up (sometimes irregularly) around its circumference. Probably at this stage a segmented ditch with at least four defined causeways was constructed in the area designated as Site 5c to the north-west.

Once the initial natural slumping and silting in the base of the ditch began, a large volume of animal bone was deposited around the full circumference of the ditch. The bone assemblage, consisting of 60-70 individual cattle, is the largest Neolithic bone assemblage from an excavated context (Finbar McCormick, pers comm.). The cattle bone was placed in both a disarticulated and articulated state with apparent selection of certain bones, such as vertebra or long bones, to be deposited together.

In some areas of the ditch the bone appeared to have been deposited from the exterior, while in others it was deposited from the interior. None of the animal bone recovered appeared to have any distinct butchery marks (this has yet to be confirmed) and the deposition of the bone varied from each area of the ditch, indicating a number of possible phases of deposition, with some distinctions noted within individual segments. Fully articulated cattle skeletons were noted, primarily in the eastern portion of the ditch, where at least three were found in close proximity. Amongst the bone were large stones and boulders, which may have eroded from the sides, possibly due to water action.

As the bone was being deposited, the silting continued and at the same time there was a series of slumps into the ditch, probably from the upcast material interior and exterior to the ditch. A further series of infillings took place, culminating in the placement of pottery within the ditch. This consisted of a large mid-Neolithic broad-rimmed, round bottomed vessel, which appears to have been deliberately placed on top of this sealing deposit in the south-eastern portion of the ditch. Other fragmentary pieces of ceramic material were recovered from just above the bone layer in the northwestern section of the enclosure ditch and these also may prove, using thin section analysis, to be Neolithic. The enclosure then appears to have been abandoned for a considerable period of time.

The next major activity occurs in the Early to Middle Bronze Age, with the deposition within the ditch of a relatively uniform deposit of orange sandy clay. This appears to have been

deliberately placed into the ditch around its full circumference, possibly to seal the earlier (Neolithic) activity. The deposition of the orange clay appears to have been immediately preceded by deposition of charcoal/wood lenses, especially in the western portion of the enclosure.

The deposition of the orange sandy clay within the ditch is another intriguing aspect of the site, with a number of questions relating to the origin of this material and why such a considerable deposit was placed in the ditch. Artefactual material and animal-bone fragments were also recovered from this orange clay deposit. Two suggestions are that the orange clay material was derived from the basal topsoil material or that it was derived from either the interior or exterior of the site, possibly from the creation of a bank. However, there was no evidence of an external or internal bank encountered during the excavation, but this may have been ploughed out.

The next defined phase of activity on Site 5a occurs during the Early Bronze Age. This activity consists primarily of a series of deposits and features associated with the later stages of the main enclosure ditch and a series of cut features, some of which, based on ceramic associations, may date to the Earlier Bronze Age.

Set on to and in many cases cut into the orange clay deposit sealing the fills of the enclosure ditch was a series of deposits, shallow scoops and pits. Most of these were located along the eastern portion of the ditch. Many of the scoops and pits intercut each other and almost all were filled with the same generally homogeneous fill, which seems to represent a midden deposit. The size and depth of these pits and scoops varied considerably, but none appear to have exceeded 0.2m in depth. Within these scoops were ash/cinder deposits and burnt and unburnt bone (some of which appears to be human). The animal-bone remains appear, on preliminary identification, to be pig and possibly ovicaprid. Some of the bone had been worked into pins or awls. Also within this deposit was a large range of lithic material in the form of flint manufacturing debris and finished tools. The predominant components of the flint manufacturing debris consisted of small pebble cores and fine micro-debitage. The secondary worked material consisted predominantly of small, high-quality thumbnail scrapers, a fine hollow-based flint arrowhead and a reworked small barb and tanged arrowhead. A well-made flint piercer and a large hollow scraper (of non-pebble flint) were also recovered. The hollow scraper represents a non-Early Bronze Age tool type and may be directly associated with the initial construction of the enclosure. Chert, quartz and other coarse stone material were also well represented.

However, it is the ceramic remains which dominate the artefactual assemblage. These consist of a substantial quantity of high-quality Early Bronze Age ceramic styles in the form of funerary and high status/ceremonial wares such as food vessels, cordoned urns, cinerary urns, Irish bowl food vessels and a small range of as yet unidentified ceramics. In many cases several ceramic styles were deposited together, with at least six different types (based on decoration and form) being recovered from one single square metre. On some occasions, burnt or partially burnt stone was also found within the deposit.

Generally overlying the artefact-rich deposit was a relatively compact metallised surface, which had its greatest extent in the extreme eastern area of the ditch. The function of this metallised deposit may have been to formally seal the midden deposit. Overlying the metallised deposit was a less artefact-rich horizon, which appears to have been partially disturbed. The extent of this deposit is greater than the underlying deposit and variants were found in the northern, southern and western portions of the enclosure ditch. A small number of inter-connecting pits containing material similar to the artefact-rich horizon were also uncovered in the northern area of the enclosure ditch (near the apex).

Associated with this Early Bronze Age activity in the ditch were a number of features located within and without the enclosure. In the northern area of the site, three rather mysterious features were also uncovered. These appear to be cremation pits, which contained unusual sloping red-orange burnt soil deposits upon which were set thin deposits of finely 'pounded' or crushed burnt bone. As two of these pits are directly associated with burials of single bones, their true function still awaits clarification. They do, however, seem to be connected with the artefact-rich horizon in the upper portion of the enclosure ditch.

During the course of the excavation of the interior of the main enclosure, a number of features were uncovered which gave the impression of having been cleaned out (sterilised) in antiquity. Several appear to have been pits for probable unprotected cremations, with much of the cremation deposits (and the putative pots into which they were placed) having been 'cleaned out' of the pits as the material was deposited into the ditch.

The only intact burial was that of a single crouched inhumation, located south of the centre point of the enclosure. The burial was orientated east-west in a shallow oval pit with no evident grave goods. It was in an extremely degraded condition due to the nature of preservation. The grave might have been tampered with, which may account for the lack of grave goods.

A further series of rather irregular features was also encountered within the interior of the enclosure and these consisted of irregularly shaped pits, which contained small amounts of charcoal and occasionally burnt bone and pottery. The pottery recovered appeared to date to the Early Bronze Age. Only one feature, a hearth, represents activity later in the Bronze Age.

Some medieval activity also occurred on Site 5a, which took the form of a large pit group with deposits of stone and medieval pottery, and another single large pit associated with a north-south-running field boundary. A second parallel field boundary was noted on the south-eastern part of the site. The last phase of activity consisted of a large east-west post-medieval culvert drain and a number of north-south-running culvert drains, which were all part of agricultural improvements to the land, which had since been used for pasture and crops.

#### Site 5b

The archaeological activity located within the confines of this area consisted of a south-north-oriented linear feature c. 9.5m in length. It varied in width from 0.44m to 0.96m and up to 1.05m where it became very shallow at its northern end. It had a variable depth of 0.1-0.2m and contained only two distinct fills. The basal fill consisted of partially burnt sandy clay with some charcoal flecking, while the upper fill consisted of grey/black sandy clay with much charcoal flecking and occasional burnt stone. Small quantities of burnt bone (and snail shell) were also recovered from the upper fill. Each of the deposits was sampled and when these are analysed a fuller determination can be made as to the function of this feature. For the moment, the linear feature in Site 5b is interpreted as a burnt-out field boundary, with the burnt bone possibly representing small rodents or birds trapped within the hedgerow. However, the fills of the feature also may suggest burnt-mound activity.

#### Site 5c

The area designated as Site 5c (located in the area of the now demolished commercial greenhouse) produced better and more definitive evidence of a causewayed ditch. This feature ran approximately north-south and had an excavated extent of c. 70m. The ditch itself had a variable depth of 0.13-0.48m, with the smaller depths occurring at the terminals of segments and the greater depths at the centre of segments. Width also varied between 0.99m and 1.77m and this corresponds to the centre and terminals of segments. At the northern and southern ends of this ditched feature, the width narrowed considerably, to 0.5m.

At present, at least four narrow causeways have been identified. The ditch itself was filled by a series of deposits, some of which contained charcoal, animal bone (predominantly cattle) and mollusc (snail) remains. Although, a number of lithic finds were recovered from the various deposits, the only artefact of note was a complete leaf-shaped arrowhead from the uppermost fill of one ditch segment. The recovery of this projectile point from such a location would tend to indicate that the causewayed ditch is Neolithic in construction.

The form of the ditch also varied, especially in the southern area of Site 5c, where the ditch not only narrowed but also divided into two. Although severely truncated by the insertion of the concrete reservoir associated with the commercial glasshouse, the ditch then appeared to deepen and widen before it was lost under modern activity. In this location, two distinct fills were evident, one of which produced a small irregular pebble core and a quantity of mollusc shell.

Also on Site 5c, the only other probable prehistoric feature was a small hearth pit containing burnt and unburnt animal bone. It is also significant to note that the upper homogeneous fill of the large west-east-running double culvert produced two retouched pieces of flint and one small thumbnail scraper. It would appear likely that the deposit within which these three secondary worked pieces were found was derived from somewhere close by, possibly from the two large pit features on the northern edge of Site 5a.

In summary, the main enclosure ditch seems to fall into the causewayed enclosure tradition or at the very least a variation of it, if not by the presence of causeways across the line of the ditch (which may have been removed) then by the segmented nature of the ditch construction; also the apparent deposition in individual segments of grouped cattle-bone deposits, of which there is an exceptionally large quantity, and the presence on top of the sealing deposits of a mid-late decorated Neolithic vessel of broad-rimmed type. In addition, the presence of the outer segmented ditch to the north-west (Site 5c) would lend further weight to the causewayed enclosure hypothesis.

**2004:0613 - KILSHANE, Dublin**

**County:** Dublin  
**Site name:** KILSHANE  
**SMR No.:** N/A  
**Licence number:** 04E1191  
**Author:** Gina Johnson, c/o Archaeological Services Unit, University College Cork.  
**Site type:** No archaeological significance  
**ITM:** E 710408m, N 742789m  
**Lat, Lon:** 53.423648, -6.338816

**Description:**

The diversion of two gas pipelines by Bord Gás was monitored over two and a half weeks in August and September 2004. The pipeline extended across three large fields which were under wheat and had been subject to reclamation in recent years, as evidenced by two ditches and a number of modern plastic and ceramic land drains noted during monitoring.

The removal of topsoil and excavation of the pipeline trenches were supervised and no archaeological features or artefacts were uncovered. The topsoil removal in the stopple locations to the north-east and south-west of the pipeline corridor was also monitored, but these were in areas already disturbed down on to the existing pipes.

**2004:0631 - NEWTOWN, Dublin**

**County:** Dublin  
**Site name:** NEWTOWN  
**SMR No.:** N/A  
**Licence number:** 03E1450 ext.  
**Author:** Holger Schweitzer, for CRDS Ltd, Unit 4, Dundrum Business Park, Dublin 14.  
**Site type:** Burnt spread  
**ITM:** E 713092m, N 725187m  
**Lat, Lon:** 53.264960, -6.304733

**Description:**

The site (Site 1) was excavated as part of the archaeological mitigation in advance of the N2 Finglas-Ashbourne road scheme (Appendix II) between 6 and 20 April 2004. It was located within the townland of Newtown, Co. Dublin. The site was formerly within an open golf course and is located c. 0.5km north of the M50 Finglas-Ashbourne interchange adjacent to the east of the existing N2. Due to the location of the site within a former golf course, the terrain has been heavily landscaped. The entire site was contained within the footprint of the road-take, with all exposed features of archaeological significance fully excavated.

The removed topsoil consisted of dark loamy soil and varied in depth between 0.2m and 1.4m, with an average depth of c. 0.4m. The natural subsoil consisted of a layer of yellowish-brown silty clay.

Excavation was carried out in two separate areas separated by a distance of c. 15m. Area 1 measured c. 20m by 13m and contained the remains of a spread of burnt-mound material, measuring 3.5m by c. 10m with an average depth of 0.15m, which was located adjacent to the south of a natural waterlogged peat basin. This basin measured c. 15m east-west and extended beyond the limit of excavation to the north. Two pits and a subcircular trough containing heat-shattered stones and charcoal-rich deposits were excavated in the vicinity of the burnt spread. No archaeological finds were encountered during the excavation. Within the peat basin a large number of preserved timbers were encountered. While most of the wood consisted of natural brushwood and branch material, two large split roundwood logs were positioned roughly parallel to each other. Although no evidence of woodworking was apparent, it cannot be ruled out that they may have been deliberately deposited within the basin to serve as an artificial subdivision, possibly contemporary with the burnt spread.

Area 2, c. 15m to the north of Area 1, covered an area measuring in total 24m<sup>2</sup>. The only archaeological feature encountered here was a small and shallow isolated deposit of burnt-mound material. No finds were recovered. The proximity and nature of this deposit could indicate that it was contemporary with the burnt-mound material in Area 1.

**2005:409 - COLDWINTERS/NEWTOWN, Dublin**

**County:** Dublin  
**Site name:** COLDWINTERS/NEWTOWN

**SMR No.:** N/A  
**Licence number:** 05E0236  
**Author:** Ellen O'Carroll, The Archaeology Company, 17 Castle Street, Dalkey, Co. Dublin.  
**Site type:** Prehistoric/medieval  
**ITM:** E 712639m, N 742975m  
**Lat, Lon:** 53.424844, -6.305201

**Description:**

A levelled site (SMR 14:6) and two further sites (14:16 and 14:53) which were recorded from aerial photography were tested in Coldwinters as part of a planning application for Logistic warehousing units. The site had been used as a golf course in the recent past. Site 14:6 was located and found to exhibit significant subsurface archaeological features. Whilst the monument displays characteristics of an early medieval multivallate ringfort, a feature within the monument complex has yielded a sherd of pottery of probable prehistoric date. Site 14:16 was not located, and testing did not reveal anything of archaeological significance. It is likely, therefore, that landscaping undertaken during construction of the golf course has removed any traces of the monument. Site 14:53 was not located during the testing. The many features such as bunkers and tees in the vicinity of the monument site, and the landscaping required to create the golf course, may have served to remove all traces of the monument.

**2008:384 - Dublin Airport Logistics Park, Coldwinters, Dublin**

**County:** Dublin  
**Site name:** Dublin Airport Logistics Park, Coldwinters  
**SMR No.:** N/A  
**Licence number:** 05E0236  
**Author:** James Lyttleton, The Archaeology Company, Hamilton House, Emmet Square, Birr, Co. Offaly.  
**Site type:** Testing  
**ITM:** E 712001m, N 741807m  
**Lat, Lon:** 53.414484, -6.315214

**Description:**

Testing was undertaken in the area of a proposed development at Dublin Airport Logistics Park, Coldwinters, Co. Dublin. The area was formerly used as a golf-course (St Margaret's). The overall area of development comprises a total of some 62.6ha on lands divided between the townlands of Coldwinters and Newtown. It is bounded to the north and south by field boundaries, to the east by the R122 and to the west by the N2 dual carriageway. A private road linking the N2 and the R122 runs through the centre of the development site. The development consists of warehouse facilities and ancillary groundworks. Some areas of the development site have already undergone different phases of archaeological investigations, including two episodes of large-scale intensive testing which took place in an area to the north of the present site in 2005 by Ellen O'Carroll (Excavations 2005, No. 409) and in 2007 by Michael Tierney and M. Rooney.

Testing was undertaken between 9 and 19 June 2008. A total of 32 trenches with a total length of 3,423m were opened, 10m apart, across the site. The work was completed using a mechanical excavator fitted with a 2.4m grading bucket to excavate topsoil to the level of potential archaeological horizons. The area was under high thick grass and all the features associated with the golf-course were levelled out prior to the development. The topsoil largely consisted of a brownish-yellow sandy clay, 0.2–0.4m in depth, overlying a layer of dark-greyish-brown sandy clay, 0.2–0.4m in depth, with moderate to frequent stones. The subsoil was a mid-greyish-brown sandy clay with moderate inclusions of stones. Besides a number of land drains associated with the golf-course and a few modern field boundaries, there was no evidence of any deposits or features of archaeological significance uncovered during the testing of the site.

**2008:481 - Newtown, Dublin**

**County:** Dublin  
**Site name:** Newtown  
**SMR No.:** N/A  
**Licence number:** 08E0043  
**Author:** Nicola Rohan, ADS Ltd, 110 Amiens Street, Dublin 1.

**Site type:** Monitoring  
**ITM:** E 711370m, N 742101m  
**Lat, Lon:** 53.417258, -6.324596

**Description:**

Monitoring of groundworks at the site of the proposed Kilshane Recycling Park in Newtown townland, Kilshane, Co. Dublin, were carried out in January and February 2008. The proposed development was a greenfield site prior to groundworks and is located in a field immediately to the south of the site of a motte and bailey, DU014-013. Nothing of archaeological significance was uncovered in the areas where topsoil-stripping took place during this phase of the development.

**2010:280 - Kildonan, Dublin**

**County:** Dublin  
**Site name:** Kildonan  
**SMR No.:** N/A  
**Licence number:** 10E0462  
**Author:** Edmond O'Donovan, Irish Archaeological Consultancy Ltd, 120b Greenpark Road, Bray, Co. Wicklow.

**Site type:** Kildonan Corn-drying kilns and enclosure site  
**ITM:** E 711697m, N 740530m  
**Lat, Lon:** 53.403080, -6.320236

**Description:**

Test excavation was carried out on behalf of the Railway Procurement Agency (RPA) at Kildonan, Co. Dublin, on 10 November 2010. This followed on from a geophysical survey carried out by Target Archaeological Geophysics during 2009 (licence 09R195). The geophysical anomalies identified in Kildonan townland were interpreted as a possible prehistoric enclosure. Three trenches were excavated as part of the programme of test excavation at the site.

The results of the geophysical survey suggest that the enclosure measures c. 35m x 25m. The testing identified the presence of a ditch relating to this enclosure within Trench 1. Two post-holes were recorded on either side of the ditch and may indicate the presence of an associated palisade. A comma-shaped corn-drying kiln and the probable flue of a second corn-drying kiln were located in Trench 3. It is likely that the subrectilinear enclosure and corn-drying kilns are contemporary; however, secure dating evidence and a direct stratigraphical relationship was not established as part of the assessment of the features.

The possibility that the remains at Kildonan 1 represent multi-phased occupation should also be considered. The site appeared as a clear anomaly on the geophysical survey and appears isolated within its immediate surroundings. The definitive interpretation of the enclosure is difficult given the scale of the investigation to date and the site requires further investigation; however, comma-shaped kilns are known to date from the early medieval period and it is tentatively suggested that the site is a granary associated with a barn.

**2017:424 - Coldwinters, Dublin**

**County:** Dublin  
**Site name:** Coldwinters  
**SMR No.:** DU014-016  
**Licence number:** 17E0285  
**Author:** Martin Byrne  
**Site type:** Enclosure; Cremation  
**ITM:** E 711987m, N 741808m  
**Lat, Lon:** 53.414499, -6.315421

**Description:**

The SMR files of the Archaeological Survey of Ireland indicate the location of an enclosure site – DU014-016 – within lands at Coldwinters, Co. Dublin. The existence of this possible monument was originally noted as a cropmark on an aerial photograph (CUCAP, BDQ 66) dating to 1971. The cropmark is approx. 40m in diameter and bounded to the immediate north and east by field boundaries. The lands were subsequently developed as a golf course and the field boundaries removed, making the exact location of the feature difficult to determine. The centre point of the monument is indicated on SMR mapping –

www.archaeology.ie – and this location was used as the basis of a programme of archaeological testing.

No evidence of the monument was uncovered during the testing. A further review of the Aerial Photograph (CUCAP, BDQ 66) on which the monument was originally identified indicated that the cropmark enclosure feature was bounded to the north and east by field boundaries, both of which were removed when the land were used as a golf course. Based on the results of the archaeological testing and reappraisal of A/P CUCAP, BDQ 66, the monument centre is located approx. 90m to the north-east of that indicated in the SMR and possibly within a copse of tree planting (Revised Centre ITM: 712014 741886).

The remains of a previously unrecorded deposit of burnt/cremated human bone were uncovered and subsequently excavated (ITM: 711972 741892). The sampled material was submitted for processing and bone identification to Dr. Clare Mullins. In summary, the sample of cremated bone contained the remains of at least one adult or individual in late adolescence and may also have contained the remains of a child. Ageing criteria for the adult was based solely on bone size and sex could not be assigned. Virtually all of the bone was fully calcined and the bone was highly fragmented. The sample weighed 96.9g, of which 59.8g could be identified to skeletal region. Fragments of skull, axial skeleton and limb bones were identified indicating that it is unlikely that specific regions of the body were selected for either cremation or collection for burial. The presence of a child was indicated only by a number of deciduous teeth but it is possible that other parts of the juvenile skeleton were fragmented beyond recognition. That so little bone was present in the sample may indicate that it was a token cremation. However, the find circumstances may indicate that the small sample size is due to post-depositional disturbance of the remains. A sample of the bone was submitted to the Chrono-Lab, Queens University Belfast (QUB) for Carbon-14 dating but a date could not be achieved

Byrne mullins & Associates, 7 Cnoc na Greine Square, Kilcullen, Co. Kildare

#### **2018:257 - Newtown, Dublin Airport Logistics Park, Fingal, Dublin**

**County:** Dublin  
**Site name:** Newtown, Dublin Airport Logistics Park, Fingal  
**SMR No.:** DU014-006001  
**Licence number:** 17E0569  
**Author:** John Tierney, Eachtra Archaeological Projects Ltd.  
**Site type:** Ringfort  
**ITM:** E 711959m, N 742455m  
**Lat, Lon:** 53.420317, -6.315613

#### **Description:**

Work took place in a green field site in Dublin Airport Logistics Park in Fingal, Co. Dublin for Rohan Holdings Ltd. The purpose was to determine the nature and extent of the archaeological remains within the western portion of the ringfort DU014-006001 in order to assess the significance of the site and the potential impacts of the proposed development on the site. The eastern half of the ringfort is preserved in situ in the adjoining site (to the east), which is occupied by a DHL warehouse. Testing was undertaken in January/February 2018.

A measured drone survey of the stripped site was conducted in January 2018 and this was used as the foundation survey to record the site. A magnetometry geophysical survey (18R0029, J. M. Leigh) was also conducted across the site once all soil stripping was complete. The drone survey and the geophysical survey results were both combined in a GIS package and this was used in the interpretation of the nature and extent of the archaeological remains.

Dr. Linda Lynch, osteoarchaeologist, visited the site to examine the human remains which were recorded in the interior of the site when the terram was removed.

An area measuring 0.5ha (5000 m<sup>2</sup>) was stripped to reveal the full extent of the ringfort and the remains of the ringfort fully occupies that area. The site comprises three concentric ditches, with the innermost 2 (Ditches 1 and 2) overlapping slightly in their southernmost arc. Ditches 2 and 3 maintain a concentric arrangement throughout their visible arcs. An entrance is formed by Ditch 1 terminating at the south end of the site however Ditches 2 and 3 do not have any termini visible.

Within the area of the 3 ditches a core occupation area measuring 2500 m<sup>2</sup> has been identified in the east and south parts of the site. The three ditches (1-3) enclose the highest point in the micro topography of the site and the occupation area is on the most level ground within their enclosing arc, albeit the ground slopes slightly to the north and west. It is



apparent that the ringfort dwellers chose to live on the best level ground at the highest point available to them.

Three other ditches (Nos 4-6) are present which appear to radiate out from, and are connected to, the arc of the inner ditch (Ditch No. 1).

Our main hypothesis for the development of the site is as follows:

a. Ditch 1 represents the earliest, univallate enclosure (c. 1300 m<sup>2</sup>) and it had an associated field system (Ditches Nos 4-6) attached to the west.

b. The early univallate ringfort was expanded outwards and replaced by a bivallate ringfort represented by Ditches 2 and 3.

The entrance to the univallate fort measures 12m in width and is located to the south. A slot trench and series of pits/post-holes are located on the west side of the entrance. The ringfort was expanded and the original ditch was backfilled and a new larger bivallate (double bank and ditch) ringfort was constructed (c. 5000 m<sup>2</sup>). The bivallate enclosing element is continuous within the area of the site so it is likely that the entrance is located to the east outside the area of development. A probable entrance is visible in the Leo Swan aerial photographs in an area east of the site.

There is extensive evidence for early medieval occupation in the interior of the site which includes two round houses and a series of pits and hearths. A group of burials, representing at least six individuals, has been recorded in the area to the north of the round houses.

Lickybeg, Clashmore, Co Waterford. P36 WA44

### **2018:258 - Newtown, Dublin Airport Logistics Park, Fingal, Dublin**

**County:** Dublin  
**Site name:** Newtown, Dublin Airport Logistics Park, Fingal  
**SMR No.:** DU014-006002  
**Licence number:** 17E0570  
**Author:** John Tierney, Eachtra Archaeological Projects Ltd.  
**Site type:** Ringfort - unclassified  
**ITM:** E 711826m, N 742446m  
**Lat, Lon:** 53.420264, -6.317616

#### **Description:**

Testing was undertaken to locate a possible ringfort in a green field site in Dublin Airport Logistics Park in Fingal, in the townland of Newtown, Co. Dublin. The clients, Rohan Holdings Ltd., are developing the site. Testing was undertaken in January/February 2018.

The Park is situated on the former St Margaret's Open Golf Course, to the east of the M2 motorway and north of Junction 5 on the M50 motorway. Dublin Airport is located to the east.

Two archaeological sites, ringfort DU014-006001- (71958 742457) and possible ringfort DU014-006002- (711825 742448) are located within the development site. The possible ringfort DU014-006002 is located approximately 50m to the west of ringfort DU014-006001. Testing (17E0569) was undertaken on the second site DU014-006001- and is the subject of a separate summary.

Ringfort DU014-006002- is described as follows on [www.archaeology.ie](http://www.archaeology.ie):

A series of aerial photographs taken after site destruction (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) shows detailed cropmark evidence for two distinct building phases on the site. A roughly circular enclosure (diam. c. 45m) with field system attached to the west appears to pre-date the ringfort (DU014-006001-) levelled in 1953 (Stout and Stout 1992, 5-14).

The wording of the entry for ringfort DU014-006002 on [www.archaeology.ie](http://www.archaeology.ie) is the same as part of the wording for the entry for ringfort DU014-006001. An examination of the aerial photographs (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) held in the archives in the National Monuments Service failed to show any trace of a crop mark in the area of the possible site of DU014-006002. Further examination of late 20th-century aerial photographs also failed to display any trace of the site (Leo Swan Photograph Collection). By contrast detailed cropmark evidence for DU014-006001, as described in the [www.archaeology.ie](http://www.archaeology.ie) text, was clearly visible on both sets of aerial photographs.

In addition the ringfort DU014-006002 is not marked on the historical editions of the Ordnance Survey maps and was not recorded during testing of the site in 2005 in conjunction with a planning application to Fingal County Council. No trace of possible ringfort DU014-006002, previously identified as a crop mark, was recorded within the development site during the previous phases of archaeological work at the site.

A programme of testing was devised to locate and establish the nature and extent of possible ringfort DU014-006002 in order to assess the significance of the site and the

potential impacts of the proposed development on the site. A measured drone survey of the stripped site was conducted in January 2018 and this was used as the foundation survey to record the site.

The site was identified using [www.archaeology.ie](http://www.archaeology.ie) and the digital copy of the SMR map. A test trench measuring 55m north-south x 1.5m wide was first excavated across the area of the possible site. This trench was then widened to 7m wide (Trench A). Two perpendicular offshoot trenches were then excavated measuring 20m east-west x 3m wide (Trench B) and another measuring 23m east-west by 3m wide (Trench C). Nothing of archaeological significance was found in any of the test trenches. The sputh end of the north-south trench had a different subsoil which appears to represent differential groundwater levels.

A separate test trench was excavated 25m east of the site of the possible ringfort to investigate a raised ridge of ground (Trench D). This ridge appears to have been a golf course feature and contained modern buried rubbish.

The excavation of test trenches failed to produce any evidence of the existence of the site. It is suggested, based on the following considerations, that the possible ringfort does not exist, within the area of the development site;

1. the lack of physical stratigraphic archaeological evidence derived from testing the area in 2018 and 2005

2. the lack of annotation on the relevant cartographic sources

3. the duplication of a site description on [www.archaeology.ie](http://www.archaeology.ie)

4. the absence of a cropmark, notwithstanding the existence of a very clear cropmark for DU014-006001, on two sets of aerial photographs.

Lickybeg, Clashmore, Co Waterford. P36 WA44

#### **2018:259 - Newtown, Dublin Airport Logistics Park, Fingal, Dublin**

**County:** Dublin

**Site name:** Newtown, Dublin Airport Logistics Park, Fingal

**SMR No.:** DU014-006001

**Licence number:** 17E0569 extension

**Author:** John Tierney, Eachtra Archaeological Projects Ltd.

**Site type:** Ringfort - skeletal remains

**ITM:** E 711959m, N 742455m

**Lat, Lon:** 53.420317, -6.315613

#### **Description:**

A group of human burials were recorded in the center of Newtown ringfort DU014-006001 during testing works. Dr. Linda Lynch confirmed the human skeletal remains to be archaeological. A decision was made to apply to the National Monuments Service to extend the licence due to concerns about further deterioration to the human remains.

The skeletons were excavated in March 2018. A total of eight skeletons were excavated from the interior of Newtown ringfort. All were incomplete as they had suffered significantly from truncation and fragmentation.

Initially six burials were recorded to the north of House Site 1 while a seventh was located to the south of House Site 2 and close to the eastern baulk of the site. The area containing the six burials (SK 1-6) measured approximately 12m north-south by 15m. No formal barrier was identified separating the burial ground from the rest of the interior of the ringfort. The burials were interred in simple earth-dug graves but no real trace of any grave cuts had survived. They were supine and extended with the head orientated to the east. Remains of two additional burials (SK 8 & SK 9) were identified post-excavation by Dr. Lynch.

Skeleton 8 (aged 3.5–4 years) was very incomplete. Fragments of the right femur and right hip (ilium) were bagged with the left hand of SK 4 and are interpreted by Dr. Lynch as the remains of a burial lying parallel to, and to the south of, SK 4. No other remains of SK 8 were recovered on site. It appears that SK 4 (possible female 17-25 years) and SK 8 (3.5-4 years) may have been buried immediately adjacent to each other. In addition one fragment of a bone from a young infant (SK 9 <6 months) was found in association with SK 4.

Few dental remains were recovered, just 23 permanent teeth from three adults, one permanent tooth from the adolescent/young adult, and two permanent teeth from a juvenile.

Two samples of bone, one from skeleton 3 and the second from skeleton 7, were chosen by Dr. Linda Lynch for AMS dating.

Lab ID UB-37844, Sample ID 17E0569:SK3, Context Female 45+ yrs Material/Type, Fragment of diaphysis of right femur, Radiocarbon BP 1499+/-33, Calibrated cal AD 432-640, Date Period, Early medieval

Lab ID UB-37845, Sample ID 17E0569:SK7, Context Male 35-39 yrs, Fragment of diaphysis of left femur, Radiocarbon BP 1066+/-33, Calibrated cal AD 895-928, Early medieval

It is possible that the eight burials (SK 1-6 and SK 8-9) date to the earlier phase of the ringfort, while SK 7, with the later date and the relatively isolated location, may represent a somewhat later burial on the site, though possibly still when the site was in use.

The skeletal assemblage, comprised a total of nine individuals, three adult females, two adult males, one young adult, two juveniles and an infant. Two of these burials, SK 3 and SK 7, were dated to the early medieval period. Eight of the individuals were recorded in a group to the north of house site 1 while the ninth was located close to the eastern boundary of the site. It should be noted that the eastern boundary of the site does not represent the perimeter of the ringfort but the boundary between the green field site and a DHL warehouse to the east. In addition four other individuals, recorded in 2005 but not excavated, are preserved in situ in the eastern portion of the ditch under the DHL carpark.

According to Dr. Lynch the Newtown individuals are quite interesting in terms of actual burial practice. They appear to be interred in relatively simple earth-dug graves, the most common form of burial in early medieval Ireland. All appear to be supine and extended. The exception was SK1 (15-20 years), whose skeletal remains were simply too disturbed to ascertain the original burial position, although it was probably at least extended. The unusual aspect of the burials was that, in the vast majority of cases (the exception again being SK1), the bodies were interred with the head to the east, directly opposite to the classic traditional Christian burial which was with the head to the west.

There is a possibility that ringfort could be classified as a cemetery settlement site though the number of known recorded burials is low. Only full excavation of the western half of the ringfort would elucidate this possibility. O'Brien (1992; 2003) believes that it was not until the 8th/9th century that burial in recognisable Christian ecclesiastical settlements became the norm in Ireland. Until then burial in unconsecrated family graveyards or *ferta* was also practised. Burial grounds have now been found in non-ecclesiastical enclosures on numerous excavated sites – often occupying the south-east quadrant and sometimes within a dedicated sub-enclosure. It is difficult to provide a definitive description of a cemetery settlement as they vary widely, however, a number of defining characteristics have emerged (O'Sullivan & Harney 2008; Ó Carragáin 2009; Stout & Stout 2008). The size of the enclosing element ranges from 40–100m and the cemetery element occupies just a small fraction of the available space. The cemetery is usually sited to the east or south-east within the enclosure which mirrors the layout of ecclesiastical cemeteries. With a few exceptions where good dating evidence is available, the sites seem to have fallen out of use by AD 1000. The cemetery settlements have a broadly similar chronology ranging from the 5th/6th century to the 9th/10th century which does tie in with the radiocarbon dates obtained from the burials at Newtown which range from AD 432 to 928.

References:

O'Brien, E. 1992 'Pagan and Christian burial in Ireland during the first millennium AD: continuity and change'. In N. Edwards and A. Lane (eds.) *The early church in Wales and the west*, 130–7. Oxbow Monograph 16. Oxford.

Ó Carragáin, T. 2009 'From family cemeteries to community cemeteries in Viking Age Ireland' In C. Corlett and M. Potterton (eds.) *Death and burial in early medieval Ireland*, Dublin.

O'Sullivan, A. and Harney, L. 2008 *Early Medieval Archaeological Project: Investigating the character of early medieval archaeological excavations, 1970 – 2002*. UCD School of Archaeology.

Stout, G. and Stout, M. 2008 *Excavation of a secular cemetery at Knowth, Site M, Co. Meath*. Bray.

Lickybeg, Clashmore, Co Waterford. P36 WA44

**2018:820 - Huntstown, Dublin**

**County:** Dublin  
**Site name:** Huntstown  
**SMR No.:** N/A  
**Licence number:** 18E0561  
**Author:** Níall Garahy, Archaeology and Built Heritage  
**Site type:** No archaeology found  
**ITM:** E 711248m, N 741351m  
**Lat, Lon:** 53.410550, -6.326694

**Description:**

Archaeological monitoring was carried out in advance of the construction of a wastewater treatment plant associated with the development of a Bioenergy Plant (FW13A/0089) at Huntstown, Finglas. The site had been previously entirely stripped of topsoil as part of a program of works associated with the construction of an existing power plant just north of this location. Construction of the power plant was completed in 2007. The area of the wastewater treatment plant and associated tank farm was covered in 200-400mm of compacted Clause 804-type material, which had been placed on top of a geotextile membrane. The hardcore in turn had been tarred over. The removal of the Clause 804-type material and the geotextile by mechanical excavator was monitored. No topsoil was present beneath the geotextile layer, which had been placed directly on top of the mid to dark yellowy-brown silty clay glacial till subsoil. From examining the surrounding landscape, an estimated 0.3-0.45m of topsoil and perhaps 0.1-0.2m of the subsoil had also been removed. This would have truncated any shallow archaeological deposits which may have been present on site but no deeper archaeological features were noted during the current phase of works, suggesting that there were no archaeological features present previously on site.

Spade Enterprise Centre, St Paul's, Smithfield, Dublin 7

**APPENDIX 12.4**  
**GRIFFITH'S VALUATION**  
**PREPARED BY CRDS LTD.**

PARISH OF FINGLAS.

9

No. on Map.	Letter or No. in Field Book.	Names of Townlands and Occupiers.	Observations.
<b>CARRAGH—continued.</b>			
5	a	Luka Carr, Esq., . . . .	House valued at 24 <i>l.</i> , raised to 30 <i>l.</i>
6		Michael Byrne, . . . .	House valued at 17 <i>l.</i> , raised to 20 <i>l.</i>
7	a	Peter Henry, Esq., . . . .	House valued at 30 <i>l.</i> , raised to 40 <i>l.</i>
<b>CARDIFFSBRIDGE.</b>			
1		Charles Wade, Esq., . . . .	Land valued at 388 <i>l.</i> 4 <i>s.</i> , reduced to 363 <i>l.</i> 16 <i>s.</i>
2	a	Anno Keefe, . . . .	House valued at 4 <i>l.</i> 15 <i>s.</i> , raised to 6 <i>l.</i>
	b	Patrick Murphy, . . . .	House valued at 1 <i>l.</i> 6 <i>s.</i> , reduced to 1 <i>l.</i>
	c	Michael Reilly, . . . .	House valued at 1 <i>l.</i> 12 <i>s.</i> , reduced to 1 <i>l.</i> 2 <i>s.</i>
	d	Matthew Connor, . . . .	House valued at 1 <i>l.</i> 17 <i>s.</i> , reduced to 1 <i>l.</i> 10 <i>s.</i>
	e	Michael M'Germack, . . . .	House valued at 1 <i>l.</i> 12 <i>s.</i> , reduced to 1 <i>l.</i> 5 <i>s.</i>
	f	Patrick Keefe, . . . .	House valued at 1 <i>l.</i> 12 <i>s.</i> , reduced to 1 <i>l.</i> 5 <i>s.</i>
	g	Thomas Mulvaney, . . . .	House valued at 18 <i>s.</i> , reduced to 15 <i>s.</i>
3		William Rathborne, Esq., . . . .	Land valued at 17 <i>l.</i> 5 <i>s.</i> , reduced to 16 <i>l.</i> 8 <i>s.</i>
<b>CARDIFFSCASTLE.</b>			
1		Richard Shew, Esq., . . . .	Content of land, 220 <i>a.</i> 3 <i>r.</i> 25 <i>p.</i> , valued at 599 <i>l.</i> 2 <i>s.</i> , to be 214 <i>a.</i> 2 <i>r.</i> 25 <i>p.</i> , value 585 <i>l.</i> 1 <i>s.</i>
2		Rev. J. D. Long, . . . .	Land, occupier, Rev. J. D. Long, to be John Courtney; lessor, John W. Bailey, Esq.; content of land, 18 <i>a.</i> 1 <i>r.</i> 10 <i>p.</i> , valued at 42 <i>l.</i> 4 <i>s.</i> , to be 8 <i>a.</i> 1 <i>r.</i> 6 <i>p.</i> , value 18 <i>l.</i> 13 <i>s.</i> ; William Courtney's land, 16 <i>a.</i> 1 <i>r.</i> 4 <i>s.</i> , value 37 <i>l.</i> 12 <i>s.</i> , to be put in; lessor, Richard Shew, Esq.
<b>CHARLESTOWN.</b>			
1		Mr. Archibald Browne, . . . .	Land valued at 140 <i>l.</i> 10 <i>s.</i> , reduced to 126 <i>l.</i> 9 <i>s.</i>
<b>COLDWINTERS.</b>			
1		Sir Simon Bradstreet, Bart., . . . .	Land valued at 169 <i>l.</i> 10 <i>s.</i> , raised to 199 <i>l.</i> 9 <i>s.</i>
3	a	Charles Donohoe, . . . .	Land valued at 25 <i>l.</i> 6 <i>s.</i> , raised to 26 <i>l.</i> 11 <i>s.</i>
4		Christopher Kelly, . . . .	Land valued at 14 <i>l.</i> 6 <i>s.</i> , raised to 15 <i>l.</i>
6		Peter Magrath, . . . .	Land valued at 11 <i>l.</i> 7 <i>s.</i> , raised to 11 <i>l.</i> 18 <i>s.</i>

4

PRIMARY VALUATION OF TENEMENTS.

No. on Map.	Letter or No. in Field Book.	Names of Townlands and Occupiers.	Observations.
<b>DISWELLSTOWN—con.</b>			
13		Patrick Flood, . . . .	Land valued at 30 <i>l.</i> 15 <i>s.</i> , raised to 34 <i>l.</i> 12 <i>s.</i>
14	a	Colonel Hill, . . . .	Land valued at 83 <i>l.</i> 8 <i>s.</i> , raised to 93 <i>l.</i> 16 <i>s.</i> ; and house valued at 48 <i>l.</i> , raised to 54 <i>l.</i>
<b>DUNSLINK.</b>			
1		Patrick Fitzsimon, . . . .	Land valued at 127 <i>l.</i> 10 <i>s.</i> , reduced to 121 <i>l.</i> 11 <i>s.</i>
4	a	Sir Wm. R. Hamilton, . . . .	House valued at 60 <i>l.</i> , raised to 70 <i>l.</i>
	c	Mr. Charles Thompson, . . . .	House valued at 10 <i>l.</i> , raised to 13 <i>l.</i>
6	a	Richard Simpson, Esq., . . . .	Land valued at 153 <i>l.</i> 14 <i>s.</i> , raised to 171 <i>l.</i> 5 <i>s.</i> ; and house valued at 45 <i>l.</i> , raised to 50 <i>l.</i>
8	a	Mr. Henry Cooper, . . . .	Land valued at 134 <i>l.</i> 18 <i>s.</i> , raised to 148 <i>l.</i> 8 <i>s.</i>
<b>HUNTSTOWN.</b>			
1	a	Mr. George Harden, . . . .	Lessor should be Anthony Hawkins, Esq.; land, 208 <i>a.</i> 3 <i>r.</i> 26 <i>p.</i> , valued at 421 <i>l.</i> 8 <i>s.</i> , to be 240 <i>a.</i> 1 <i>r.</i> 19 <i>p.</i> , value 446 <i>l.</i> ; and house valued at 36 <i>l.</i> , reduced to 30 <i>l.</i>
2		Mr. Christopher Kelly, . . . .	Occupier, Mr. Christopher Kelly, should be Anthony Hawkins, Esq.; lessor should be in fee; and land, 91 <i>a.</i> 0 <i>r.</i> 12 <i>p.</i> , valued at 181 <i>l.</i> 2 <i>s.</i> , to be 59 <i>a.</i> 2 <i>r.</i> 19 <i>p.</i> , value 127 <i>l.</i> 1 <i>s.</i>

**APPENDIX 12.5**

**METHOD STATEMENT SUMMARY FOR ADDITIONAL ARCHAEOLOGICAL TESTING**

**PREPARED BY CRDS LTD.**

## Summary

This method statement accompanies a licence application to conduct archaeological monitoring of Site Investigation (SI) works and a programme of archaeological testing at a proposed development site in Huntstown and Johnstown townlands, Old Ashbourne Road, Co. Dublin. The proposed archaeological works will be undertaken by AMS on behalf of Energia Group ROI Holdings (DAC).

The proposed development site incorporates 7 arable fields bordered by the Ashbourne Road to the east, the grounds of the Dogs Trust Ireland to the north, the large-scale modern industrial development of the Huntstown Power Station to the immediate west and an access road to Huntstown quarry to the south. A series of mature hedgerows and tree-lined boundaries sub-divide the fields. One structure, a ruined shed surrounded by overgrown vegetation, and facing onto the Old Ashbourne Road is present within the site boundary.

The proposed development site was subject to a geophysical survey (19R0159, Leigh) in August 2019, and subsequent targeted archaeological test trenching (19E0645, Bayley) in October 2019. These archaeological works identified an oval enclosure in the north of the site, measuring 42m x 50m and containing a number of internal features. Testing revealed the enclosure ditch on its eastern side is 3.6m wide and 1.3m deep, and indications of an outer ditch and associated field system. Associated gullies, ditches, and pits containing animal bone, seashell, and medieval pottery fragments were also identified. A nearby isolated pit similar to that found in burnt mound activity was discovered c.50m southeast of the main enclosure. A total of 45 Trenches were mechanically investigated across the test area, measuring 1,931 linear metres, which equates to 3,476m<sup>2</sup> (or 2.7% of the total site). The geophysical survey did not incorporate either the field to the southeast of the site or the easternmost field within the site, as they fell outside the original site boundary.

SI works are scheduled to be carried out as part of pre-planning works. Due to the archaeological potential within the site, the original layout plan of the SI works has been reviewed and in consultation with the client, and modified for archaeological reasons. It has been agreed to relocate the majority (i.e., 45 out of 52) of trial pits, plate bearing tests, and soakaways to areas previously disturbed by the excavation of test trenches in 2019. Boreholes close to the identified enclosure have also been relocated. An archaeological monitoring licence is being requested for these SI works. This is to ensure that all SI excavation works into previously undisturbed ground (as well as those SI works that have been relocated) and any unforeseen changes to the SI programme are monitored by a suitable qualified archaeologist.

A programme of archaeological testing is also proposed under this licence to further inform the understanding of archaeological material present on site. This targeted and comprehensive programme of test trenching, totalling 5,212 linear metres, equates to 9,382m<sup>2</sup> (or 7.3% of the total site). This proposed programme of testing follows on from the testing undertaken under Licence No.19E0645 (Bayley, 2019), and will bring the total surface area investigated to 10% of the entire site. The targeted test trenching will focus primarily on any anomalies highlighted in the geophysical survey that were not investigated during the 2019 test trenching, as well as further investigating the nature and extent of the identified enclosure (Figure 9). It is the aim of the development-wide trenching to comprise an intensive testing programme throughout the remaining areas and would include areas not included in the initial testing scheme; such as the areas under the overhead ESB wires, the easternmost field (Field 1), and the field to the southeast (Field 7).

It would be anticipated that any archaeological features will be subject to archaeological resolution or preservation in situ—in consultation with the Department of Housing, Local Government and Heritage (DHLGH)—prior to development. It is also anticipated that areas where the geophysical survey has not identified anything of potential archaeological significance, and have been subject to intensive testing, and no archaeology is found, that these areas would be considered archaeologically resolved.

An application for a metal detection device for use during the archaeological works accompanies this



**APPENDIX 12.6**

**COPY OF LICENSES AS ISSUED BY THE NATIONAL MONUMENTS SERVICE**

**PREPARED BY CRDS LTD.**

**From:** licensingsection [licensingsection@chg.gov.ie](mailto:licensingsection@chg.gov.ie)  
**Sent:** Tuesday 16 March 2021 12:10  
**To:** Stephen Hickey [Stephen.Hickey@ams-consultancy.com](mailto:Stephen.Hickey@ams-consultancy.com)  
**Subject:** Licence No. 21E0185 & 21R0064 - Co Dublin, Dublin, Johnstown, Huntstown - Stephen Hickey - Excavation & Detection Device Licence

Dear Stephen

I confirm that our archaeologist has approved the above mentioned applications.

Please note that Licence Nos. 21E0185 & 21R0064 now issued by email is subject to the conditions set out on the application form as completed by you the applicant/licensee.

In view of the current uncertainty, we would ask that you bear in mind the need to let us know of when the works are commencing/ceasing/concluding, in accordance with section/condition 17, and 9 & 11, as appropriate.

The timeframe for the licence 21E0185 is 16<sup>th</sup> March, 2021 to 27<sup>th</sup> August, 2021.  
The timeframe for the licence 21R0064 is 16<sup>th</sup> March, 2021, to 25<sup>th</sup> August, 2021.

We request notification of commencement of works for both the archaeological monitoring phase, and the archaeological testing phase.

Hard copies of licences are not being issued at present.

Kind regards,  
Camilla

—  
**Camilla With Pedersen**  
*ational on ments er ice*

—  
**An Roinn Tith ochta, Rialtais ití il agus Oidhreachtá**  
Department of Housing, Local Government and Heritage  
**Teach an Chustaim, Baile tha Cliath 1, D01W6XO**  
Custom House, Dublin 1, D01W6XO

—  
T +353 (0)1 888 2871  
[www.archaeology.ie](http://www.archaeology.ie)



**APPENDIX 13.1**

**TRACSIS TRAFFIC DATA**

Prepared by

CST Group

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Origin Arm A R135(NNW)

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm B N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	6	1	2	6	0	0	2	17
07:15	6	4	1	3	0	0	1	15
07:30	11	0	1	7	0	0	1	20
07:45	10	2	2	12	0	0	0	26
1 Hr	33	7	6	28	0	0	4	78
08:00	4	1	0	15	0	0	0	20
08:15	4	3	3	8	0	0	0	18
08:30	3	2	1	11	0	1	0	18
08:45	3	3	0	6	0	0	2	14
1 Hr	14	9	4	40	0	1	2	70
09:00	5	0	2	13	0	0	0	20
09:15	4	2	2	12	0	0	0	20
09:30	4	1	0	9	0	0	0	14
09:45	2	0	1	10	0	0	0	13
1 Hr	15	3	5	44	0	0	0	67
10:00	7	1	0	6	0	0	0	14
10:15	9	2	1	6	0	0	0	18
10:30	5	5	0	6	0	0	0	16
10:45	7	2	0	19	0	0	0	28
1 Hr	28	10	1	37	0	0	0	76
11:00	5	1	1	8	0	0	0	15
11:15	4	0	1	5	0	0	0	10
11:30	2	3	0	11	0	0	0	16
11:45	3	1	0	13	0	0	0	17
1 Hr	14	5	2	37	0	0	0	58
12:00	6	1	0	4	0	0	1	12
12:15	2	2	1	9	0	0	0	14
12:30	6	3	1	6	0	0	0	16
12:45	7	3	2	8	0	0	0	20
1 Hr	21	9	4	27	0	0	1	62

Arm Totals
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17
15
20
26
78
20
18
18
14
70
20
20
14
13
67
14
18
16
28
76
15
10
16
17
58
12
14
16
20
62



Origin Arm B N2 Slip

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	46	25	7	10	2	0	0	90
07:15	61	12	7	3	1	1	0	85
07:30	53	20	2	3	2	1	0	81
07:45	69	23	6	8	1	1	0	108
1 Hr	229	80	22	24	6	3	0	364
08:00	55	17	2	7	0	0	0	81
08:15	72	20	4	5	1	0	0	102
08:30	67	11	7	6	1	0	0	92
08:45	90	15	3	5	0	1	0	114
1 Hr	284	63	16	23	2	1	0	389
09:00	43	14	5	7	2	0	0	71
09:15	43	15	7	1	1	0	0	67
09:30	27	10	5	6	1	0	0	49
09:45	28	17	5	2	1	0	0	53
1 Hr	141	56	22	16	5	0	0	240
10:00	25	17	9	8	2	0	0	61
10:15	32	10	8	8	1	0	0	59
10:30	32	15	11	10	1	0	0	69
10:45	25	15	9	4	1	0	0	54
1 Hr	114	57	37	30	5	0	0	243
11:00	30	10	6	13	1	1	0	61
11:15	34	22	13	7	1	0	0	77
11:30	23	15	6	7	0	0	0	51
11:45	31	13	13	9	1	0	0	67
1 Hr	118	60	38	36	3	1	0	256
12:00	39	15	6	5	1	0	0	66
12:15	36	19	10	5	1	1	0	72
12:30	39	12	9	12	1	0	0	73
12:45	37	12	12	8	1	1	0	71
1 Hr	151	58	37	30	4	2	0	282

	Destination : Arm B N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	16	6	1	11	0	0	0	34
07:15	15	2	0	28	0	0	0	45
07:30	11	3	1	12	0	0	0	27
07:45	20	3	1	13	0	0	0	37
1 Hr	62	14	3	64	0	0	0	143
08:00	12	1	1	15	0	0	0	29
08:15	6	2	0	43	0	0	0	51
08:30	5	2	1	23	0	0	0	31
08:45	6	1	2	21	0	0	0	30
1 Hr	29	6	4	102	0	0	0	141
09:00	10	0	0	13	0	0	0	23
09:15	3	1	1	15	0	0	0	20
09:30	3	0	0	29	0	0	0	32
09:45	4	4	1	29	0	0	0	38
1 Hr	20	5	2	86	0	0	0	113
10:00	2	2	2	29	0	0	0	35
10:15	3	2	1	25	0	0	0	31
10:30	4	4	1	22	0	0	0	31
10:45	5	2	1	22	0	1	0	31
1 Hr	14	10	5	98	0	1	0	128
11:00	4	1	1	21	0	0	0	27
11:15	4	5	1	24	0	0	0	34
11:30	3	0	0	25	0	0	0	28
11:45	12	5	1	13	0	0	0	31
1 Hr	23	11	3	83	0	0	0	120
12:00	1	3	2	16	0	0	0	22
12:15	2	1	1	14	0	0	0	18
12:30	3	3	1	18	0	0	0	25
12:45	3	2	1	24	0	0	0	30
1 Hr	9	9	5	72	0	0	0	95

Arm Totals
124
130
108
145
507
110
153
123
144
530
94
87
81
91
353
96
90
100
85
371
88
111
79
98
376
88
90
98
101
377





Origin Arm C R135(SSE)

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	2	2	1	30	0	0	0	35
07:15	2	0	1	40	0	0	0	43
07:30	3	1	0	40	0	0	0	44
07:45	0	0	3	28	0	0	0	31
1 Hr	7	3	5	138	0	0	0	153
08:00	4	3	4	16	0	0	0	27
08:15	2	1	0	29	0	0	0	32
08:30	4	1	2	34	0	1	1	43
08:45	3	2	1	43	0	0	0	49
1 Hr	13	7	7	122	0	1	1	151
09:00	8	1	2	33	0	0	0	44
09:15	7	3	3	31	0	0	0	44
09:30	4	3	2	21	0	0	0	30
09:45	9	2	1	33	0	0	1	46
1 Hr	28	9	8	118	0	0	1	164
10:00	10	2	1	32	0	0	1	46
10:15	4	4	1	41	0	0	0	50
10:30	7	4	1	34	0	0	0	46
10:45	9	5	4	37	0	0	0	55
1 Hr	30	15	7	144	0	0	1	197
11:00	21	0	3	34	0	0	0	58
11:15	4	3	0	33	0	0	0	40
11:30	8	4	3	24	0	0	0	39
11:45	16	2	0	28	0	0	0	46
1 Hr	49	9	6	119	0	0	0	183
12:00	12	4	2	19	0	0	0	37
12:15	4	2	1	22	0	0	0	29
12:30	19	10	2	39	0	0	0	70
12:45	22	3	4	32	0	0	0	61
1 Hr	57	19	9	112	0	0	0	197

	Destination : Arm B N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

Arm Totals
35
43
44
31
153
27
32
43
49
151
44
44
30
46
164
46
50
46
55
197
58
40
39
46
183
37
29
70
61
197







ORIGIN SUMMARY

	Origin : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	6	1	2	6	0	0	2	17
07:15	6	4	1	3	0	0	1	15
07:30	11	0	1	7	0	0	1	20
07:45	10	2	2	12	0	0	0	26
1 Hr	33	7	6	28	0	0	4	78
08:00	4	1	0	15	0	0	0	20
08:15	4	3	3	8	0	0	0	18
08:30	3	2	1	11	0	1	0	18
08:45	3	3	0	6	0	0	2	14
1 Hr	14	9	4	40	0	1	2	70
09:00	5	0	2	13	0	0	0	20
09:15	4	2	2	12	0	0	0	20
09:30	4	1	0	9	0	0	0	14
09:45	2	0	1	10	0	0	0	13
1 Hr	15	3	5	44	0	0	0	67
10:00	7	1	0	6	0	0	0	14
10:15	9	2	1	6	0	0	0	18
10:30	5	5	0	6	0	0	0	16
10:45	7	2	0	19	0	0	0	28
1 Hr	28	10	1	37	0	0	0	76
11:00	5	1	1	8	0	0	0	15
11:15	4	0	1	5	0	0	0	10
11:30	2	3	0	11	0	0	0	16
11:45	3	1	0	13	0	0	0	17
1 Hr	14	5	2	37	0	0	0	58
12:00	6	1	0	4	0	0	1	12
12:15	2	2	1	9	0	0	0	14
12:30	6	3	1	6	0	0	0	16
12:45	7	3	2	8	0	0	0	20
1 Hr	21	9	4	27	0	0	1	62

	Origin : Arm B N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	62	31	8	21	2	0	0	124
07:15	76	14	7	31	1	1	0	130
07:30	64	23	3	15	2	1	0	108
07:45	89	26	7	21	1	1	0	145
1 Hr	291	94	25	88	6	3	0	507
08:00	67	18	3	22	0	0	0	110
08:15	78	22	4	48	1	0	0	153
08:30	72	13	8	29	1	0	0	123
08:45	96	16	5	26	0	1	0	144
1 Hr	313	69	20	125	2	1	0	530
09:00	53	14	5	20	2	0	0	94
09:15	46	16	8	16	1	0	0	87
09:30	30	10	5	35	1	0	0	81
09:45	32	21	6	31	1	0	0	91
1 Hr	161	61	24	102	5	0	0	353
10:00	27	19	11	37	2	0	0	96
10:15	35	12	9	33	1	0	0	90
10:30	36	19	12	32	1	0	0	100
10:45	30	17	10	26	1	1	0	85
1 Hr	128	67	42	128	5	1	0	371
11:00	34	11	7	34	1	1	0	88
11:15	38	27	14	31	1	0	0	111
11:30	26	15	6	32	0	0	0	79
11:45	43	18	14	22	1	0	0	98
1 Hr	141	71	41	119	3	1	0	376
12:00	40	18	8	21	1	0	0	88
12:15	38	20	11	19	1	1	0	90
12:30	42	15	10	30	1	0	0	98
12:45	40	14	13	32	1	1	0	101
1 Hr	160	67	42	102	4	2	0	377

	Origin : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	2	2	1	30	0	0	0	35
07:15	2	0	1	40	0	0	0	43
07:30	3	1	0	40	0	0	0	44
07:45	0	0	3	28	0	0	0	31
1 Hr	7	3	5	138	0	0	0	153
08:00	4	3	4	16	0	0	0	27
08:15	2	1	0	29	0	0	0	32
08:30	4	1	2	34	0	1	1	43
08:45	3	2	1	43	0	0	0	49
1 Hr	13	7	7	122	0	1	1	151
09:00	8	1	2	33	0	0	0	44
09:15	7	3	3	31	0	0	0	44
09:30	4	3	2	21	0	0	0	30
09:45	9	2	1	33	0	0	1	46
1 Hr	28	9	8	118	0	0	1	164
10:00	10	2	1	32	0	0	1	46
10:15	4	4	1	41	0	0	0	50
10:30	7	4	1	34	0	0	0	46
10:45	9	5	4	37	0	0	0	55
1 Hr	30	15	7	144	0	0	1	197
11:00	21	0	3	34	0	0	0	58
11:15	4	3	0	33	0	0	0	40
11:30	8	4	3	24	0	0	0	39
11:45	16	2	0	28	0	0	0	46
1 Hr	49	9	6	119	0	0	0	183
12:00	12	4	2	19	0	0	0	37
12:15	4	2	1	22	0	0	0	29
12:30	19	10	2	39	0	0	0	70
12:45	22	3	4	32	0	0	0	61
1 Hr	57	19	9	112	0	0	0	197

Origin Totals
176
188
172
202
738
157
203
184
207
751
158
151
125
150
584
156
158
162
168
644
161
161
134
161
617
137
133
184
182
636



13:00	3	0	1	9	0	0	0	13
13:15	4	2	0	8	0	0	0	14
13:30	4	4	0	12	0	0	0	20
13:45	6	0	0	9	0	0	1	16
1 Hr	17	6	1	38	0	0	1	63
14:00	4	3	3	6	0	0	1	17
14:15	2	4	3	9	0	0	0	18
14:30	5	1	1	8	0	0	0	15
14:45	3	0	0	13	0	1	0	17
1 Hr	14	8	7	36	0	1	1	67
15:00	4	1	0	11	0	0	0	16
15:15	2	1	1	10	0	0	0	14
15:30	1	1	1	2	0	0	0	5
15:45	1	2	1	7	0	0	0	11
1 Hr	8	5	3	30	0	0	0	46
16:00	4	2	0	8	0	0	0	14
16:15	3	0	0	4	0	0	0	7
16:30	2	1	0	4	0	0	1	8
16:45	2	0	1	4	0	0	1	8
1 Hr	11	3	1	20	0	0	2	37
17:00	2	0	0	3	0	0	0	5
17:15	0	1	0	2	0	0	0	3
17:30	1	0	0	5	0	0	0	6
17:45	1	1	0	1	0	0	0	3
1 Hr	4	2	0	11	0	0	0	17
18:00	0	0	0	0	0	0	0	0
18:15	2	0	0	3	0	0	0	5
18:30	2	0	1	0	0	2	0	5
18:45	1	1	1	0	0	0	0	3
1 Hr	5	1	2	3	0	2	0	13

Total	184	68	36	351	0	4	11	654
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35	18	10	25	2	3	0	93
31	16	8	37	1	0	0	93
35	16	11	41	0	1	0	104
39	20	20	35	2	0	0	116
140	70	49	138	5	4	0	406
39	10	13	39	2	0	0	103
50	16	7	27	1	0	0	101
39	13	15	39	1	0	0	107
47	16	17	28	1	0	0	109
175	55	52	133	5	0	0	420
31	16	14	34	1	1	0	97
43	22	12	24	1	2	0	104
38	12	11	31	0	0	0	92
33	27	17	34	2	1	0	114
145	77	54	123	4	4	0	407
43	15	11	17	1	2	0	89
42	21	11	36	1	0	0	111
62	17	8	16	2	1	0	106
50	22	6	14	1	1	0	94
197	75	36	83	5	4	0	400
42	13	7	17	1	1	0	81
45	16	6	8	0	0	0	75
50	16	5	11	1	3	0	86
41	10	6	7	2	0	0	66
178	55	24	43	4	4	0	308
37	15	3	12	2	0	0	69
47	9	5	14	2	2	0	79
38	8	3	14	1	0	0	64
25	9	2	10	0	1	0	47
147	41	13	50	5	3	0	259

2176	802	422	1234	53	27	0	4714
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15	6	1	35	0	0	0	57
9	4	2	25	0	0	0	40
8	3	3	30	0	0	0	44
10	9	2	35	0	0	0	56
42	22	8	125	0	0	0	197
8	6	2	46	0	0	0	62
5	5	2	35	0	0	0	47
9	4	2	35	0	0	0	50
12	2	4	32	0	0	0	50
34	17	10	148	0	0	0	209
14	0	2	14	0	0	0	30
19	2	1	20	0	0	0	42
9	4	1	53	0	0	0	67
4	2	1	42	0	0	0	49
46	8	5	129	0	0	0	188
28	7	0	25	0	0	2	62
14	6	2	28	0	0	0	50
20	4	2	19	0	0	1	46
22	8	2	15	0	0	1	48
84	25	6	87	0	0	4	206
30	7	1	7	0	0	1	46
20	3	0	8	0	0	3	34
14	2	0	8	0	0	0	24
21	5	2	2	0	0	0	30
85	17	3	25	0	0	4	134
19	7	1	9	0	0	1	37
16	4	0	2	0	0	0	22
15	3	1	1	0	3	1	24
10	3	0	4	0	0	0	17
60	17	2	16	0	3	2	100

535	168	76	1283	0	4	13	2079
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163
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106
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372

7447
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DESTINATION SUMMARY

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	48	27	8	40	2	0	0	125
07:15	63	12	8	43	1	1	0	128
07:30	56	21	2	43	2	1	0	125
07:45	69	23	9	36	1	1	0	139
1 Hr	236	83	27	162	6	3	0	517
08:00	59	20	6	23	0	0	0	108
08:15	74	21	4	34	1	0	0	134
08:30	71	12	9	40	1	1	1	135
08:45	93	17	4	48	0	1	0	163
1 Hr	297	70	23	145	2	2	1	540
09:00	51	15	7	40	2	0	0	115
09:15	50	18	10	32	1	0	0	111
09:30	31	13	7	27	1	0	0	79
09:45	37	19	6	35	1	0	1	99
1 Hr	169	65	30	134	5	0	1	404
10:00	35	19	10	40	2	0	1	107
10:15	36	14	9	49	1	0	0	109
10:30	39	19	12	44	1	0	0	115
10:45	34	20	13	41	1	0	0	109
1 Hr	144	72	44	174	5	0	1	440
11:00	51	10	9	47	1	1	0	119
11:15	38	25	13	40	1	0	0	117
11:30	31	19	9	31	0	0	0	90
11:45	47	15	13	37	1	0	0	113
1 Hr	167	69	44	155	3	1	0	439
12:00	51	19	8	24	1	0	0	103
12:15	40	21	11	27	1	1	0	101
12:30	58	22	11	51	1	0	0	143
12:45	59	15	16	40	1	1	0	132
1 Hr	208	77	46	142	4	2	0	479

	Destination : Arm B N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	22	7	3	17	0	0	2	51
07:15	21	6	1	31	0	0	1	60
07:30	22	3	2	19	0	0	1	47
07:45	30	5	3	25	0	0	0	63
1 Hr	95	21	9	92	0	0	4	221
08:00	16	2	1	30	0	0	0	49
08:15	10	5	3	51	0	0	0	69
08:30	8	4	2	34	0	1	0	49
08:45	9	4	2	27	0	0	2	44
1 Hr	43	15	8	142	0	1	2	211
09:00	15	0	2	26	0	0	0	43
09:15	7	3	3	27	0	0	0	40
09:30	7	1	0	38	0	0	0	46
09:45	6	4	2	39	0	0	0	51
1 Hr	35	8	7	130	0	0	0	180
10:00	9	3	2	35	0	0	0	49
10:15	12	4	2	31	0	0	0	49
10:30	9	9	1	28	0	0	0	47
10:45	12	4	1	41	0	1	0	59
1 Hr	42	20	6	135	0	1	0	204
11:00	9	2	2	29	0	0	0	42
11:15	8	5	2	29	0	0	0	44
11:30	5	3	0	36	0	0	0	44
11:45	15	6	1	26	0	0	0	48
1 Hr	37	16	5	120	0	0	0	178
12:00	7	4	2	20	0	0	1	34
12:15	4	3	2	23	0	0	0	32
12:30	9	6	2	24	0	0	0	41
12:45	10	5	3	32	0	0	0	50
1 Hr	30	18	9	99	0	0	1	157

Dest Totals
176
188
172
202
738
157
203
184
207
751
158
151
125
150
584
156
158
162
168
644
161
161
134
161
617
137
133
184
182
636





Origin Arm A Elm Road

	Destination : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	1	0	0	0	1
07:15	1	0	0	0	0	0	0	1
07:30	0	0	1	0	0	0	0	1
07:45	0	0	0	0	0	0	0	0
1 Hr	1	0	1	1	0	0	0	3
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	1	0	0	0	1
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	1	0	0	0	1
09:00	0	0	0	0	0	0	0	0
09:15	1	1	1	0	0	0	0	3
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	1	1	1	0	0	0	0	3
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	1	1	0	0	0	0	0	2
10:45	0	0	0	0	0	0	0	0
1 Hr	1	1	0	0	0	0	0	2
11:00	2	0	0	0	0	0	0	2
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	2	0	0	0	0	0	0	2
12:00	1	0	1	0	0	0	0	2
12:15	0	0	1	0	0	0	0	1
12:30	0	0	0	0	0	0	0	0
12:45	1	1	1	0	0	0	0	3
1 Hr	2	1	3	0	0	0	0	6

	Destination : Arm C R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	1	1	0	0	0	0	2
07:30	0	1	0	0	0	0	0	1
07:45	1	2	0	0	0	0	0	3
1 Hr	1	4	1	0	0	0	0	6
08:00	2	1	1	1	0	0	0	5
08:15	1	12	1	1	0	0	0	15
08:30	3	2	0	0	0	0	0	5
08:45	5	2	0	1	0	1	0	9
1 Hr	11	17	2	3	0	1	0	34
09:00	2	4	0	1	0	0	0	7
09:15	2	2	1	1	0	0	0	6
09:30	1	5	0	0	0	0	0	6
09:45	2	1	1	0	0	0	0	4
1 Hr	7	12	2	2	0	0	0	23
10:00	0	1	1	1	0	0	0	3
10:15	2	2	0	0	0	0	0	4
10:30	5	1	0	1	0	0	0	7
10:45	1	1	1	2	0	0	0	5
1 Hr	8	5	2	4	0	0	0	19
11:00	2	0	1	0	0	0	0	3
11:15	1	0	0	0	0	0	0	1
11:30	1	0	0	0	0	0	0	1
11:45	1	0	0	0	0	0	0	1
1 Hr	5	0	1	0	0	0	0	6
12:00	6	1	0	0	0	0	0	7
12:15	2	1	1	1	0	0	0	5
12:30	2	0	0	0	0	0	0	2
12:45	4	3	0	0	0	0	0	7
1 Hr	14	5	1	1	0	0	0	21

Arm Totals
1
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2
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9
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16
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35
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6
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26
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21
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1
1
1
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2
10
27



13:00	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0

1	0	0	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	2
0	0	1	0	0	0	0	0	0	1
1	0	1	0	0	0	0	0	0	2
1	0	1	0	0	0	0	0	0	2
0	0	0	1	0	0	0	0	0	1
2	0	3	1	0	0	0	0	0	6
0	0	0	0	0	0	0	0	0	0
0	1	0	2	0	0	0	0	0	3
1	0	1	0	0	0	0	0	0	2
0	1	0	0	0	0	0	0	0	1
1	2	1	2	0	0	0	0	0	6
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	1
1	1	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	0	1
Total	13	8	9	5	0	0	0	0	35

2	0	0	0	0	0	0	0	0	2
3	1	0	0	0	0	0	0	0	4
3	1	0	0	0	0	0	0	1	5
3	1	0	0	0	0	0	0	0	4
11	3	0	0	0	0	0	0	1	15
2	0	1	0	0	0	0	0	0	3
4	1	0	0	0	0	0	0	0	5
0	0	0	2	0	0	0	0	0	2
4	1	0	0	0	0	0	0	0	5
10	2	1	2	0	0	0	0	0	15
1	2	0	0	0	0	0	0	0	3
3	0	1	0	0	0	0	0	0	4
2	1	1	0	0	0	1	0	0	5
2	1	0	0	0	0	1	0	0	4
8	4	2	0	0	2	0	0	0	16
8	0	0	1	0	0	0	0	0	9
4	1	1	1	0	0	0	1	0	8
4	3	0	0	0	0	0	0	0	7
8	3	0	0	0	0	0	0	0	11
24	7	1	2	0	0	0	1	0	35
11	2	1	1	0	0	0	0	0	15
8	5	0	0	0	0	0	0	0	13
9	1	1	0	0	0	0	0	0	11
4	1	0	0	0	0	0	1	0	6
32	9	2	1	0	0	0	1	0	45
6	3	0	1	0	0	0	0	0	10
9	2	1	0	0	0	0	0	0	12
2	3	1	0	0	0	0	0	0	6
3	0	1	1	0	0	0	0	0	5
20	8	3	2	0	0	0	0	0	33
Total	151	76	18	17	0	3	3	0	268

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21
3
7
7
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22
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12
37
15
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12
6
46
10
12
6
6
34
303



Origin Arm B R135(SSE)

	Destination : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	16	17	0	21	0	0	0	54
07:15	18	11	2	33	0	0	0	64
07:30	5	6	0	34	0	0	0	45
07:45	4	1	5	22	0	0	0	32
1 Hr	43	35	7	110	0	0	0	195
08:00	20	5	0	11	0	0	0	36
08:15	17	3	1	17	0	0	0	38
08:30	15	6	2	24	0	1	0	48
08:45	18	2	1	34	0	0	0	55
1 Hr	70	16	4	86	0	1	0	177
09:00	17	3	5	29	0	0	0	54
09:15	16	3	3	15	0	0	0	37
09:30	8	3	1	20	0	0	0	32
09:45	17	5	1	22	0	0	0	45
1 Hr	58	14	10	86	0	0	0	168
10:00	5	1	2	22	0	0	0	30
10:15	12	3	0	31	0	0	0	46
10:30	8	5	4	27	0	0	0	44
10:45	6	3	3	35	0	0	0	47
1 Hr	31	12	9	115	0	0	0	167
11:00	17	2	1	23	0	0	0	43
11:15	10	8	0	21	0	0	0	39
11:30	13	4	2	20	0	0	0	39
11:45	17	3	1	16	0	0	0	37
1 Hr	57	17	4	80	0	0	0	158
12:00	12	4	1	13	0	0	0	30
12:15	11	2	2	14	0	0	0	29
12:30	23	3	2	32	0	0	0	60
12:45	24	4	2	24	0	0	0	54
1 Hr	70	13	7	83	0	0	0	173

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	1	0	0	0	0	1
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	1	0	0	0	0	1
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm C R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	35	10	8	16	1	0	0	70
07:15	46	6	5	10	1	1	0	69
07:30	37	14	4	7	2	1	0	65
07:45	56	17	3	14	1	1	0	92
1 Hr	174	47	20	47	5	3	0	296
08:00	36	18	4	13	0	0	0	71
08:15	50	13	1	15	1	0	0	80
08:30	63	12	6	16	0	0	0	97
08:45	68	17	3	16	1	1	0	106
1 Hr	217	60	14	60	2	1	0	354
09:00	37	16	5	10	2	0	0	70
09:15	37	12	7	17	1	0	0	74
09:30	24	13	5	9	1	0	0	52
09:45	23	12	5	13	1	0	1	55
1 Hr	121	53	22	49	5	0	1	251
10:00	37	15	7	15	2	0	0	76
10:15	25	13	9	18	1	0	0	66
10:30	26	12	9	20	1	0	0	68
10:45	35	15	9	10	1	0	0	70
1 Hr	123	55	34	63	5	0	0	280
11:00	33	14	6	21	1	0	0	75
11:15	26	22	12	17	1	1	0	79
11:30	20	12	7	16	0	0	0	55
11:45	29	11	8	18	1	0	0	67
1 Hr	108	59	33	72	3	1	0	276
12:00	36	15	6	12	1	0	0	70
12:15	36	16	7	9	1	1	0	70
12:30	37	16	10	22	0	0	0	85
12:45	32	17	10	18	1	1	0	79
1 Hr	141	64	33	61	3	2	0	304

Arm Totals
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124
133
110
124
491
107
119
145
161
532
124
111
84
100
419
106
112
112
117
447
118
118
94
104
434
100
99
145
133
477





Origin Arm C R135(NNW)

	Destination : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	29	12	11	9	1	0	0	62
07:15	36	15	16	4	2	1	0	74
07:30	36	12	8	7	2	0	0	65
07:45	28	13	7	3	3	0	0	54
1 Hr	129	52	42	23	8	1	0	255
08:00	22	12	6	4	2	1	0	47
08:15	38	11	4	11	0	0	0	64
08:30	41	10	5	7	1	1	0	65
08:45	29	21	7	5	0	0	0	62
1 Hr	130	54	22	27	3	2	0	238
09:00	34	19	6	7	2	0	0	68
09:15	26	15	9	8	1	0	0	59
09:30	26	12	4	8	1	0	0	51
09:45	21	16	3	5	1	0	0	46
1 Hr	107	62	22	28	5	0	0	224
10:00	21	10	6	6	0	1	0	44
10:15	22	17	7	6	1	1	0	54
10:30	37	15	4	16	0	0	0	72
10:45	28	13	5	1	2	1	0	50
1 Hr	108	55	22	29	3	3	0	220
11:00	26	16	9	6	0	0	0	57
11:15	31	13	5	8	1	0	0	58
11:30	27	14	11	12	1	0	0	65
11:45	25	14	9	7	3	0	0	58
1 Hr	109	57	34	33	5	0	0	238
12:00	31	17	12	4	0	0	0	64
12:15	28	18	10	9	1	0	0	66
12:30	25	9	8	3	2	0	0	47
12:45	49	17	12	8	1	0	0	87

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	6	1	1	5	0	0	3	16
07:15	5	4	1	3	0	0	0	13
07:30	13	1	1	7	0	0	1	23
07:45	13	2	2	12	0	0	0	29
1 Hr	37	8	5	27	0	0	4	81
08:00	6	1	0	15	0	0	0	22
08:15	4	4	2	11	0	0	0	21
08:30	4	2	1	7	0	1	0	15
08:45	6	3	1	8	0	0	2	20
1 Hr	20	10	4	41	0	1	2	78
09:00	6	0	1	12	0	0	0	19
09:15	4	1	2	11	0	0	0	18
09:30	6	1	0	10	0	0	0	17
09:45	4	2	1	10	0	1	0	18
1 Hr	20	4	4	43	0	1	0	72
10:00	8	1	0	7	0	0	0	16
10:15	12	2	1	5	0	0	0	20
10:30	7	4	0	6	0	0	0	17
10:45	8	2	0	22	0	0	0	32
1 Hr	35	9	1	40	0	0	0	85
11:00	7	1	0	5	0	0	0	13
11:15	6	0	1	6	0	0	0	13
11:30	5	2	0	10	0	0	0	17
11:45	5	1	0	15	0	0	1	22
1 Hr	23	4	1	36	0	0	1	65
12:00	9	2	0	3	0	0	0	14
12:15	2	2	1	8	0	0	0	13
12:30	5	3	0	6	0	0	0	14
12:45	10	2	1	8	0	0	0	21

	Destination : Arm C R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0

Arm Totals
78
87
88
83
336
69
85
80
82
316
87
77
68
64
296
60
74
89
82
305
70
71
82
80
303
78
79
61
108



ORIGIN SUMMARY

	Origin : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	1	0	0	0	1
07:15	1	1	1	0	0	0	0	3
07:30	0	1	1	0	0	0	0	2
07:45	1	2	0	0	0	0	0	3
1 Hr	2	4	2	1	0	0	0	9
08:00	2	1	1	1	0	0	0	5
08:15	1	12	1	2	0	0	0	16
08:30	3	2	0	0	0	0	0	5
08:45	5	2	0	1	0	1	0	9
1 Hr	11	17	2	4	0	1	0	35
09:00	2	4	0	1	0	0	0	7
09:15	3	3	2	1	0	0	0	9
09:30	1	5	0	0	0	0	0	6
09:45	2	1	1	0	0	0	0	4
1 Hr	8	13	3	2	0	0	0	26
10:00	0	1	1	1	0	0	0	3
10:15	2	2	0	0	0	0	0	4
10:30	6	2	0	1	0	0	0	9
10:45	1	1	1	2	0	0	0	5
1 Hr	9	6	2	4	0	0	0	21
11:00	4	0	1	0	0	0	0	5
11:15	1	0	0	0	0	0	0	1
11:30	1	0	0	0	0	0	0	1
11:45	1	0	0	0	0	0	0	1
1 Hr	7	0	1	0	0	0	0	8
12:00	7	1	1	0	0	0	0	9
12:15	2	1	2	1	0	0	0	6
12:30	2	0	0	0	0	0	0	2
12:45	5	4	1	0	0	0	0	10
1 Hr	16	6	4	1	0	0	0	27

	Origin : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
51	27	8	37	1	0	0	124	
64	17	7	43	1	1	0	133	
42	20	4	41	2	1	0	110	
60	18	8	36	1	1	0	124	
217	82	27	157	5	3	0	491	
56	23	4	24	0	0	0	107	
67	16	3	32	1	0	0	119	
78	18	8	40	0	1	0	145	
86	19	4	50	1	1	0	161	
287	76	19	146	2	2	0	532	
54	19	10	39	2	0	0	124	
53	15	10	32	1	0	0	111	
32	16	6	29	1	0	0	84	
40	17	6	35	1	0	1	100	
179	67	32	135	5	0	1	419	
42	16	9	37	2	0	0	106	
37	16	9	49	1	0	0	112	
34	17	13	47	1	0	0	112	
41	18	12	45	1	0	0	117	
154	67	43	178	5	0	0	447	
50	16	7	44	1	0	0	118	
36	30	12	38	1	1	0	118	
33	16	9	36	0	0	0	94	
46	14	9	34	1	0	0	104	
165	76	37	152	3	1	0	434	
48	19	7	25	1	0	0	100	
47	18	9	23	1	1	0	99	
60	19	12	54	0	0	0	145	
56	21	12	42	1	1	0	133	
211	77	40	144	3	2	0	477	

	Origin : Arm C R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
35	13	12	14	1	0	3	78	
41	19	17	7	2	1	0	87	
49	13	9	14	2	0	1	88	
41	15	9	15	3	0	0	83	
166	60	47	50	8	1	4	336	
28	13	6	19	2	1	0	69	
42	15	6	22	0	0	0	85	
45	12	6	14	1	2	0	80	
35	24	8	13	0	0	2	82	
150	64	26	68	3	3	2	316	
40	19	7	19	2	0	0	87	
30	16	11	19	1	0	0	77	
32	13	4	18	1	0	0	68	
25	18	4	15	1	1	0	64	
127	66	26	71	5	1	0	296	
29	11	6	13	0	1	0	60	
34	19	8	11	1	1	0	74	
44	19	4	22	0	0	0	89	
36	15	5	23	2	1	0	82	
143	64	23	69	3	3	0	305	
33	17	9	11	0	0	0	70	
37	13	6	14	1	0	0	71	
32	16	11	22	1	0	0	82	
30	15	9	22	3	0	1	80	
132	61	35	69	5	0	1	303	
40	19	12	7	0	0	0	78	
30	20	11	17	1	0	0	79	
30	12	8	9	2	0	0	61	
59	19	13	16	1	0	0	108	
159	70	44	49	4	0	0	326	

Origin Totals
203
223
200
210
836
181
220
230
82
252
883
218
197
158
168
741
169
190
210
204
773
193
190
177
185
745
187
184
208
251
830



13:00	3	0	0	0	0	0	0	3
13:15	3	2	0	0	0	0	0	5
13:30	3	1	0	0	0	0	1	5
13:45	3	1	0	0	0	0	0	4
1 Hr	12	4	0	0	0	0	1	17
14:00	2	0	2	0	0	0	0	4
14:15	5	1	1	0	0	0	0	7
14:30	1	0	1	2	0	0	0	4
14:45	4	1	0	1	0	0	0	6
1 Hr	12	2	4	3	0	0	0	21
15:00	1	2	0	0	0	0	0	3
15:15	3	1	1	2	0	0	0	7
15:30	3	1	2	0	0	1	0	7
15:45	2	2	0	0	0	1	0	5
1 Hr	9	6	3	2	0	2	0	22
16:00	8	0	0	1	0	0	0	9
16:15	5	1	1	1	0	0	1	9
16:30	4	3	0	0	0	0	0	7
16:45	8	4	0	0	0	0	0	12
1 Hr	25	8	1	2	0	0	1	37
17:00	11	2	1	1	0	0	0	15
17:15	8	5	0	0	0	0	0	13
17:30	10	1	1	0	0	0	0	12
17:45	4	1	0	0	0	0	1	6
1 Hr	33	9	2	1	0	0	1	46
18:00	6	3	0	1	0	0	0	10
18:15	9	2	1	0	0	0	0	12
18:30	2	3	1	0	0	0	0	6
18:45	3	1	1	1	0	0	0	6
1 Hr	20	9	3	2	0	0	0	34
Total	164	84	27	22	0	3	3	303

51	21	11	40	2	3	0	128	
44	14	9	38	1	0	0	106	
34	16	11	37	0	1	0	99	
39	25	17	43	2	0	0	126	
168	76	48	158	5	4	0	459	
41	18	10	56	2	0	0	127	
56	18	11	46	1	0	0	132	
32	19	17	44	1	1	0	114	
62	20	17	34	1	0	0	134	
191	75	55	180	5	1	0	507	
42	14	14	32	1	1	0	104	
58	20	13	30	1	2	1	125	
50	17	10	58	0	0	0	135	
39	20	16	54	2	3	0	134	
189	71	53	174	4	6	1	498	
71	24	15	35	1	1	1	148	
54	27	8	42	1	0	0	132	
84	17	13	24	3	1	0	142	
71	28	10	20	1	1	2	133	
280	96	46	121	6	3	3	555	
92	18	5	16	1	1	1	134	
70	20	6	12	0	0	3	111	
66	17	6	14	1	3	0	107	
66	15	8	7	1	0	0	97	
294	70	25	49	3	4	4	449	
53	23	6	19	2	0	0	103	
62	13	5	8	3	1	1	93	
49	12	4	8	1	1	1	76	
40	10	1	9	0	2	0	62	
204	58	16	44	6	4	2	334	
Total	2539	891	441	1638	52	30	11	5602

43	11	9	14	1	0	0	78	
26	13	5	17	1	0	0	62	
37	9	7	19	1	0	0	73	
31	12	6	13	1	0	1	64	
137	45	27	63	4	0	1	277	
44	12	13	15	1	0	1	86	
48	17	18	17	0	0	0	100	
39	21	9	17	1	0	0	87	
39	13	4	12	1	2	0	71	
170	63	44	61	3	2	1	344	
56	19	5	22	0	0	0	102	
39	8	5	17	1	1	0	71	
32	18	10	9	1	3	1	74	
38	17	2	13	1	0	0	71	
165	62	22	61	3	4	1	318	
59	18	4	11	0	0	0	92	
47	19	2	5	2	1	0	76	
66	14	3	5	0	1	1	90	
70	6	4	10	1	0	1	92	
242	57	13	31	3	2	2	350	
72	15	4	9	1	1	1	103	
77	16	2	5	1	0	0	101	
58	9	1	10	0	1	0	79	
79	8	3	4	1	0	0	95	
286	48	10	28	3	2	1	378	
65	9	1	1	0	0	0	76	
52	9	3	4	1	1	0	70	
61	12	0	2	1	0	0	76	
41	4	2	3	0	2	0	52	
219	34	6	10	2	3	0	274	
Total	2096	694	323	630	46	21	13	3823

209
173
177
194
753
217
239
205
211
872
209
203
216
210
838
249
217
239
237
942
252
225
198
198
873
189
175
158
120
642
9728



DESTINATION SUMMARY

	Destination : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	45	29	11	30	1	0	0	116
07:15	54	26	18	37	2	1	0	138
07:30	41	18	8	41	2	0	0	110
07:45	32	14	12	25	3	0	0	86
1 Hr	172	87	49	133	8	1	0	450
08:00	42	17	6	15	2	1	0	83
08:15	55	14	5	28	0	0	0	102
08:30	56	16	7	31	1	2	0	113
08:45	47	23	8	39	0	0	0	117
1 Hr	200	70	26	113	3	3	0	415
09:00	51	22	11	36	2	0	0	122
09:15	42	18	12	23	1	0	0	96
09:30	34	15	5	28	1	0	0	83
09:45	38	21	4	27	1	0	0	91
1 Hr	165	76	32	114	5	0	0	392
10:00	26	11	8	28	0	1	0	74
10:15	34	20	7	37	1	1	0	100
10:30	45	20	8	43	0	0	0	116
10:45	34	16	8	36	2	1	0	97
1 Hr	139	67	31	144	3	3	0	387
11:00	43	18	10	29	0	0	0	100
11:15	41	21	5	29	1	0	0	97
11:30	40	18	13	32	1	0	0	104
11:45	42	17	10	23	3	0	0	95
1 Hr	166	74	38	113	5	0	0	396
12:00	43	21	13	17	0	0	0	94
12:15	39	20	12	23	1	0	0	95
12:30	48	12	10	35	2	0	0	107
12:45	73	21	14	32	1	0	0	141
1 Hr	203	74	49	107	4	0	0	437

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
6	1	1	6	0	0	3	17	
6	4	1	3	0	0	0	14	
13	1	2	7	0	0	1	24	
13	2	2	12	0	0	0	29	
38	8	6	28	0	0	4	84	
6	1	0	15	0	0	0	22	
4	4	3	12	0	0	0	23	
4	2	1	7	0	1	0	15	
6	3	1	8	0	0	2	20	
20	10	5	42	0	1	2	80	
6	0	1	12	0	0	0	19	
5	2	3	11	0	0	0	21	
6	1	0	10	0	0	0	17	
4	2	1	10	0	1	0	18	
21	5	5	43	0	1	0	75	
8	1	0	7	0	0	0	16	
12	2	1	5	0	0	0	20	
8	5	0	6	0	0	0	19	
8	2	0	22	0	0	0	32	
36	10	1	40	0	0	0	87	
9	1	0	5	0	0	0	15	
6	0	1	6	0	0	0	13	
5	2	0	10	0	0	0	17	
5	1	0	15	0	0	1	22	
25	4	1	36	0	0	1	67	
10	2	1	3	0	0	0	16	
2	2	2	8	0	0	0	14	
5	3	0	6	0	0	0	14	
11	3	2	8	0	0	0	24	
28	10	5	25	0	0	0	68	

	Destination : Arm C R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
35	10	8	16	1	0	0	70	
46	7	6	10	1	1	0	71	
37	15	4	7	2	1	0	66	
57	19	3	14	1	1	0	95	
175	51	21	47	5	3	0	302	
38	19	5	14	0	0	0	76	
51	25	2	16	1	0	0	95	
66	14	6	16	0	0	0	102	
73	19	3	17	1	2	0	115	
228	77	16	63	2	2	0	388	
39	20	5	11	2	0	0	77	
39	14	8	18	1	0	0	80	
25	18	5	9	1	0	0	58	
25	13	6	13	1	0	1	59	
128	65	24	51	5	0	1	274	
37	16	8	16	2	0	0	79	
27	15	9	18	1	0	0	70	
31	13	9	21	1	0	0	75	
36	16	10	12	1	0	0	75	
131	60	36	67	5	0	0	299	
35	14	7	21	1	0	0	78	
27	22	12	17	1	1	0	80	
21	12	7	16	0	0	0	56	
30	11	8	18	1	0	0	68	
113	59	34	72	3	1	0	282	
42	16	6	12	1	0	0	77	
38	17	8	10	1	1	0	75	
39	16	10	22	0	0	0	87	
36	20	10	18	1	1	0	86	
155	69	34	62	3	2	0	325	

Dest Totals
203
223
200
210
836
181
220
230
252
883
218
197
158
168
741
169
190
210
204
773
193
190
177
185
745
187
184
208
251
830



13:00	59	14	8	27	1	0	0	109
13:15	31	16	8	38	1	0	0	94
13:30	39	8	9	33	1	1	0	91
13:45	46	19	8	32	1	0	0	106
1 Hr	175	57	33	130	4	1	0	400
14:00	52	15	14	44	1	0	0	126
14:15	61	16	19	34	0	0	0	130
14:30	41	29	10	33	1	0	0	114
14:45	47	13	9	30	1	1	0	101
1 Hr	201	73	52	141	3	1	0	471
15:00	61	22	10	28	0	0	0	121
15:15	54	13	9	21	1	1	0	99
15:30	48	24	11	43	1	1	1	129
15:45	44	21	6	41	1	1	0	114
1 Hr	207	80	36	133	3	3	1	463
16:00	77	25	6	29	0	0	0	137
16:15	59	27	4	25	2	1	0	118
16:30	84	17	7	12	0	1	0	121
16:45	85	10	7	18	1	0	0	121
1 Hr	305	79	24	84	3	2	0	497
17:00	108	23	5	11	1	1	1	150
17:15	103	23	3	8	1	0	0	138
17:30	71	13	3	10	0	1	0	98
17:45	95	15	5	6	1	0	0	122
1 Hr	377	74	16	35	3	2	1	508
18:00	80	19	4	6	0	0	0	109
18:15	64	15	4	3	1	1	0	88
18:30	72	14	2	3	1	0	0	92
18:45	53	7	2	5	0	2	0	69
1 Hr	269	55	12	17	2	3	0	358

Total	2579	866	398	1264	46	19	2	5174
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5	1	1	9	0	0	0	16
5	1	0	7	0	0	0	13
6	4	0	12	0	0	0	22
3	2	0	8	0	0	1	14
19	8	1	36	0	0	1	65
8	2	2	6	0	0	1	19
5	4	2	10	0	0	0	21
6	1	3	12	0	0	0	22
6	1	1	9	0	1	0	18
25	8	8	37	0	1	1	80
10	2	0	11	0	0	0	23
6	1	0	12	0	0	0	19
1	1	3	2	0	2	0	9
3	3	0	7	0	0	0	13
20	7	3	32	0	2	0	64
4	3	0	7	0	0	0	14
4	0	0	4	0	0	0	8
2	1	1	4	0	0	1	9
4	1	2	4	0	0	1	12
14	5	3	19	0	0	2	43
2	0	0	3	0	0	0	5
2	1	1	2	0	0	0	6
1	0	0	5	0	0	0	6
3	2	0	1	0	0	0	6
8	3	1	11	0	0	0	23
1	0	0	0	0	0	0	1
4	0	1	3	0	0	0	8
3	2	0	0	0	0	0	5
3	2	0	0	0	0	0	5
11	4	1	3	0	0	0	19

265	82	40	352	0	5	11	755
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33	17	11	18	2	3	0	84
37	12	6	10	1	0	0	66
29	14	9	11	0	0	1	64
24	17	15	16	2	0	0	74
123	60	41	55	5	3	1	288
27	13	9	21	2	0	0	72
43	16	9	19	1	0	0	88
25	10	14	18	1	1	0	69
52	20	11	8	1	0	0	92
147	59	43	66	5	1	0	321
28	11	9	15	1	1	0	65
40	15	10	16	1	2	1	85
36	11	8	22	0	1	0	78
32	15	12	19	2	3	0	83
136	52	39	72	4	7	1	311
57	14	13	11	1	1	1	98
43	20	7	19	1	0	1	91
68	16	8	13	3	1	0	109
60	27	5	8	1	1	2	104
228	77	33	51	6	3	4	402
65	12	5	12	1	1	1	97
50	17	4	7	0	0	3	81
62	14	5	9	1	3	0	94
51	7	6	4	1	0	1	70
228	50	20	32	3	4	5	342
43	16	3	15	2	0	0	79
55	9	4	6	3	1	1	79
37	11	3	7	1	1	1	61
28	6	2	8	0	2	0	46
163	42	12	36	6	4	2	265

1955	721	353	674	52	30	14	3799
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209
173
177
194
753
217
239
205
211
872
209
203
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210
838
249
217
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237
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252
225
198
198
873
189
175
158
120
642

9728
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Origin : Arm A R135(NNW)

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	1	0	0	0	0	0	0	1
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	1	0	0	0	0	0	0	1
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm B Kilshane Cross(ENE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
23	9	2	1	3	0	0	0	38
41	11	4	1	6	0	0	0	63
39	6	0	1	4	1	0	0	51
47	20	1	1	1	1	0	0	71
150	46	7	4	14	2	0	0	223
58	8	1	1	1	0	0	0	69
53	6	2	0	2	0	0	0	63
44	8	1	4	0	0	0	0	57
48	5	1	4	0	1	0	0	59
203	27	5	9	3	1	0	0	248
38	4	3	1	2	0	0	0	48
34	6	4	4	1	0	0	0	49
38	6	1	7	2	0	0	0	54
20	8	2	2	0	0	0	0	32
130	24	10	14	5	0	0	0	183
25	4	0	2	3	0	1	0	35
14	9	3	0	0	0	0	0	26
20	9	0	0	0	0	0	0	29
21	2	3	0	0	0	0	0	26
80	24	6	2	3	0	1	0	116
23	7	2	2	2	0	0	0	36
20	6	4	4	2	0	0	0	36
24	9	1	0	1	0	0	0	35
28	5	2	5	3	0	1	0	44
95	27	9	11	8	0	1	0	151
12	10	0	2	0	0	0	0	24
25	10	2	1	3	0	1	0	42
23	5	0	4	0	0	0	0	32
22	1	0	2	1	0	0	0	26
82	26	2	9	4	0	1	0	124

	Destination : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
11	6	1	1	1	0	2	0	22
15	8	2	1	1	0	0	0	27
15	5	3	5	2	0	1	0	31
20	5	3	3	2	0	0	0	33
61	24	9	10	6	0	3	0	113
7	2	1	3	2	1	0	0	16
17	6	1	8	0	0	0	0	32
14	5	1	3	1	0	2	0	26
13	4	3	4	0	0	0	0	24
51	17	6	18	3	1	2	0	98
8	3	0	3	2	0	0	0	16
12	4	1	5	0	0	0	0	22
11	8	1	2	1	0	0	0	23
8	5	2	3	1	1	0	0	20
39	20	4	13	4	1	0	0	81
11	2	1	5	0	0	0	0	19
18	2	1	1	1	1	0	0	24
18	5	1	6	0	0	0	0	30
8	3	0	3	2	0	0	0	16
55	12	3	15	3	1	0	0	89
11	3	2	0	0	0	0	0	16
14	1	1	2	1	0	0	0	19
13	3	2	4	1	0	0	0	23
13	3	2	2	1	0	2	0	23
51	10	7	8	3	0	2	0	81
17	2	1	1	0	0	0	0	21
9	5	0	6	1	0	0	0	21
15	4	0	2	1	0	0	0	22
18	3	1	2	1	0	0	0	25
59	14	2	11	3	0	0	0	89

	Destination : Arm D Kilshane Cross(WSW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
4	1	0	2	0	0	0	0	7
3	1	2	2	0	0	0	0	8
4	2	0	0	0	0	0	0	6
7	2	0	0	0	0	0	0	9
18	6	2	4	0	0	0	0	30
7	3	0	1	0	0	0	0	11
6	3	0	0	0	0	0	0	9
5	2	0	0	0	0	0	0	7
8	3	0	0	0	1	0	0	12
26	11	0	1	0	1	0	0	39
3	1	1	0	0	0	0	0	5
4	1	0	0	0	0	0	0	5
3	3	1	0	0	0	0	0	7
3	2	1	0	0	0	0	0	6
13	7	3	0	0	0	0	0	23
3	1	0	3	0	0	0	0	7
3	3	1	0	0	0	0	0	7
2	1	0	0	0	0	0	0	3
4	4	0	0	0	1	0	0	9
12	9	1	3	0	1	0	0	26
3	1	0	0	0	0	0	0	4
4	1	0	0	0	0	0	0	5
2	0	0	0	0	0	0	0	2
3	2	0	0	0	0	0	0	5
12	4	0	0	0	0	0	0	16
4	0	1	2	0	0	0	0	7
1	0	0	0	0	0	0	0	1
3	3	1	0	0	0	0	0	7
4	2	0	0	0	0	0	0	6
12	5	2	2	0	0	0	0	21

Arm Totals
68
99
88
113
367
96
104
90
95
385
69
76
84
58
287
61
57
62
51
231
56
60
60
72
248
52
64
61
57
234





13:00	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0
Total	1	0	0	0	0	0	0	0	0	1

25	5	1	1	2	0	0	0	34
36	4	2	3	0	0	0	0	45
29	5	1	0	0	0	0	0	35
29	3	2	2	1	0	0	0	37
119	17	6	6	3	0	0	0	151
26	5	2	2	2	1	0	0	38
27	6	2	2	0	0	0	0	37
22	2	0	4	0	0	0	0	28
26	4	1	3	1	0	0	0	35
101	17	5	11	3	1	0	0	138
24	5	2	2	3	0	0	0	36
13	6	3	1	0	0	0	0	23
22	3	1	1	1	0	0	0	28
24	5	2	2	1	0	0	0	34
83	19	8	6	5	0	0	0	121
16	6	2	3	1	0	0	0	28
25	3	2	3	2	1	1	1	37
31	3	0	2	1	0	0	0	37
29	11	2	3	0	1	1	1	47
101	23	6	11	4	2	2	2	149
36	3	0	1	2	0	0	0	42
40	5	1	0	1	0	1	1	48
35	1	0	2	0	0	0	0	38
34	4	1	3	0	0	0	0	42
145	13	2	6	3	0	1	1	170
18	1	0	1	2	0	0	0	22
33	2	0	0	0	0	0	0	35
25	4	2	0	1	0	0	0	32
23	2	0	1	0	0	0	0	26
99	9	2	2	3	0	0	0	115
1388	272	68	91	58	6	6	6	1889

8	0	2	2	1	0	0	0	13
9	4	3	4	1	0	0	0	21
14	5	1	4	1	0	0	0	25
10	4	4	3	1	0	1	1	23
41	13	10	13	4	0	1	1	82
14	3	5	3	1	0	1	1	27
19	6	0	1	0	0	0	0	26
12	5	1	2	1	0	0	0	21
8	0	0	1	1	0	0	0	10
53	14	6	7	3	0	1	1	84
15	3	1	5	0	0	0	0	24
7	2	1	4	1	1	1	1	17
6	6	1	0	1	0	0	0	14
8	3	0	1	1	0	0	0	13
36	14	3	10	3	1	1	1	68
11	4	2	0	0	0	0	0	17
8	3	0	1	2	0	0	0	14
9	1	1	3	0	0	1	1	15
13	2	3	1	1	0	1	1	21
41	10	6	5	3	0	2	2	67
14	1	2	3	1	0	0	0	21
14	4	0	1	1	0	0	0	20
8	1	0	4	0	0	1	1	14
17	4	1	0	1	0	0	0	23
53	10	3	8	3	0	1	1	78
16	2	1	1	0	0	0	0	20
5	0	1	1	1	0	0	0	8
13	0	0	0	1	1	1	1	16
10	0	1	0	0	1	0	1	12
44	2	3	2	2	2	1	1	56
584	160	62	120	40	6	14	14	986

3	2	1	0	0	0	0	0	6
2	1	1	0	0	0	0	0	4
10	1	0	0	0	0	0	0	11
3	2	0	0	0	0	0	0	5
18	6	2	0	0	0	0	0	26
5	0	3	1	0	0	0	0	9
3	0	0	0	0	0	0	1	4
3	2	1	0	0	0	0	0	6
1	1	1	0	0	0	0	0	3
12	3	5	1	0	0	1	1	22
4	2	1	0	0	0	0	0	7
5	3	1	0	0	0	0	0	9
4	2	0	0	0	0	1	1	7
3	2	0	0	0	0	0	0	5
16	9	2	0	0	0	1	1	28
1	1	1	0	0	0	0	0	3
2	3	0	0	0	0	0	0	5
1	2	2	1	0	0	0	0	6
2	1	1	0	0	0	0	0	4
6	7	4	1	0	0	0	0	18
0	1	0	0	0	0	0	0	1
4	0	0	0	0	0	0	0	4
0	1	1	0	0	0	0	0	2
4	1	0	0	0	0	0	0	5
8	3	1	0	0	0	0	0	12
3	0	1	1	0	0	0	0	5
2	1	0	0	0	0	0	0	3
0	0	1	0	0	0	0	0	1
2	0	0	0	0	0	0	0	2
7	1	2	1	0	0	0	0	11
160	71	24	13	0	2	2	2	272

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182
3148















ORIGIN SUMMARY

	Origin : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	39	16	3	4	4	0	2	68
07:15	59	20	8	4	7	0	0	98
07:30	58	13	3	6	6	1	1	88
07:45	74	27	4	4	3	1	0	113
1 Hr	230	76	18	18	20	2	3	367
08:00	72	13	2	5	3	1	0	96
08:15	76	15	3	8	2	0	0	104
08:30	63	15	2	7	1	0	2	90
08:45	69	12	4	8	0	2	0	95
1 Hr	280	55	11	28	6	3	2	385
09:00	49	8	4	4	4	0	0	69
09:15	50	11	5	9	1	0	0	76
09:30	52	17	3	9	3	0	0	84
09:45	31	15	5	5	1	1	0	58
1 Hr	182	51	17	27	9	1	0	287
10:00	39	7	1	10	3	0	1	61
10:15	35	14	5	1	1	1	0	57
10:30	40	15	1	6	0	0	0	62
10:45	33	9	3	3	2	1	0	51
1 Hr	147	45	10	20	6	2	1	231
11:00	37	11	4	2	2	0	0	56
11:15	38	8	5	6	3	0	0	60
11:30	39	12	3	4	2	0	0	60
11:45	44	10	4	7	4	0	3	72
1 Hr	158	41	16	19	11	0	3	248
12:00	33	12	2	5	0	0	0	52
12:15	35	15	2	7	4	0	1	64
12:30	41	12	1	6	1	0	0	61
12:45	44	6	1	4	2	0	0	57
1 Hr	153	45	6	22	7	0	1	234

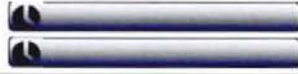
	Origin : Arm B Kilshane Cross(ENE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
82	16	4	12	2	0	1	117	
84	9	4	3	0	1	1	102	
103	24	7	10	0	1	0	145	
111	21	2	9	0	0	2	145	
380	70	17	34	2	2	4	509	
129	13	4	15	0	0	0	161	
93	16	9	11	0	1	0	130	
136	21	5	8	1	2	1	174	
77	14	9	6	0	2	2	110	
435	64	27	40	1	5	3	575	
86	27	10	15	2	0	0	140	
78	16	11	13	1	0	0	119	
61	17	6	6	0	1	0	91	
54	17	9	8	1	1	1	91	
279	77	36	42	4	2	1	441	
53	14	6	13	2	1	0	89	
56	23	8	12	0	1	0	100	
39	22	1	8	1	0	0	71	
60	19	6	15	0	1	0	101	
208	78	21	48	3	3	0	361	
51	22	7	12	1	0	1	94	
53	21	4	9	1	0	0	88	
40	16	8	10	2	0	0	76	
55	19	7	17	0	0	0	98	
199	78	26	48	4	0	1	356	
50	20	13	5	2	1	0	91	
55	22	7	9	1	0	0	94	
46	11	2	2	1	0	0	62	
70	10	10	12	2	1	0	105	
221	63	32	28	6	2	0	352	

	Origin : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
35	11	7	16	2	0	0	71	
47	7	6	11	1	1	0	73	
35	11	4	5	2	1	0	58	
57	18	4	15	1	1	0	96	
174	47	21	47	6	3	0	298	
41	25	5	16	0	0	0	87	
54	21	4	12	1	0	1	93	
66	17	4	16	0	0	0	103	
69	16	5	17	1	2	0	110	
230	79	18	61	2	2	1	393	
44	18	2	8	2	0	0	74	
38	17	8	19	0	0	0	82	
24	19	6	12	1	0	0	62	
29	15	5	15	2	0	1	67	
135	69	21	54	5	0	1	285	
31	16	8	16	2	0	0	73	
27	16	8	17	1	0	0	69	
29	11	8	20	1	0	0	69	
34	17	12	16	1	0	0	80	
121	60	36	69	5	0	0	291	
41	13	6	17	1	0	0	78	
26	20	8	21	1	1	0	77	
23	15	11	16	0	0	0	65	
28	10	9	19	1	0	0	67	
118	58	34	73	3	1	0	287	
42	17	7	11	1	0	0	78	
29	17	8	8	1	0	0	63	
44	17	9	21	0	1	1	93	
33	20	8	19	1	1	0	82	
148	71	32	59	3	2	1	316	

	Origin : Arm D Kilshane Cross(WSW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
16	8	11	6	0	0	1	42	
25	14	16	4	1	0	0	60	
33	12	7	11	0	0	0	63	
37	13	11	7	1	0	0	69	
111	47	45	28	2	0	1	234	
15	15	7	6	0	0	0	43	
35	19	6	9	0	0	0	69	
24	11	13	4	0	0	0	52	
42	30	14	5	0	1	0	92	
116	75	40	24	0	1	0	256	
30	25	8	10	0	0	0	73	
24	17	11	7	0	1	0	60	
17	19	8	10	2	0	0	56	
34	25	2	5	0	1	1	68	
105	86	29	32	2	2	1	257	
32	29	7	5	0	1	0	74	
23	19	9	5	0	1	0	57	
34	18	11	15	1	0	1	80	
32	14	6	7	0	1	0	60	
121	80	33	32	1	3	1	271	
30	21	8	4	0	1	0	64	
41	27	6	12	0	0	0	86	
34	25	10	10	0	1	0	80	
31	24	10	10	1	1	0	77	
136	97	34	36	1	3	0	307	
39	19	9	4	0	1	0	72	
44	18	12	8	0	0	0	82	
36	19	13	5	0	1	0	74	
52	28	13	7	0	0	0	100	
171	84	47	24	0	2	0	328	

Origin Totals
298
333
354
423
1408
387
396
419
407
1600
356
337
293
284
1270
297
283
282
292
1154
292
311
281
314
1198
293
303
290
344
1230





13:00	36	7	4	3	3	0	0	53
13:15	47	9	6	7	1	0	0	70
13:30	53	11	2	4	1	0	0	71
13:45	42	9	6	5	2	0	1	65
1 Hr	178	36	18	19	7	0	1	259
14:00	45	8	10	6	3	1	1	74
14:15	49	12	2	3	0	0	1	67
14:30	37	9	2	6	1	0	0	55
14:45	35	5	2	4	2	0	0	48
1 Hr	166	34	16	19	6	1	2	244
15:00	43	10	4	7	3	0	0	67
15:15	25	11	5	5	1	1	1	49
15:30	32	11	2	1	2	0	1	49
15:45	35	10	2	3	2	0	0	52
1 Hr	135	42	13	16	8	1	2	217
16:00	28	11	5	3	1	0	0	48
16:15	35	9	2	4	4	1	1	56
16:30	41	6	3	6	1	0	1	58
16:45	44	14	6	4	1	1	2	72
1 Hr	148	40	16	17	7	2	4	234
17:00	50	5	2	4	3	0	0	64
17:15	58	9	1	1	2	0	1	72
17:30	43	3	1	6	0	0	1	54
17:45	55	9	2	3	1	0	0	70
1 Hr	206	26	6	14	6	0	2	260
18:00	37	3	2	3	2	0	0	47
18:15	40	3	1	1	1	0	0	46
18:30	38	4	3	0	2	1	1	49
18:45	35	2	1	1	0	1	0	40
1 Hr	150	12	7	5	5	2	1	182
Total	2133	503	154	224	98	14	22	3148

69	16	7	12	1	2	0	107
50	25	7	15	0	1	0	98
61	13	9	13	1	0	0	97
62	15	4	7	1	1	0	80
242	69	27	47	3	4	0	392
79	19	4	11	1	1	0	115
78	18	5	8	3	0	0	112
78	15	7	13	0	1	0	114
56	21	9	8	1	0	0	95
291	73	25	40	5	2	0	436
63	13	7	18	1	0	0	102
73	15	9	7	1	2	0	107
64	23	8	7	0	0	0	102
62	19	8	14	2	1	0	106
262	70	32	46	4	3	0	417
83	22	7	11	0	1	0	104
98	19	6	9	1	0	0	133
85	22	10	7	0	2	0	126
80	15	2	12	1	0	0	110
326	78	25	39	2	3	0	473
112	24	6	10	1	1	0	154
93	15	5	4	0	4	0	121
101	22	5	4	0	0	1	133
108	12	2	3	1	2	0	128
414	73	18	21	2	7	1	536
167	21	3	2	0	1	1	195
149	20	1	8	4	2	0	184
114	15	2	4	6	0	2	143
76	13	3	4	4	2	0	102
506	69	9	18	14	5	3	624
3763	862	295	451	50	38	13	5472

31	16	15	20	2	3	0	87
38	12	9	10	1	0	0	70
27	12	6	10	0	0	0	55
28	18	17	19	2	0	0	84
124	58	47	59	5	3	0	296
24	15	10	16	2	0	0	67
36	12	9	21	1	0	0	79
29	12	14	19	1	1	0	76
49	21	10	10	1	0	0	91
138	60	43	66	5	1	0	313
26	7	11	12	1	1	0	58
40	18	10	13	0	2	1	84
39	11	10	23	1	0	0	84
26	13	11	18	1	3	0	72
131	49	42	66	3	6	1	298
59	18	11	12	2	2	1	105
34	17	8	17	0	0	0	76
55	14	6	10	3	1	1	90
73	35	5	16	1	1	2	133
221	84	30	55	6	4	4	404
52	10	4	11	0	1	1	79
53	18	4	5	1	0	3	84
64	15	4	10	1	2	0	96
56	9	7	7	1	0	2	82
225	52	19	33	3	3	6	341
40	14	3	13	2	0	0	72
49	11	4	6	2	1	2	75
41	11	3	9	2	1	1	68
28	6	2	7	0	2	0	45
158	42	12	35	6	4	3	260
1923	729	355	677	52	29	17	3782

44	20	8	5	0	0	0	77
43	14	4	4	0	0	0	65
46	7	3	7	0	0	0	63
51	14	5	4	0	0	1	75
184	55	20	20	0	0	1	280
51	21	6	8	0	0	1	87
42	20	18	11	0	0	0	91
37	26	6	6	0	0	2	77
48	24	9	4	0	1	1	87
178	91	39	29	0	1	4	342
59	19	10	8	0	0	1	97
46	16	9	6	0	0	0	77
55	22	11	5	0	1	0	94
56	20	6	8	0	1	0	91
216	77	36	27	0	2	1	359
85	20	3	2	0	0	1	111
71	25	1	1	0	1	0	99
100	18	7	0	0	1	1	127
93	11	3	1	0	0	0	108
349	74	14	4	0	2	2	445
86	14	6	1	1	3	1	112
128	15	1	3	0	1	1	149
96	11	4	3	0	1	0	115
108	9	3	3	0	1	1	125
418	49	14	10	1	6	3	501
55	8	2	0	0	1	0	66
57	8	6	0	0	1	1	73
41	8	2	1	0	0	1	53
50	3	2	3	0	2	0	60
203	27	12	4	0	4	2	252
2308	842	363	270	7	26	16	3832

324
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321
1291
368
364
401
423
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409
426
398
405
1638
380
378
313
247
1318
16234



DESTINATION SUMMARY

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	24	6	3	5	4	0	0	42
07:15	16	1	4	4	1	0	0	26
07:30	16	5	4	6	2	0	0	33
07:45	25	8	1	3	1	0	0	38
1 Hr	81	20	12	18	8	0	0	139
08:00	20	8	4	9	0	0	0	41
08:15	21	18	1	5	1	0	0	46
08:30	18	8	1	6	0	0	0	33
08:45	18	8	6	7	1	1	0	41
1 Hr	77	42	12	27	2	1	0	161
09:00	23	13	4	6	4	0	0	50
09:15	27	10	4	8	0	0	0	49
09:30	20	13	4	6	1	0	0	44
09:45	29	7	3	4	3	1	1	48
1 Hr	99	43	15	24	8	1	1	191
10:00	33	9	3	9	3	0	0	57
10:15	31	10	2	12	1	2	0	58
10:30	22	8	3	3	3	0	0	39
10:45	35	15	3	7	1	1	0	62
1 Hr	121	42	11	31	8	3	0	216
11:00	40	12	4	7	2	0	1	66
11:15	28	15	4	6	2	0	0	55
11:30	37	4	7	7	2	0	0	57
11:45	34	6	1	13	1	0	0	55
1 Hr	139	37	16	33	7	0	1	233
12:00	39	6	3	4	3	0	0	55
12:15	39	14	5	3	2	0	0	63
12:30	44	8	4	4	0	0	1	61
12:45	40	5	5	6	3	0	0	59
1 Hr	162	33	17	17	8	0	1	238

	Destination : Arm B Kilshane Cross(ENE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
45	17	8	8	3	0	1	82	
77	16	7	8	6	0	0	114	
67	18	1	6	4	2	0	98	
93	28	9	13	1	2	0	146	
282	79	25	35	14	4	1	440	
86	26	4	7	1	0	0	124	
86	18	5	6	2	0	0	117	
75	18	10	12	0	0	0	115	
91	20	10	9	0	2	0	132	
338	82	29	34	3	2	0	488	
60	21	7	4	2	0	0	94	
54	15	6	13	1	1	0	90	
52	19	5	12	4	0	0	92	
50	20	5	11	0	0	0	86	
216	75	23	40	7	1	0	362	
55	26	4	8	4	0	1	98	
34	17	7	11	0	0	0	69	
42	21	8	12	0	0	0	83	
41	12	8	6	0	0	0	67	
172	76	27	37	4	0	1	317	
46	22	5	10	2	1	0	86	
45	23	7	13	2	1	0	91	
43	30	6	9	1	1	0	90	
51	25	7	15	3	1	1	103	
185	100	25	47	8	4	1	370	
41	20	4	8	0	1	0	74	
62	17	6	4	3	0	1	93	
54	17	7	17	0	2	0	97	
59	20	6	10	1	0	0	96	
216	74	23	39	4	3	1	360	

	Destination : Arm C R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
34	14	9	16	1	0	2	76	
41	21	16	5	2	1	0	86	
46	14	10	16	2	0	1	89	
44	15	7	14	3	0	0	83	
165	64	42	51	8	1	3	334	
27	10	7	18	2	1	0	65	
39	15	7	22	0	0	0	83	
40	14	7	13	1	1	2	78	
32	24	7	13	0	0	0	76	
138	63	28	66	3	2	2	302	
42	21	6	20	2	0	0	91	
29	15	10	18	1	0	0	73	
30	14	6	16	1	0	0	67	
23	19	4	12	1	1	1	61	
124	69	26	66	5	1	1	292	
29	12	6	14	0	1	0	62	
34	17	8	10	1	1	0	71	
42	21	3	24	0	0	1	91	
36	14	4	22	2	1	0	79	
141	64	21	70	3	3	1	303	
31	16	9	10	0	0	0	66	
40	13	5	16	1	0	0	75	
30	18	11	20	1	0	0	80	
32	15	10	22	2	0	2	83	
133	62	35	68	4	0	2	304	
42	17	11	7	0	0	0	77	
29	22	9	19	1	0	0	80	
31	11	9	8	2	0	0	61	
61	19	12	17	1	0	0	110	
163	69	41	51	4	0	0	328	

	Destination : Arm D Kilshane Cross(WSW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
69	14	5	9	0	0	1	98	
81	12	7	5	0	1	1	107	
100	23	6	4	0	1	0	134	
117	28	4	5	0	0	2	156	
367	77	22	23	0	2	4	495	
124	22	3	8	0	0	0	157	
112	20	9	7	0	1	1	150	
156	24	6	4	1	1	1	193	
116	20	9	7	0	4	2	158	
508	86	27	26	1	6	4	658	
84	23	7	7	0	0	0	121	
80	21	15	9	0	0	0	125	
52	26	8	3	0	1	0	90	
46	26	9	6	0	1	1	89	
262	96	39	25	0	2	1	425	
38	19	9	13	0	1	0	80	
42	28	13	2	0	0	0	85	
36	16	7	10	0	0	0	69	
47	18	12	6	0	1	0	84	
163	81	41	31	0	2	0	318	
42	17	7	8	0	0	0	74	
45	25	7	13	0	0	0	90	
26	16	8	4	0	0	0	54	
41	17	12	3	0	0	0	73	
154	75	34	28	0	0	0	291	
42	25	13	6	0	1	0	87	
33	19	9	6	0	0	0	67	
38	23	5	5	0	0	0	71	
39	20	9	9	0	2	0	79	
152	87	36	26	0	3	0	304	

Dest Totals
298
333
354
423
1408
387
396
419
407
1609
356
337
293
284
1270
297
283
282
292
1154
292
311
281
314
1198
293
303
290
344
1230



13:00	30	11	6	10	3	2	0	62
13:15	36	17	2	5	1	0	0	61
13:30	35	8	4	3	1	0	0	51
13:45	44	7	10	5	3	1	1	71
1 Hr	145	43	22	23	8	3	1	245
14:00	43	7	3	4	1	0	0	58
14:15	54	12	5	7	3	0	0	81
14:30	48	12	9	7	1	1	2	80
14:45	41	12	6	2	2	0	0	63
1 Hr	186	43	23	20	7	1	2	282
15:00	37	2	3	5	2	0	1	50
15:15	48	6	3	3	1	3	1	65
15:30	40	9	3	5	1	0	0	58
15:45	29	11	3	9	3	3	0	58
1 Hr	154	28	12	22	7	6	2	231
16:00	52	12	3	3	2	2	1	75
16:15	64	13	2	4	1	0	0	84
16:30	53	13	7	5	1	1	1	81
16:45	55	18	1	4	2	0	2	82
1 Hr	224	56	13	16	6	3	4	322
17:00	68	11	1	10	1	0	1	92
17:15	61	12	1	5	1	5	4	89
17:30	68	18	2	2	1	0	0	91
17:45	59	12	2	2	2	1	1	79
1 Hr	256	53	6	19	5	6	6	351
18:00	75	20	2	3	2	0	0	102
18:15	95	11	4	8	5	1	2	126
18:30	59	11	0	3	8	0	1	82
18:45	50	8	3	5	4	1	0	71
1 Hr	279	50	9	19	19	2	3	381
Total	1923	490	168	269	93	26	21	2990

59	16	8	10	2	2	0	0	97
69	14	8	8	0	0	0	0	99
68	12	3	5	0	0	0	0	88
66	15	4	9	1	0	0	0	95
262	57	23	32	3	2	0	0	379
61	21	4	12	3	1	0	0	102
65	14	6	14	0	0	0	0	99
54	19	3	12	0	0	0	0	88
77	19	9	8	1	0	0	0	114
257	73	22	46	4	1	0	0	403
58	17	9	8	3	0	0	0	95
49	20	10	12	0	0	0	0	91
74	15	8	18	1	0	0	0	116
70	14	9	14	1	1	0	0	109
251	66	36	52	5	1	0	0	411
89	21	3	8	1	1	1	1	124
83	22	4	16	2	1	1	1	129
125	16	7	8	1	2	1	1	160
133	32	5	14	0	1	1	1	186
430	91	19	46	4	5	4	4	599
114	16	3	3	3	3	0	0	142
135	17	3	3	1	0	1	0	160
128	13	5	11	0	1	0	1	158
134	9	4	9	0	1	1	1	158
511	55	15	26	4	5	2	2	618
75	7	1	5	2	1	0	0	91
84	7	4	1	0	2	1	0	99
69	10	5	5	1	1	0	0	91
66	8	0	6	0	2	0	0	82
294	32	10	17	3	6	1	1	363
3414	860	277	451	63	34	11	11	5110

42	11	8	14	1	0	0	0	76
27	11	6	19	1	0	0	0	64
35	9	5	18	1	0	0	0	68
33	12	9	11	1	0	1	0	67
137	43	28	62	4	0	1	1	275
45	14	10	16	1	0	2	0	88
45	22	15	16	0	0	0	0	98
35	19	8	18	1	1	0	0	82
37	14	4	11	1	1	1	0	69
162	69	37	61	3	2	3	3	337
56	19	5	26	0	0	0	0	106
38	9	5	13	1	1	1	1	68
32	18	8	9	1	1	0	0	69
41	17	1	14	1	0	0	0	74
167	63	19	62	3	2	1	1	317
55	18	5	11	0	0	0	0	89
46	18	1	5	2	1	0	0	73
66	16	2	5	0	1	1	1	91
65	5	4	10	1	0	1	0	86
232	57	12	31	3	2	2	2	339
73	15	4	9	1	1	1	1	104
80	18	0	5	1	0	0	0	104
58	9	0	10	0	1	1	1	79
79	8	3	4	1	0	0	0	95
290	50	7	28	3	2	2	2	382
67	10	1	1	0	0	0	0	79
54	8	3	4	1	1	0	0	71
57	11	0	2	1	1	2	74	
40	4	3	3	0	2	0	0	52
218	33	7	10	2	4	2	2	276
2070	706	303	626	45	19	20	19	3789

49	21	12	6	0	1	0	0	89
46	18	10	4	0	1	0	0	79
49	14	8	8	0	0	0	0	79
40	22	9	10	0	0	0	0	81
184	75	39	28	0	2	0	0	328
50	21	13	9	1	1	0	0	95
41	14	8	6	1	0	1	1	71
44	12	9	7	0	0	0	0	72
33	26	11	5	0	0	0	0	75
168	73	41	27	2	1	1	1	313
40	11	15	6	0	1	0	0	73
49	25	15	3	0	1	0	0	93
44	25	12	4	0	0	1	0	86
39	20	14	6	0	1	0	0	80
172	81	56	19	0	3	1	1	332
39	20	15	6	0	0	0	0	80
45	17	10	6	0	0	0	0	78
37	15	10	5	2	0	0	0	69
37	20	6	5	0	1	0	0	69
158	72	41	22	2	1	0	0	296
45	11	10	4	0	1	0	0	71
56	10	7	0	0	0	0	0	73
50	11	7	0	0	1	1	1	70
55	10	5	1	0	1	1	1	73
206	42	29	5	0	3	2	2	287
82	9	6	9	0	1	1	1	108
62	16	1	2	1	0	0	0	82
49	6	5	4	0	0	2	66	
33	4	2	1	0	2	0	0	42
226	35	14	16	1	3	3	3	298
2720	880	419	276	6	28	16	16	4345

324
303
286
314
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401
423
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409
426
398
405
1638
380
378
313
247
1318
16234



Origin Arm A R135(NNW)

Destination : Arm A R135(NNW)								Total
Car	LGV	OGV1	OGV2	PSV	MC	PC		

07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	1	0	0	0	0	0	0	1
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	2	0	2
1 Hr	1	0	0	0	0	2	0	3
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	1	0	0	0	0	0	1
1 Hr	0	1	0	0	0	0	0	1
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

Destination : Arm B R135(SSE)								Total
Car	LGV	OGV1	OGV2	PSV	MC	PC		

18	5	1	2	1	0	3	30
30	9	6	1	1	0	1	48
39	6	1	4	2	0	0	52
37	10	1	0	2	2	1	53
124	30	9	7	6	2	5	183
39	11	0	1	3	0	0	54
30	4	2	0	0	1	0	37
28	5	1	1	1	2	2	40
32	5	3	2	0	1	0	43
129	25	6	4	4	4	2	174
28	4	0	1	3	0	0	36
27	4	0	2	1	0	0	34
31	8	0	4	1	0	0	44
16	3	3	5	1	0	0	28
102	19	3	12	6	0	0	142
21	3	1	0	1	0	0	26
15	6	1	0	1	0	0	23
16	2	1	0	1	0	0	20
16	5	2	0	1	0	0	24
68	16	5	0	4	0	0	93
16	4	1	2	2	0	0	25
10	2	0	1	1	0	0	14
16	3	0	0	2	0	0	21
17	2	4	1	2	0	1	27
59	11	5	4	7	0	1	87
30	6	0	1	1	0	0	38
20	4	0	0	2	0	1	27
25	6	0	1	1	0	0	33
21	5	2	1	1	0	0	30
96	21	2	3	5	0	1	128

Destination : Arm C N2 Slip								Total
Car	LGV	OGV1	OGV2	PSV	MC	PC		

19	5	5	8	1	0	0	38
32	10	3	4	0	0	1	50
27	6	1	0	2	0	0	36
34	4	2	4	2	1	0	47
112	25	11	16	5	1	1	171
23	3	5	0	0	0	0	31
31	2	3	4	0	0	0	40
29	3	1	0	0	0	0	33
18	4	3	2	1	1	0	29
101	12	12	6	1	1	0	133
27	5	2	0	0	0	0	34
19	5	0	1	0	1	0	26
10	4	5	3	0	0	0	22
10	4	3	1	0	0	0	18
66	18	10	5	0	1	0	100
9	1	1	0	0	0	0	11
14	2	0	1	0	0	0	17
9	4	4	0	0	0	0	17
13	4	1	1	0	0	0	19
45	11	6	2	0	0	0	64
13	10	4	3	1	0	0	31
20	2	0	3	0	0	0	25
12	6	3	4	0	2	0	27
17	4	2	2	0	0	0	25
62	22	9	12	1	2	0	108
13	2	4	2	1	0	0	22
9	7	1	2	0	0	0	19
10	4	3	2	0	0	0	19
12	5	2	3	0	0	0	22
44	18	10	9	1	0	0	82

Arm Totals
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68
98
88
100
354
86
77
73
74
310
70
60
66
46
242
37
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37
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158
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39
48
52
195
60
46
52
52
210



13:00	1	0	0	0	0	0	0	0	1
13:15	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0
1 Hr	1	0	0	0	0	0	0	0	1
14:00	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0
15:00	1	0	0	0	0	0	0	0	1
15:15	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0
1 Hr	1	0	0	0	0	0	0	0	1
16:00	0	0	0	0	0	0	0	0	0
16:15	0	1	0	0	0	0	0	0	1
16:30	1	0	0	0	0	0	0	0	1
16:45	1	0	0	0	0	0	0	0	1
1 Hr	2	1	0	0	0	0	0	0	3
17:00	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0
17:45	1	1	0	0	0	0	0	0	2
1 Hr	1	1	0	0	0	0	0	0	2
18:00	0	0	0	0	0	0	0	0	0
18:15	1	0	0	0	0	0	0	0	1
18:30	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0
1 Hr	1	0	0	0	0	0	0	0	1

Total	7	3	0	0	0	2	0	0	12
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20	8	1	2	2	0	0	0	33
21	6	1	0	1	0	0	0	29
23	7	1	0	1	0	0	0	32
18	2	5	1	1	0	1	0	28
82	23	8	3	5	0	1	1	122
19	6	1	0	2	1	0	0	29
23	5	2	0	0	0	0	0	30
27	3	1	0	1	0	0	0	32
17	3	0	0	1	0	0	0	21
86	17	4	0	4	1	0	0	112
21	4	3	1	3	0	0	0	32
19	6	4	0	1	1	0	0	31
11	5	1	0	1	0	0	0	18
16	8	0	0	2	0	0	0	26
67	23	8	1	7	1	0	0	107
16	4	0	1	0	0	0	0	21
16	3	0	2	2	0	1	0	24
17	2	2	0	1	0	1	0	23
15	5	0	0	0	0	1	0	21
64	14	2	3	3	0	3	0	89
23	1	1	0	2	0	0	0	27
16	3	0	0	2	0	1	0	22
24	2	0	0	0	0	0	0	26
17	2	0	1	1	0	0	0	21
80	8	1	1	5	0	1	0	96
15	1	1	0	1	0	0	0	18
17	1	0	0	1	0	0	0	19
21	2	0	0	1	1	1	0	26
20	1	1	1	0	1	0	0	24
73	5	2	1	3	2	1	0	87

1030	212	55	39	59	10	15	1420
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10	3	1	0	0	0	0	0	14
13	2	1	2	0	0	0	0	18
15	3	2	0	0	0	0	0	20
14	3	2	1	0	0	0	0	20
52	11	6	3	0	0	0	0	72
14	3	2	0	0	0	0	0	19
15	7	1	0	0	0	0	0	23
12	3	0	1	0	0	0	0	16
20	3	6	3	1	0	0	0	33
61	16	9	4	1	0	0	0	91
9	5	2	1	0	0	0	0	17
13	5	2	1	0	0	0	0	21
11	6	1	3	0	1	0	0	22
11	3	3	2	1	0	0	0	20
44	19	8	7	1	1	0	0	80
14	3	1	0	0	0	0	0	18
9	4	0	0	0	3	0	0	16
16	4	0	0	0	0	0	0	20
15	2	3	1	0	0	0	0	21
54	13	4	1	0	3	0	0	75
19	5	0	0	0	0	0	0	24
17	1	1	0	0	0	0	0	19
22	5	1	1	0	0	0	0	29
18	4	1	0	0	0	0	0	23
76	15	3	1	0	0	0	0	95
18	1	0	0	0	0	0	0	19
21	1	2	1	0	0	0	0	25
17	2	0	0	0	0	0	0	19
10	1	0	1	0	0	0	0	12
66	5	2	2	0	0	0	0	75

783	185	90	68	10	9	1	1146
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195
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203
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188
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163

2578
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Origin Arm B R135(SSE)

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	6	1	0	0	3	0	0	10
07:15	4	1	0	1	1	0	0	7
07:30	8	1	1	0	2	0	0	12
07:45	11	1	1	0	1	0	0	14
1 Hr	29	4	2	1	7	0	0	43
08:00	6	1	1	1	0	0	0	9
08:15	11	4	0	0	1	0	0	16
08:30	8	1	0	1	0	0	0	10
08:45	7	3	4	1	1	1	0	17
1 Hr	32	9	5	3	2	1	0	52
09:00	5	8	2	0	3	0	0	18
09:15	11	5	0	1	0	0	0	17
09:30	8	4	1	0	1	0	0	14
09:45	12	2	1	0	2	0	1	18
1 Hr	36	19	4	1	6	0	1	67
10:00	16	4	0	1	1	0	0	22
10:15	17	3	0	1	1	0	0	22
10:30	8	3	0	0	2	0	0	13
10:45	17	4	4	1	1	0	0	27
1 Hr	58	14	4	3	5	0	0	84
11:00	17	3	0	0	1	0	0	21
11:15	13	9	3	2	1	0	0	28
11:30	17	3	5	1	1	0	0	27
11:45	14	2	1	0	1	0	0	18
1 Hr	61	17	9	3	4	0	0	94
12:00	21	1	2	0	2	0	0	26
12:15	23	4	0	0	1	0	0	28
12:30	17	2	1	1	0	0	1	22
12:45	20	2	1	0	1	0	0	24
1 Hr	81	9	4	1	4	0	1	100

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	1	1	0	0	0	2
1 Hr	0	0	1	1	0	0	0	2
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	1	0	0	0	1
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	1	0	0	0	1
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	1	0	0	0	1
11:15	0	1	0	0	0	0	0	1
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	1	0	0	0	1
1 Hr	0	1	0	2	0	0	0	3
12:00	0	0	0	0	0	0	0	0
12:15	1	0	0	0	0	0	0	1
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	1	0	0	0	0	0	0	1

	Destination : Arm C N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	

07:00	10	2	3	7	1	0	0	23
07:15	8	1	1	3	0	0	0	13
07:30	9	2	1	5	0	0	0	17
07:45	19	2	0	4	0	0	0	25
1 Hr	46	7	5	19	1	0	0	78
08:00	9	3	0	7	0	0	0	19
08:15	16	10	1	5	0	0	0	32
08:30	10	2	1	2	0	0	0	15
08:45	15	5	1	5	0	0	0	26
1 Hr	50	20	3	19	0	0	0	92
09:00	11	1	2	5	1	0	0	20
09:15	11	3	2	7	0	0	0	23
09:30	9	3	4	5	0	0	0	21
09:45	8	6	5	7	1	0	0	27
1 Hr	39	13	13	24	2	0	0	91
10:00	7	4	0	7	2	0	0	20
10:15	12	3	3	10	0	0	0	28
10:30	15	8	1	6	1	1	0	32
10:45	10	6	3	7	0	0	0	26
1 Hr	44	21	7	30	3	1	0	106
11:00	17	9	5	4	1	0	0	36
11:15	11	5	1	3	1	0	1	22
11:30	17	3	3	5	0	0	0	28
11:45	25	2	1	12	0	0	0	40
1 Hr	70	19	10	24	2	0	1	126
12:00	12	2	0	0	1	0	0	15
12:15	16	5	2	3	1	0	0	27
12:30	21	5	0	2	0	0	1	29
12:45	12	4	2	6	1	0	0	25
1 Hr	61	16	4	11	3	0	1	96

Arm Totals
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33
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121
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146
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159
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223
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197



13:00	14	4	1	0	2	1	0	22
13:15	26	10	0	2	0	1	0	39
13:30	15	5	0	0	0	0	1	21
13:45	22	4	0	1	2	0	0	29
1 Hr	77	23	1	3	4	2	1	111
14:00	25	2	1	0	1	0	0	29
14:15	31	4	3	0	0	0	0	38
14:30	26	5	4	3	1	0	0	39
14:45	21	3	1	0	2	0	0	27
1 Hr	103	14	9	3	4	0	0	133
15:00	31	1	2	0	2	0	1	37
15:15	28	5	1	1	0	1	0	36
15:30	22	0	0	0	1	1	0	24
15:45	21	8	1	2	1	1	0	34
1 Hr	102	14	4	3	4	3	1	131
16:00	22	6	1	1	2	0	1	33
16:15	29	5	1	0	0	0	1	36
16:30	37	5	3	1	1	1	1	49
16:45	33	10	3	0	0	0	2	48
1 Hr	121	26	8	2	3	1	5	166
17:00	39	8	0	1	1	0	0	49
17:15	39	5	0	2	2	1	4	53
17:30	27	5	0	1	0	0	1	34
17:45	34	2	1	0	1	0	2	40
1 Hr	139	20	1	4	4	1	7	176
18:00	33	9	0	0	2	0	0	44
18:15	55	8	1	4	3	1	1	73
18:30	30	1	0	4	1	0	1	37
18:45	27	4	3	1	1	0	0	36
1 Hr	145	22	4	9	7	1	2	190
Total	984	191	55	36	54	9	18	1347

1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	2
0	0	1	0	0	0	0	0	1
0	1	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	4
0	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	1
0	0	0	2	0	0	0	0	2
0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	2
0	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0	2
0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	1
8	3	2	7	0	0	0	0	20

12	3	2	9	2	0	0	28
19	8	3	3	1	0	0	34
18	6	4	2	1	1	1	33
22	4	5	4	0	1	0	36
71	21	14	18	4	2	1	131
21	5	1	5	1	0	0	33
27	4	3	4	2	0	1	41
21	6	5	6	0	0	0	38
27	9	3	1	1	0	0	41
96	24	12	16	4	0	1	153
17	4	1	2	0	0	0	24
28	1	4	2	1	0	0	36
18	6	2	3	0	1	0	30
10	4	2	8	2	2	0	28
73	15	9	15	3	3	0	118
23	5	3	2	0	0	0	33
37	6	0	5	0	1	0	49
33	8	2	2	1	0	0	46
25	7	0	3	1	0	0	36
118	26	5	12	2	1	0	164
40	6	1	4	0	0	0	51
40	9	0	3	0	3	0	55
43	8	2	1	1	1	0	56
48	8	0	3	1	1	0	61
171	31	3	11	2	5	0	223
46	9	1	3	0	0	0	59
55	6	2	4	2	0	0	69
34	6	1	0	6	0	0	47
27	8	1	4	2	0	0	42
162	29	5	11	10	0	0	217
1001	242	90	210	36	12	4	1595

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73
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244
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80
79
68
290
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72
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251
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332
101
108
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101
401
103
143
84
78
408
2962



Origin Arm C N2 Slip

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	4	1	1	0	1	0	0	7
07:15	6	0	2	0	0	0	0	8
07:30	14	4	2	0	0	0	0	20
07:45	7	1	0	0	1	0	0	9
1 Hr	31	6	5	0	2	0	0	44
08:00	13	2	1	1	0	0	0	17
08:15	19	5	2	0	1	1	0	28
08:30	13	7	1	0	0	0	0	21
08:45	22	3	1	0	0	0	0	26
1 Hr	67	17	5	1	1	1	0	92
09:00	7	2	0	2	0	0	0	11
09:15	10	0	3	2	0	0	0	15
09:30	15	2	0	0	0	0	0	17
09:45	6	4	1	0	1	0	0	12
1 Hr	38	8	4	4	1	0	0	55
10:00	13	1	2	1	0	2	0	19
10:15	11	2	6	1	1	0	0	21
10:30	11	11	4	4	0	0	0	30
10:45	12	2	3	1	0	0	0	18
1 Hr	47	16	15	7	1	2	0	88
11:00	17	3	0	2	0	0	0	22
11:15	9	3	2	2	0	0	0	16
11:30	12	4	2	1	0	0	0	19
11:45	23	4	1	1	0	0	0	29
1 Hr	61	14	5	6	0	0	0	86
12:00	11	7	0	3	0	0	0	21
12:15	9	3	1	3	0	0	0	16
12:30	15	4	1	2	0	0	0	22
12:45	18	7	1	2	0	0	0	28
1 Hr	53	21	3	10	0	0	0	87

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	22	12	1	3	2	0	0	40
07:15	29	5	3	1	6	0	0	44
07:30	38	10	0	2	4	1	0	55
07:45	35	9	2	5	0	0	0	51
1 Hr	124	36	6	11	12	1	0	190
08:00	47	3	2	3	1	0	0	56
08:15	41	7	1	9	1	0	0	59
08:30	31	6	1	5	0	0	0	43
08:45	37	2	3	5	0	0	0	47
1 Hr	156	18	7	22	2	0	0	205
09:00	29	6	1	5	1	0	0	42
09:15	26	7	2	4	2	0	0	41
09:30	9	2	0	7	0	0	0	18
09:45	18	9	3	3	1	0	0	34
1 Hr	82	24	6	19	4	0	0	135
10:00	16	7	0	3	1	1	1	29
10:15	16	7	4	3	0	0	0	30
10:30	17	12	1	2	0	0	0	32
10:45	19	6	3	4	0	0	0	32
1 Hr	68	32	8	12	1	1	1	123
11:00	21	4	1	2	1	0	0	29
11:15	24	3	3	4	1	0	0	35
11:30	17	7	1	2	0	0	0	27
11:45	19	5	1	4	2	0	1	32
1 Hr	81	19	6	12	4	0	1	123
12:00	9	5	0	7	0	0	0	21
12:15	19	5	1	2	1	0	0	28
12:30	14	2	0	4	0	0	0	20
12:45	25	5	1	5	1	0	0	37
1 Hr	67	17	2	18	2	0	0	106

	Destination : Arm C N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	2	1	0	0	0	0	0	3
09:30	1	0	0	0	0	0	0	1
09:45	0	0	0	0	0	0	0	0
1 Hr	3	1	0	0	0	0	0	4
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	1	1	0	0	0	0	0	2
1 Hr	1	1	0	0	0	0	0	2
11:00	1	0	0	1	0	0	0	2
11:15	1	0	0	0	0	0	0	1
11:30	1	0	0	0	0	0	0	1
11:45	0	0	0	0	0	0	0	0
1 Hr	3	0	0	1	0	0	0	4
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	1	0	0	0	1
12:45	1	0	0	1	0	0	0	2
1 Hr	1	0	0	2	0	0	0	3

Arm Totals
47
52
75
60
234
73
87
64
73
297
53
59
36
46
194
48
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62
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213
53
52
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61
213
42
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43
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196





13:00	16	5	2	0	0	0	0	23
13:15	12	5	2	2	0	0	0	21
13:30	9	3	2	0	1	2	0	17
13:45	14	3	0	4	0	0	0	21
1 Hr	51	16	6	6	1	2	0	82
14:00	10	1	0	3	0	1	0	15
14:15	25	5	1	3	0	0	0	34
14:30	15	4	1	1	0	0	0	21
14:45	22	10	2	2	0	1	0	37
1 Hr	72	20	4	9	0	2	0	107
15:00	13	8	2	2	1	0	0	26
15:15	17	3	4	3	0	1	0	28
15:30	17	12	0	1	0	0	0	30
15:45	15	8	5	0	0	0	0	28
1 Hr	62	31	11	6	1	1	0	112
16:00	20	5	2	0	0	0	0	27
16:15	31	10	3	2	0	0	0	46
16:30	22	10	2	2	1	0	0	37
16:45	28	8	0	4	0	0	0	40
1 Hr	101	33	7	8	1	0	0	150
17:00	31	8	1	3	0	0	0	43
17:15	32	8	2	5	0	0	0	47
17:30	32	9	1	5	0	0	0	47
17:45	38	7	0	2	2	1	0	50
1 Hr	133	32	4	15	2	1	0	187
18:00	33	8	1	4	1	0	0	47
18:15	34	5	1	2	1	0	1	44
18:30	27	5	1	2	0	0	0	35
18:45	25	6	0	2	0	0	0	33
1 Hr	119	24	3	10	2	0	1	159

Total	835	238	72	82	12	9	1	1249
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17	3	2	0	1	0	0	0	23
21	2	1	7	0	0	1	1	32
25	3	0	5	0	0	0	0	33
24	5	0	4	1	0	0	0	34
87	13	3	16	2	0	1	1	122
17	1	2	4	1	0	0	0	25
16	5	2	2	0	0	0	0	25
21	2	2	4	0	0	0	0	29
18	3	1	5	1	1	0	0	29
72	11	7	15	2	1	0	0	108
22	3	2	5	0	0	0	0	32
7	6	0	2	0	0	1	1	16
14	6	2	1	1	0	0	0	24
23	2	5	3	0	0	0	0	33
66	17	9	11	1	0	1	1	105
16	5	2	3	1	0	0	0	27
13	3	3	6	2	0	0	0	27
29	5	2	5	1	1	0	0	43
24	4	1	3	1	0	0	0	33
82	17	8	17	5	1	0	0	130
28	7	1	1	0	0	0	0	37
38	5	0	2	0	0	0	0	45
29	4	0	5	0	0	0	0	38
24	2	1	1	1	0	0	0	29
119	18	2	9	1	0	0	0	149
20	3	2	4	0	0	0	0	29
24	1	0	2	0	0	0	0	27
11	2	2	2	1	0	0	0	18
15	3	1	1	0	0	0	0	20
70	9	5	9	1	0	0	0	94

1074	231	69	171	37	4	4	1590
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1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	2
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
3	0	0	0	0	0	0	0	3
1	0	0	0	0	0	0	0	1
1	0	0	0	0	0	0	0	1
6	0	0	0	0	0	0	0	6

22	2	0	3	0	0	0	27
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86
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337
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54
259

2866
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ORIGIN SUMMARY

	Origin : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	37	10	6	10	2	0	3	68
07:15	62	19	9	5	1	0	2	98
07:30	66	12	2	4	4	0	0	88
07:45	71	14	3	4	4	3	1	100
1 Hr	236	55	20	23	11	3	6	354
08:00	63	14	5	1	3	0	0	86
08:15	61	6	5	4	0	1	0	77
08:30	57	8	2	1	1	2	2	73
08:45	50	9	6	4	1	4	0	74
1 Hr	231	37	18	10	5	7	2	310
09:00	55	9	2	1	3	0	0	70
09:15	46	9	0	3	1	1	0	60
09:30	41	12	5	7	1	0	0	66
09:45	26	7	6	6	1	0	0	46
1 Hr	168	37	13	17	6	1	0	242
10:00	30	4	2	0	1	0	0	37
10:15	29	8	1	1	1	0	0	40
10:30	25	6	5	0	1	0	0	37
10:45	29	10	3	1	1	0	0	44
1 Hr	113	28	11	2	4	0	0	158
11:00	29	14	5	5	3	0	0	56
11:15	30	4	0	4	1	0	0	39
11:30	28	9	3	4	2	2	0	48
11:45	34	6	6	3	2	0	1	52
1 Hr	121	33	14	16	8	2	1	195
12:00	43	8	4	3	2	0	0	60
12:15	29	11	1	2	2	0	1	46
12:30	35	10	3	3	1	0	0	52
12:45	33	10	4	4	1	0	0	52
1 Hr	140	39	12	12	6	0	1	210

	Origin : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
16	3	3	7	4	0	0	33	
12	2	1	4	1	0	0	20	
17	3	2	5	2	0	0	29	
30	3	1	4	1	0	0	39	
75	11	7	20	8	0	0	121	
15	4	1	8	0	0	0	28	
27	14	1	5	1	0	0	48	
18	3	1	3	0	0	0	25	
22	8	6	7	1	1	0	45	
82	29	9	23	2	1	0	146	
16	9	4	5	4	0	0	38	
22	8	2	8	0	0	0	40	
17	7	5	6	1	0	0	36	
20	8	6	7	3	0	1	45	
75	32	17	26	8	0	1	159	
23	8	0	8	3	0	0	42	
29	6	3	11	1	0	0	50	
23	11	1	6	3	1	0	45	
27	10	7	8	1	0	0	53	
102	35	11	33	8	1	0	190	
34	12	5	5	2	0	0	58	
24	15	4	5	2	0	1	51	
34	6	8	6	1	0	0	55	
39	4	2	13	1	0	0	59	
131	37	19	29	6	0	1	223	
33	3	2	0	3	0	0	41	
40	9	2	3	2	0	0	56	
38	7	1	3	0	0	2	51	
32	6	2	6	2	0	0	49	
143	25	8	2	7	0	2	197	

	Origin : Arm C N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
26	13	2	3	3	0	0	47	
35	5	5	1	6	0	0	52	
52	14	2	2	4	1	0	75	
42	10	2	5	1	0	0	60	
155	42	11	11	14	1	0	234	
60	5	3	4	1	0	0	73	
60	12	3	9	2	1	0	87	
44	13	2	5	0	0	0	64	
59	5	4	5	0	0	0	73	
223	35	12	23	3	1	0	297	
36	8	1	7	1	0	0	53	
38	8	5	6	2	0	0	59	
25	4	0	7	0	0	0	36	
24	13	4	3	2	0	0	46	
123	33	10	23	5	0	0	194	
29	8	2	4	1	3	1	48	
27	9	10	4	1	0	0	51	
28	23	5	6	0	0	0	62	
32	9	6	5	0	0	0	52	
116	49	23	19	2	3	1	213	
39	7	1	5	1	0	0	53	
34	6	5	6	1	0	0	52	
30	11	3	3	0	0	0	47	
42	9	2	5	2	0	1	61	
145	33	11	19	4	0	1	213	
20	12	0	10	0	0	0	42	
28	8	2	5	1	0	0	44	
29	6	1	7	0	0	0	43	
44	12	2	8	1	0	0	67	
121	38	5	30	2	0	0	196	

Origin Totals
148
170
192
199
709
187
212
162
192
753
161
159
138
137
595
127
141
144
149
561
167
142
150
172
631
143
146
146
168
603

**ADDITIONAL INFORMATION**  
**REGISTRY**  
**1 1 FEB 2022**  
**FINGAL COUNTY COUNCIL**  
**PLANNING DEPARTMENT**



13:00	31	11	2	2	2	0	0	48
13:15	34	8	2	2	1	0	0	47
13:30	38	10	3	0	1	0	0	52
13:45	32	5	7	2	1	0	1	48
1 Hr	135	34	14	6	5	0	1	195
14:00	33	9	3	0	2	1	0	48
14:15	38	12	3	0	0	0	0	53
14:30	39	6	1	1	1	0	0	48
14:45	37	6	6	3	2	0	0	54
1 Hr	147	33	13	4	5	1	0	203
15:00	31	9	5	2	3	0	0	50
15:15	32	11	6	1	1	1	0	52
15:30	22	11	2	3	1	1	0	40
15:45	27	11	3	2	3	0	0	46
1 Hr	112	42	16	8	8	2	0	188
16:00	30	7	1	1	0	0	0	39
16:15	25	8	0	2	2	3	1	41
16:30	34	6	2	0	1	0	1	44
16:45	31	7	3	1	0	0	1	43
1 Hr	120	28	6	4	3	3	3	167
17:00	42	6	1	0	2	0	0	51
17:15	33	4	1	0	2	0	1	41
17:30	46	7	1	1	0	0	0	55
17:45	36	7	1	1	1	0	0	46
1 Hr	157	24	4	2	5	0	1	193
18:00	33	2	1	0	1	0	0	37
18:15	39	2	2	1	1	0	0	45
18:30	38	4	0	0	1	1	1	45
18:45	30	2	1	2	0	1	0	36
1 Hr	140	10	4	3	3	2	1	163
Total	1820	400	145	107	69	21	16	2578

27	7	3	9	4	1	0	51
45	18	3	5	1	1	0	73
34	11	4	2	1	1	2	55
44	8	5	5	2	1	0	65
150	44	15	21	8	4	2	244
46	7	3	5	2	0	0	63
58	9	6	4	2	0	1	80
49	11	9	9	1	0	0	79
48	12	4	1	3	0	0	68
201	39	22	19	8	0	1	290
48	5	3	3	2	0	1	62
56	6	5	3	1	1	0	72
40	6	2	3	1	2	0	54
31	12	3	11	3	3	0	63
175	29	13	20	7	6	1	251
45	11	4	3	2	0	1	66
68	11	1	5	0	1	1	87
70	13	5	3	2	1	1	95
58	17	3	3	1	0	2	84
241	52	13	14	5	2	5	332
79	14	1	6	1	0	0	101
79	14	0	5	2	4	4	108
71	13	2	2	1	1	1	91
82	10	1	3	2	1	2	101
311	51	4	16	6	6	7	401
79	18	1	3	2	0	0	103
110	15	3	8	5	1	1	143
64	7	1	4	7	0	1	84
54	12	4	5	3	0	0	78
307	52	9	20	17	1	2	408
1993	436	147	253	90	21	22	2962

34	8	4	0	1	0	0	47
33	7	3	9	0	0	1	53
35	6	2	5	1	2	0	51
38	8	0	8	1	0	0	55
140	29	9	22	3	2	1	206
28	2	2	7	1	1	0	41
41	10	3	5	0	0	0	59
36	6	3	5	0	0	0	50
41	13	3	7	1	2	0	67
146	31	11	24	2	3	0	217
35	11	4	7	1	0	0	58
25	9	4	5	0	1	1	45
31	18	2	2	1	0	0	54
39	10	10	3	0	0	0	62
130	48	20	17	2	1	1	219
37	10	4	3	1	0	0	55
44	13	6	8	2	0	0	73
51	15	4	7	2	1	0	80
52	12	1	7	1	0	0	73
184	50	15	25	6	1	0	281
59	15	2	4	0	0	0	80
70	13	2	7	0	0	0	92
62	13	1	10	0	0	0	86
62	9	1	3	3	1	0	79
253	50	6	24	3	1	0	337
54	11	3	8	1	0	0	77
61	6	1	4	1	0	1	74
39	7	3	4	1	0	0	54
41	9	1	3	0	0	0	54
195	33	8	19	3	0	1	259
1931	471	141	256	49	13	5	2866

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8406



DESTINATION SUMMARY

	Destination : Arm A R135(NNW)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	10	2	1	0	4	0	0	17
07:15	10	1	2	1	1	0	0	15
07:30	22	5	3	0	2	0	0	32
07:45	18	2	1	0	2	0	0	23
1 Hr	60	10	7	1	9	0	0	87
08:00	20	3	2	2	0	0	0	27
08:15	30	9	2	0	2	1	0	44
08:30	21	8	1	1	0	0	0	31
08:45	29	6	5	1	1	3	0	45
1 Hr	100	26	10	4	3	4	0	147
09:00	12	10	2	2	3	0	0	29
09:15	21	5	3	3	0	0	0	32
09:30	23	6	1	0	1	0	0	31
09:45	18	6	2	0	3	0	1	30
1 Hr	74	27	8	5	7	0	1	122
10:00	29	5	2	2	1	2	0	41
10:15	28	5	6	2	2	0	0	43
10:30	19	14	4	4	2	0	0	43
10:45	29	7	7	2	1	0	0	46
1 Hr	105	31	19	10	6	2	0	173
11:00	34	6	0	2	1	0	0	43
11:15	22	12	5	4	1	0	0	44
11:30	29	7	7	2	1	0	0	46
11:45	37	6	2	1	1	0	0	47
1 Hr	122	31	14	9	4	0	0	180
12:00	32	8	2	3	2	0	0	47
12:15	32	7	1	3	1	0	0	44
12:30	32	6	2	3	0	0	1	44
12:45	38	9	2	2	1	0	0	52
1 Hr	134	30	7	11	4	0	1	187

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
40	17	2	5	3	0	3	70	
59	14	9	2	7	0	1	92	
77	16	1	6	6	1	0	107	
72	19	3	5	2	2	1	104	
248	66	15	18	18	3	5	373	
86	14	2	4	4	0	0	110	
71	11	3	9	1	1	0	96	
59	11	2	6	1	2	2	83	
69	7	7	8	0	1	0	92	
285	43	14	27	6	4	2	381	
57	10	1	6	4	0	0	78	
53	11	2	6	3	0	0	75	
40	10	0	12	1	0	0	63	
34	12	6	8	2	0	0	62	
184	43	9	32	10	0	0	278	
37	10	1	3	2	1	1	55	
31	13	5	3	1	0	0	53	
33	14	2	2	1	0	0	52	
35	11	5	4	1	0	0	56	
136	48	13	12	5	1	1	216	
37	8	2	5	3	0	0	55	
34	6	3	5	2	0	0	50	
33	10	1	2	2	0	0	48	
36	7	5	6	4	0	2	60	
140	31	11	18	11	0	2	213	
39	11	0	8	1	0	0	59	
40	9	1	2	3	0	1	56	
39	8	0	5	1	0	0	53	
46	10	3	6	2	0	0	67	
164	38	4	21	7	0	1	235	

	Destination : Arm C N2 Slip							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
29	7	8	15	2	0	0	61	
40	11	4	7	0	0	1	63	
36	8	2	5	2	0	0	53	
53	6	2	8	2	1	0	72	
158	32	16	35	6	1	1	249	
32	6	5	7	0	0	0	50	
47	12	4	9	0	0	0	72	
39	5	2	2	0	0	0	48	
33	9	4	7	1	1	0	55	
151	32	15	25	1	1	0	225	
38	6	4	5	1	0	0	54	
32	9	2	8	0	1	0	52	
20	7	9	8	0	0	0	44	
18	10	8	8	1	0	0	45	
108	32	23	29	2	1	0	195	
16	5	1	7	2	0	0	31	
26	5	3	11	0	0	0	45	
24	12	5	6	1	1	0	49	
24	11	4	8	0	0	0	47	
90	33	13	32	3	1	0	172	
31	19	9	8	2	0	0	69	
32	7	1	6	1	0	1	48	
30	9	6	9	0	2	0	56	
42	6	3	14	0	0	0	65	
135	41	19	37	3	2	1	238	
25	4	4	2	2	0	0	37	
25	12	3	5	1	0	0	46	
31	9	3	5	0	0	1	49	
25	9	4	10	1	0	0	49	
106	34	14	22	4	0	1	181	

Dest Totals
148
170
192
199
709
187
212
162
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753
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159
138
137
595
127
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167
142
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172
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143
146
146
168
603



13:00	31	9	3	0	2	1	0	46
13:15	38	15	2	4	0	1	0	60
13:30	24	8	2	0	1	2	1	38
13:45	36	7	0	5	2	0	0	50
1 Hr	129	39	7	9	5	4	1	194
14:00	35	3	1	3	1	1	0	44
14:15	56	9	4	3	0	0	0	72
14:30	41	9	5	4	1	0	0	60
14:45	43	13	3	2	2	1	0	64
1 Hr	175	34	13	12	4	2	0	240
15:00	45	9	4	2	3	0	1	64
15:15	45	8	5	4	0	2	0	64
15:30	39	12	0	1	1	1	0	54
15:45	36	16	6	2	1	1	0	62
1 Hr	165	45	15	9	5	4	1	244
16:00	42	11	3	1	2	0	1	60
16:15	60	16	4	2	0	0	1	83
16:30	60	15	5	3	2	1	1	87
16:45	62	18	3	4	0	0	2	89
1 Hr	224	60	15	10	4	1	5	319
17:00	70	16	1	4	1	0	0	92
17:15	71	13	2	7	2	1	4	100
17:30	59	14	1	6	0	0	1	81
17:45	73	10	1	2	3	1	2	92
1 Hr	273	53	5	19	6	2	7	365
18:00	66	17	1	4	3	0	0	91
18:15	90	13	2	6	4	1	2	118
18:30	57	6	1	6	1	0	1	72
18:45	52	10	3	3	1	0	0	69
1 Hr	265	46	7	19	9	1	3	350

Total	1826	432	127	118	66	20	19	2608
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38	11	3	2	3	0	0	57
42	8	2	7	1	0	1	61
49	10	1	5	1	0	0	66
42	7	5	5	2	0	1	62
171	36	11	19	7	0	2	246
36	7	4	4	3	1	0	55
39	11	4	2	0	0	0	56
50	5	3	4	1	0	0	63
35	6	1	5	2	1	0	50
160	29	12	15	6	2	0	224
43	7	5	7	3	0	0	65
26	12	4	2	1	1	1	47
25	11	3	1	2	0	0	42
39	10	5	4	2	0	0	60
133	40	17	14	8	1	1	214
32	9	2	4	1	0	0	48
31	6	3	8	4	0	1	53
46	7	4	5	2	1	1	66
39	9	1	3	1	0	1	54
148	31	10	20	8	1	3	221
51	8	2	2	2	0	0	65
54	8	0	2	2	0	1	67
54	6	0	5	0	0	0	65
41	4	1	2	2	0	0	50
200	26	3	11	6	0	1	247
35	4	3	4	1	0	0	47
41	3	0	2	1	0	0	47
32	4	2	2	2	1	1	44
35	4	2	2	0	1	0	44
143	15	7	10	4	2	1	182

2112	446	126	217	96	14	19	3030
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23	6	3	9	2	0	0	43
32	10	4	5	1	0	0	52
34	9	6	2	1	1	1	54
36	7	7	5	0	1	0	56
125	32	20	21	4	2	1	205
36	8	3	5	1	0	0	53
42	11	4	4	2	0	1	64
33	9	5	7	0	0	0	54
48	12	9	4	2	0	0	75
159	40	21	20	5	0	1	246
26	9	3	3	0	0	0	41
42	6	6	3	1	0	0	58
29	12	3	6	0	2	0	52
22	7	5	10	3	2	0	49
119	34	17	22	4	4	0	200
38	8	4	2	0	0	0	52
46	10	0	5	0	4	0	65
49	12	2	2	1	0	0	66
40	9	3	4	1	0	0	57
173	39	9	13	2	4	0	240
59	11	1	4	0	0	0	75
57	10	1	3	0	3	0	74
66	13	3	2	1	1	0	86
66	12	1	3	1	1	0	84
248	46	6	12	2	5	0	319
65	10	1	3	0	0	0	79
79	7	4	5	2	0	0	97
52	8	1	0	6	0	0	67
38	9	1	5	2	0	0	55
234	34	7	13	10	0	0	298

1806	429	180	281	46	21	5	2768
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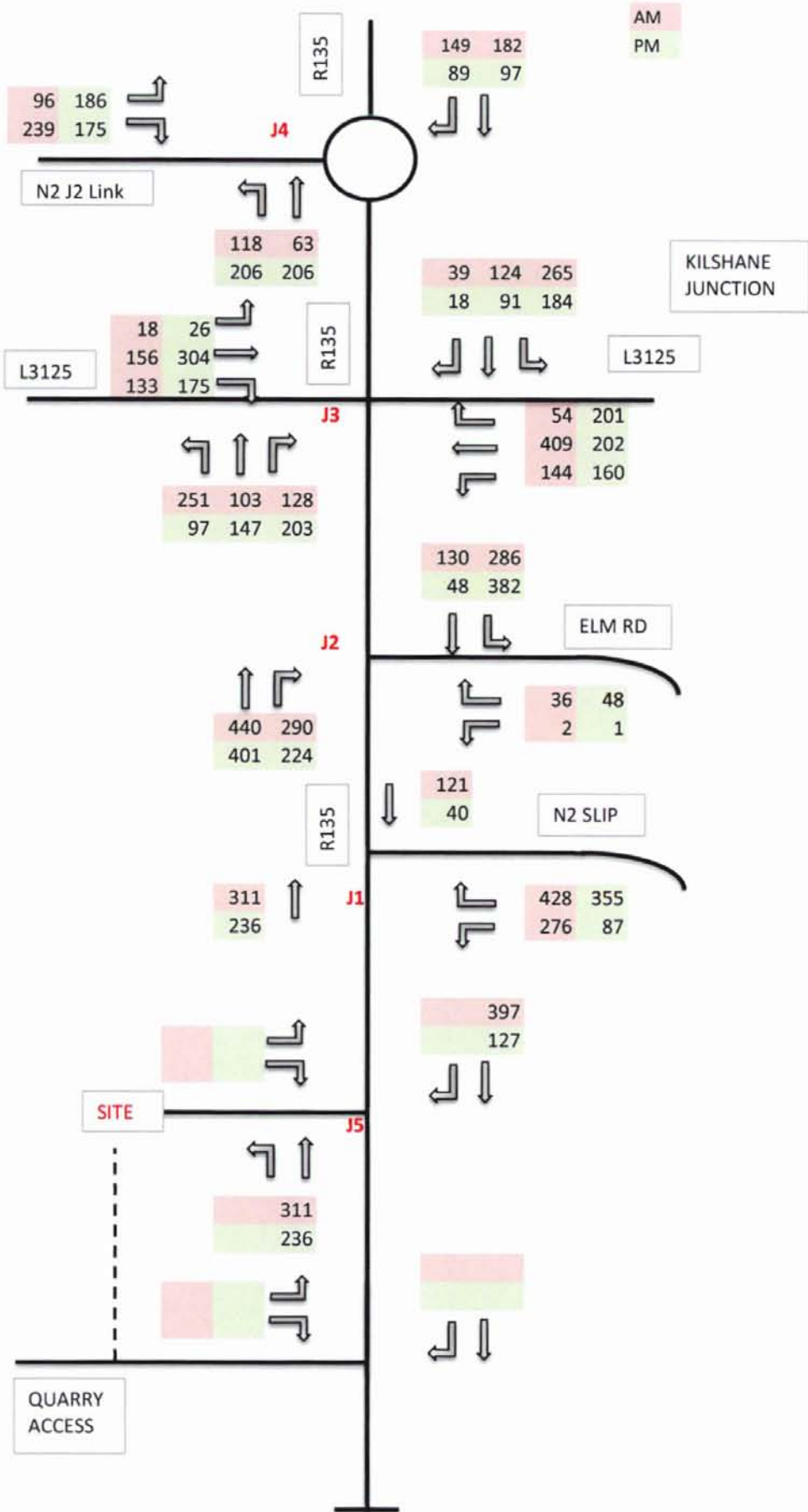
**APPENDIX 13.2**

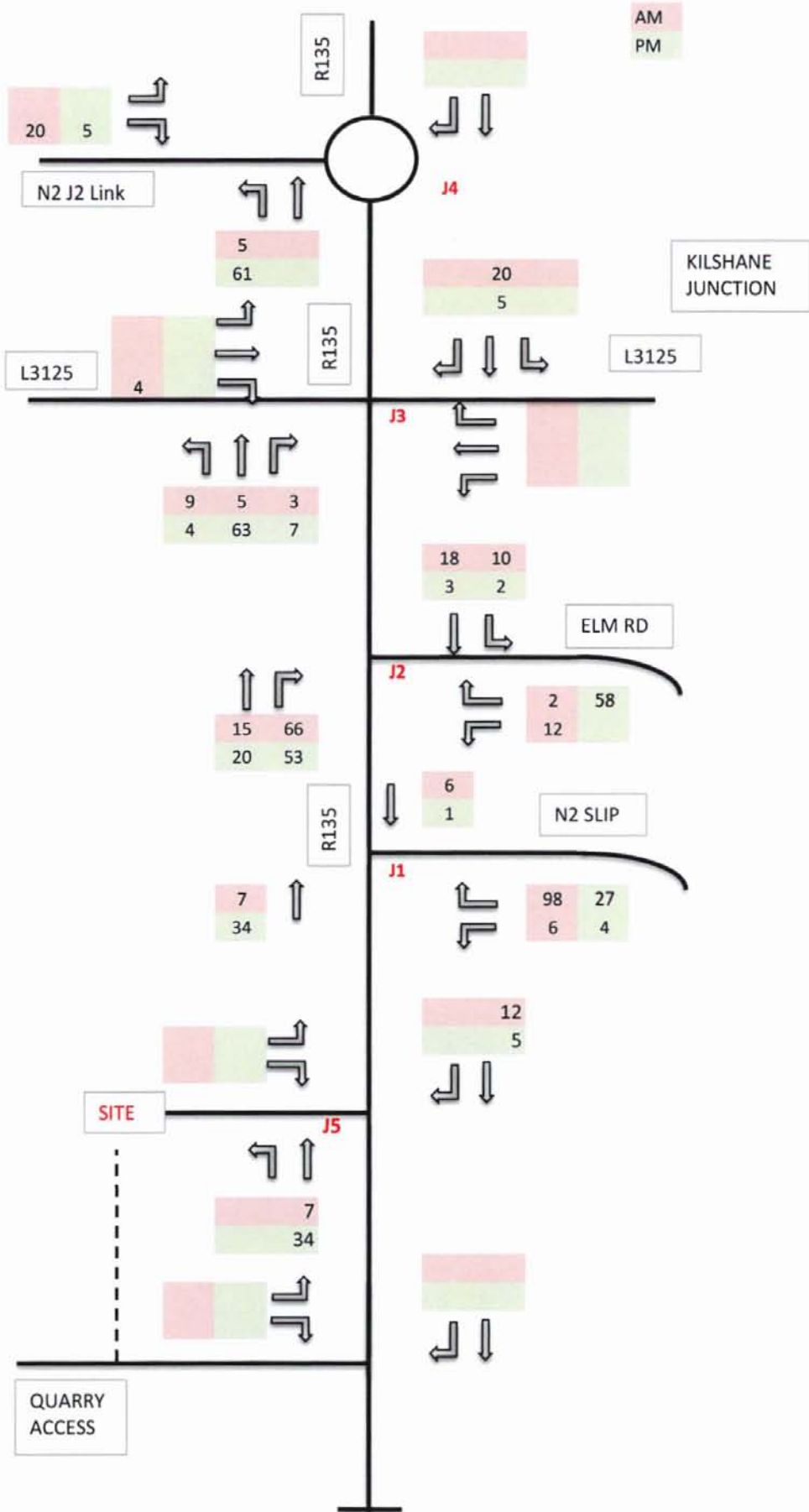
**TRAFFIC DATA**

Prepared by

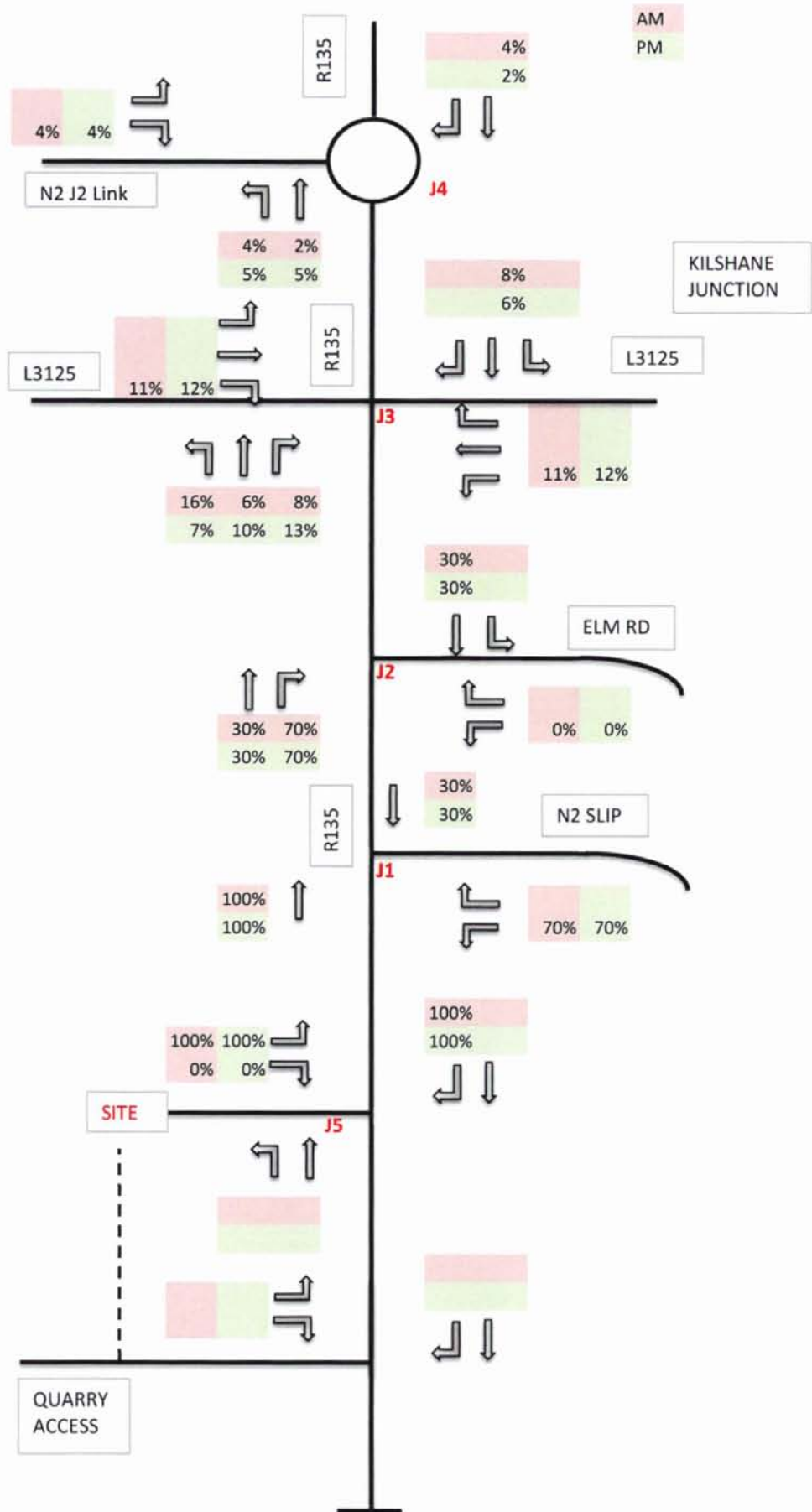
CST Group

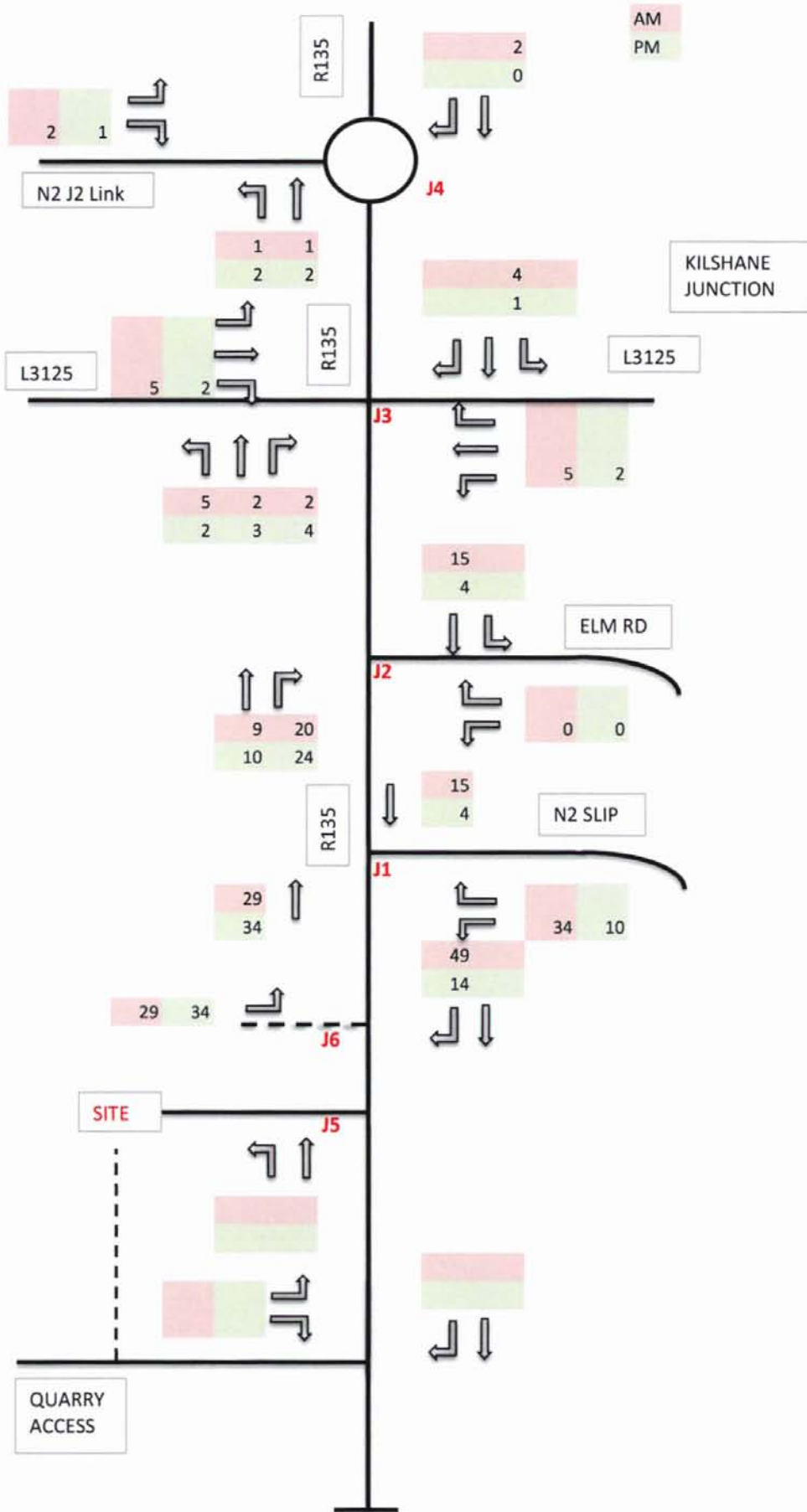
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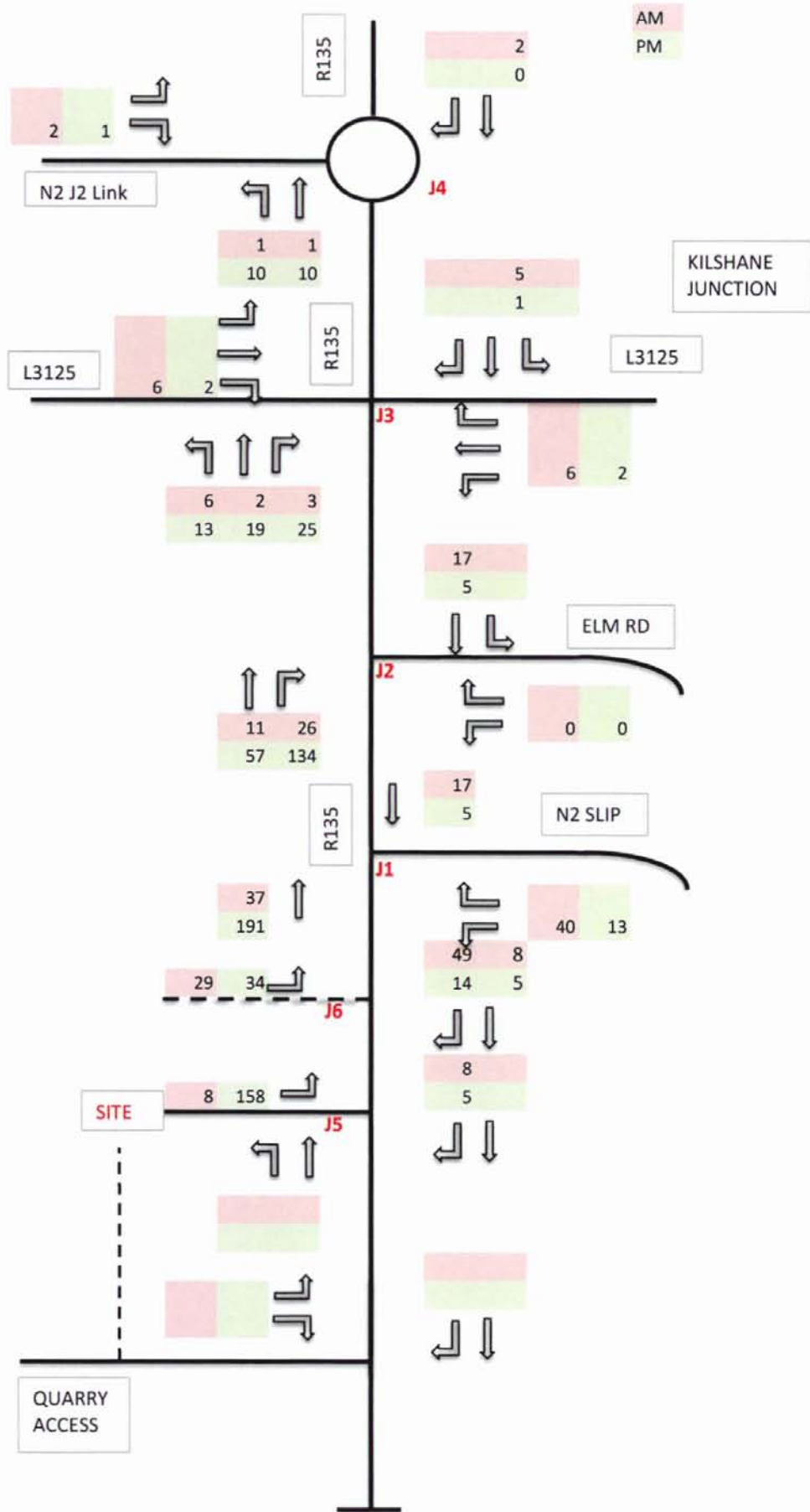


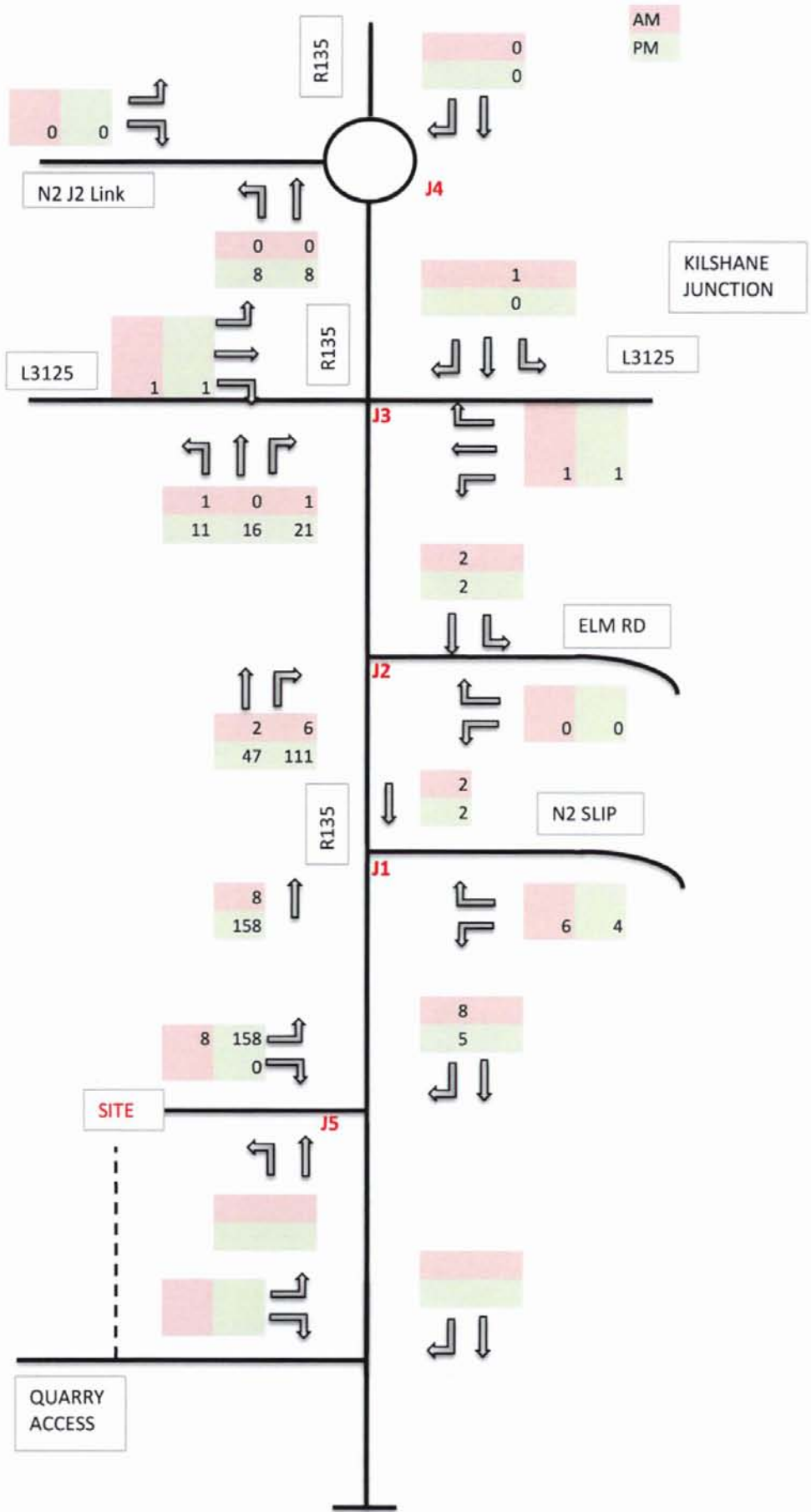


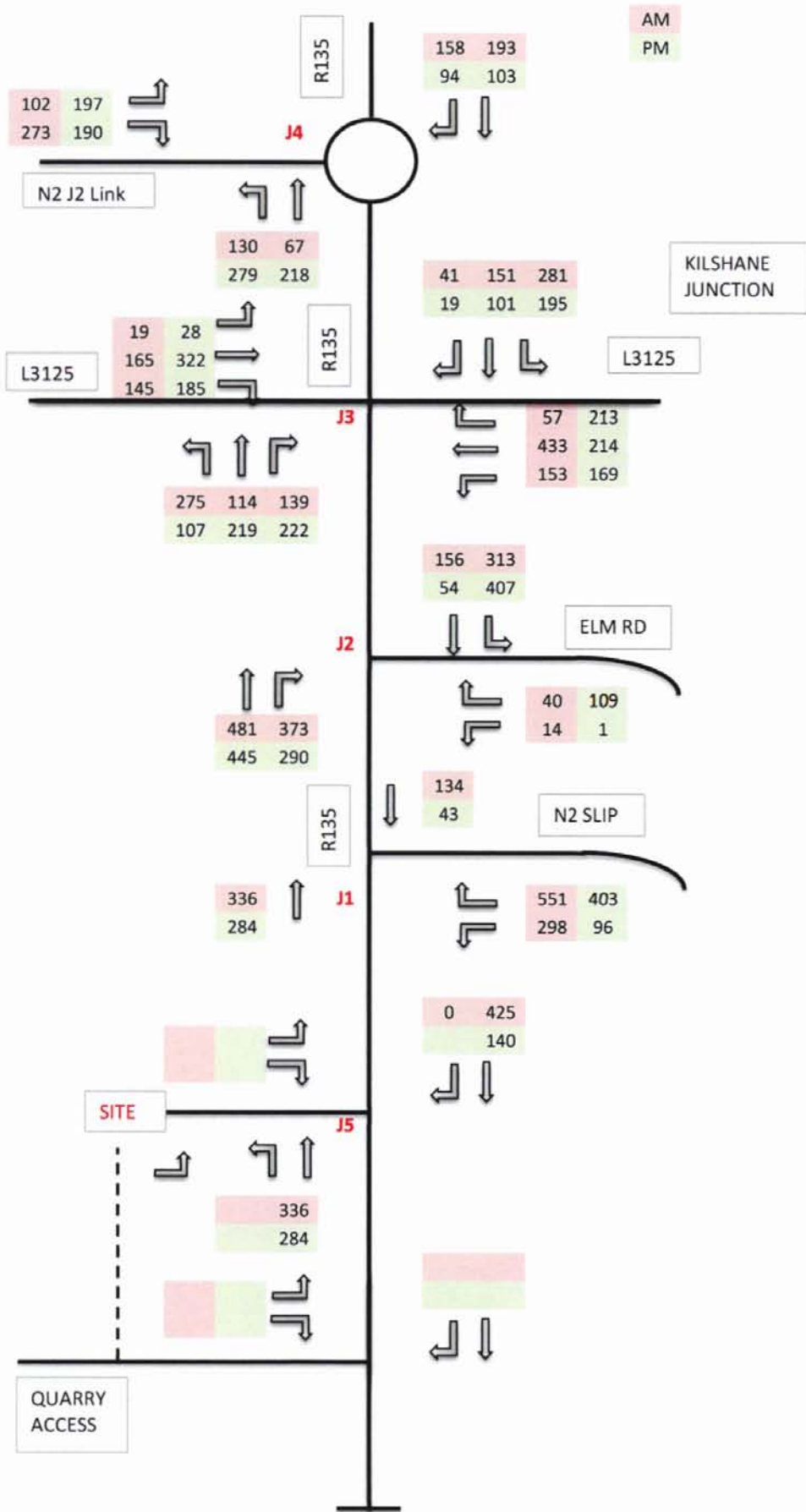










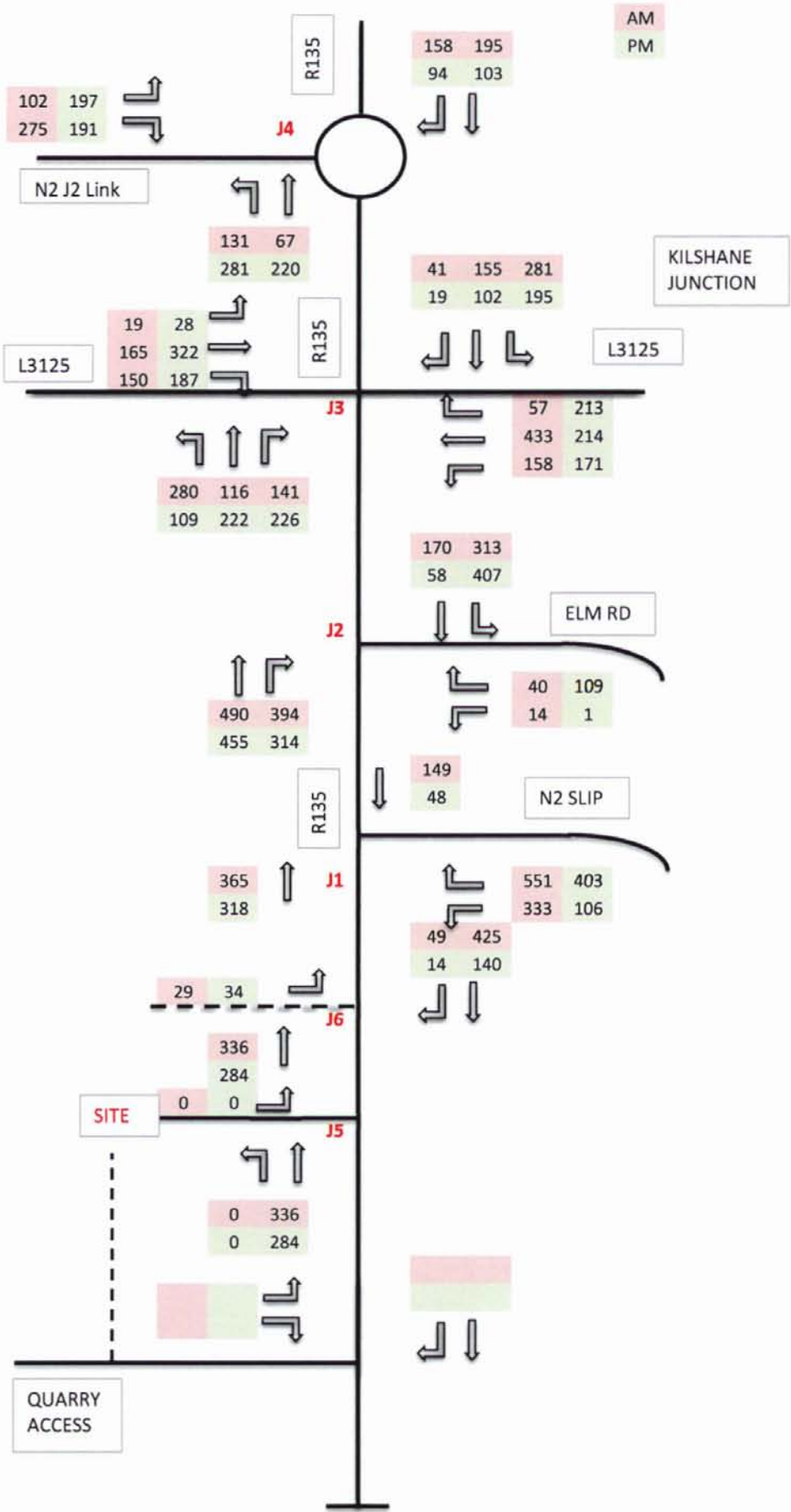


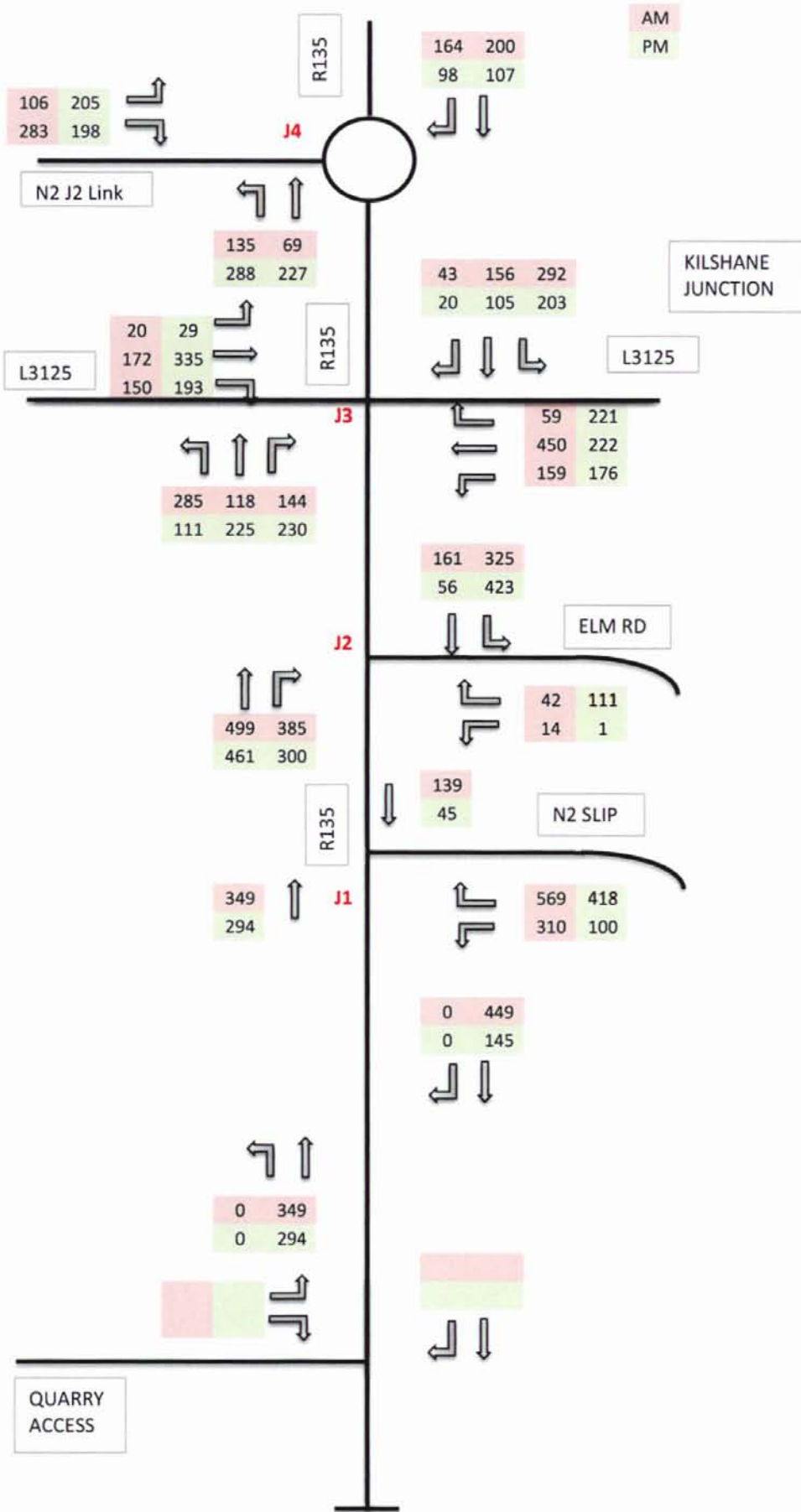
Job No: 119216

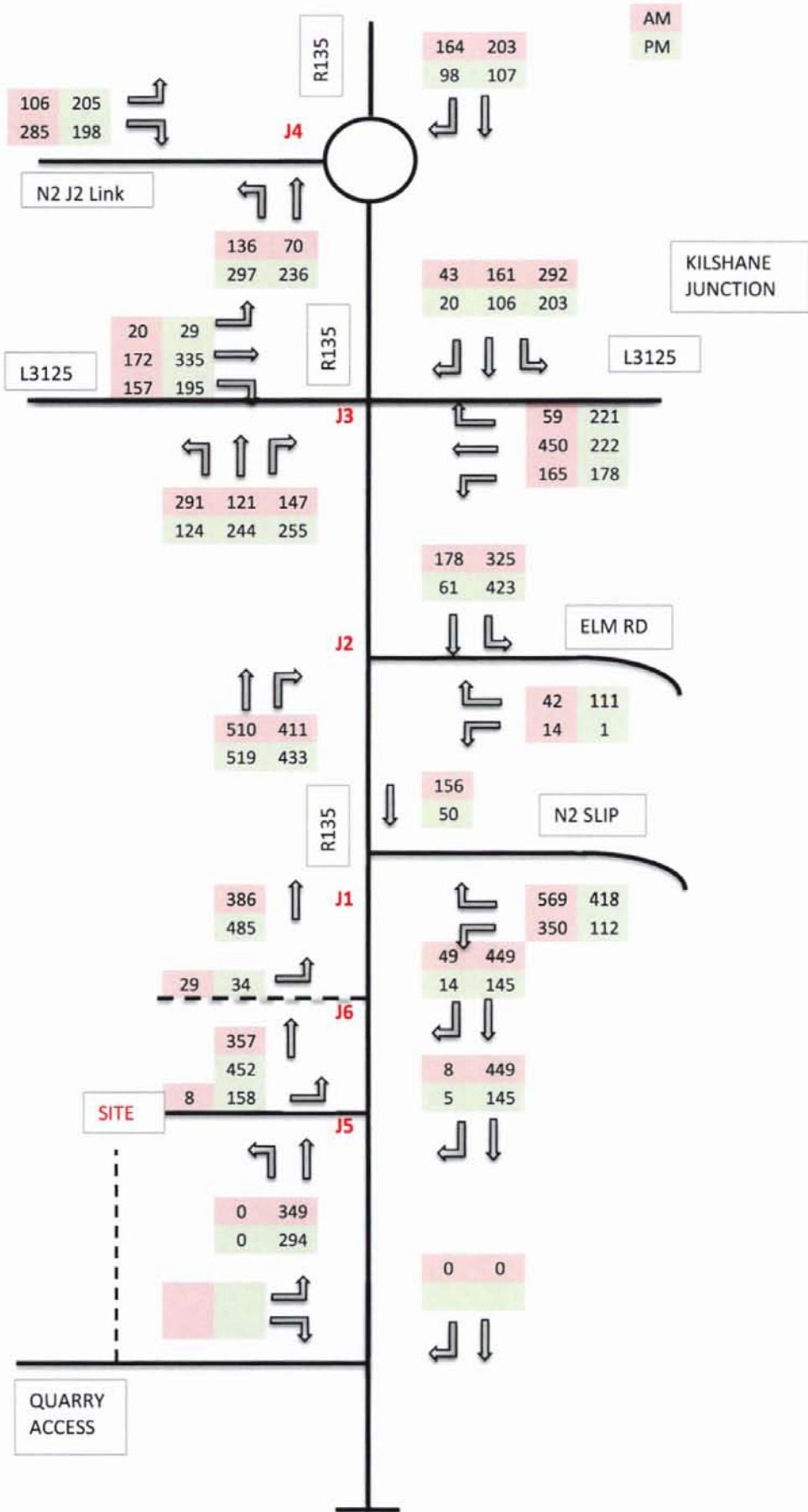
Job Title: Huntstown DC

2022 Traffic (Do Nothing)  
Figure 7

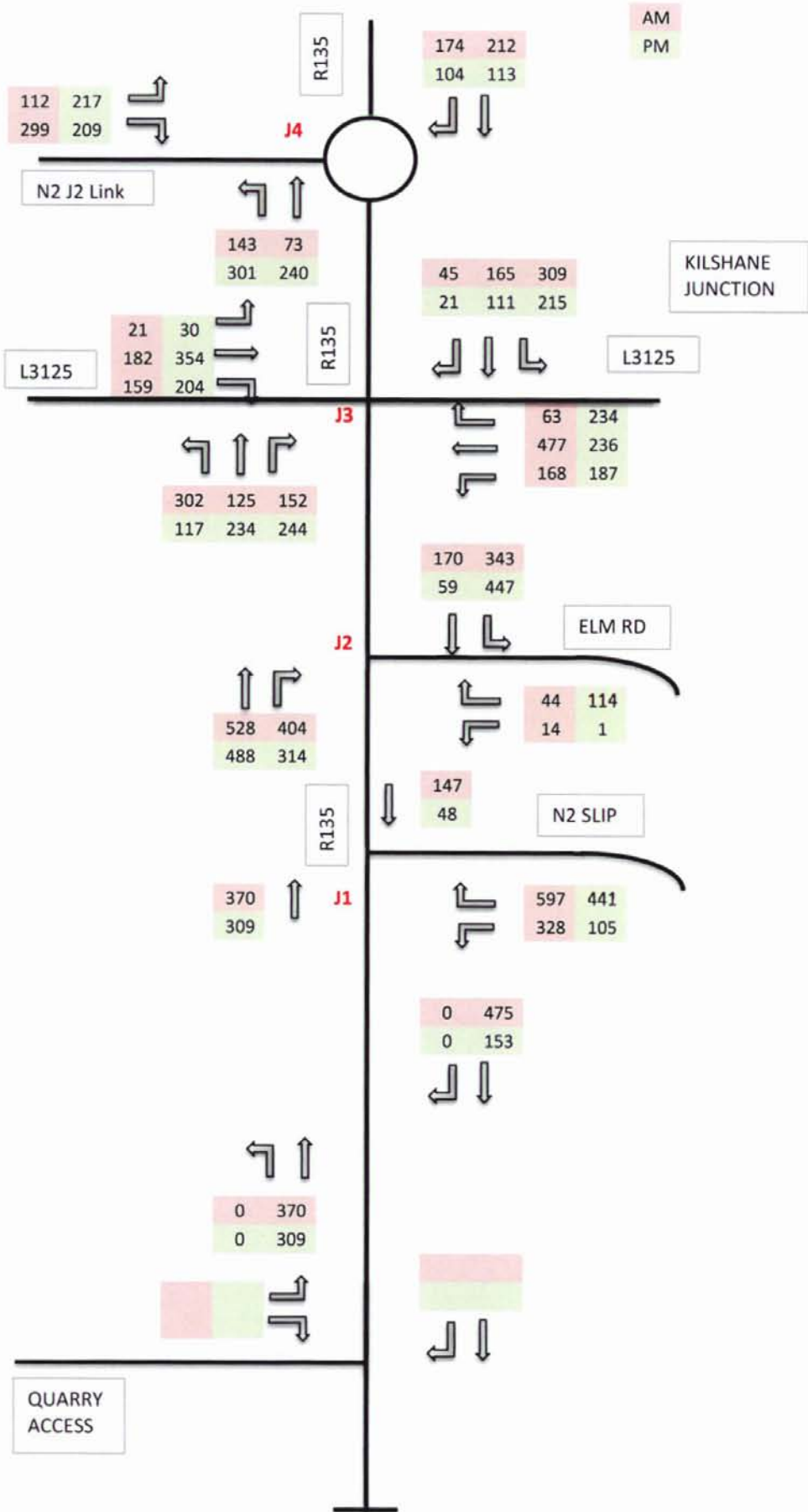








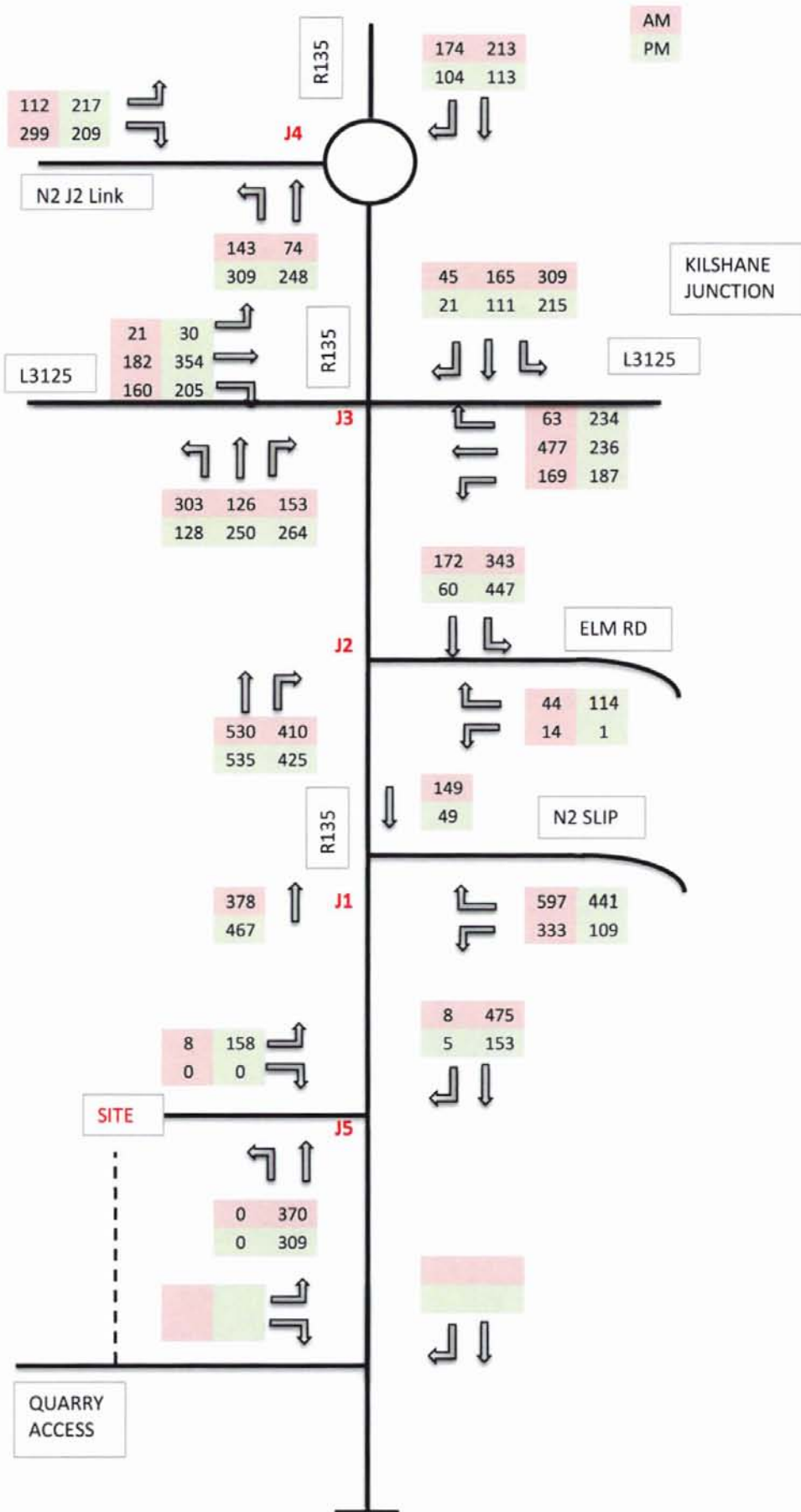


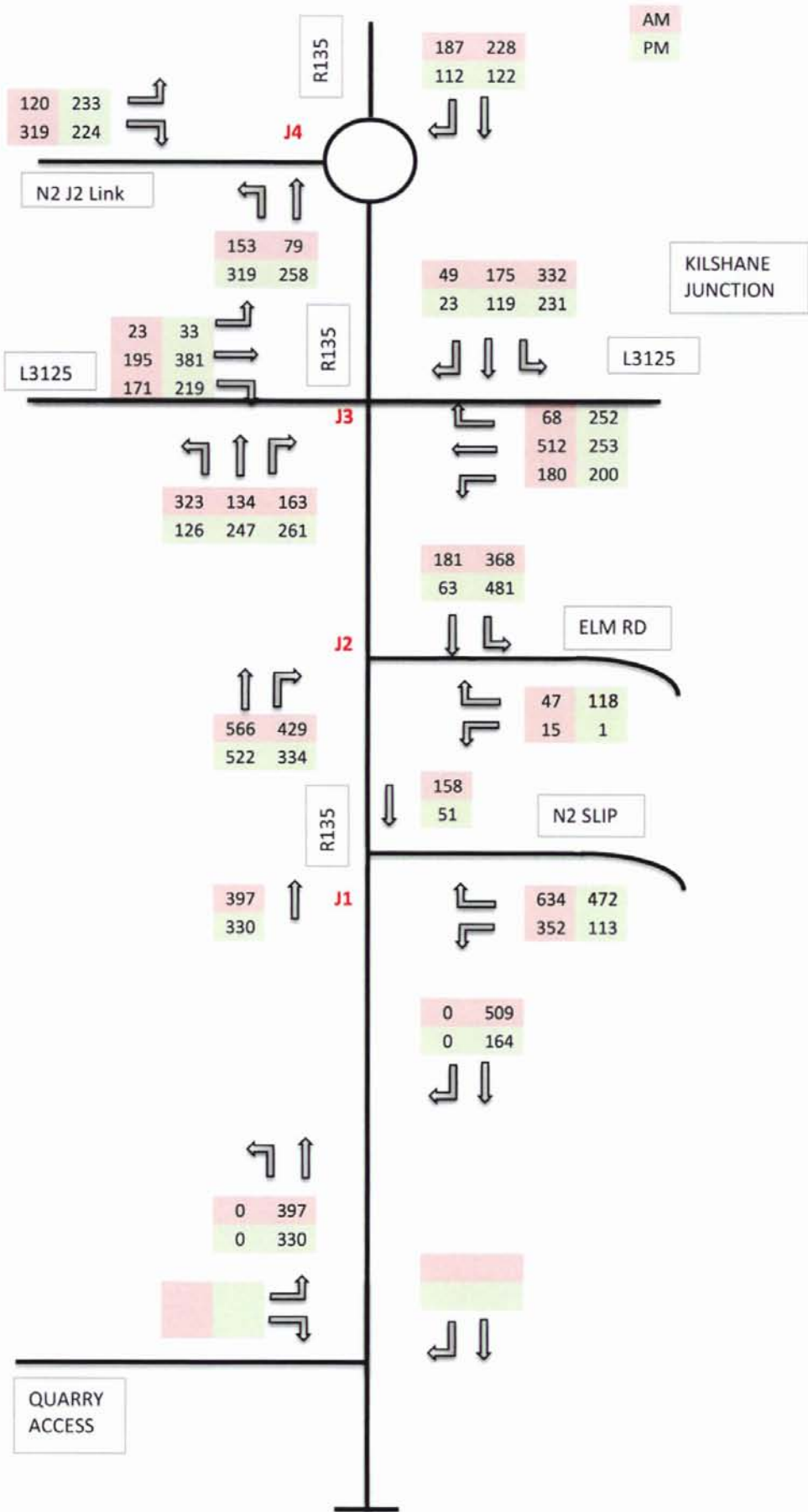


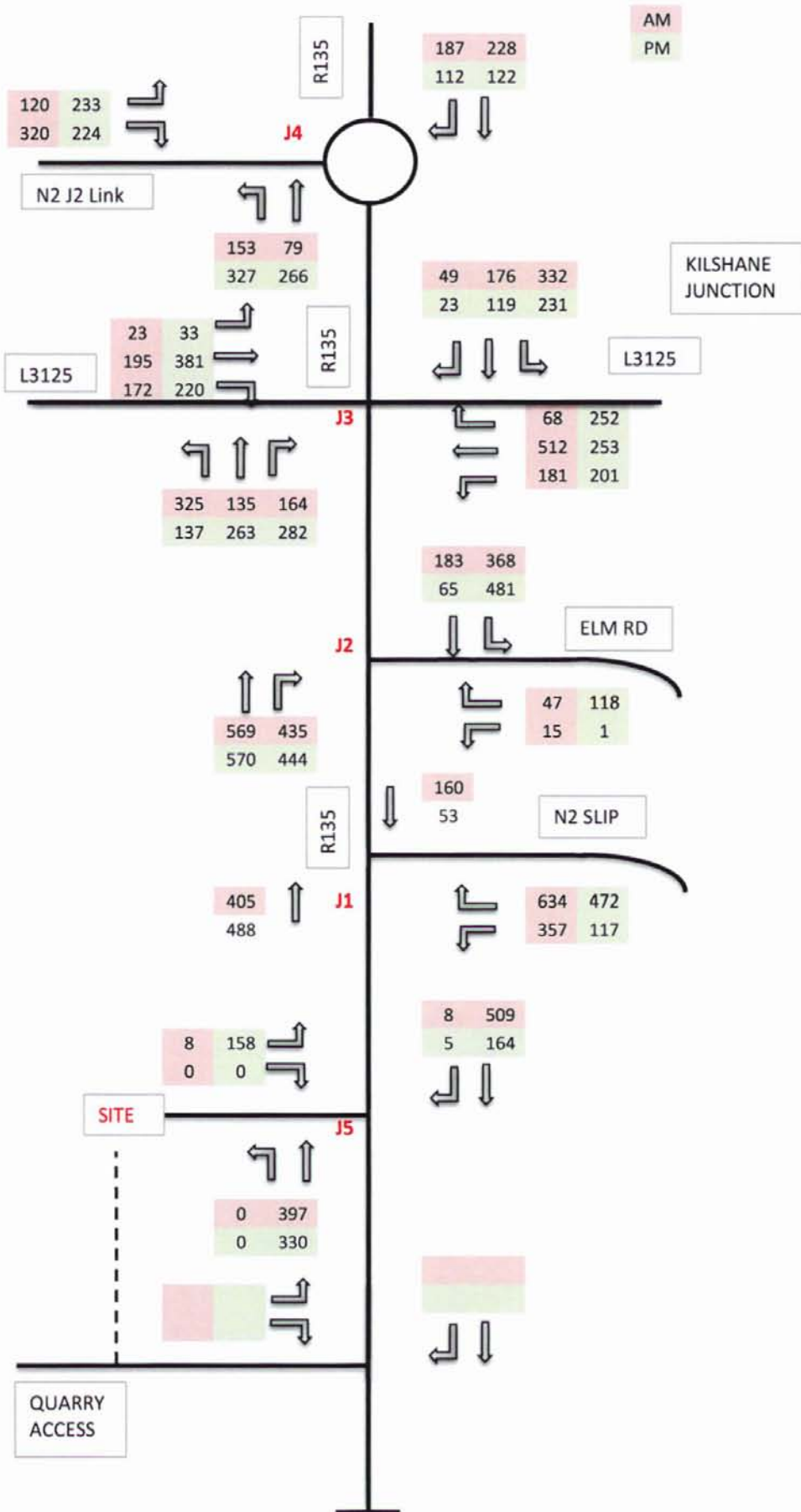
Job No: 119216  
 Job Title: Huntstown DC

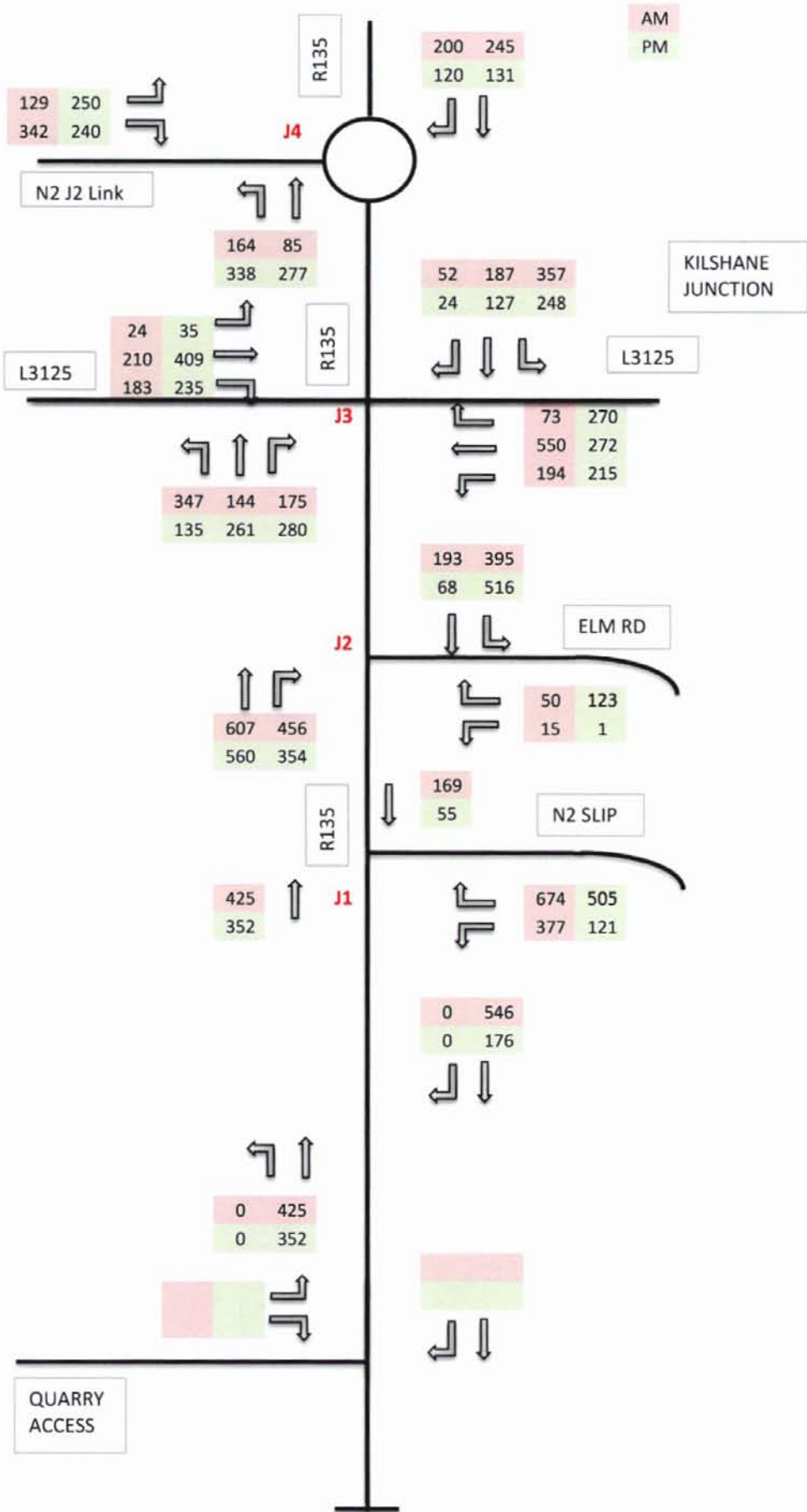


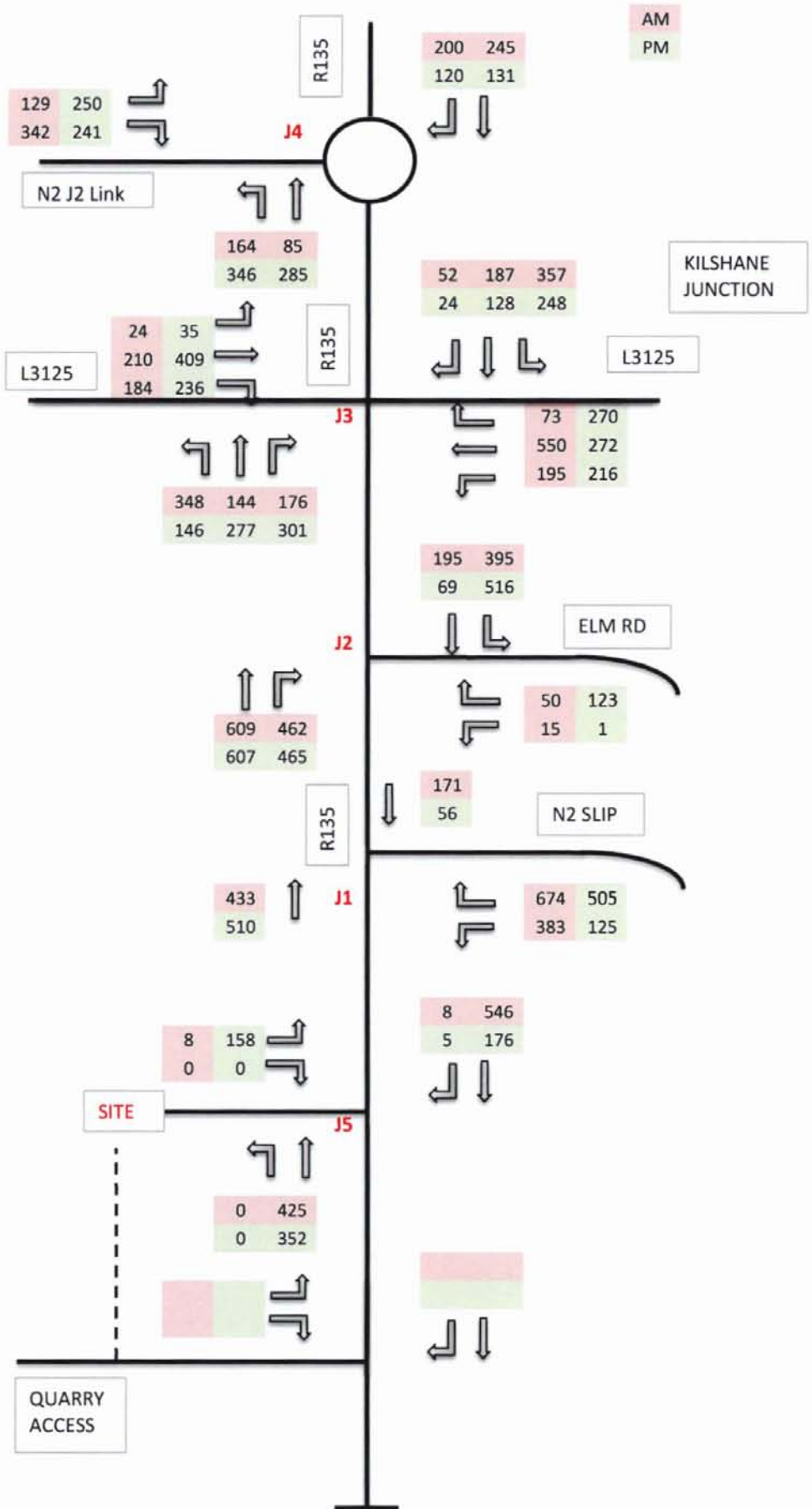
2027 Do Nothing Figure 11











**APPENDIX 13.3**

**PICADY REPORT**

Prepared by

CST Group

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# Junctions 9

## PICADY 9 - Priority Intersection Module

Version: 9.0.1.4646 []  
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** 119216 PICADY R135-N2 Slip DF 2022.j9

**Path:** I:\CST\119\201-250\119216\calcs\PICADY

**Report generation date:** 30/07/2021 11:10:38

- »2022 Do Nothing, AM
- »2022 Do Nothing, PM
- »2022 Do Something , AM
- »2022 Do Something , PM
- »2024 Do Nothing , AM
- »2024 Do Nothing, PM
- »2024 Do Something , PM
- »2027 Do Nothing, PM
- »2027 Do Something, PM
- »2032 Do Nothing, PM
- »2032 Do Something , PM
- »2042 Do Nothing, PM
- »2024 Do Something , AM
- »2042 Do Something, PM



**Summary of junction performance**

	AM						PM					
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
2022 Do Nothing												
Stream B-C	38.2	76.0	516.88	1.23	F	-26 % [Stream B-A]	0.3	1.4	11.67	0.26	B	16 % [Stream B-A]
Stream B-A	69.4	121.0	503.91	1.24	F		2.2	10.1	18.63	0.70	C	
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
2022 Do Something												
Stream B-C	53.8	98.1	664.31	1.30	F	-28 % [Stream B-A]	0.4	1.4	12.50	0.29	B	14 % [Stream B-A]
Stream B-A	88.3	145.1	654.58	1.31	F		2.4	11.2	19.80	0.71	C	
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
2024 Do Nothing												
Stream B-C	48.4	90.2	640.71	1.28	F	-28 % [Stream B-A]	0.4	1.2	13.04	0.29	B	12 % [Stream B-A]
Stream B-A	87.9	144.5	628.68	1.30	F		2.6	12.7	20.89	0.73	C	
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
2024 Do Something												
Stream B-C	68.3	122.2	816.41	1.36	F	-31 % [Stream B-A]	0.6	2.4	17.11	0.37	C	4 % [Stream B-A]
Stream B-A	110.5	178.4	807.52	1.37	F		3.4	17.3	28.01	0.79	D	
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
2027 Do Nothing												
Stream B-C							0.5	1.9	16.11	0.34	C	6 % [Stream B-A]
Stream B-A							3.3	16.9	25.57	0.78	D	
Stream C-AB							0.0	~1	0.00	0.00	A	
2027 Do Something												
Stream B-C							0.7	3.0	21.16	0.41	C	1 % [Stream B-A]
Stream B-A							4.2	22.3	33.34	0.82	D	
Stream C-AB							0.0	~1	0.00	0.00	A	
2032 Do Nothing												
Stream B-C							0.3	1.2	18.14	0.23	C	2 % [Stream B-A]
Stream B-A							4.3	21.9	31.13	0.82	D	
Stream C-AB							0.0	~1	0.00	0.00	A	
2032 Do Something												
Stream B-C							1.7	7.6	49.22	0.65	E	-6 % [Stream B-A]
Stream B-A							7.1	37.3	52.92	0.90	F	
Stream C-AB							0.0	~1	0.00	0.00	A	
2042 Do Nothing												
Stream B-C							3.0	11.9	87.49	0.81	F	-7 % [Stream B-A]
Stream B-A							9.0	44.0	62.08	0.93	F	
Stream C-AB							0.0	~1	0.00	0.00	A	
2042 Do Something												
Stream B-C							6.3	23.0	170.56	0.99	F	-11 % [Stream B-A]
Stream B-A							14.9	54.5	98.87	0.99	F	
Stream C-AB							0.0	~1	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

**File summary**

**File Description**

Title	R135/N2 Slip
Location	Huntstown, Co Dublin
Site number	
Date	19/03/2021
Version	
Status	TIA
Identifier	
Client	Microsoft
Jobnumber	119216
Enumerator	Donal
Description	

**Units**

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

**Analysis Options**

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

**Demand Set Summary**

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Nothing	AM	2022 Baseline Traffic AM	ONE HOUR	07:45	09:15	15	✓
D2	2022 Do Nothing	PM	2022 Baseline Traffic PM	ONE HOUR	16:15	17:45	15	✓
D3	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D4	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D5	2024 Do Nothing	AM	2024 Do Nothing AM	ONE HOUR	07:45	09:15	15	✓
D6	2024 Do Nothing	PM	2024 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D7	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D8	2027 Do Nothing	PM	2027 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D9	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D10	2032 Do Nothing	PM	2032 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D11	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D12	2042 Do Nothing	PM	2042 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D13	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D14	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓

**Analysis Set Details**

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

# 2022 Do Nothing, AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	327.28	F

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-26	Stream B-A

## Arms

### Arms

Arm	Name	Description	Arm type
A	R135(NNW)		Major
B	N2 Slip		Minor
C	R135(SSE)		Major

### Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	8.70			200.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

### Minor Arm Geometry

Arm	Minor arm type	Width at give-way (m)	Width at 5m (m)	Width at 10m (m)	Width at 15m (m)	Width at 20m (m)	Estimate flare length	Flare length (PCU)	Visibility to left (m)	Visibility to right (m)
B	One lane plus flare	10.00	6.40	3.90	3.90	3.90	✓	1.00	250	140

## Slope / Intercept / Capacity

### Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	710	0.114	0.288	0.181	0.412
1	B-C	756	0.102	0.259	-	-
1	C-B	690	0.236	0.236	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.

Streams may be combined, in which case capacity will be adjusted.

Values are shown for the first time segment only; they may differ for subsequent time segments.

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Nothing	AM	2022 Baseline Traffic AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

## Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	134	100.000
B		ONE HOUR	✓	849	100.000
C		ONE HOUR	✓	336	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	134
	B	551	0	298
	C	336	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.23	516.88	38.2	76.0	F	273	410
B-A	1.24	503.91	69.4	121.0	F	506	758
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						308	462
A-B						0	0
A-C						123	184

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	224	56	453	0.495	221	0.0	0.9	15.238	C
B-A	415	104	583	0.712	406	0.0	2.3	19.424	C
C-AB	0	0	666	0.000	0	0.0	0.0	0.000	A
C-A	253	63			253				
A-B	0	0			0				
A-C	101	25			101				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	268	67	288	0.929	249	0.9	5.7	71.193	F
B-A	495	124	516	0.959	470	2.3	8.7	58.337	F
C-AB	0	0	661	0.000	0	0.0	0.0	0.000	A
C-A	302	76			302				
A-B	0	0			0				
A-C	120	30			120				

## 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	328	82	267	1.229	262	5.7	22.3	221.650	F
B-A	607	152	487	1.244	483	8.7	39.5	198.038	F
C-AB	0	0	655	0.000	0	0.0	0.0	0.000	A
C-A	370	92			370				
A-B	0	0			0				
A-C	148	37			148				

## 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	328	82	266	1.232	265	22.3	38.1	430.571	F
B-A	607	152	488	1.243	487	39.5	69.4	412.974	F
C-AB	0	0	655	0.000	0	0.0	0.0	0.000	A
C-A	370	92			370				
A-B	0	0			0				
A-C	148	37			148				

## 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	268	67	273	0.983	267	38.1	38.2	516.881	F
B-A	495	124	501	0.988	495	69.4	69.4	503.906	F
C-AB	0	0	661	0.000	0	0.0	0.0	0.000	A
C-A	302	76			302				
A-B	0	0			0				
A-C	120	30			120				

## 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	224	56	278	0.807	271	38.2	26.6	434.654	F
B-A	415	104	510	0.813	503	69.4	47.4	420.304	F
C-AB	0	0	666	0.000	0	0.0	0.0	0.000	A
C-A	253	63			253				
A-B	0	0			0				
A-C	101	25			101				

## Queue Variation Results for each time segment

## 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.95	0.03	0.28	0.95	3.51			N/A	N/A
B-A	2.29	0.04	0.36	5.68	12.03			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	5.74	0.09	1.84	15.36	22.41			N/A	N/A
B-A	8.65	0.14	3.67	22.60	31.98			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	22.31	5.47	19.35	39.23	46.55			N/A	N/A
B-A	39.50	14.57	36.26	63.27	72.75			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	38.06	14.24	34.99	60.70	69.71			N/A	N/A
B-A	69.37	34.40	66.09	101.18	112.98			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	38.21	11.48	34.21	64.88	75.97			N/A	N/A
B-A	69.41	29.88	65.14	106.67	120.96			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	26.60	3.00	20.85	54.00	67.22			N/A	N/A
B-A	47.39	11.39	41.28	85.25	101.60			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2022 Do Nothing, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	10.45	B

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	16	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2022 Do Nothing	PM	2022 Baseline Traffic PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	43	100.000
B		ONE HOUR	✓	499	100.000
C		ONE HOUR	✓	284	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	43
	B	403	0	96
	C	284	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.26	11.67	0.3	1.4	B	88	132
B-A	0.70	18.63	2.2	10.1	C	370	555
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						261	391
A-B						0	0
A-C						39	59

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	72	18	585	0.123	72	0.0	0.1	7.001	A
B-A	303	76	668	0.454	300	0.0	0.8	9.699	A
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	214	53			214				
A-B	0	0			0				
A-C	32	8			32				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	86	22	526	0.164	86	0.1	0.2	8.176	A
B-A	362	91	656	0.552	361	0.8	1.2	12.136	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	255	64			255				
A-B	0	0			0				
A-C	39	10			39				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	106	26	419	0.252	105	0.2	0.3	11.443	B
B-A	444	111	636	0.697	440	1.2	2.2	17.972	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	313	78			313				
A-B	0	0			0				
A-C	47	12			47				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	106	26	414	0.255	106	0.3	0.3	11.674	B
B-A	444	111	636	0.698	443	2.2	2.2	18.632	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	313	78			313				
A-B	0	0			0				
A-C	47	12			47				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	86	22	521	0.166	87	0.3	0.2	8.313	A
B-A	362	91	656	0.553	366	2.2	1.3	12.602	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	255	64			255				
A-B	0	0			0				
A-C	39	10			39				



## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	72	18	581	0.124	73	0.2	0.1	7.075	A
B-A	303	76	668	0.454	305	1.3	0.8	9.965	A
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	214	53			214				
A-B	0	0			0				
A-C	32	8			32				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.14	0.00	0.00	0.14	0.14			N/A	N/A
B-A	0.82	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.19	0.00	0.00	0.19	0.19			N/A	N/A
B-A	1.20	0.10	1.05	1.98	2.70			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.33	0.03	0.26	0.46	0.49			N/A	N/A
B-A	2.17	0.03	0.30	2.45	10.13			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.34	0.03	0.32	1.15	1.42			N/A	N/A
B-A	2.23	0.03	0.28	2.23	7.13			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.20	0.00	0.00	0.20	0.20			N/A	N/A
B-A	1.27	0.05	0.65	2.92	4.34			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.14	0.00	0.00	0.14	0.14			N/A	N/A
B-A	0.85	0.04	0.40	1.95	3.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2022 Do Something , AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	416.23	F

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-28	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	149	100.000
B		ONE HOUR	✓	884	100.000
C		ONE HOUR	✓	365	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	149
	B	551	0	333
	C	365	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.30	664.31	53.8	98.1	F	306	458
B-A	1.31	654.58	88.3	145.1	F	506	758
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						335	502
A-B						0	0
A-C						137	205

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	251	63	443	0.566	246	0.0	1.2	17.812	C
B-A	415	104	560	0.741	404	0.0	2.6	21.915	C
C-AB	0	0	663	0.000	0	0.0	0.0	0.000	A
C-A	275	69			275				
A-B	0	0			0				
A-C	112	28			112				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	299	75	294	1.018	268	1.2	9.0	94.280	F
B-A	495	124	489	1.013	458	2.6	11.9	76.384	F
C-AB	0	0	658	0.000	0	0.0	0.0	0.000	A
C-A	328	82			328				
A-B	0	0			0				
A-C	134	33			134				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	367	92	285	1.286	282	9.0	30.1	276.078	F
B-A	607	152	463	1.310	461	11.9	48.3	253.198	F
C-AB	0	0	651	0.000	0	0.0	0.0	0.000	A
C-A	402	100			402				
A-B	0	0			0				
A-C	164	41			164				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	367	92	283	1.296	282	30.1	51.2	534.287	F
B-A	607	152	465	1.305	464	48.3	83.9	520.598	F
C-AB	0	0	651	0.000	0	0.0	0.0	0.000	A
C-A	402	100			402				
A-B	0	0			0				
A-C	164	41			164				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	299	75	290	1.031	289	51.2	53.8	664.305	F
B-A	495	124	479	1.035	478	83.9	88.3	654.579	F
C-AB	0	0	658	0.000	0	0.0	0.0	0.000	A
C-A	328	82			328				
A-B	0	0			0				
A-C	134	33			134				

## 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	251	63	296	0.847	291	53.8	43.8	606.535	F
B-A	415	104	488	0.850	483	88.3	71.4	596.939	F
C-AB	0	0	663	0.000	0	0.0	0.0	0.000	A
C-A	275	69			275				
A-B	0	0			0				
A-C	112	28			112				

## Queue Variation Results for each time segment

## 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.24	0.03	0.27	1.24	1.48			N/A	N/A
B-A	2.60	0.03	0.30	2.60	11.63			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	8.99	0.11	3.00	24.53	35.87			N/A	N/A
B-A	11.91	0.14	4.58	32.17	46.38			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	30.10	7.59	26.29	53.07	62.95			N/A	N/A
B-A	48.35	17.56	44.39	78.14	90.05			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	51.17	21.57	47.81	78.86	89.56			N/A	N/A
B-A	83.89	43.87	80.43	120.01	133.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	53.80	20.73	49.79	85.56	98.09			N/A	N/A
B-A	88.35	43.26	84.17	129.77	145.12			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	43.82	10.94	38.34	78.09	92.81			N/A	N/A
B-A	71.39	25.76	65.66	116.19	134.06			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2022 Do Something , PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	10.64	B

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	14	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	48	100.000
B		ONE HOUR	✓	509	100.000
C		ONE HOUR	✓	318	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	48
	B	403	0	106
	C	318	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.29	12.50	0.4	1.4	B	97	146
B-A	0.71	19.80	2.4	11.2	C	370	555
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						292	438
A-B						0	0
A-C						44	66

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ADDITIONAL INFORMATION  
REGISTRY

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	80	20	583	0.137	79	0.0	0.2	7.140	A
B-A	303	76	662	0.459	300	0.0	0.8	9.871	A
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	239	60			239				
A-B	0	0			0				
A-C	36	9			36				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	95	24	522	0.183	95	0.2	0.2	8.433	A
B-A	362	91	647	0.560	361	0.8	1.2	12.483	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	286	71			286				
A-B	0	0			0				
A-C	43	11			43				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	117	29	410	0.284	116	0.2	0.4	12.199	B
B-A	444	111	625	0.710	439	1.2	2.3	18.993	C
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	350	88			350				
A-B	0	0			0				
A-C	53	13			53				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	117	29	405	0.288	117	0.4	0.4	12.500	B
B-A	444	111	624	0.711	443	2.3	2.4	19.803	C
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	350	88			350				
A-B	0	0			0				
A-C	53	13			53				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	95	24	515	0.185	96	0.4	0.2	8.597	A
B-A	362	91	647	0.560	367	2.4	1.3	13.017	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	286	71			286				
A-B	0	0			0				
A-C	43	11			43				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	80	20	579	0.138	80	0.2	0.2	7.226	A
B-A	303	76	661	0.459	305	1.3	0.9	10.156	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	239	60			239				
A-B	0	0			0				
A-C	36	9			36				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.16	0.00	0.00	0.16	0.16			N/A	N/A
B-A	0.83	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.22	0.00	0.00	0.22	0.22			N/A	N/A
B-A	1.23	0.10	1.05	2.14	2.83			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.39	0.03	0.26	0.46	0.49			N/A	N/A
B-A	2.29	0.03	0.31	3.06	11.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.40	0.03	0.33	1.30	1.36			N/A	N/A
B-A	2.37	0.03	0.29	2.37	8.17			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.23	0.00	0.00	0.23	0.23			N/A	N/A
B-A	1.31	0.05	0.59	3.10	4.67			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.16	0.00	0.00	0.16	0.16			N/A	N/A
B-A	0.86	0.04	0.39	2.00	3.42			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2024 Do Nothing , AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	406.98	F

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-28	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2024 Do Nothing	AM	2024 Do Nothing AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	139	100.000
B		ONE HOUR	✓	879	100.000
C		ONE HOUR	✓	349	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	139
	B	569	0	310
	C	349	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0



## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.28	640.71	48.4	90.2	F	284	427
B-A	1.30	628.68	87.9	144.5	F	522	783
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						320	480
A-B						0	0
A-C						128	191

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	233	58	431	0.542	229	0.0	1.1	17.458	C
B-A	428	107	573	0.748	418	0.0	2.7	21.904	C
C-AB	0	0	665	0.000	0	0.0	0.0	0.000	A
C-A	263	66			263				
A-B	0	0			0				
A-C	105	26			105				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	279	70	275	1.014	249	1.1	8.5	95.840	F
B-A	512	128	507	1.009	475	2.7	11.8	73.841	F
C-AB	0	0	660	0.000	0	0.0	0.0	0.000	A
C-A	314	78			314				
A-B	0	0			0				
A-C	125	31			125				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	341	85	269	1.271	265	8.5	27.4	271.683	F
B-A	626	157	482	1.299	480	11.8	48.5	243.806	F
C-AB	0	0	654	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	153	38			153				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	341	85	266	1.282	265	27.4	46.4	518.847	F
B-A	626	157	484	1.294	484	48.5	84.2	501.930	F
C-AB	0	0	654	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	153	38			153				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	279	70	273	1.022	271	46.4	48.4	640.707	F
B-A	512	128	498	1.027	497	84.2	87.9	628.676	F
C-AB	0	0	660	0.000	0	0.0	0.0	0.000	A
C-A	314	78			314				
A-B	0	0			0				
A-C	125	31			125				

## 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	233	58	278	0.840	272	48.4	38.7	577.856	F
B-A	428	107	508	0.844	502	87.9	69.5	565.729	F
C-AB	0	0	665	0.000	0	0.0	0.0	0.000	A
C-A	263	66			263				
A-B	0	0			0				
A-C	105	26			105				

## Queue Variation Results for each time segment

## 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.13	0.03	0.27	1.13	1.13			N/A	N/A
B-A	2.69	0.03	0.31	3.69	13.22			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	8.47	0.12	3.09	22.75	32.87			N/A	N/A
B-A	11.84	0.16	4.93	31.42	44.73			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	27.43	6.68	23.83	48.66	57.85			N/A	N/A
B-A	48.49	18.21	44.70	77.59	89.13			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	46.40	18.83	43.14	72.37	82.51			N/A	N/A
B-A	84.18	44.40	80.76	119.93	132.92			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	48.38	17.53	44.41	78.26	90.20			N/A	N/A
B-A	87.87	42.93	83.69	129.18	144.51			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	38.67	8.40	33.19	70.89	85.06			N/A	N/A
B-A	69.50	24.40	63.69	113.97	131.80			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2024 Do Nothing, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	11.71	B

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	12	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D6	2024 Do Nothing	PM	2024 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	45	100.000
B		ONE HOUR	✓	518	100.000
C		ONE HOUR	✓	294	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	45
	B	418	0	100
	C	294	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.29	13.04	0.4	1.2	B	92	138
B-A	0.73	20.89	2.6	12.7	C	384	575
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						270	405
A-B						0	0
A-C						41	62

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	75	19	576	0.131	75	0.0	0.1	7.175	A
B-A	315	79	666	0.473	311	0.0	0.9	10.054	B
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	221	55			221				
A-B	0	0			0				
A-C	34	8			34				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	90	22	511	0.176	90	0.1	0.2	8.543	A
B-A	376	94	653	0.576	374	0.9	1.3	12.835	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	264	66			264				
A-B	0	0			0				
A-C	40	10			40				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	110	28	393	0.280	109	0.2	0.4	12.672	B
B-A	460	115	632	0.729	456	1.3	2.5	19.909	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	324	81			324				
A-B	0	0			0				
A-C	50	12			50				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	110	28	386	0.285	110	0.4	0.4	13.039	B
B-A	460	115	631	0.729	460	2.5	2.6	20.887	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	324	81			324				
A-B	0	0			0				
A-C	50	12			50				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	90	22	504	0.179	91	0.4	0.2	8.731	A
B-A	376	94	652	0.576	380	2.6	1.4	13.464	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	264	66			264				
A-B	0	0			0				
A-C	40	10			40				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	75	19	571	0.132	76	0.2	0.2	7.267	A
B-A	315	79	666	0.473	317	1.4	0.9	10.372	B
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	221	55			221				
A-B	0	0			0				
A-C	34	8			34				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.15	0.00	0.00	0.15	0.15			N/A	N/A
B-A	0.88	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.21	0.00	0.00	0.21	0.21			N/A	N/A
B-A	1.32	0.09	1.07	2.46	3.20			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.38	0.03	0.26	0.46	0.49			N/A	N/A
B-A	2.49	0.03	0.31	3.96	12.71			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.39	0.03	0.33	1.25	1.25			N/A	N/A
B-A	2.58	0.03	0.29	2.58	9.50			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.22	0.00	0.00	0.22	0.22			N/A	N/A
B-A	1.40	0.05	0.51	3.47	5.27			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.15	0.00	0.00	0.15	0.15			N/A	N/A
B-A	0.92	0.04	0.38	2.22	3.81			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2024 Do Something , PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	12.79	B

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	4	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	50	100.000
B		ONE HOUR	✓	530	100.000
C		ONE HOUR	✓	485	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	50
	B	418	0	112
	C	485	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.37	17.11	0.6	2.4	C	103	154
B-A	0.79	28.01	3.4	17.3	D	384	575
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						445	668
A-B						0	0
A-C						46	69

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	84	21	564	0.150	84	0.0	0.2	7.483	A
B-A	315	79	637	0.494	311	0.0	1.0	10.910	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	365	91			365				
A-B	0	0			0				
A-C	38	9			38				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	101	25	488	0.206	100	0.2	0.3	9.269	A
B-A	376	94	618	0.608	374	1.0	1.5	14.612	B
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	436	109			436				
A-B	0	0			0				
A-C	45	11			45				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	123	31	345	0.357	122	0.3	0.5	16.079	C
B-A	460	115	587	0.784	453	1.5	3.2	25.682	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	534	133			534				
A-B	0	0			0				
A-C	55	14			55				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	123	31	333	0.370	123	0.5	0.6	17.108	C
B-A	460	115	586	0.785	459	3.2	3.4	28.009	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	534	133			534				
A-B	0	0			0				
A-C	55	14			55				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	101	25	477	0.211	102	0.6	0.3	9.634	A
B-A	376	94	617	0.609	383	3.4	1.6	15.814	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	436	109			436				
A-B	0	0			0				
A-C	45	11			45				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	84	21	558	0.151	85	0.3	0.2	7.606	A
B-A	315	79	637	0.494	317	1.6	1.0	11.344	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	365	91			365				
A-B	0	0			0				
A-C	38	9			38				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.17	0.00	0.00	0.17	0.17			N/A	N/A
B-A	0.95	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.26	0.00	0.00	0.26	0.26			N/A	N/A
B-A	1.49	0.08	1.10	2.99	4.08			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.54	0.03	0.26	0.54	0.54			N/A	N/A
B-A	3.23	0.04	0.36	7.67	17.28			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.57	0.03	0.33	1.24	2.41			N/A	N/A
B-A	3.42	0.03	0.31	4.08	16.24			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.27	0.00	0.00	0.27	0.27			N/A	N/A
B-A	1.62	0.04	0.45	4.28	6.98			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.18	0.00	0.00	0.18	0.18			N/A	N/A
B-A	1.00	0.03	0.35	2.42	4.74			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A



# 2027 Do Nothing, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	14.36	B

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	6	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2027 Do Nothing	PM	2027 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	48	100.000
B		ONE HOUR	✓	546	100.000
C		ONE HOUR	✓	309	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	48
	B	441	0	105
	C	309	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.34	16.11	0.5	1.9	C	96	145
B-A	0.78	25.57	3.3	16.9	D	405	607
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						284	425
A-B						0	0
A-C						44	66

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	79	20	560	0.141	78	0.0	0.2	7.469	A
B-A	332	83	662	0.501	328	0.0	1.0	10.648	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	233	58			233				
A-B	0	0			0				
A-C	36	9			36				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	485	0.194	94	0.2	0.2	9.186	A
B-A	396	99	648	0.612	394	1.0	1.5	14.063	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	278	69			278				
A-B	0	0			0				
A-C	43	11			43				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	116	29	349	0.331	115	0.2	0.5	15.296	C
B-A	486	121	625	0.777	479	1.5	3.1	23.705	C
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	340	85			340				
A-B	0	0			0				
A-C	53	13			53				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	116	29	339	0.341	116	0.5	0.5	16.107	C
B-A	486	121	624	0.778	485	3.1	3.3	25.565	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	340	85			340				
A-B	0	0			0				
A-C	53	13			53				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	475	0.199	95	0.5	0.3	9.516	A
B-A	396	99	647	0.612	403	3.3	1.6	15.103	C
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	278	69			278				
A-B	0	0			0				
A-C	43	11			43				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	79	20	554	0.143	79	0.3	0.2	7.590	A
B-A	332	83	662	0.501	334	1.6	1.0	11.065	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	233	58			233				
A-B	0	0			0				
A-C	36	9			36				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.16	0.00	0.00	0.16	0.16			N/A	N/A
B-A	0.98	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.24	0.00	0.00	0.24	0.24			N/A	N/A
B-A	1.52	0.09	1.11	3.07	4.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.48	0.03	0.26	0.48	0.49			N/A	N/A
B-A	3.14	0.03	0.35	7.02	16.90			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.51	0.03	0.33	1.49	1.93			N/A	N/A
B-A	3.30	0.03	0.30	3.30	14.87			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.25	0.00	0.00	0.25	0.25			N/A	N/A
B-A	1.64	0.05	0.46	4.32	6.97			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.17	0.00	0.00	0.17	0.17			N/A	N/A
B-A	1.03	0.04	0.36	2.55	4.81			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2027 Do Something, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	15.96	C

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	1	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D9	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	49	100.000
B		ONE HOUR	✓	550	100.000
C		ONE HOUR	✓	467	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	49
	B	441	0	109
	C	467	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.41	21.16	0.7	3.0	C	100	150
B-A	0.82	33.34	4.2	22.3	D	405	607
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						429	643
A-B						0	0
A-C						45	67

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	82	21	550	0.149	81	0.0	0.2	7.675	A
B-A	332	83	640	0.519	328	0.0	1.1	11.391	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	352	88			352				
A-B	0	0			0				
A-C	37	9			37				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	98	24	465	0.211	98	0.2	0.3	9.775	A
B-A	396	99	621	0.639	394	1.1	1.7	15.683	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	420	105			420				
A-B	0	0			0				
A-C	44	11			44				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	120	30	306	0.393	119	0.3	0.6	19.111	C
B-A	486	121	590	0.822	477	1.7	3.9	29.508	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	514	129			514				
A-B	0	0			0				
A-C	54	13			54				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	120	30	290	0.415	120	0.6	0.7	21.160	C
B-A	486	121	589	0.824	484	3.9	4.2	33.341	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	514	129			514				
A-B	0	0			0				
A-C	54	13			54				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	98	24	449	0.218	100	0.7	0.3	10.343	B
B-A	396	99	620	0.640	406	4.2	1.9	17.509	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	420	105			420				
A-B	0	0			0				
A-C	44	11			44				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	82	21	543	0.151	82	0.3	0.2	7.828	A
B-A	332	83	640	0.519	335	1.9	1.1	11.935	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	352	88			352				
A-B	0	0			0				
A-C	37	9			37				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.17	0.00	0.00	0.17	0.17			N/A	N/A
B-A	1.05	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.26	0.00	0.00	0.26	0.26			N/A	N/A
B-A	1.69	0.08	1.13	3.69	5.03			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.63	0.03	0.26	0.63	0.63			N/A	N/A
B-A	3.93	0.04	0.40	10.61	20.74			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.69	0.03	0.34	1.59	2.95			N/A	N/A
B-A	4.25	0.03	0.33	7.52	22.34			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.28	0.03	0.25	0.45	0.48			N/A	N/A
B-A	1.86	0.04	0.43	4.99	8.58			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.18	0.03	0.25	0.45	0.48			N/A	N/A
B-A	1.11	0.03	0.34	2.57	5.54			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2032 Do Nothing, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	17.28	C

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	2	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D10	2032 Do Nothing	PM	2032 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	51	100.000
B		ONE HOUR	✓	526	100.000
C		ONE HOUR	✓	330	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	51
	B	472	0	54
	C	330	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.23	18.14	0.3	1.2	C	50	74
B-A	0.82	31.13	4.3	21.9	D	433	650
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						303	454
A-B						0	0
A-C						47	70

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	41	10	534	0.076	40	0.0	0.1	7.294	A
B-A	355	89	662	0.537	351	0.0	1.1	11.410	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	248	62			248				
A-B	0	0			0				
A-C	38	10			38				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	49	12	442	0.110	48	0.1	0.1	9.133	A
B-A	424	106	650	0.653	422	1.1	1.8	15.587	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	297	74			297				
A-B	0	0			0				
A-C	46	11			46				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	59	15	274	0.217	59	0.1	0.3	16.723	C
B-A	520	130	632	0.823	511	1.8	4.0	27.937	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	363	91			363				
A-B	0	0			0				
A-C	56	14			56				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	59	15	258	0.231	59	0.3	0.3	18.141	C
B-A	520	130	631	0.823	519	4.0	4.3	31.127	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	363	91			363				
A-B	0	0			0				
A-C	56	14			56				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	49	12	426	0.114	49	0.3	0.1	9.574	A
B-A	424	106	650	0.653	433	4.3	2.0	17.295	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	297	74			297				
A-B	0	0			0				
A-C	46	11			46				



## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	41	10	526	0.077	41	0.1	0.1	7.425	A
B-A	355	89	662	0.537	358	2.0	1.2	11.979	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	248	62			248				
A-B	0	0			0				
A-C	38	10			38				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.08	0.00	0.00	0.08	0.08			N/A	N/A
B-A	1.13	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.12	0.00	0.00	0.12	0.12			N/A	N/A
B-A	1.80	0.08	1.18	3.94	5.49			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.27	0.03	0.26	0.47	0.50			N/A	N/A
B-A	3.97	0.04	0.40	10.57	21.14			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.29	0.03	0.30	0.90	1.20			N/A	N/A
B-A	4.26	0.03	0.32	6.83	21.88			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.13	0.00	0.00	0.13	0.13			N/A	N/A
B-A	1.97	0.04	0.43	5.36	9.14			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.08	0.00	0.00	0.08	0.08			N/A	N/A
B-A	1.19	0.03	0.34	2.82	5.94			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2032 Do Something , PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	27.20	D

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-6	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D11	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	53	100.000
B		ONE HOUR	✓	589	100.000
C		ONE HOUR	✓	488	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	53
	B	472	0	117
	C	488	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.65	49.22	1.7	7.6	E	107	161
B-A	0.90	52.92	7.1	37.3	F	433	650
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						448	672
A-B						0	0
A-C						49	73

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	88	22	525	0.168	87	0.0	0.2	8.218	A
B-A	355	89	635	0.560	350	0.0	1.2	12.458	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	367	92			367				
A-B	0	0			0				
A-C	40	10			40				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	105	26	424	0.248	105	0.2	0.3	11.269	B
B-A	424	106	614	0.692	421	1.2	2.1	18.328	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	439	110			439				
A-B	0	0			0				
A-C	48	12			48				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	129	32	230	0.561	125	0.3	1.2	33.559	D
B-A	520	130	579	0.898	504	2.1	6.1	41.180	E
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	537	134			537				
A-B	0	0			0				
A-C	58	15			58				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	129	32	198	0.651	127	1.2	1.7	49.225	E
B-A	520	130	576	0.902	515	6.1	7.1	52.922	F
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	537	134			537				
A-B	0	0			0				
A-C	58	15			58				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	105	26	390	0.270	110	1.7	0.4	13.097	B
B-A	424	106	611	0.694	443	7.1	2.4	23.406	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	439	110			439				
A-B	0	0			0				
A-C	48	12			48				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	88	22	514	0.171	89	0.4	0.2	8.469	A
B-A	355	89	634	0.560	360	2.4	1.3	13.317	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	367	92			367				
A-B	0	0			0				
A-C	40	10			40				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.20	0.00	0.00	0.20	0.20			N/A	N/A
B-A	1.23	0.56	1.07	1.23	1.62			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.33	0.00	0.00	0.33	0.33			N/A	N/A
B-A	2.11	0.08	1.21	4.96	7.01			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.18	0.03	0.28	1.18	4.43			N/A	N/A
B-A	6.06	0.06	1.33	17.34	27.52			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.66	0.04	0.42	4.43	7.55			N/A	N/A
B-A	7.10	0.05	0.45	19.89	37.34			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.38	0.03	0.33	1.10	1.31			N/A	N/A
B-A	2.43	0.04	0.41	6.60	12.10			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.21	0.03	0.28	0.50	1.00			N/A	N/A
B-A	1.31	0.03	0.32	2.48	6.75			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2042 Do Nothing, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	40.60	E

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-7	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D12	2042 Do Nothing	PM	2042 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	55	100.000
B		ONE HOUR	✓	626	100.000
C		ONE HOUR	✓	352	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	55
	B	505	0	121
	C	352	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.81	87.49	3.0	11.9	F	111	167
B-A	0.93	62.08	9.0	44.0	F	463	695
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						323	485
A-B						0	0
A-C						50	76

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	91	23	509	0.179	90	0.0	0.2	8.572	A
B-A	380	95	652	0.583	375	0.0	1.4	12.748	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	265	66			265				
A-B	0	0			0				
A-C	41	10			41				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	109	27	403	0.270	108	0.2	0.4	12.194	B
B-A	454	113	634	0.716	450	1.4	2.4	19.168	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	316	79			316				
A-B	0	0			0				
A-C	49	12			49				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	133	33	203	0.656	128	0.4	1.7	45.397	E
B-A	556	139	602	0.924	536	2.4	7.3	45.317	E
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	388	97			388				
A-B	0	0			0				
A-C	61	15			61				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	133	33	164	0.813	128	1.7	3.0	87.487	F
B-A	556	139	598	0.930	549	7.3	9.0	62.078	F
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	388	97			388				
A-B	0	0			0				
A-C	61	15			61				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	109	27	359	0.303	119	3.0	0.4	15.646	C
B-A	454	113	629	0.722	479	9.0	2.8	27.048	D
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	316	79			316				
A-B	0	0			0				
A-C	49	12			49				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	91	23	497	0.183	92	0.4	0.2	8.898	A
B-A	380	95	652	0.584	386	2.8	1.4	13.802	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	265	66			265				
A-B	0	0			0				
A-C	41	10			41				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.22	0.00	0.00	0.22	0.22			N/A	N/A
B-A	1.35	0.57	1.22	1.67	1.84			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.36	0.03	0.28	0.61	1.05			N/A	N/A
B-A	2.36	0.08	1.27	5.72	8.11			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.66	0.03	0.32	3.17	8.66			N/A	N/A
B-A	7.26	0.08	1.81	20.27	30.58			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	3.04	0.07	1.20	8.00	11.93			N/A	N/A
B-A	8.95	0.06	1.14	26.12	44.00			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.45	0.04	0.37	1.28	1.46			N/A	N/A
B-A	2.81	0.04	0.41	7.68	14.15			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.23	0.03	0.29	0.82	1.25			N/A	N/A
B-A	1.45	0.03	0.31	2.57	7.43			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2024 Do Something , AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	510.08	F

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-31	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D13	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	156	100.000
B		ONE HOUR	✓	919	100.000
C		ONE HOUR	✓	386	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	156
	B	569	0	350
	C	386	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0



## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.36	816.41	68.3	122.2	F	321	482
B-A	1.37	807.52	110.5	178.4	F	522	783
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						354	531
A-B						0	0
A-C						143	215

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	263	66	417	0.631	257	0.0	1.6	21.673	C
B-A	428	107	544	0.787	415	0.0	3.2	25.872	D
C-AB	0	0	662	0.000	0	0.0	0.0	0.000	A
C-A	291	73			291				
A-B	0	0			0				
A-C	117	29			117				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	315	79	294	1.068	275	1.6	11.5	112.191	F
B-A	512	128	481	1.063	460	3.2	16.0	95.906	F
C-AB	0	0	657	0.000	0	0.0	0.0	0.000	A
C-A	347	87			347				
A-B	0	0			0				
A-C	140	35			140				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	385	96	286	1.350	284	11.5	36.9	332.224	F
B-A	626	157	457	1.370	456	16.0	58.7	311.574	F
C-AB	0	0	649	0.000	0	0.0	0.0	0.000	A
C-A	425	106			425				
A-B	0	0			0				
A-C	172	43			172				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	385	96	284	1.358	283	36.9	62.4	642.976	F
B-A	626	157	459	1.366	458	58.7	100.7	630.716	F
C-AB	0	0	649	0.000	0	0.0	0.0	0.000	A
C-A	425	106			425				
A-B	0	0			0				
A-C	172	43			172				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	315	79	292	1.078	291	62.4	68.3	816.412	F
B-A	512	128	473	1.082	472	100.7	110.5	807.525	F
C-AB	0	0	657	0.000	0	0.0	0.0	0.000	A
C-A	347	87			347				
A-B	0	0			0				
A-C	140	35			140				

## 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	263	66	298	0.885	293	68.3	60.8	792.715	F
B-A	428	107	483	0.887	479	110.5	97.9	784.588	F
C-AB	0	0	662	0.000	0	0.0	0.0	0.000	A
C-A	291	73			291				
A-B	0	0			0				
A-C	117	29			117				

## Queue Variation Results for each time segment

## 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.60	0.03	0.26	1.60	1.60			N/A	N/A
B-A	3.23	0.03	0.28	3.23	6.79			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	11.47	0.08	2.11	33.19	51.98			N/A	N/A
B-A	16.01	0.11	4.60	45.34	68.04			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	36.87	7.27	31.23	68.88	83.19			N/A	N/A
B-A	58.67	18.32	52.94	99.30	116.00			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	62.37	25.04	58.03	97.96	111.82			N/A	N/A
B-A	100.70	51.09	96.33	145.99	162.61			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	68.25	27.59	63.59	107.07	122.15			N/A	N/A
B-A	110.47	56.18	105.75	160.15	178.36			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	60.78	19.36	55.00	102.34	119.36			N/A	N/A
B-A	97.93	41.90	92.00	151.27	171.69			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

# 2042 Do Something, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	59.57	F

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-11	Stream B-A

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D14	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	56	100.000
B		ONE HOUR	✓	630	100.000
C		ONE HOUR	✓	510	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	56
	B	505	0	125
	C	510	0	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.99	170.56	6.3	23.0	F	115	172
B-A	0.99	98.87	14.9	54.5	F	463	695
C-AB	0.00	0.00	0.0	-1	A	0	0
C-A						468	702
A-B						0	0
A-C						51	77

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	495	0.190	93	0.0	0.2	8.934	A
B-A	380	95	629	0.604	374	0.0	1.5	13.817	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	42	11			42				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	112	28	374	0.300	112	0.2	0.4	13.683	B
B-A	454	113	606	0.749	449	1.5	2.7	22.209	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	458	115			458				
A-B	0	0			0				
A-C	50	13			50				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	138	34	139	0.989	118	0.4	5.3	124.220	F
B-A	556	139	566	0.982	525	2.7	10.5	61.886	F
C-AB	0	0	675	0.000	0	0.0	0.0	0.000	A
C-A	562	140			562				
A-B	0	0			0				
A-C	62	15			62				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	138	34	149	0.925	134	5.3	6.3	170.558	F
B-A	556	139	561	0.992	538	10.5	14.9	98.871	F
C-AB	0	0	675	0.000	0	0.0	0.0	0.000	A
C-A	562	140			562				
A-B	0	0			0				
A-C	62	15			62				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	112	28	285	0.395	135	6.3	0.7	27.327	D
B-A	454	113	595	0.763	499	14.9	3.7	47.382	E
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	458	115			458				
A-B	0	0			0				
A-C	50	13			50				

## 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	478	0.197	96	0.7	0.2	9.456	A
B-A	380	95	629	0.605	389	3.7	1.6	15.480	C
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	42	11			42				

## Queue Variation Results for each time segment

## 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.23	0.00	0.00	0.23	0.23			N/A	N/A
B-A	1.47	0.58	1.37	1.84	1.97			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.42	0.03	0.34	1.30	1.30			N/A	N/A
B-A	2.73	0.08	1.38	6.77	9.67			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	5.26	0.17	2.72	12.50	16.94			N/A	N/A
B-A	10.50	0.25	5.67	25.81	35.12			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	6.25	0.12	2.51	16.22	23.03			N/A	N/A
B-A	14.92	0.21	6.98	38.87	54.46			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.68	0.03	0.32	1.44	3.19			N/A	N/A
B-A	3.67	0.04	0.44	10.30	18.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

## 17:30 - 17:45

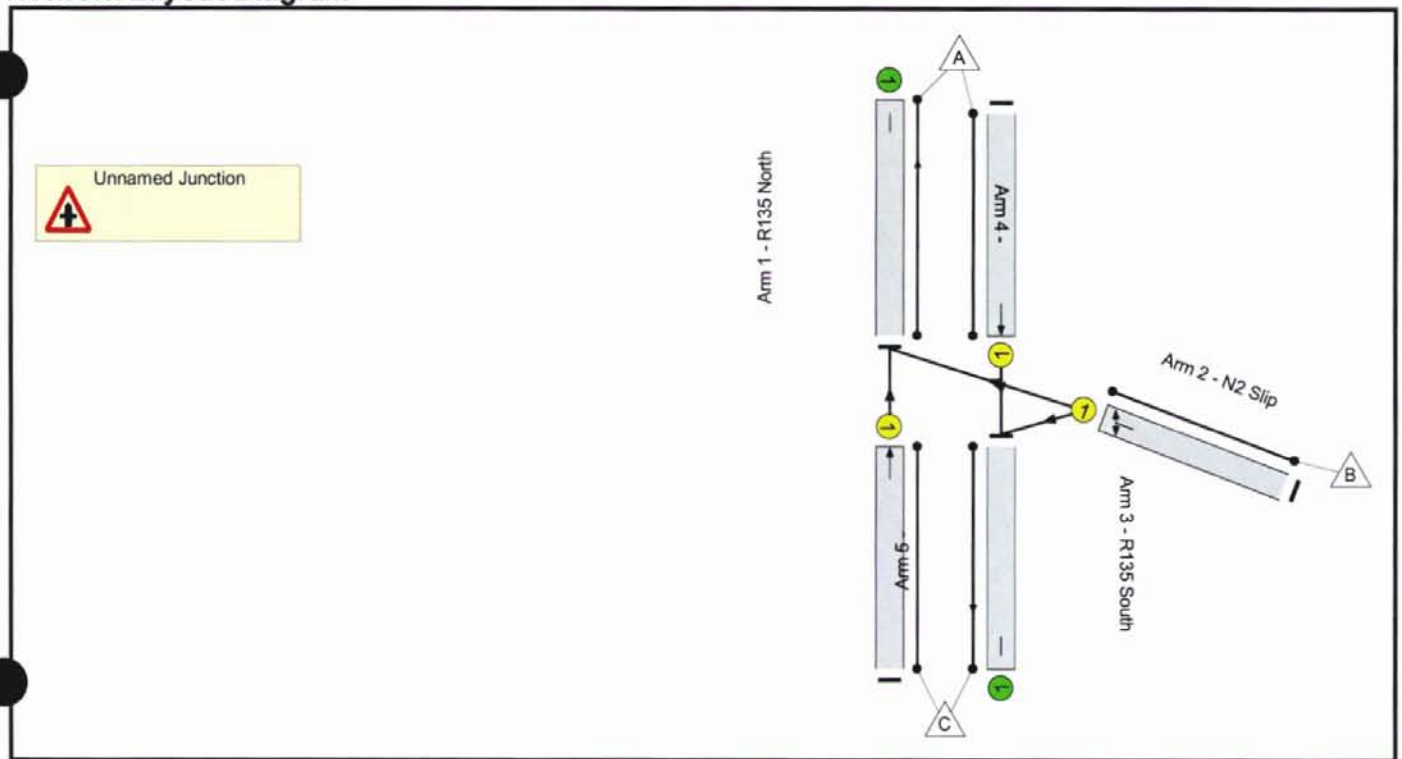
Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.25	0.03	0.26	0.47	0.50			N/A	N/A
B-A	1.59	0.03	0.30	2.12	7.74			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

Full Input Data And Results  
Full Input Data And Results

User and Project Details

Project:	
Title:	
Location:	
File name:	119216 LinSig R135-N2 Slip.lsg3x
Author:	
Company:	
Address:	
Notes:	

Network Layout Diagram

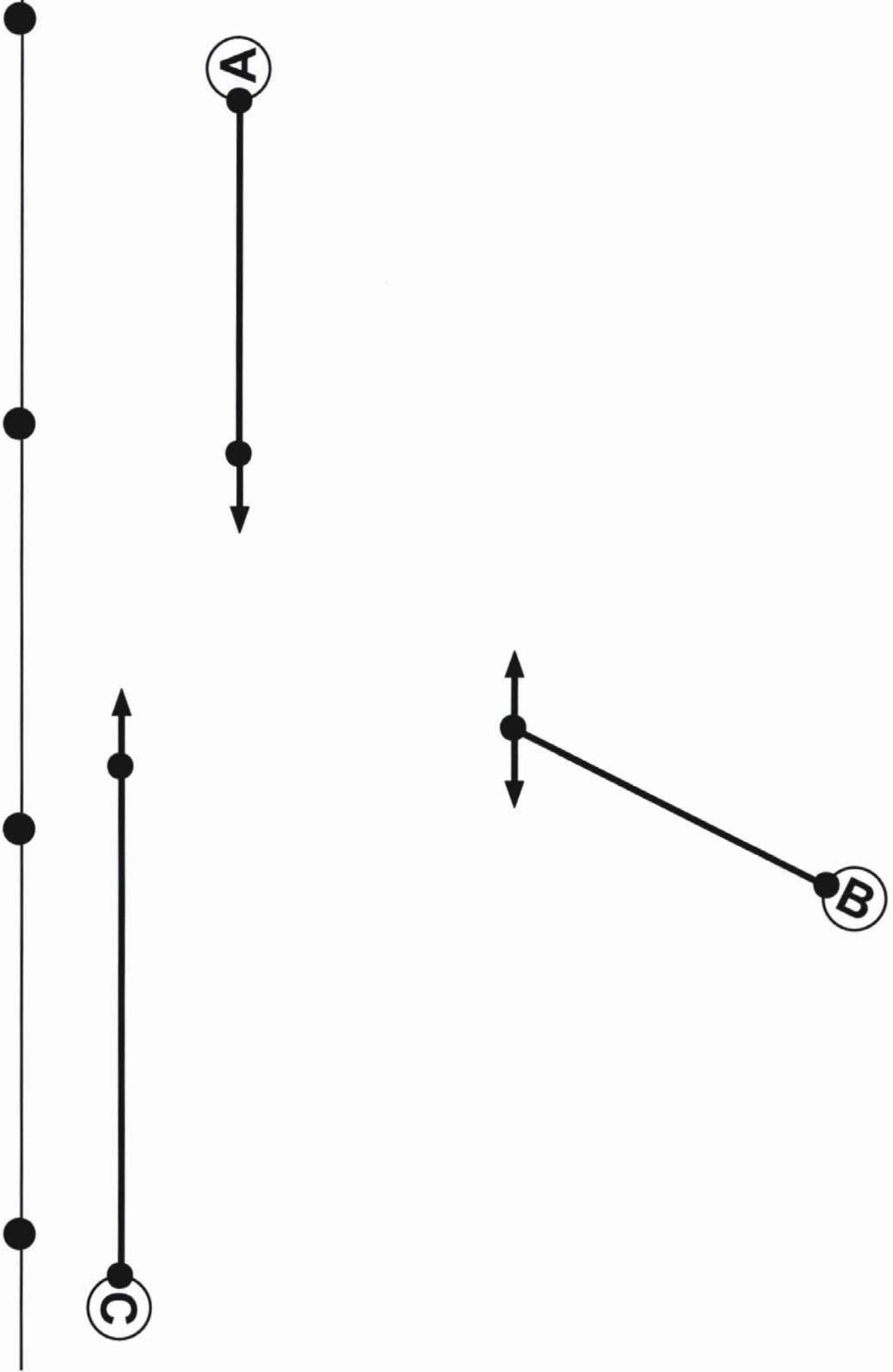


Full Input Data And Results

**Phase Diagram**



Full Input Data And Results





Full Input Data And Results

Phase Input Data

Phase Name	Phase type	Assoc Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7

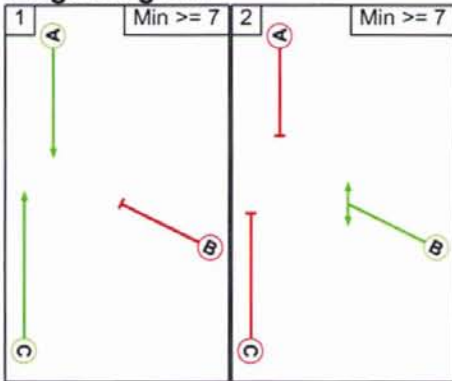
Phase Intergreens Matrix

		Starting Phase		
		A	B	C
Terminating Phase	A		5	-
	B	5		5
	C	-	5	

Phases in Stage

Stage No.	Phases in Stage
1	A C
2	B

Stage Diagram



Lane Input Data

Junction: Unnamed Junction												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (R135 North)	U	A	2	3	60.0	Geom	-	3.60	0.00	Y	Arm 5 Ahead	Inf
2/1 (N2 Slip)	U	B	2	3	60.0	Geom	-	3.90	0.00	Y	Arm 4 Right	13.00
											Arm 5 Left	12.00
3/1 (R135 South)	U	C	2	3	60.0	Geom	-	3.60	0.00	Y	Arm 4 Ahead	Inf
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1	U		2	3	60.0	Inf	-	-	-	-	-	-

Full Input Data And Results

**Traffic Flow Groups**

Flow Group	Start Time	End Time	Duration	Formula
1: '2042 Do Something AM'	08:00	09:00	01:00	
2: '2042 Do Something PM'	16:30	17:30	01:00	

**Traffic Flows, Desired**

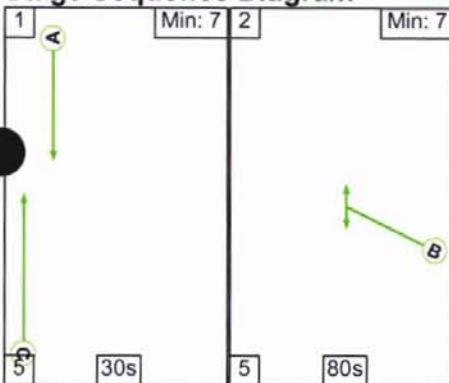
**Scenario 1: Scenario 1** (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')  
**Desired Flow :**

	Destination				Tot.
	A	B	C	Tot.	
Origin	A	0	0	56	56
	B	505	0	125	630
	C	510	0	0	510
	Tot.	1015	0	181	1196

**Scenario 2: Scenario 2** (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')  
**Desired Flow :**

	Destination				Tot.
	A	B	C	Tot.	
Origin	A	0	0	56	56
	B	505	0	125	630
	C	510	0	0	510
	Tot.	1015	0	181	1196

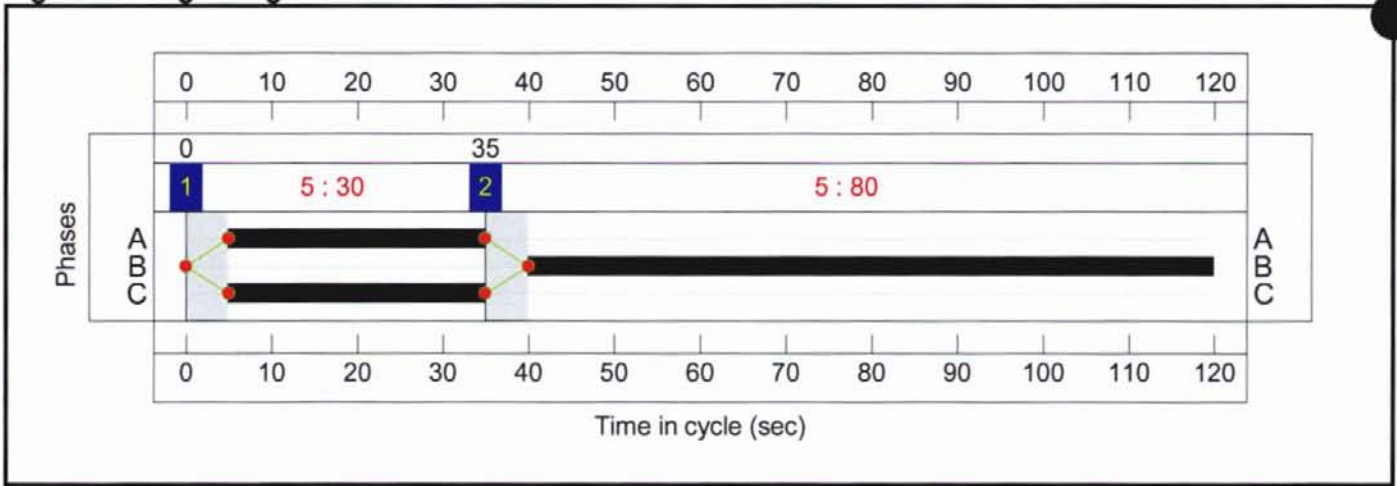
**Scenario 1: Scenario 1** (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')  
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2
Duration	30	80
Change Point	0	35

### Signal Timings Diagram



Full Input Data And Results

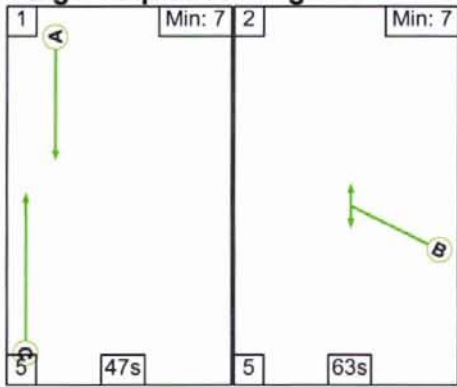
**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	87.4
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	87.4
1/1	R135 North Ahead	U	N/A	N/A	A		1	30	-	171	1975	510	33.5%
2/1	N2 Slip Right Left	U	N/A	N/A	B		1	80	-	1057	1792	1210	87.4%
3/1	R135 South Ahead	U	N/A	N/A	C		1	30	-	433	1975	510	84.9%
4/1		U	N/A	N/A	-		-	-	-	1107	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	554	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	11.3	6.2	0.0	17.5	-	-	-	-
Unnamed Junction	-	-	0	0	0	11.3	6.2	0.0	17.5	-	-	-	-
1/1	171	171	-	-	-	1.7	0.3	-	2.0	41.4	4.6	0.3	4.9
2/1	1057	1057	-	-	-	4.5	3.3	-	7.9	26.8	27.9	3.3	31.2
3/1	433	433	-	-	-	5.1	2.6	-	7.7	64.1	13.6	2.6	16.2
4/1	1107	1107	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	554	554	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		3.0	Total Delay for Signalled Lanes (pcuHr):		17.53					
			PRC Over All Lanes (%):		3.0	Total Delay Over All Lanes(pcuHr):		17.53	Cycle Time (s): 120				

Full Input Data And Results

Scenario 2: Scenario 2 (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

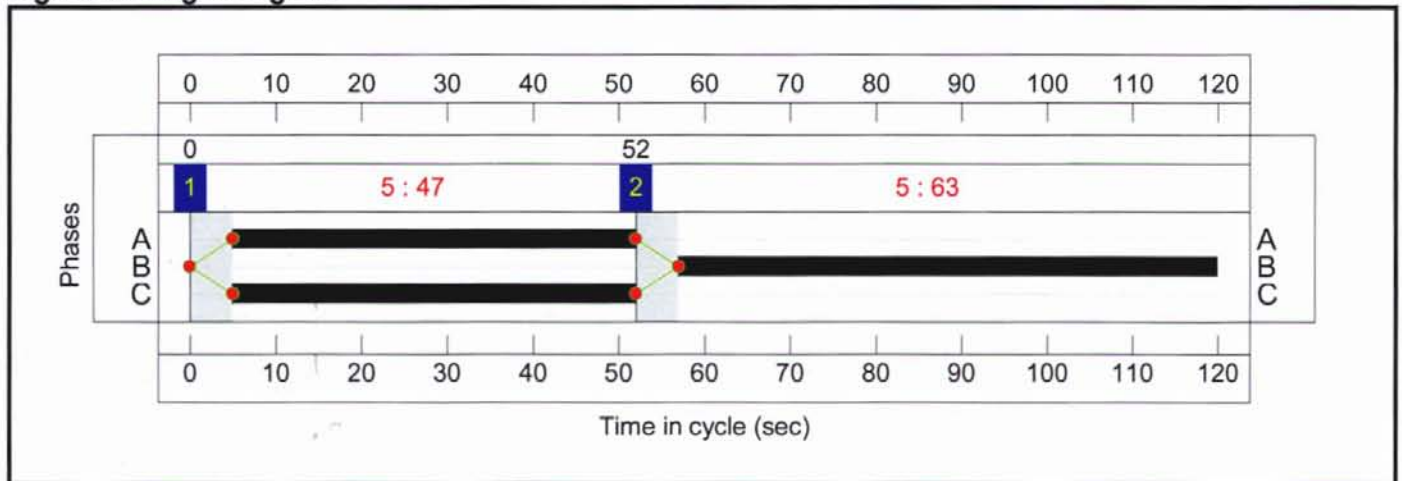
Stage Sequence Diagram



Stage Timings

Stage	1	2
Duration	47	63
Change Point	0	52

Signal Timings Diagram



**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	65.8
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	65.8
1/1	R135 North Ahead	U	N/A	N/A	A		1	47	-	56	1975	790	7.1%
2/1	N2 Slip Right Left	U	N/A	N/A	B		1	63	-	630	1795	957	65.8%
3/1	R135 South Ahead	U	N/A	N/A	C		1	47	-	510	1975	790	64.6%
4/1		U	N/A	N/A	-		-	-	-	1015	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	181	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	8.0	1.9	0.0	9.9	-	-	-	-
Unnamed Junction	-	-	0	0	0	8.0	1.9	0.0	9.9	-	-	-	-
1/1	56	56	-	-	-	0.3	0.0	-	0.4	24.7	1.2	0.0	1.2
2/1	630	630	-	-	-	3.5	1.0	-	4.5	25.6	15.1	1.0	16.0
3/1	510	510	-	-	-	4.1	0.9	-	5.0	35.5	13.7	0.9	14.6
4/1	1015	1015	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	181	181	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		36.8	Total Delay for Signalled Lanes (pcuHr):		9.89					
			PRC Over All Lanes (%):		36.8	Total Delay Over All Lanes(pcuHr):		9.89	Cycle Time (s): 120				

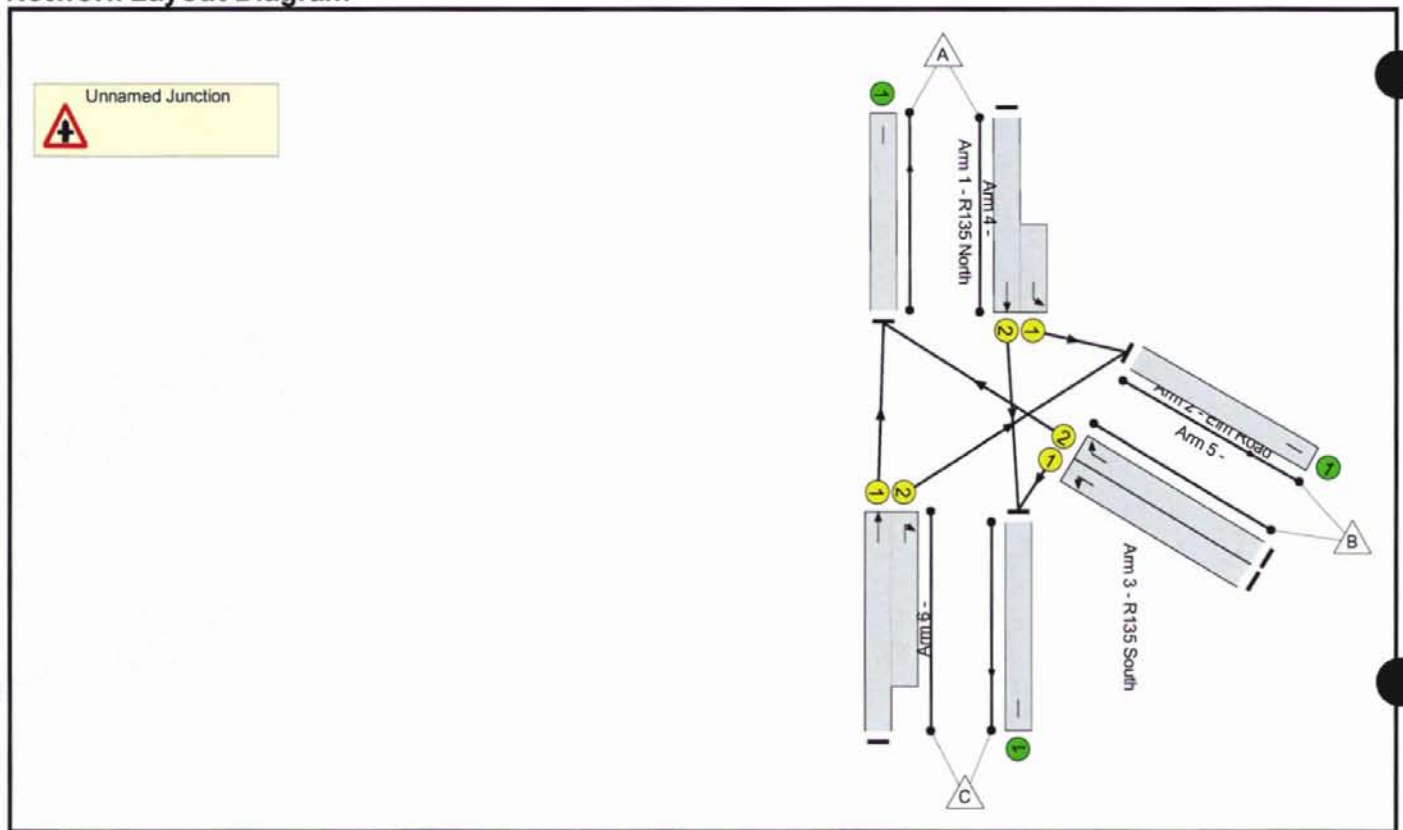
ADDITIONAL INFORMATION  
 11 FEB 2022  
 FINGAL COUNTY COUNCIL  
 PLANNING DEPARTMENT  
 REGISTRY

Full Input Data And Results  
Full Input Data And Results

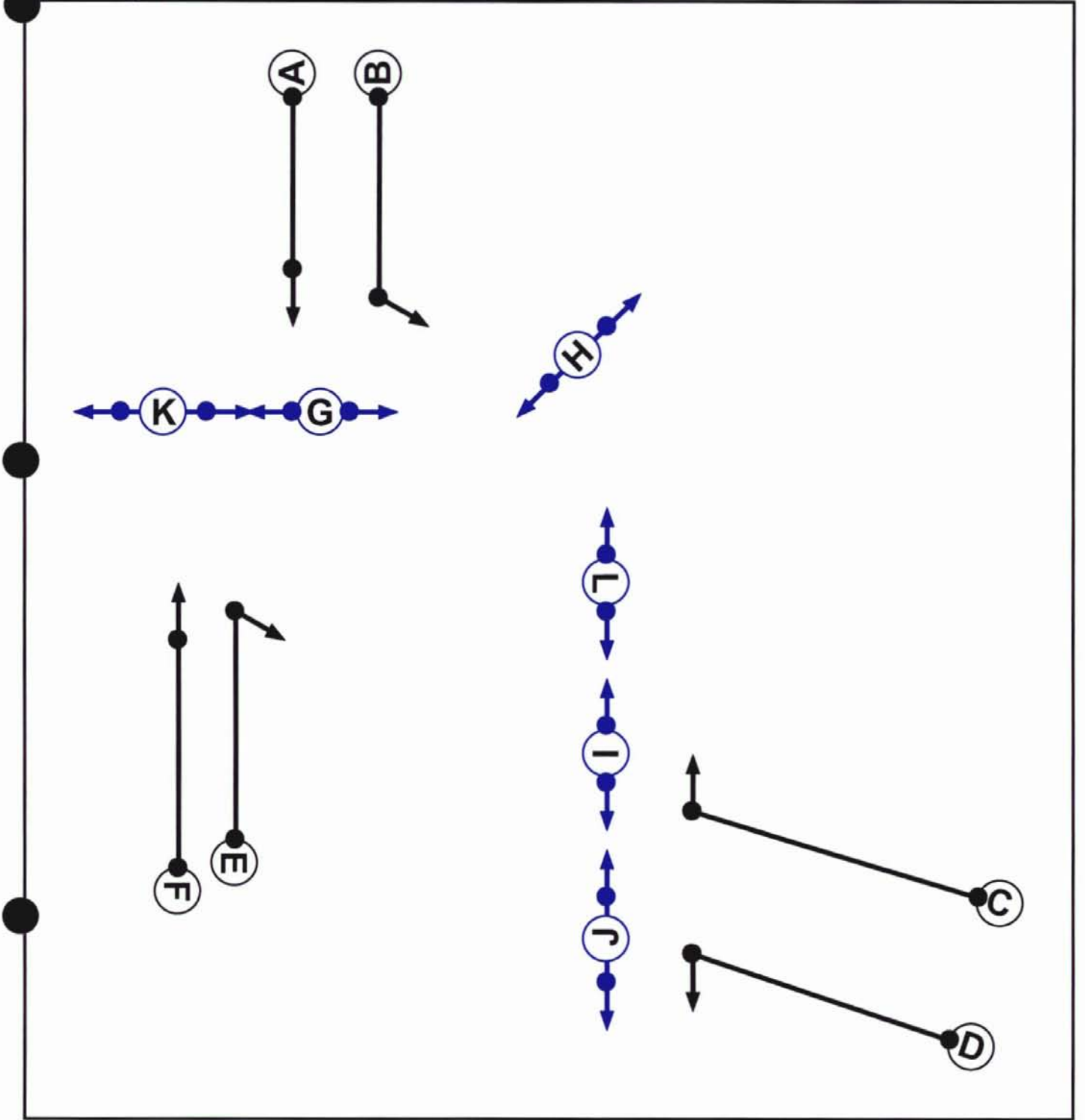
User and Project Details

Project:	
Title:	
Location:	
File name:	119216 Linsig R135-Elm Road DF 2022.lsg3x
Author:	
Company:	
Address:	
Notes:	

Network Layout Diagram



Phase Diagram





Full Input Data And Results

**Phase Input Data**

Phase Name	Phase type	Assoc Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Traffic		7	7
F	Traffic		7	7
G	Pedestrian		7	7
H	Pedestrian		7	7
I	Pedestrian		7	7
J	Pedestrian		7	7
K	Pedestrian		7	7
L	Pedestrian		7	7

**Phase Intergreens Matrix**

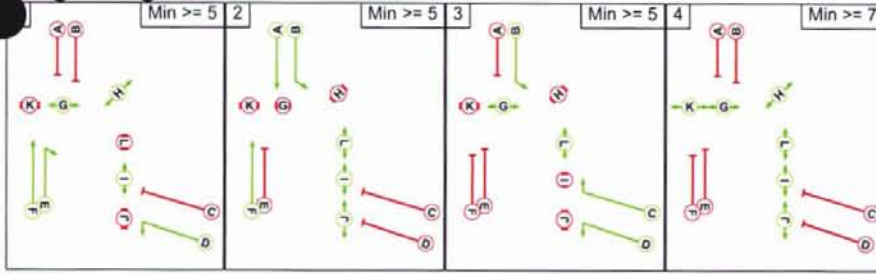
		Starting Phase											
		A	B	C	D	E	F	G	H	I	J	K	L
Terminating Phase	A	-	5	-	5	-	5	-	-	-	-	-	-
	B	-	-	-	5	-	-	5	-	-	-	-	-
	C	5	-	-	5	5	-	-	5	-	8	-	-
	D	-	-	-	-	-	-	-	-	5	-	-	-
	E	5	6	5	-	-	-	-	-	-	-	-	7
	F	-	-	5	-	-	-	-	-	-	8	-	-
	G	5	-	-	-	-	-	-	-	-	-	-	-
	H	-	6	-	-	-	-	-	-	-	-	-	-
	I	-	-	5	-	-	-	-	-	-	-	-	-
	J	-	-	-	7	-	-	-	-	-	-	-	-
	K	-	-	5	-	-	5	-	-	-	-	-	-
	L	-	-	-	-	5	-	-	-	-	-	-	-

**Phases in Stage**

Stage No.	Phases in Stage
1	DEFGHI
2	ABFIJL
3	BCDGL
4	GHIJKL

Full Input Data And Results

Stage Diagram



Lane Input Data

Junction: Unnamed Junction												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (R135 North)	U	B	2	3	5.0	Geom	-	4.20	0.00	Y	Arm 5 Left	90.00
1/2 (R135 North)	U	A	2	3	60.0	Geom	-	3.70	0.00	Y	Arm 6 Ahead	Inf
2/1 (Elm Road)	U	D	2	3	60.0	Geom	-	3.70	0.00	Y	Arm 6 Left	12.00
2/2 (Elm Road)	U	C	2	3	60.0	Geom	-	3.70	0.00	Y	Arm 4 Right	17.00
3/1 (R135 South)	U	F	2	3	60.0	Geom	-	4.00	0.00	Y	Arm 4 Ahead	Inf
3/2 (R135 South)	U	E	2	3	27.1	Geom	-	3.40	0.00	Y	Arm 5 Right	14.00
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1	U		2	3	60.0	Inf	-	-	-	-	-	-
6/1	U		2	3	60.0	Inf	-	-	-	-	-	-

Full Input Data And Results

**Traffic Flow Groups**

Flow Group	Start Time	End Time	Duration	Formula
1: '2022 Do Nothing AM'	08:00	09:00	01:00	
2: '2022 Do Nothing PM'	16:30	17:30	01:00	
3: '2022 Do Something AM'	08:00	09:00	01:00	
4: '2022 Do Something PM'	16:30	17:30	01:00	
5: '2024 Do Nothing AM'	08:00	09:00	01:00	
6: '2024 Do Nothing PM'	16:30	17:30	01:00	
7: '2024 Do Something AM'	08:00	09:00	01:00	
8: '2024 Do Something PM'	16:30	17:30	01:00	
9: '2027 Do Nothing PM'	16:30	17:30	01:00	
10: '2027 Do Something PM'	16:30	17:30	01:00	
11: '2032 Do Nothing PM'	16:30	17:30	01:00	
12: '2032 Do Something PM'	16:30	17:30	01:00	
13: '2042 Do Nothing PM'	16:30	17:30	01:00	
14: '2042 Do Something PM'	16:30	17:30	01:00	

**Traffic Flows, Desired**

**Scenario 1: Scenario 1** (FG1: '2022 Do Nothing AM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	313	156	469
	B	40	0	14	54
	C	481	373	0	854
	Tot.	521	686	170	1377

**Scenario 2: Scenario 2** (FG2: '2022 Do Nothing PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	407	54	461
	B	109	0	1	110
	C	445	290	0	735
	Tot.	554	697	55	1306

Full Input Data And Results

**Scenario 3: Scenario 3** (FG3: '2022 Do Something AM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	313	170	483
	B	40	0	14	54
	C	490	394	0	884
	Tot.	530	707	184	1421

**Scenario 4: Scenario 4** (FG4: '2022 Do Something PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	407	58	465
	B	109	0	1	110
	C	455	314	0	769
	Tot.	564	721	59	1344

**Scenario 5: Scenario 5** (FG5: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	325	161	486
	B	42	0	14	56
	C	499	385	0	884
	Tot.	541	710	175	1426

**Scenario 6: Scenario 6** (FG6: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	423	56	479
	B	111	0	1	112
	C	461	300	0	761
	Tot.	572	723	57	1352

**Scenario 7: Scenario 7** (FG7: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	325	178	503
	B	42	0	14	56
	C	510	411	0	921
	Tot.	552	736	192	1480

Full Input Data And Results

**Scenario 8: Scenario 8** (FG8: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	423	61	484
	B	111	0	1	112
	C	519	433	0	952
	Tot.	630	856	62	1548

**Scenario 9: Scenario 9** (FG9: '2027 Do Nothing PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	447	59	506
	B	114	0	1	115
	C	488	314	0	802
	Tot.	602	761	60	1423

**Scenario 10: Scenario 10** (FG10: '2027 Do Something PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	447	60	507
	B	114	0	1	115
	C	535	425	0	960
	Tot.	649	872	61	1582

**Scenario 11: Scenario 11** (FG11: '2032 Do Nothing PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	481	63	544
	B	118	0	1	119
	C	522	334	0	856
	Tot.	640	815	64	1519

**Scenario 12: Scenario 12** (FG12: '2032 Do Something PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	481	65	546
	B	118	0	1	119
	C	570	444	0	1014
	Tot.	688	925	66	1679

Full Input Data And Results

**Scenario 13: Scenario 13** (FG13: '2042 Do Nothing PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	516	68	584
	B	123	0	1	124
	C	560	354	0	914
	Tot.	683	870	69	1622

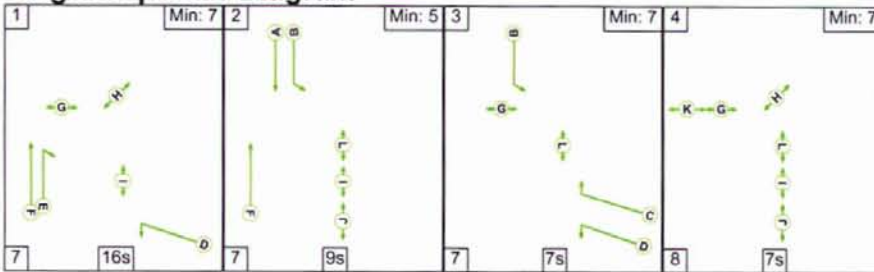
**Scenario 14: Scenario 14** (FG14: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination			
		A	B	C	Tot.
Origin	A	0	516	69	585
	B	123	0	1	124
	C	607	465	0	1072
	Tot.	730	981	70	1781

**Scenario 1: Scenario 1** (FG1: '2022 Do Nothing AM', Plan 1: 'Network Control Plan 1')

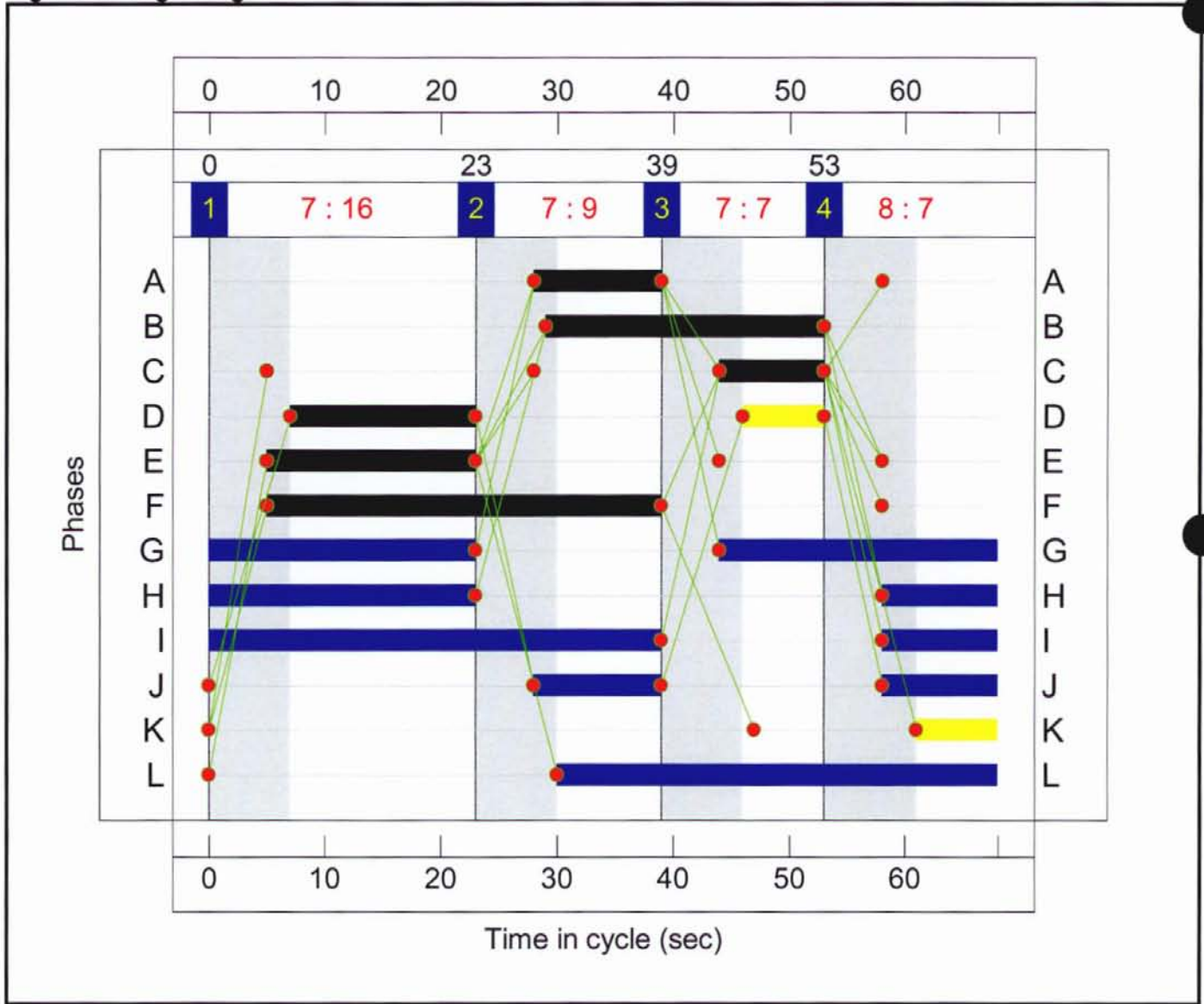
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

### Signal Timings Diagram



Full Input Data And Results

**Network Results**

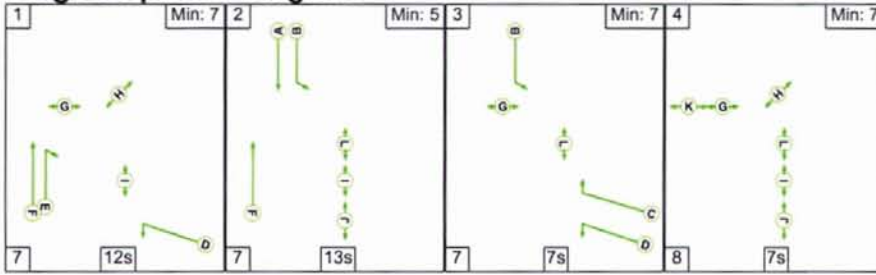
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	55.8
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	55.8
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		469	1985:2002	870	53.9%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	40	1824	268	14.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		854	2015:1766	1531	55.8%
4/1		U	N/A	N/A	-		-	-	-	521	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	686	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	170	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.5	1.3	0.0	7.8	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.5	1.3	0.0	7.8	-	-	-	-
1/2+1/1	469	469	-	-	-	2.5	0.6	-	3.1	23.6	4.3	0.6	4.9
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	40	40	-	-	-	0.3	0.1	-	0.4	33.2	0.7	0.1	0.7
3/1+3/2	854	854	-	-	-	3.7	0.6	-	4.4	18.4	6.4	0.6	7.1
4/1	521	521	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	686	686	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	170	170	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		61.3	Total Delay for Signalled Lanes (pcuHr):			7.83				
			PRC Over All Lanes (%):		61.3	Total Delay Over All Lanes(pcuHr):			7.83	Cycle Time (s): 68			



Full Input Data And Results

Scenario 2: Scenario 2 (FG2: '2022 Do Nothing PM', Plan 1: 'Network Control Plan 1')

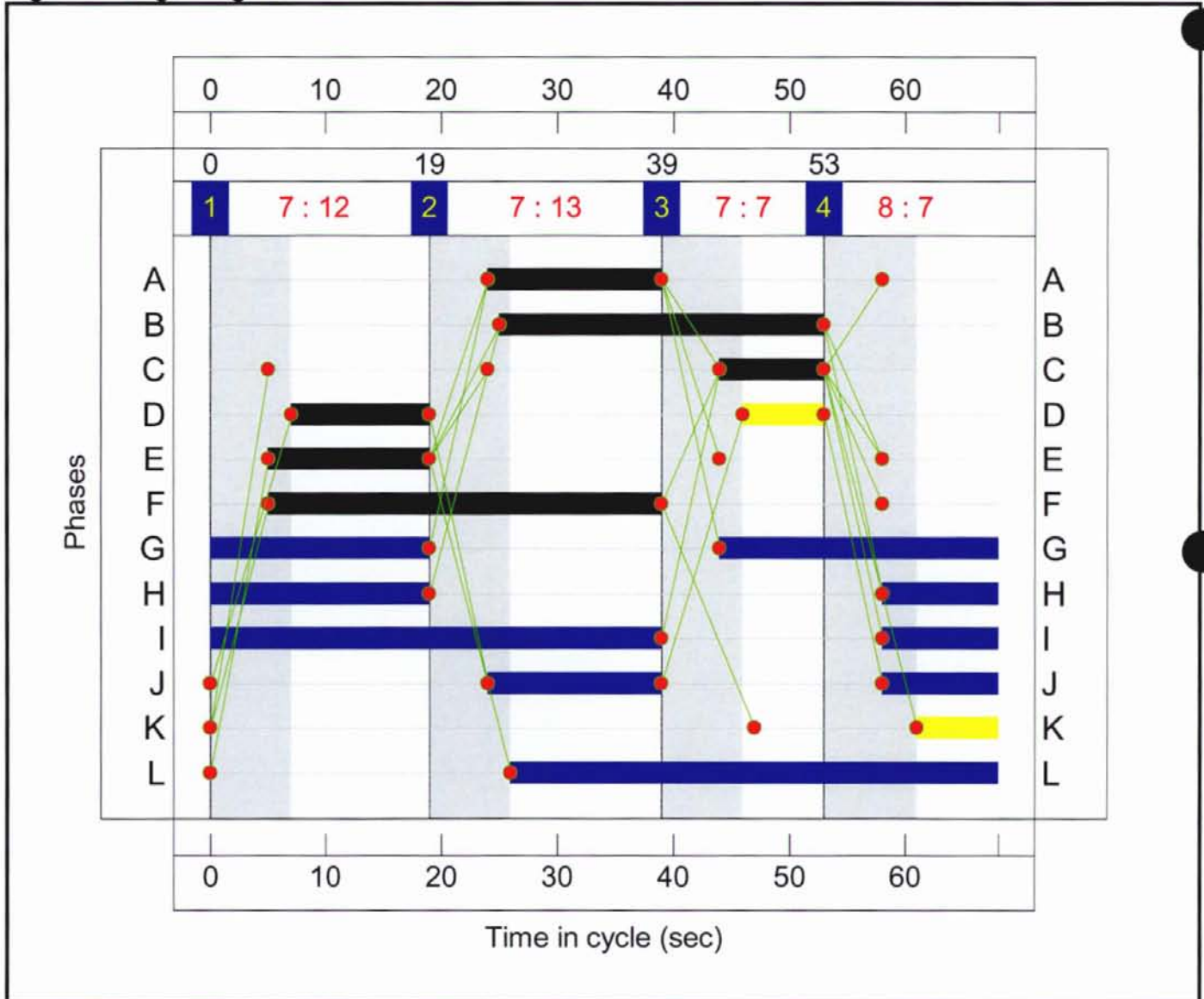
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

Signal Timings Diagram



Full Input Data And Results

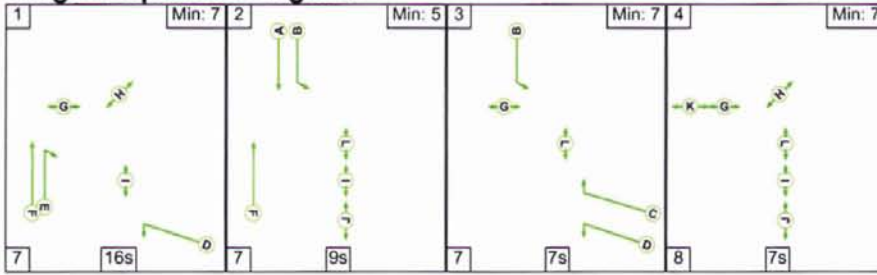
**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	51.9
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	51.9
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		461	1985:2002	888	51.9%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	109	1824	268	40.6%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		735	2015:1766	1427	51.5%
4/1		U	N/A	N/A	-		-	-	-	554	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	697	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	55	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.0	1.4	0.0	7.4	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.0	1.4	0.0	7.4	-	-	-	-
1/2+1/1	461	461	-	-	-	1.9	0.5	-	2.4	19.0	5.6	0.5	6.2
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	109	109	-	-	-	0.8	0.3	-	1.1	37.6	1.8	0.3	2.2
3/1+3/2	735	735	-	-	-	3.3	0.5	-	3.8	18.6	5.2	0.5	5.7
4/1	554	554	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	697	697	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	55	55	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		73.4	Total Delay for Signalled Lanes (pcuHr):			7.37				
			PRC Over All Lanes (%):		73.4	Total Delay Over All Lanes(pcuHr):			7.37	Cycle Time (s): 68			

Full Input Data And Results

Scenario 3: Scenario 3 (FG3: '2022 Do Something AM', Plan 1: 'Network Control Plan 1')

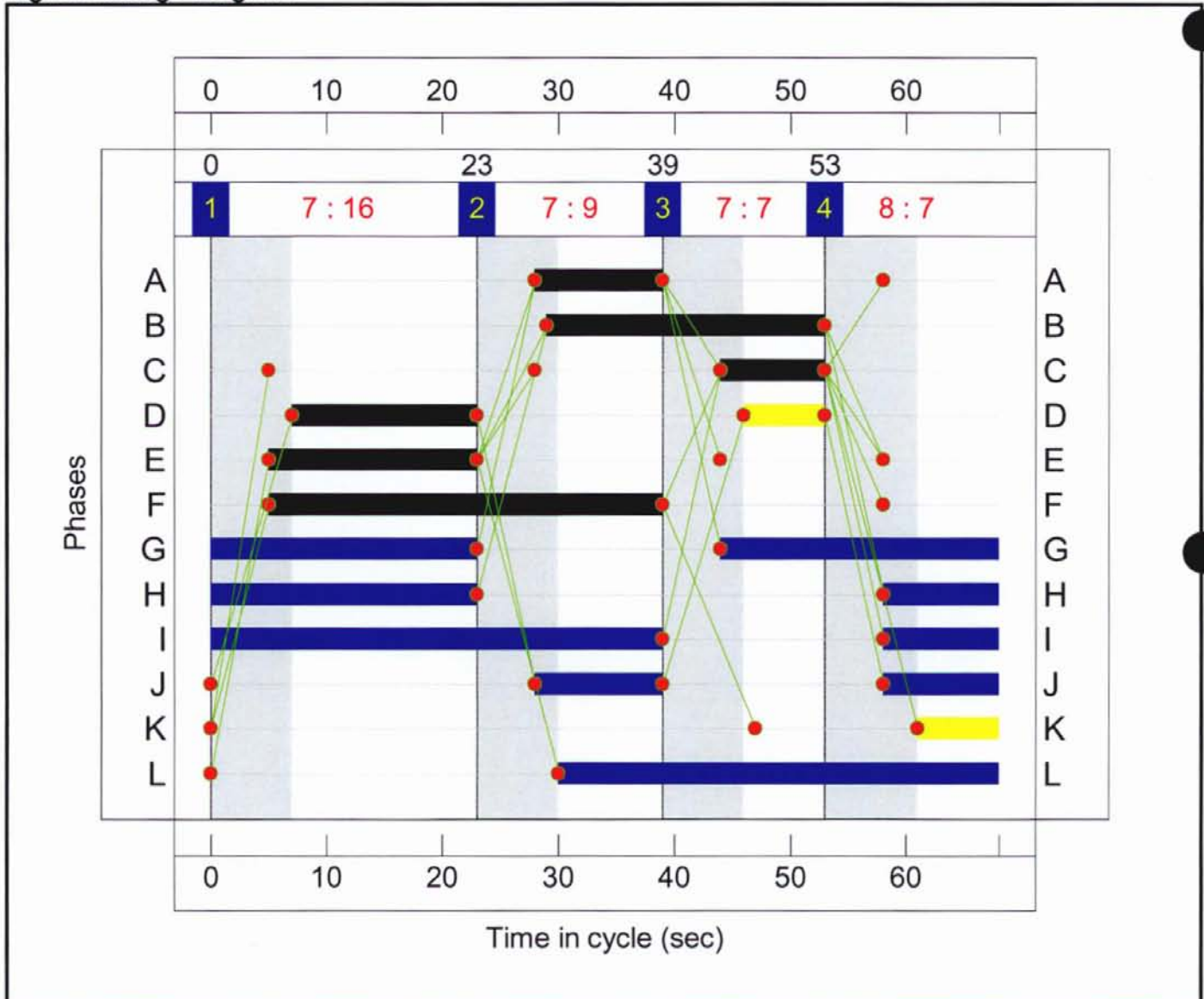
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

Signal Timings Diagram



Full Input Data And Results

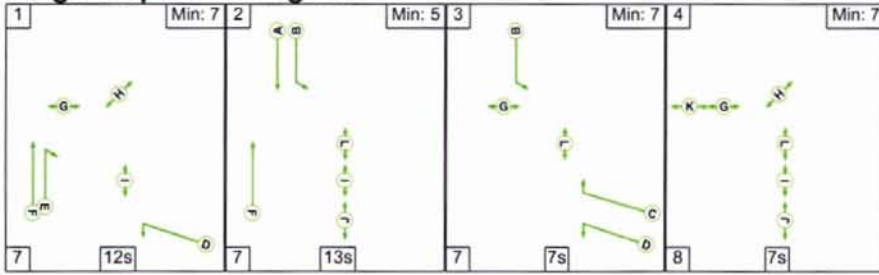
**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	57.8
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	57.8
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		483	1985:2002	840	57.5%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	40	1824	268	14.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		884	2015:1766	1530	57.8%
4/1		U	N/A	N/A	-		-	-	-	530	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	707	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	184	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.8	1.5	0.0	8.3	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.8	1.5	0.0	8.3	-	-	-	-
1/2+1/1	483	483	-	-	-	2.6	0.7	-	3.3	24.3	4.3	0.7	5.0
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	40	40	-	-	-	0.3	0.1	-	0.4	33.2	0.7	0.1	0.7
3/1+3/2	884	884	-	-	-	3.9	0.7	-	4.6	18.8	6.9	0.7	7.6
4/1	530	530	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	707	707	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	184	184	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		55.7	Total Delay for Signalled Lanes (pcuHr):			8.29				
			PRC Over All Lanes (%):		55.7	Total Delay Over All Lanes(pcuHr):			8.29	Cycle Time (s): 68			

Full Input Data And Results

**Scenario 4: Scenario 4** (FG4: '2022 Do Something PM', Plan 1: 'Network Control Plan 1')

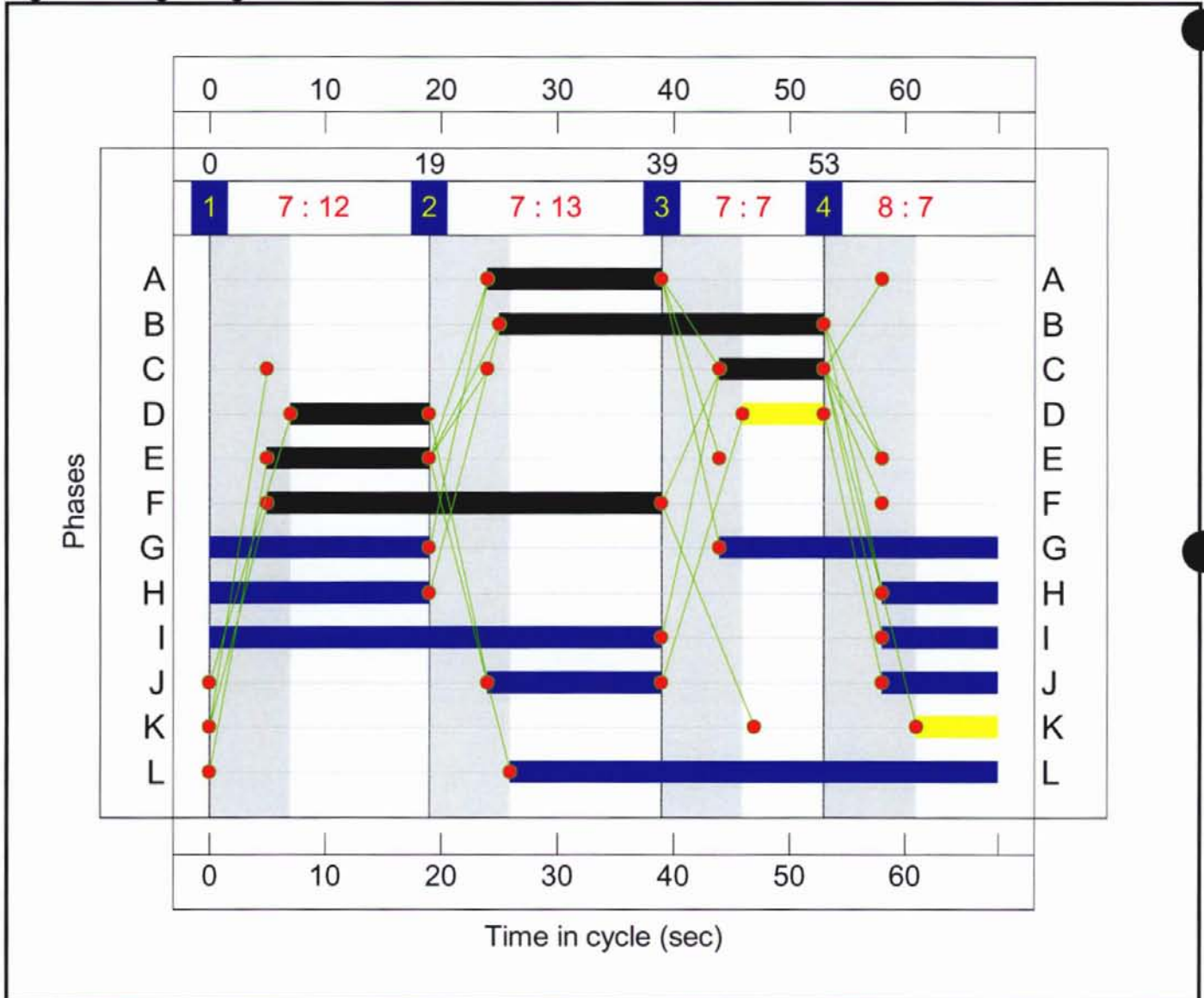
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

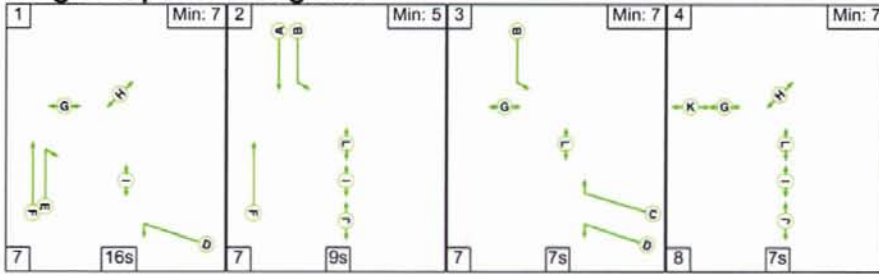
**Signal Timings Diagram**



**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	53.9
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	53.9
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		465	1985:2002	891	52.2%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	109	1824	268	40.6%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		769	2015:1766	1427	53.9%
4/1		U	N/A	N/A	-		-	-	-	564	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	721	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	59	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.2	1.5	0.0	7.7	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.2	1.5	0.0	7.7	-	-	-	-
1/2+1/1	465	465	-	-	-	1.9	0.5	-	2.5	19.1	5.6	0.5	6.2
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	109	109	-	-	-	0.8	0.3	-	1.1	37.6	1.8	0.3	2.2
3/1+3/2	769	769	-	-	-	3.5	0.6	-	4.1	19.1	5.6	0.6	6.2
4/1	564	564	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	721	721	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	59	59	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		67.0	Total Delay for Signalled Lanes (pcuHr):			7.69				
			PRC Over All Lanes (%):		67.0	Total Delay Over All Lanes(pcuHr):			7.69	Cycle Time (s): 68			

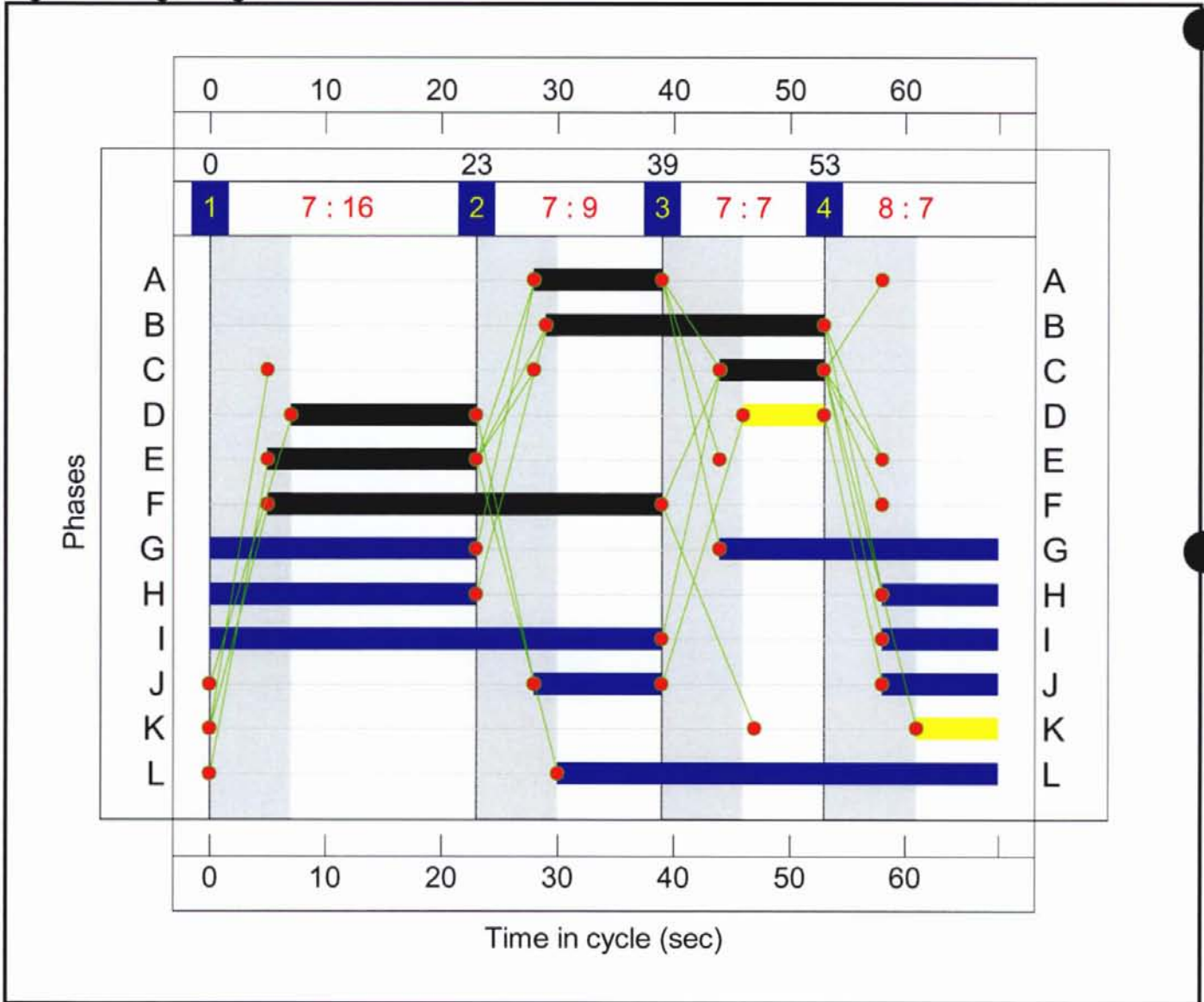
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

Signal Timings Diagram



**Network Results**

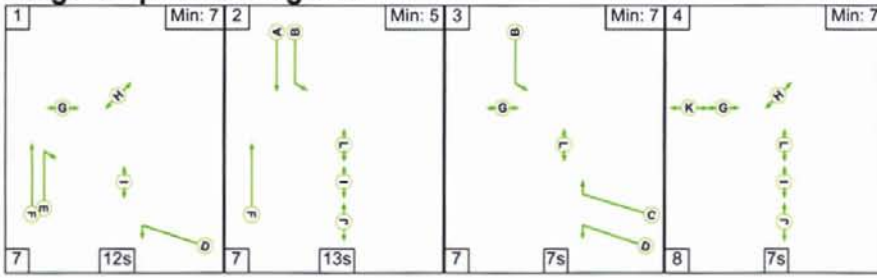
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	57.8
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	57.8
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		486	1985:2002	868	56.0%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	42	1824	268	15.7%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		884	2015:1766	1531	57.8%
4/1		U	N/A	N/A	-		-	-	-	541	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	710	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	175	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.8	1.4	0.0	8.2	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.8	1.4	0.0	8.2	-	-	-	-
1/2+1/1	486	486	-	-	-	2.6	0.6	-	3.2	23.9	4.6	0.6	5.2
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	42	42	-	-	-	0.3	0.1	-	0.4	33.3	0.7	0.1	0.8
3/1+3/2	884	884	-	-	-	3.9	0.7	-	4.6	18.6	6.6	0.7	7.3
4/1	541	541	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	710	710	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	175	175	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		55.8	Total Delay for Signalled Lanes (pcuHr):		8.22					
			PRC Over All Lanes (%):		55.8	Total Delay Over All Lanes (pcuHr):		8.22	Cycle Time (s): 68				



Full Input Data And Results

**Scenario 6: Scenario 6** (FG6: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')

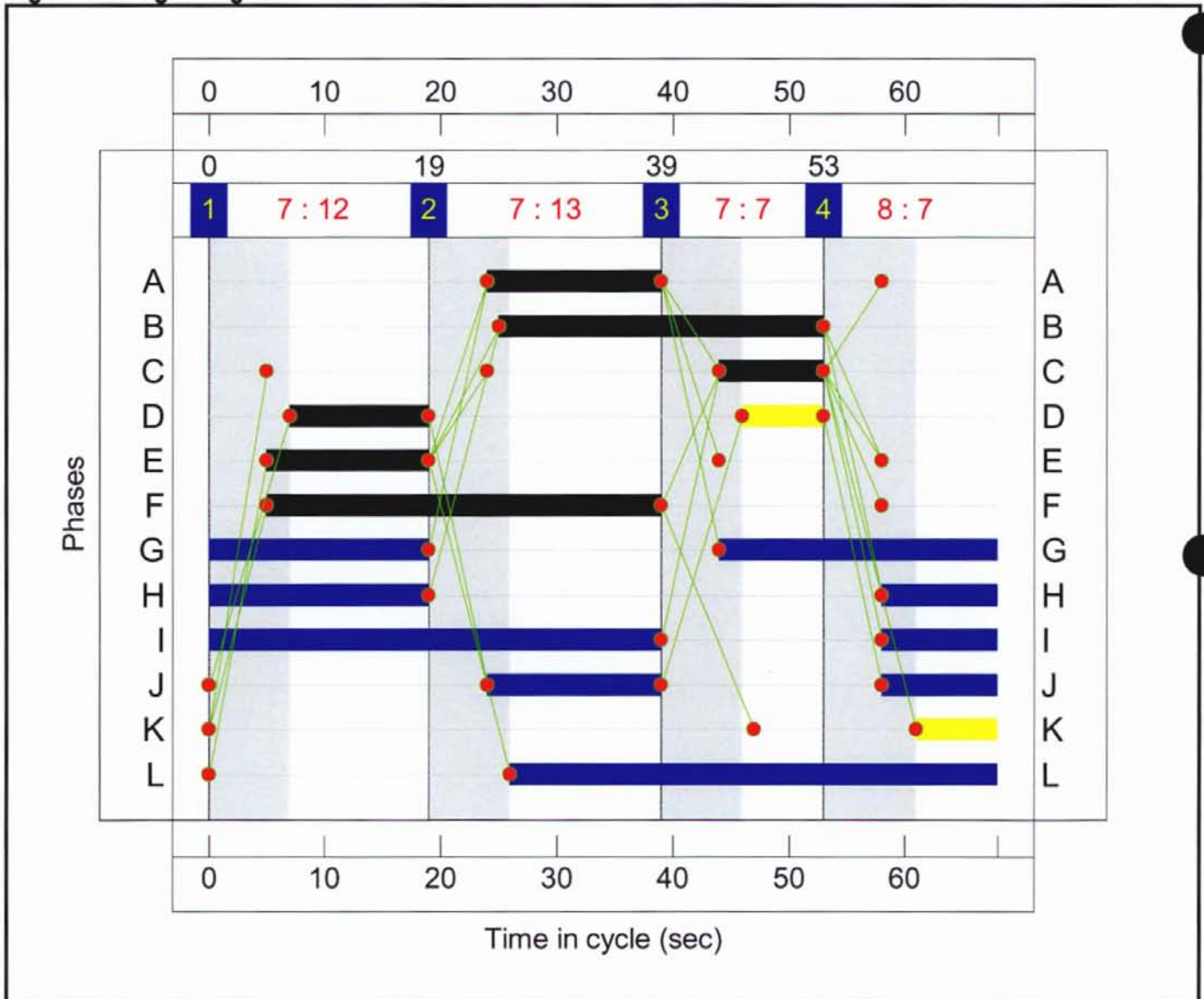
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

**Signal Timings Diagram**



Full Input Data And Results

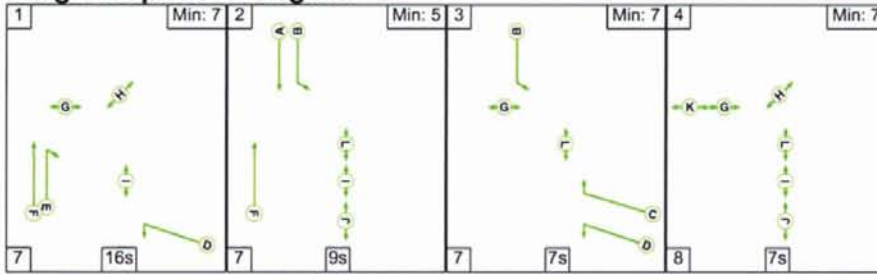
**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	53.9
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	53.9
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		479	1985:2002	888	53.9%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	111	1824	268	41.4%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		761	2015:1766	1427	53.3%
4/1		U	N/A	N/A	-		-	-	-	572	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	723	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	57	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.2	1.5	0.0	7.7	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.2	1.5	0.0	7.7	-	-	-	-
1/2+1/1	479	479	-	-	-	2.0	0.6	-	2.6	19.4	5.9	0.6	6.5
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	111	111	-	-	-	0.8	0.4	-	1.2	37.8	1.9	0.4	2.2
3/1+3/2	761	761	-	-	-	3.4	0.6	-	4.0	18.8	5.4	0.6	5.9
4/1	572	572	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	723	723	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	57	57	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		66.8	Total Delay for Signalled Lanes (pcuHr):			7.72				
			PRC Over All Lanes (%):		66.8	Total Delay Over All Lanes(pcuHr):			7.72	Cycle Time (s): 68			

Full Input Data And Results

**Scenario 7: Scenario 7** (FG7: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')

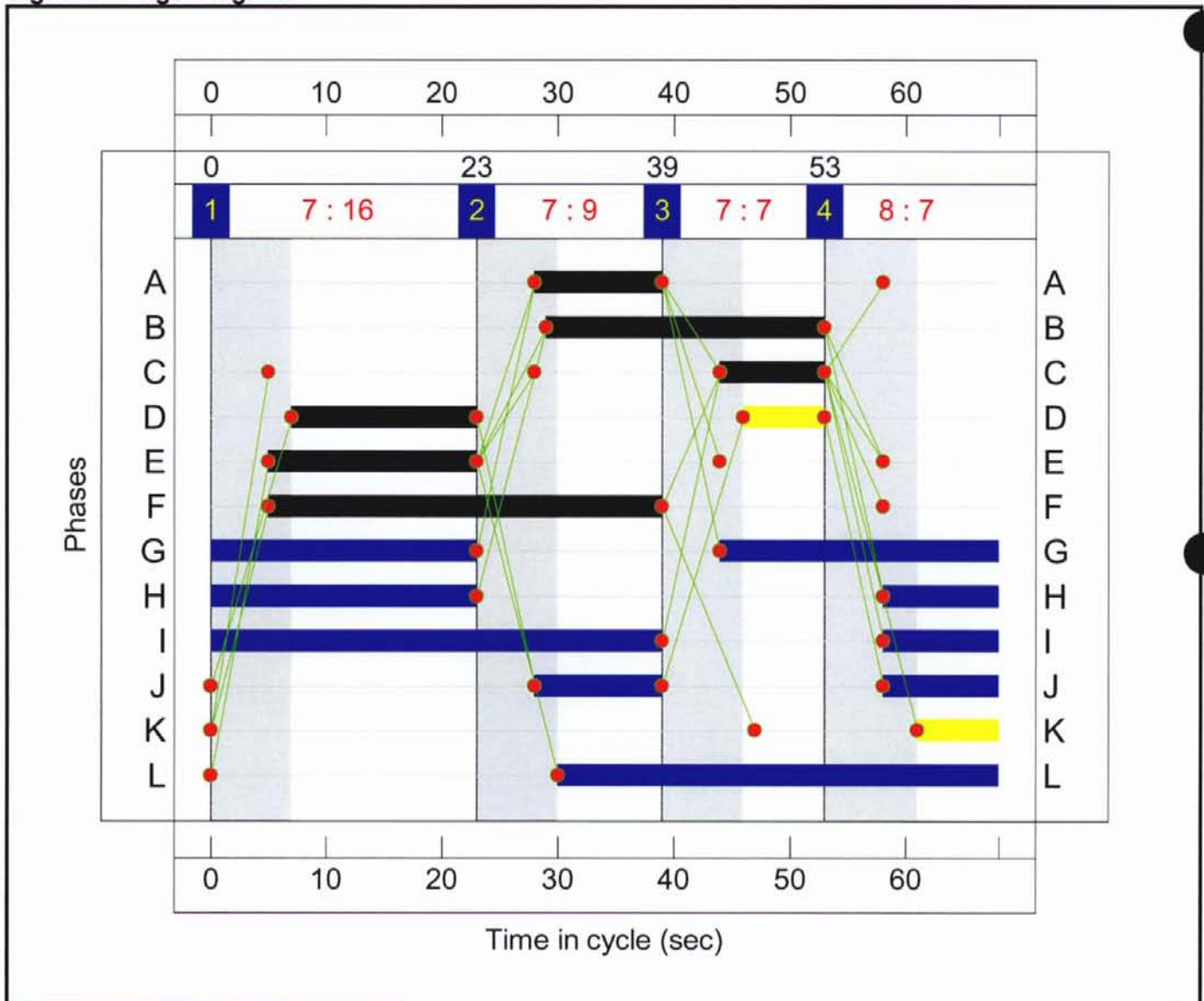
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

**Signal Timings Diagram**

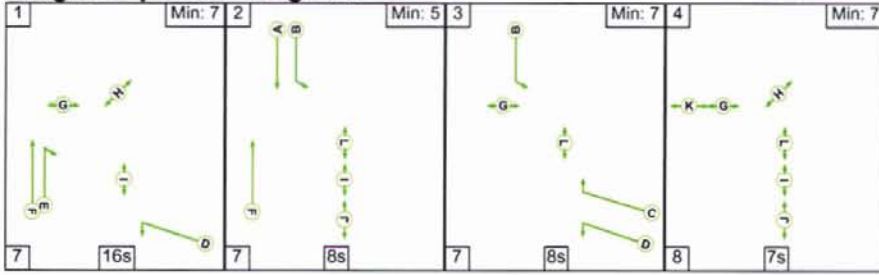


Full Input Data And Results

**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	60.4
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	60.4
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		503	1985:2002	836	60.2%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	42	1824	268	15.7%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		921	2015:1766	1525	60.4%
4/1		U	N/A	N/A	-		-	-	-	552	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	736	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	192	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	7.2	1.6	0.0	8.8	-	-	-	-
Unnamed Junction	-	-	0	0	0	7.2	1.6	0.0	8.8	-	-	-	-
1/2+1/1	503	503	-	-	-	2.7	0.8	-	3.5	24.8	4.6	0.8	5.4
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	42	42	-	-	-	0.3	0.1	-	0.4	33.3	0.7	0.1	0.8
3/1+3/2	921	921	-	-	-	4.1	0.8	-	4.9	19.2	7.2	0.8	8.0
4/1	552	552	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	736	736	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	192	192	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		49.0	Total Delay for Signalled Lanes (pcuHr):			8.81				
			PRC Over All Lanes (%):		49.0	Total Delay Over All Lanes(pcuHr):			8.81	Cycle Time (s): 68			

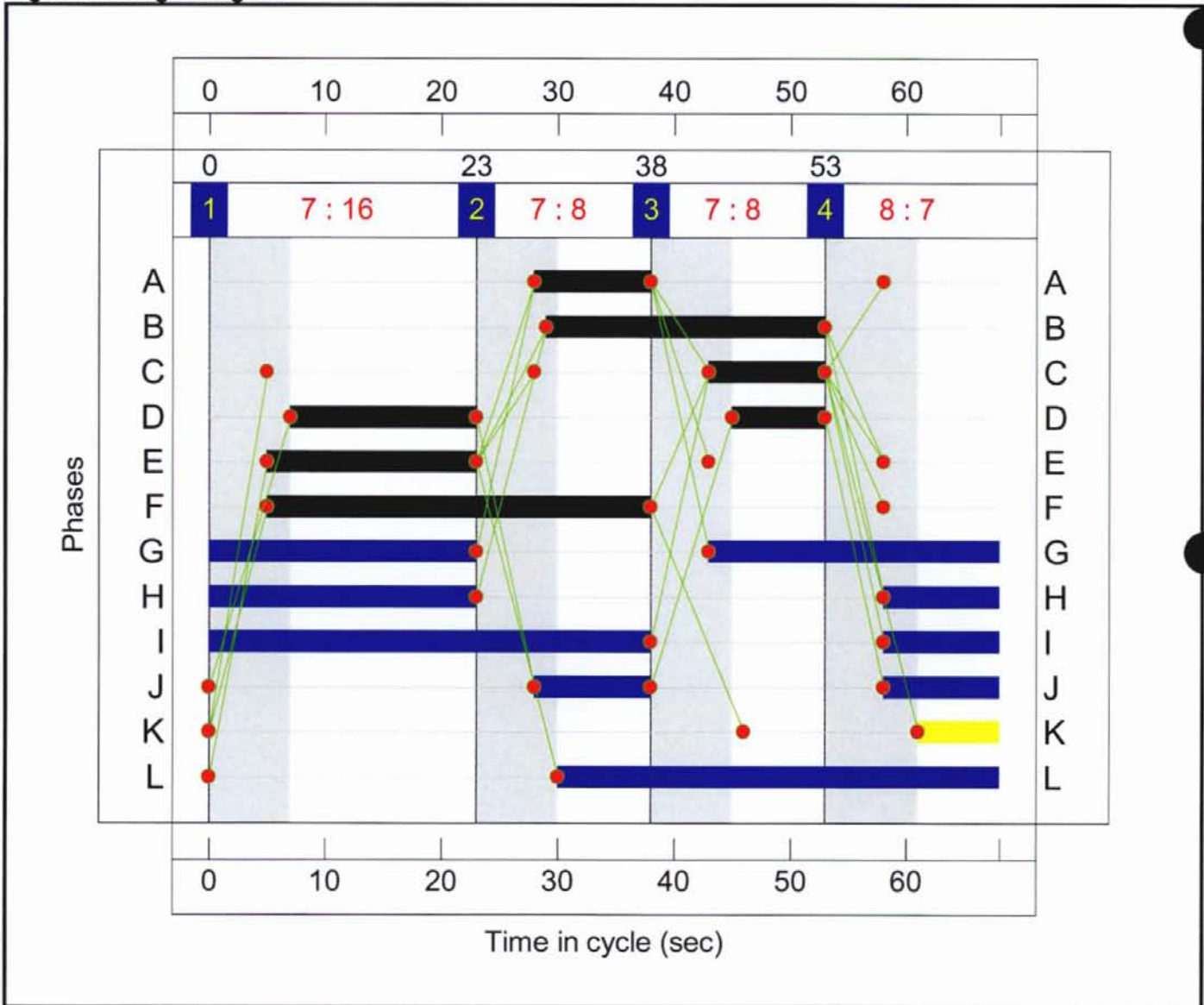
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	8	8	7
Change Point	0	23	38	53

Signal Timings Diagram



Full Input Data And Results

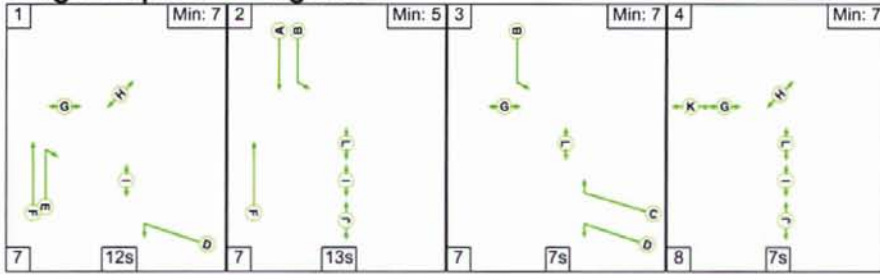
**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	63.7
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	63.7
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	10:24		484	1985:2002	773	62.6%
2/1	Elm Road Left	U	N/A	N/A	D		2	24	-	1	1764	674	0.1%
2/2	Elm Road Right	U	N/A	N/A	C		1	10	-	111	1824	295	37.6%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	33:18		952	2015:1766	1493	63.7%
4/1		U	N/A	N/A	-		-	-	-	630	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	856	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	62	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	7.8	2.0	0.0	9.8	-	-	-	-
Unnamed Junction	-	-	0	0	0	7.8	2.0	0.0	9.8	-	-	-	-
1/2+1/1	484	484	-	-	-	2.6	0.8	-	3.4	25.2	6.7	0.8	7.5
2/1	1	1	-	-	-	0.0	0.0	-	0.0	9.5	0.0	0.0	0.0
2/2	111	111	-	-	-	0.8	0.3	-	1.1	35.2	1.8	0.3	2.2
3/1+3/2	952	952	-	-	-	4.5	0.9	-	5.3	20.2	7.7	0.9	8.6
4/1	630	630	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	856	856	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	62	62	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		41.2	Total Delay for Signalled Lanes (pcuHr):			9.81				
			PRC Over All Lanes (%):		41.2	Total Delay Over All Lanes (pcuHr):			9.81	Cycle Time (s): 68			

Full Input Data And Results

**Scenario 9: Scenario 9** (FG9: '2027 Do Nothing PM', Plan 1: 'Network Control Plan 1')

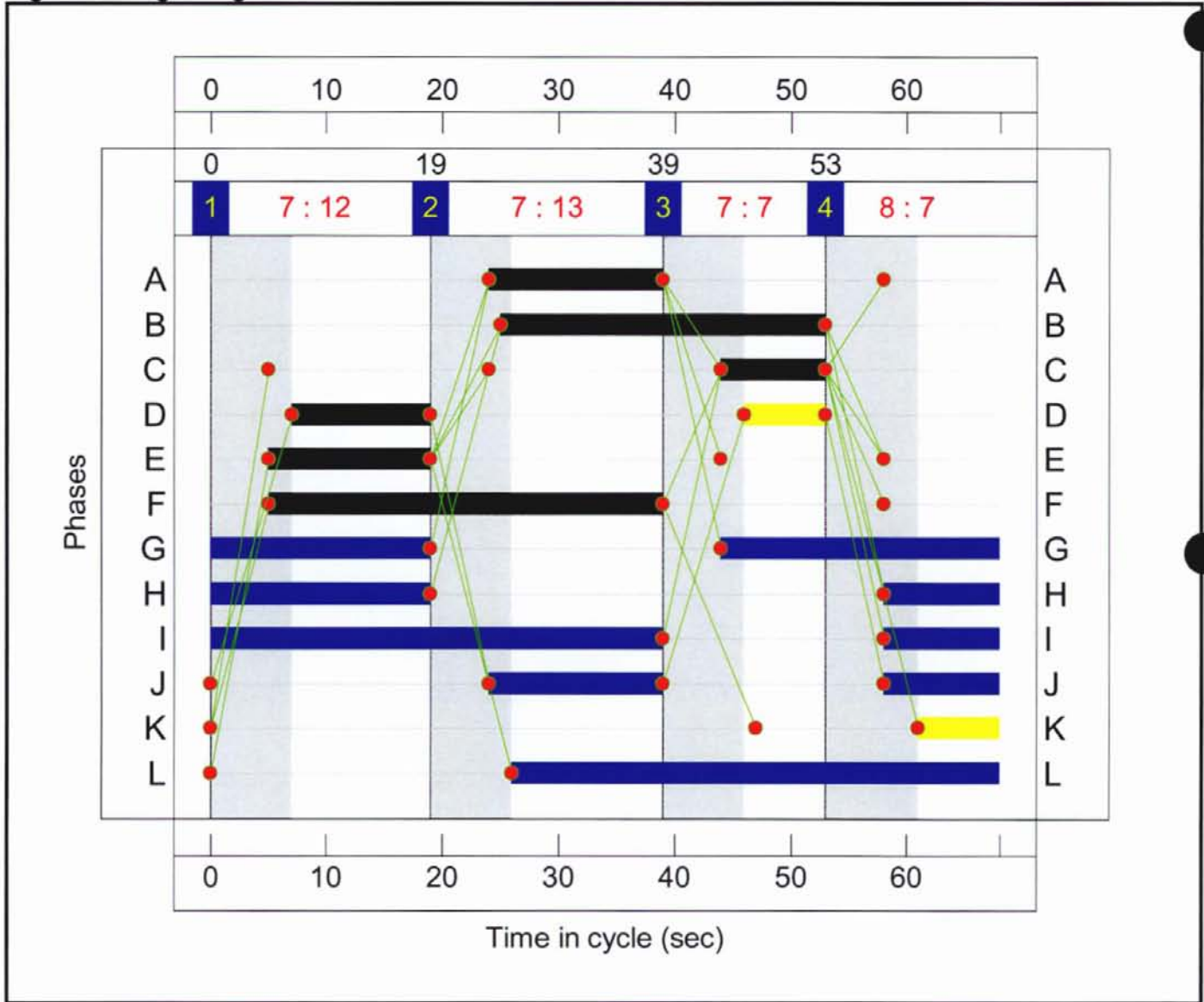
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

**Signal Timings Diagram**



Full Input Data And Results

**Network Results**

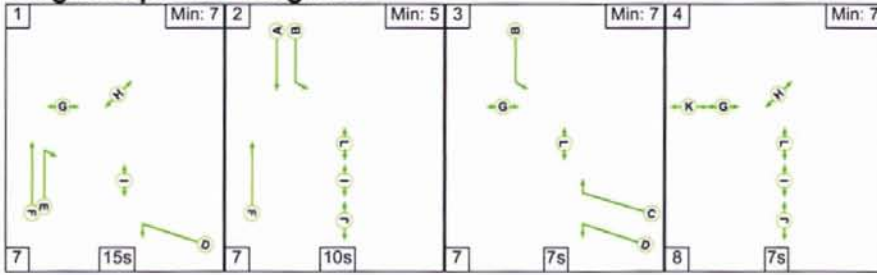
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	57.0
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	57.0
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		506	1985:2002	888	57.0%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	114	1824	268	42.5%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		802	2015:1766	1427	56.2%
4/1		U	N/A	N/A	-		-	-	-	602	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	761	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	60	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	6.6	1.7	0.0	8.3	-	-	-	-
Unnamed Junction	-	-	0	0	0	6.6	1.7	0.0	8.3	-	-	-	-
1/2+1/1	506	506	-	-	-	2.1	0.7	-	2.8	19.9	6.4	0.7	7.0
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	114	114	-	-	-	0.8	0.4	-	1.2	38.0	1.9	0.4	2.3
3/1+3/2	802	802	-	-	-	3.6	0.6	-	4.3	19.1	5.8	0.6	6.5
4/1	602	602	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	761	761	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	60	60	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		57.9	Total Delay for Signalled Lanes (pcuHr):			8.27				
			PRC Over All Lanes (%):		57.9	Total Delay Over All Lanes(pcuHr):			8.27	Cycle Time (s): 68			



Full Input Data And Results

**Scenario 10: Scenario 10** (FG10: '2027 Do Something PM', Plan 1: 'Network Control Plan 1')

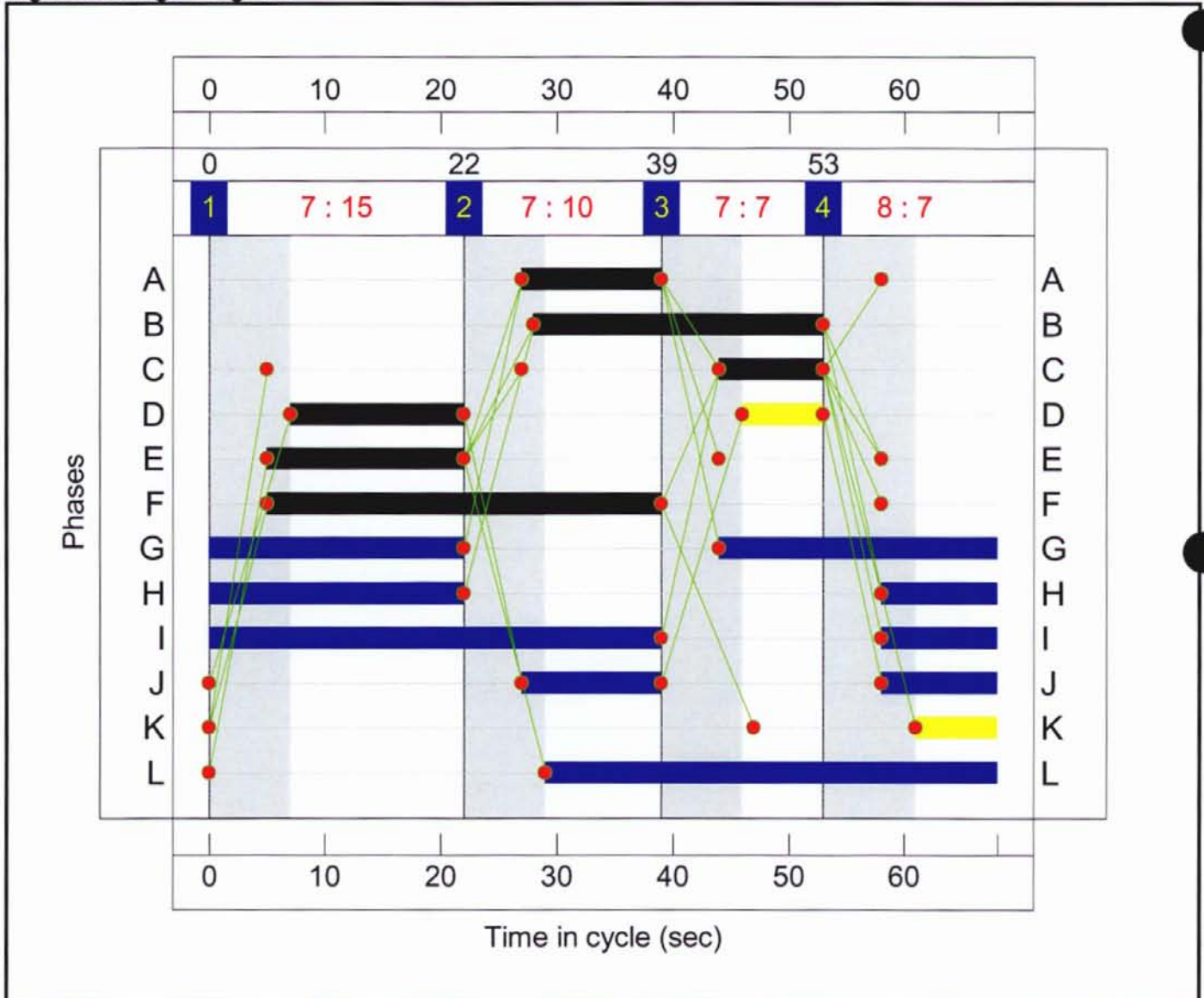
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	15	10	7	7
Change Point	0	22	39	53

**Signal Timings Diagram**



Full Input Data And Results

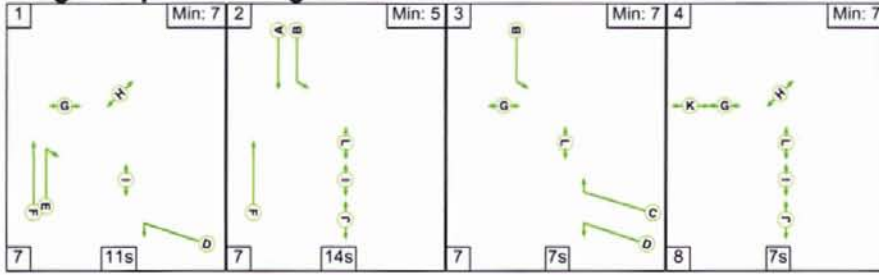
**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	64.1
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	64.1
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	12:25		507	1985:2002	800	63.4%
2/1	Elm Road Left	U	N/A	N/A	D		2	22	-	1	1764	623	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	114	1824	268	42.5%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:17		960	2015:1766	1498	64.1%
4/1		U	N/A	N/A	-		-	-	-	649	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	872	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	61	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	7.8	2.1	0.0	9.9	-	-	-	-
Unnamed Junction	-	-	0	0	0	7.8	2.1	0.0	9.9	-	-	-	-
1/2+1/1	507	507	-	-	-	2.5	0.9	-	3.4	23.9	6.9	0.9	7.8
2/1	1	1	-	-	-	0.0	0.0	-	0.0	10.3	0.0	0.0	0.0
2/2	114	114	-	-	-	0.8	0.4	-	1.2	38.0	1.9	0.4	2.3
3/1+3/2	960	960	-	-	-	4.5	0.9	-	5.4	20.1	7.7	0.9	8.6
4/1	649	649	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	872	872	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	61	61	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		40.5	Total Delay for Signalled Lanes (pcuHr):		9.94					
			PRC Over All Lanes (%):		40.5	Total Delay Over All Lanes(pcuHr):		9.94	Cycle Time (s): 68				

Full Input Data And Results

**Scenario 11: Scenario 11** (FG11: '2032 Do Nothing PM', Plan 1: 'Network Control Plan 1')

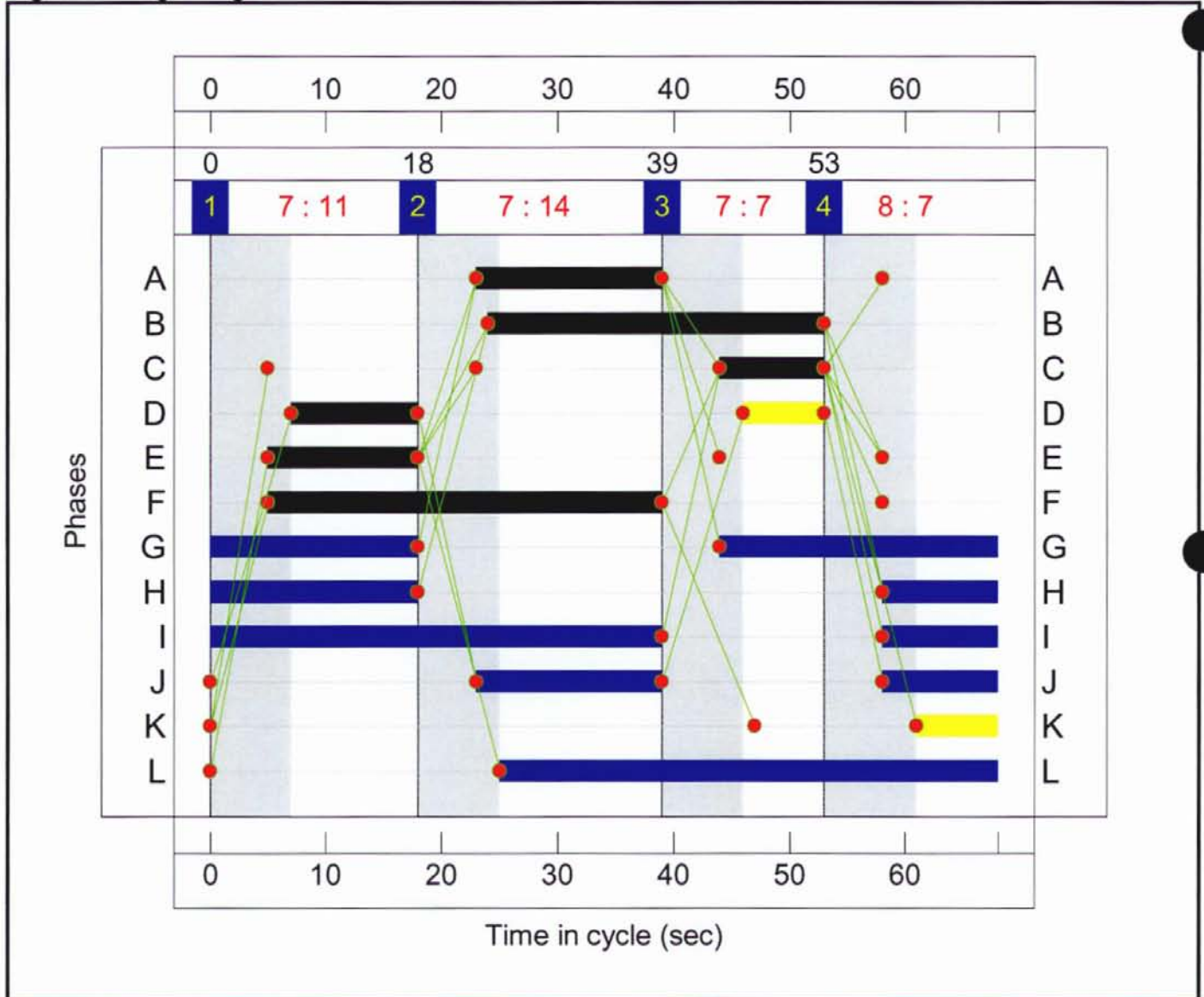
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	11	14	7	7
Change Point	0	18	39	53

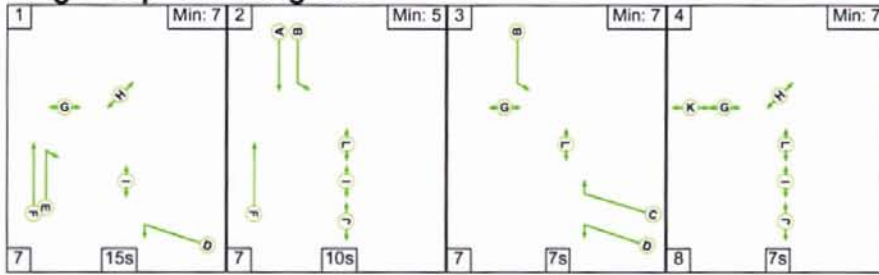
**Signal Timings Diagram**



**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	61.1
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	61.1
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	16:29		544	1985:2002	917	59.3%
2/1	Elm Road Left	U	N/A	N/A	D		2	18	-	1	1764	519	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	118	1824	268	44.0%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:13		856	2015:1766	1401	61.1%
4/1		U	N/A	N/A	-		-	-	-	640	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	815	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	64	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	7.1	1.9	0.0	9.0	-	-	-	-
Unnamed Junction	-	-	0	0	0	7.1	1.9	0.0	9.0	-	-	-	-
1/2+1/1	544	544	-	-	-	2.2	0.7	-	3.0	19.6	6.9	0.7	7.6
2/1	1	1	-	-	-	0.0	0.0	-	0.0	12.4	0.0	0.0	0.0
2/2	118	118	-	-	-	0.9	0.4	-	1.3	38.4	2.0	0.4	2.4
3/1+3/2	856	856	-	-	-	4.0	0.8	-	4.8	20.2	6.4	0.8	7.2
4/1	640	640	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	815	815	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	64	64	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		47.3	Total Delay for Signalled Lanes (pcuHr):			9.03				
			PRC Over All Lanes (%):		47.3	Total Delay Over All Lanes (pcuHr):			9.03	Cycle Time (s): 68			

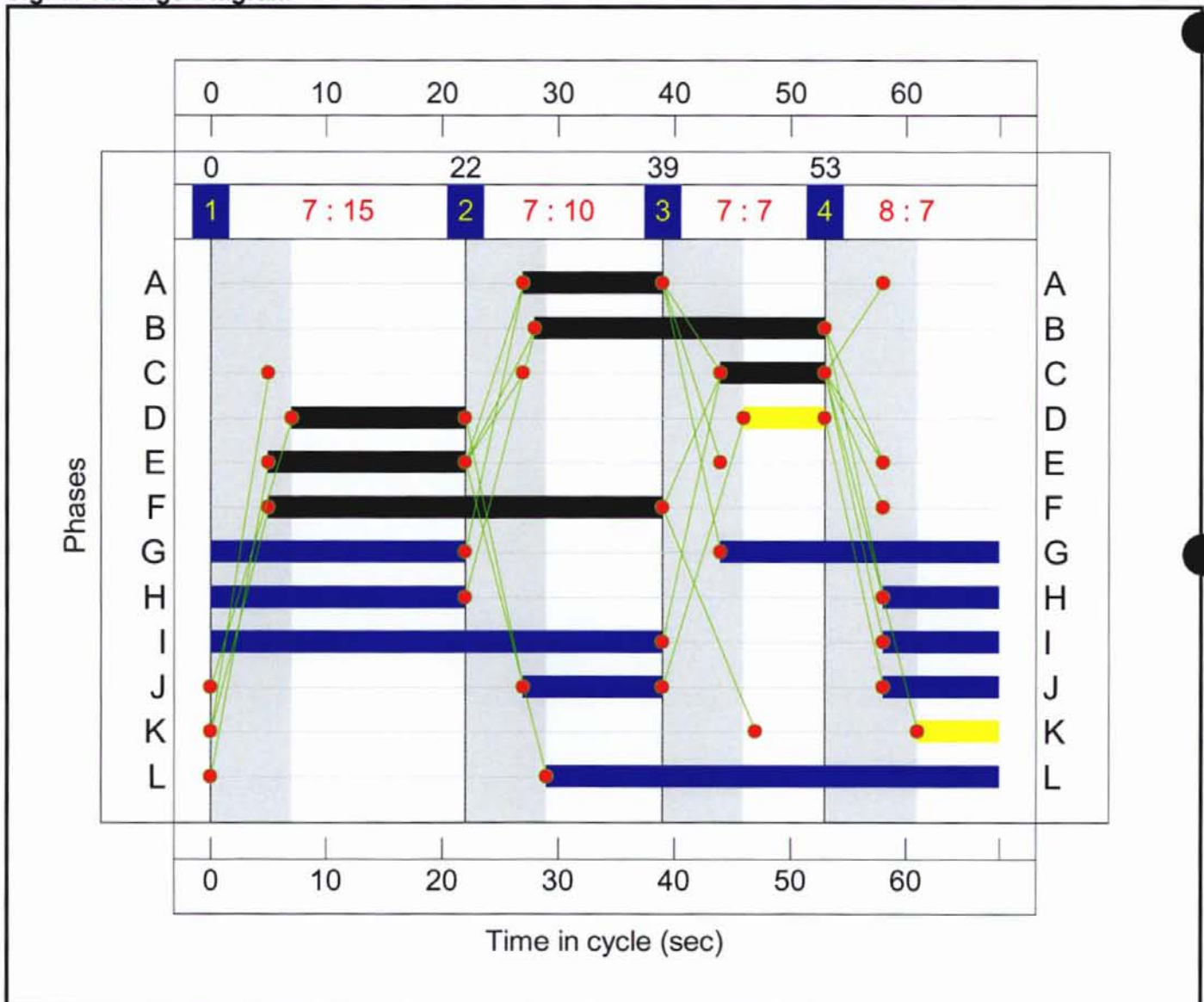
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	15	10	7	7
Change Point	0	22	39	53

**Signal Timings Diagram**

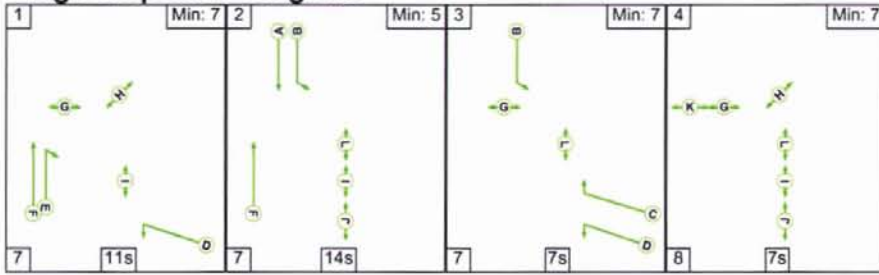


Full Input Data And Results

**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	68.2
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	68.2
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	12:25		546	1985:2002	800	68.2%
2/1	Elm Road Left	U	N/A	N/A	D		2	22	-	1	1764	623	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	118	1824	268	44.0%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:17		1014	2015:1766	1505	67.4%
4/1		U	N/A	N/A	-		-	-	-	688	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	925	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	66	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	8.5	2.5	0.0	11.0	-	-	-	-
Unnamed Junction	-	-	0	0	0	8.5	2.5	0.0	11.0	-	-	-	-
1/2+1/1	546	546	-	-	-	2.8	1.1	-	3.9	25.6	7.8	1.1	8.9
2/1	1	1	-	-	-	0.0	0.0	-	0.0	10.3	0.0	0.0	0.0
2/2	118	118	-	-	-	0.9	0.4	-	1.3	38.4	2.0	0.4	2.4
3/1+3/2	1014	1014	-	-	-	4.8	1.0	-	5.8	20.7	8.1	1.0	9.2
4/1	688	688	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	925	925	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	66	66	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		31.9	Total Delay for Signalled Lanes (pcuHr):		10.97					
			PRC Over All Lanes (%):		31.9	Total Delay Over All Lanes (pcuHr):		10.97	Cycle Time (s): 68				

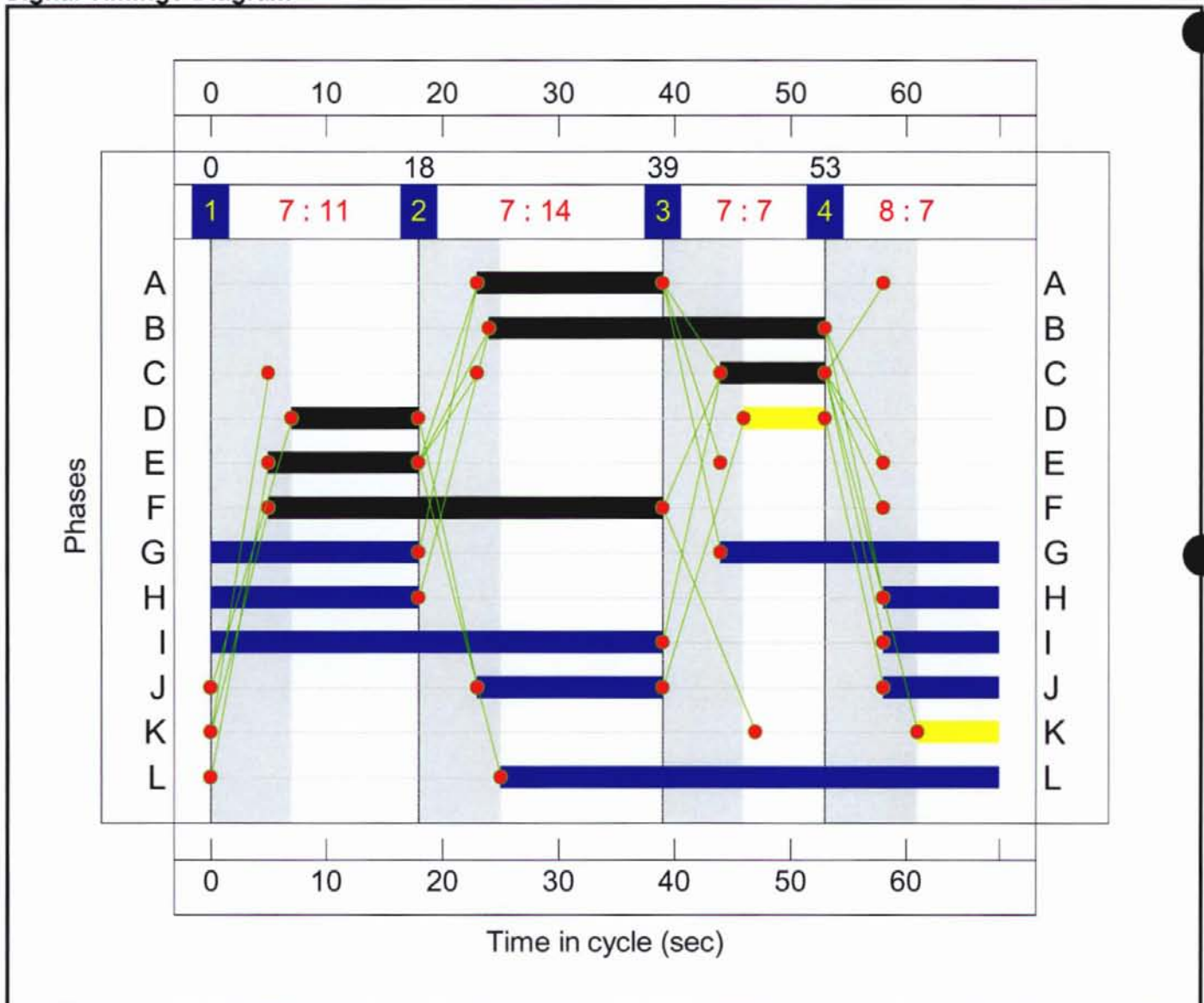
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	11	14	7	7
Change Point	0	18	39	53

**Signal Timings Diagram**



Full Input Data And Results

**Network Results**

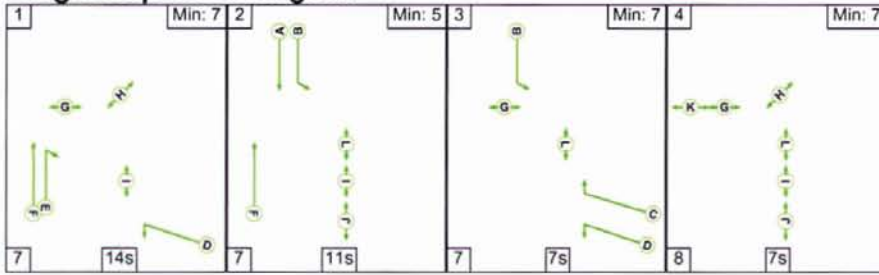
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	65.3
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	65.3
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	16:29		584	1985:2002	917	63.7%
2/1	Elm Road Left	U	N/A	N/A	D		2	18	-	1	1764	519	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	123	1824	268	45.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:13		914	2015:1766	1401	65.3%
4/1		U	N/A	N/A	-		-	-	-	683	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	870	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	69	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	7.7	2.2	0.0	10.0	-	-	-	-
Unnamed Junction	-	-	0	0	0	7.7	2.2	0.0	10.0	-	-	-	-
1/2+1/1	584	584	-	-	-	2.5	0.9	-	3.3	20.6	7.6	0.9	8.5
2/1	1	1	-	-	-	0.0	0.0	-	0.0	12.4	0.0	0.0	0.0
2/2	123	123	-	-	-	0.9	0.4	-	1.3	38.9	2.1	0.4	2.5
3/1+3/2	914	914	-	-	-	4.4	0.9	-	5.3	20.9	7.0	0.9	7.9
4/1	683	683	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	870	870	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	69	69	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		37.9	Total Delay for Signalled Lanes (pcuHr):			9.96				
			PRC Over All Lanes (%):		37.9	Total Delay Over All Lanes(pcuHr):			9.96	Cycle Time (s): 68			



Full Input Data And Results

**Scenario 14: Scenario 14** (FG14: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

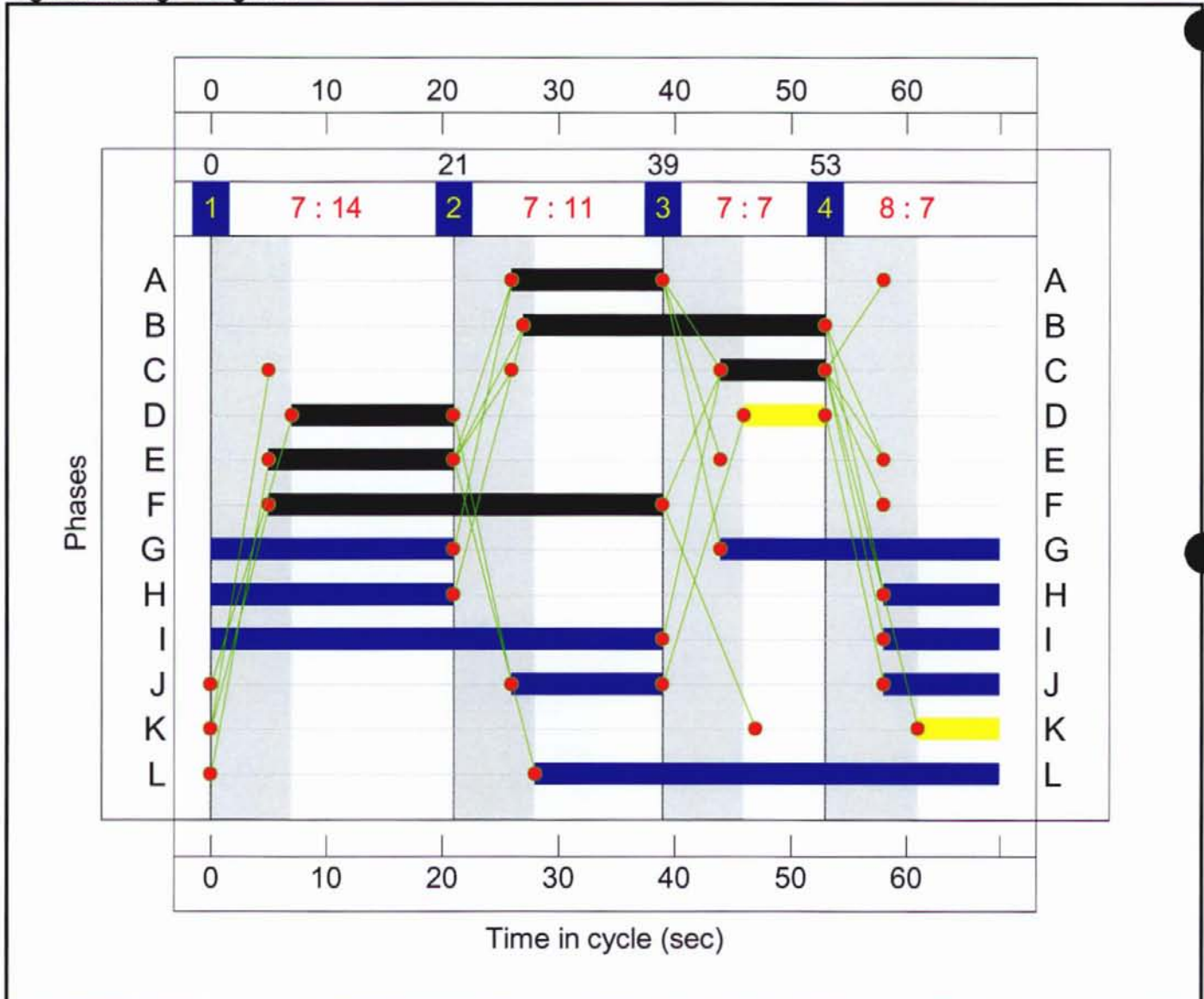
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	14	11	7	7
Change Point	0	21	39	53

**Signal Timings Diagram**



Full Input Data And Results

**Network Results**

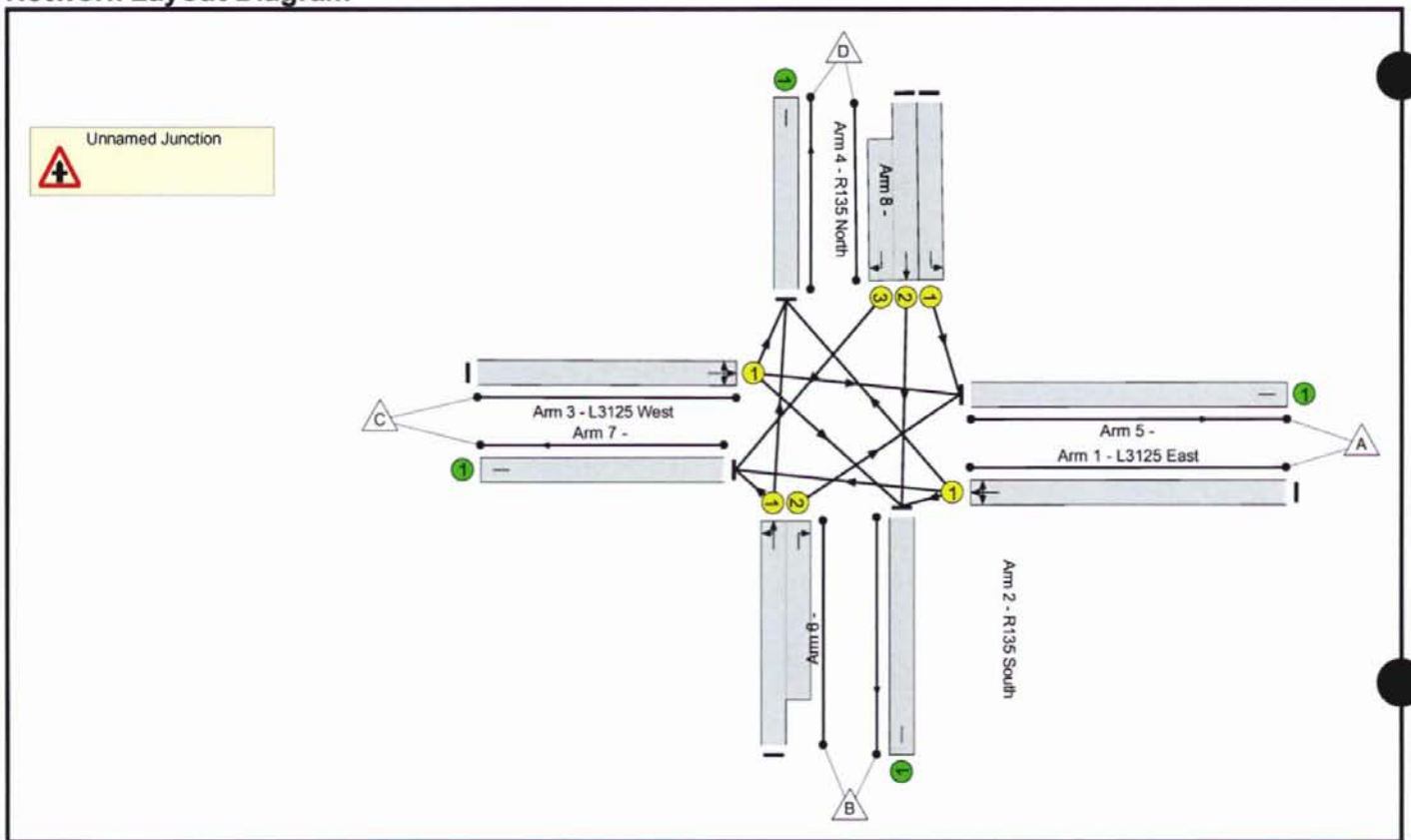
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	72.5
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	72.5
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	13:26		585	1985:2002	830	70.5%
2/1	Elm Road Left	U	N/A	N/A	D		2	21	-	1	1764	597	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	123	1824	268	45.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:16		1072	2015:1766	1479	72.5%
4/1		U	N/A	N/A	-		-	-	-	730	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	981	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	70	1	Inf	0.0%
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	9.4	2.9	0.0	12.4	-	-	-	-
Unnamed Junction	-	-	0	0	0	9.4	2.9	0.0	12.4	-	-	-	-
1/2+1/1	585	585	-	-	-	3.0	1.2	-	4.1	25.5	8.4	1.2	9.6
2/1	1	1	-	-	-	0.0	0.0	-	0.0	10.8	0.0	0.0	0.0
2/2	123	123	-	-	-	0.9	0.4	-	1.3	38.9	2.1	0.4	2.5
3/1+3/2	1072	1049	-	-	-	5.6	1.3	-	6.9	23.1	8.8	1.3	10.1
4/1	730	730	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	958	958	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	70	70	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		24.1	Total Delay for Signalled Lanes (pcuHr):		12.35					
			PRC Over All Lanes (%):		24.1	Total Delay Over All Lanes(pcuHr):		12.35	Cycle Time (s): 68				

Full Input Data And Results  
**Full Input Data And Results**

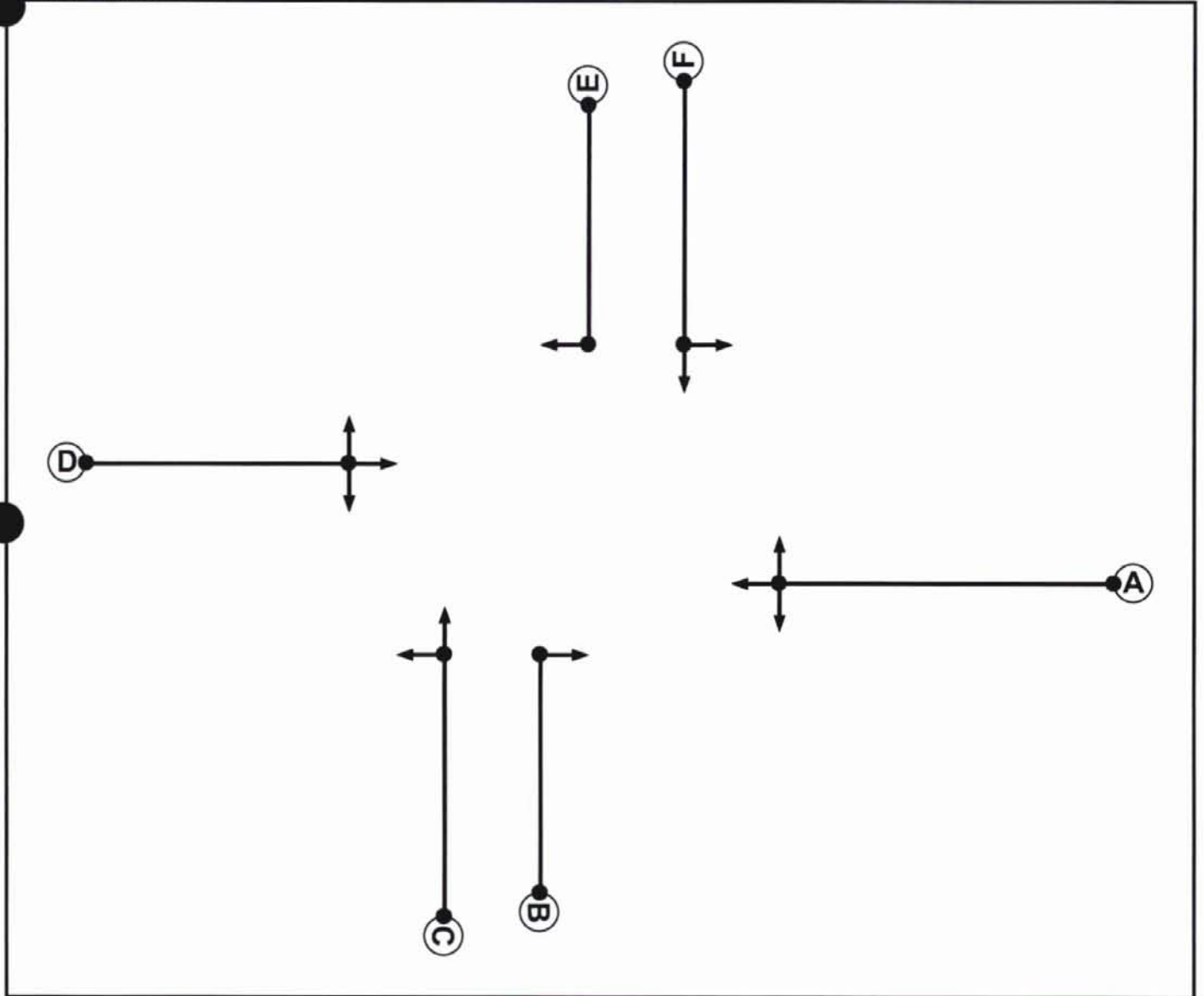
**User and Project Details**

<b>Project:</b>	
<b>Title:</b>	
<b>Location:</b>	
<b>File name:</b>	119216 LinSig Kilshane Cross.lsg3x
<b>Author:</b>	
<b>Company:</b>	
<b>Address:</b>	
<b>Notes:</b>	

**Network Layout Diagram**



Phase Diagram



Phase Input Data

Phase Name	Phase type	Assoc Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Traffic		7	7
F	Traffic		7	7

Full Input Data And Results

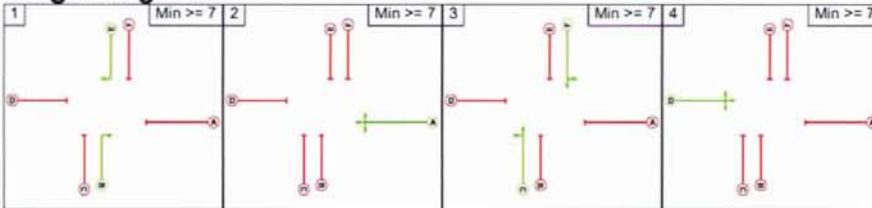
**Phase Intergreens Matrix**

		Starting Phase					
		A	B	C	D	E	F
Terminating Phase	A		5	5	5	5	5
	B	6		5	6	-	5
	C	6	5		6	5	-
	D	5	5	5		5	5
	E	6	-	5	6		5
	F	6	5	-	6	5	

**Phases in Stage**

Stage No.	Phases in Stage
1	B E
2	A
3	C F
4	D

**Stage Diagram**



**Lane Input Data**

Junction: Unnamed Junction												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (L3125 East)	U	A	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 6 Left	8.00
											Arm 7 Ahead	Inf
											Arm 8 Right	12.00
2/1 (R135 South)	U	C	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 7 Left	10.00
											Arm 8 Ahead	Inf
2/2 (R135 South)	U	B	2	3	11.8	Geom	-	3.00	0.00	N	Arm 5 Right	15.00
3/1 (L3125 West)	U	D	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 5 Ahead	Inf
											Arm 6 Right	15.00
											Arm 8 Left	10.00
4/1 (R135 North)	U	F	2	3	9.5	Geom	-	3.00	0.00	Y	Arm 5 Left	14.00
4/2 (R135 North)	U	F	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 6 Ahead	Inf
4/3 (R135 North)	U	E	2	3	9.5	Geom	-	3.00	0.00	Y	Arm 7 Right	15.00
5/1	U		2	3	60.0	Inf	-	-	-	-	-	-
6/1	U		2	3	60.0	Inf	-	-	-	-	-	-
7/1	U		2	3	60.0	Inf	-	-	-	-	-	-
8/1	U		2	3	60.0	Inf	-	-	-	-	-	-

**Traffic Flow Groups**

Flow Group	Start Time	End Time	Duration	Formula
1: '2024 Do Nothing AM'	08:00	09:00	01:00	
2: '2024 Do Nothing PM'	16:30	17:30	01:00	
3: '2024 Do Something AM'	08:00	09:00	01:00	
4: '2024 Do Something PM'	16:30	17:30	01:00	

**Traffic Flows, Desired**

**Scenario 1: Scenario 1** (FG1: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination				
		A	B	C	D	Tot.
Origin	A	0	159	450	59	668
	B	144	0	285	118	547
	C	172	150	0	20	342
	D	292	156	43	0	491
	Tot.	608	465	778	197	2048

**Scenario 2: Scenario 2** (FG2: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination				
		A	B	C	D	Tot.
Origin	A	0	176	222	221	619
	B	230	0	111	225	566
	C	335	193	0	29	557
	D	203	105	20	0	328
	Tot.	768	474	353	475	2070

**Scenario 3: Scenario 3** (FG3: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')

**Desired Flow :**

		Destination				
		A	B	C	D	Tot.
Origin	A	0	165	450	59	674
	B	147	0	291	121	559
	C	172	157	0	20	349
	D	292	161	43	0	496
	Tot.	611	483	784	200	2078

**Scenario 4: Scenario 4** (FG4: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')

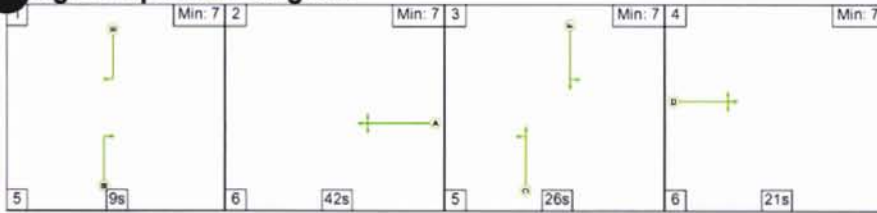
**Desired Flow :**

		Destination				
		A	B	C	D	Tot.
Origin	A	0	178	222	221	621
	B	255	0	124	244	623
	C	335	195	0	29	559
	D	203	106	20	0	329
	Tot.	793	479	366	494	2132

Full Input Data And Results

Scenario 1: Scenario 1 (FG1: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')

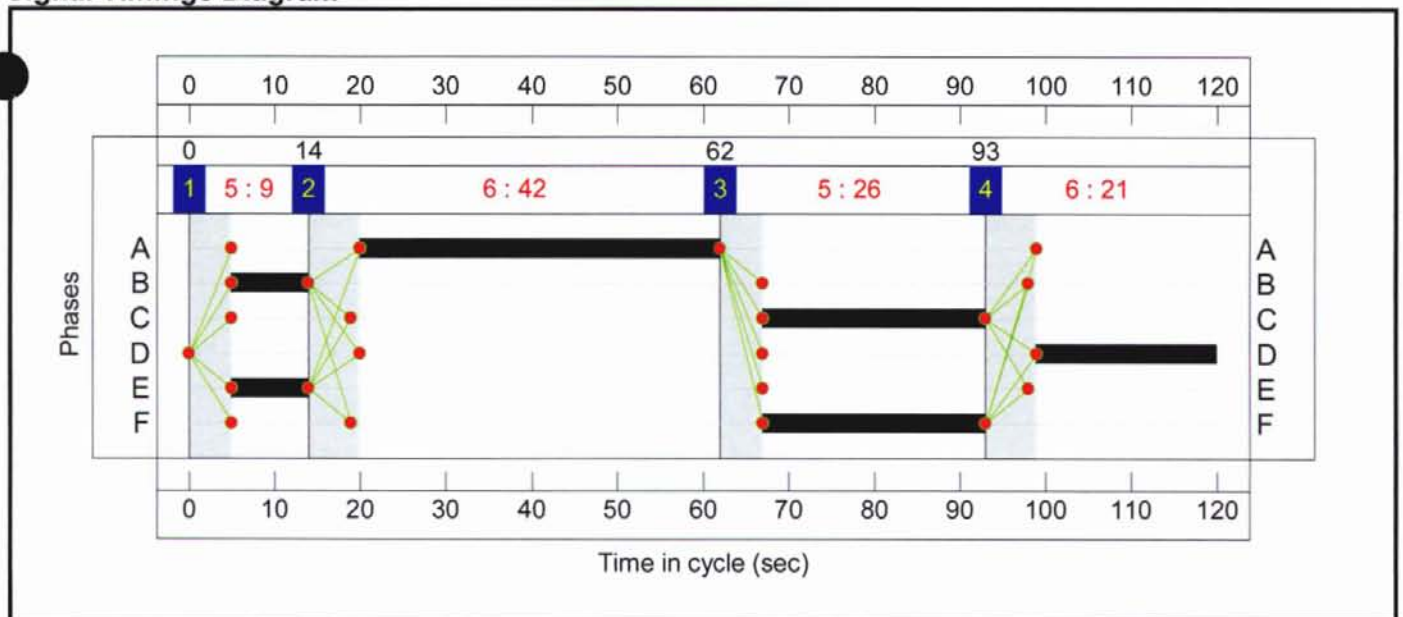
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	9	42	26	21
Change Point	0	14	62	93

Signal Timings Diagram





## Full Input Data And Results

**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	102.8
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	102.8
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	42	-	668	1814	650	102.8%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	26:9		547	1731:1868	545	100.4%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	21	-	342	1819	333	102.6%
4/1	R135 North Left	U	N/A	N/A	F		1	26	-	292	1730	389	75.0%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	26:9		199	1915:1741	534	37.3%
5/1		U	N/A	N/A	-		-	-	-	608	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	465	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	778	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	197	1	Inf	0.0%

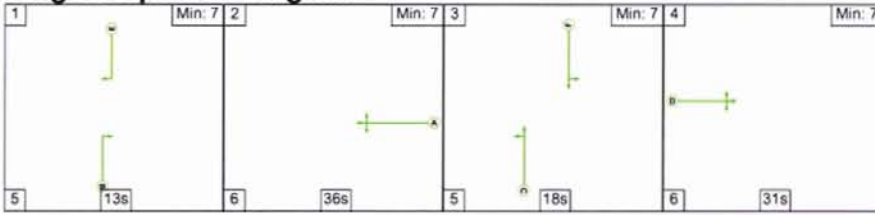
Full Input Data And Results

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	27.2	43.8	0.0	71.0	-	-	-	-
Unnamed Junction	-	-	0	0	0	27.2	43.8	0.0	71.0	-	-	-	-
1/1	668	650	-	-	-	8.1	18.2	-	26.3	141.8	22.9	18.2	41.0
2/1+2/2	547	533	-	-	-	8.0	12.2	-	20.2	133.1	15.1	12.2	27.3
3/1	342	333	-	-	-	5.2	11.6	-	16.9	177.5	11.7	11.6	23.3
4/1	292	292	-	-	-	3.5	1.5	-	5.0	61.3	9.0	1.5	10.5
4/2+4/3	199	199	-	-	-	2.3	0.3	-	2.6	47.3	4.4	0.3	4.7
5/1	604	604	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	457	457	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	756	756	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	191	191	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
<p>C1                      PRC for Signalled Lanes (%): -14.2                      Total Delay for Signalled Lanes (pcuHr): 70.99</p> <p>                                 PRC Over All Lanes (%): -14.2                      Total Delay Over All Lanes(pcuHr): 70.99                      Cycle Time (s): 120</p>													

Full Input Data And Results

**Scenario 2: Scenario 2** (FG2: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')

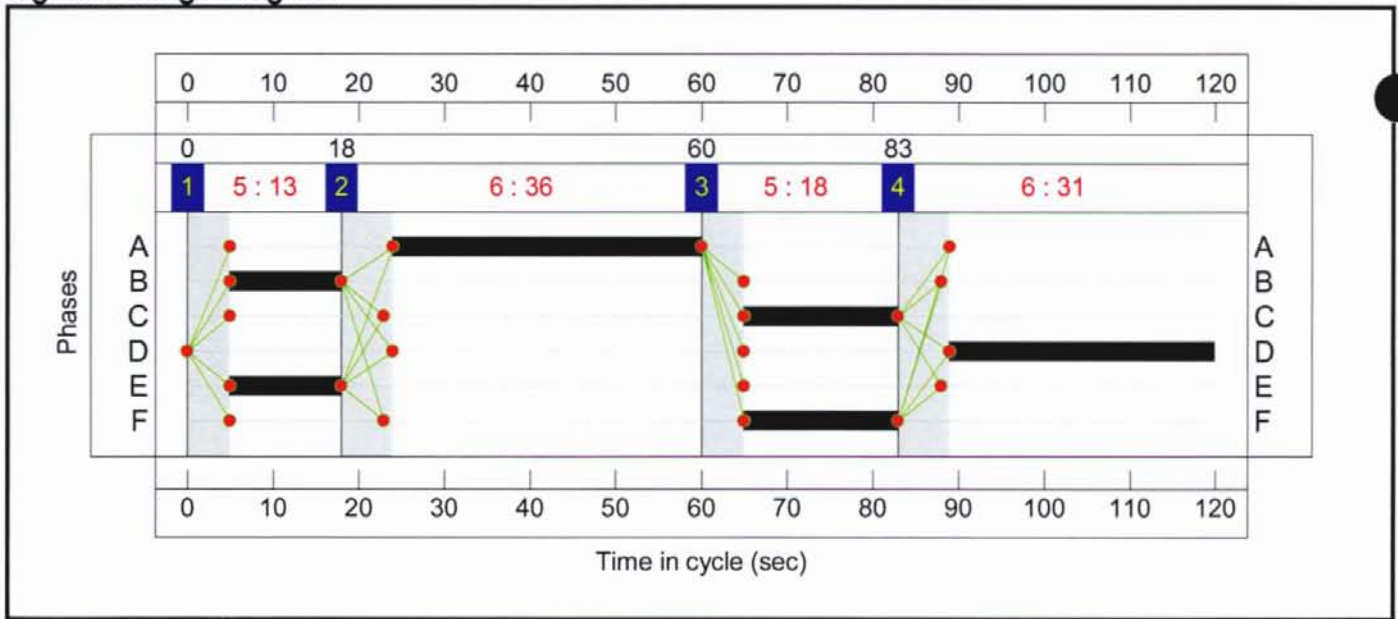
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	13	36	18	31
Change Point	0	18	60	83

**Signal Timings Diagram**



**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	115.1
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	115.1
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	36	-	619	1744	538	115.1%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	18:13		566	1825:1868	507	111.7%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	31	-	557	1837	490	113.7%
4/1	R135 North Left	U	N/A	N/A	F		1	18	-	203	1730	274	74.1%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	18:13		125	1915:1741	361	34.6%
5/1		U	N/A	N/A	-		-	-	-	768	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	474	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	353	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	475	1	Inf	0.0%

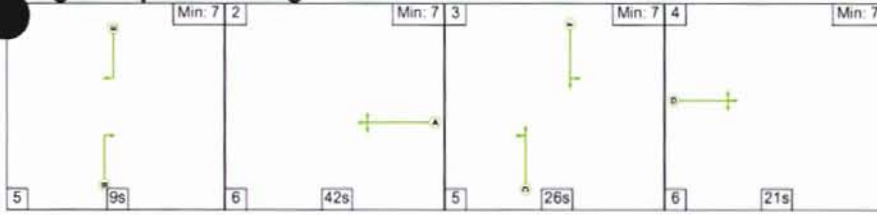
Full Input Data And Results

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	38.4	116.8	0.0	155.2	-	-	-	-
Unnamed Junction	-	-	0	0	0	38.4	116.8	0.0	155.2	-	-	-	-
1/1	619	538	-	-	-	11.6	44.1	-	55.7	323.9	23.3	44.1	67.5
2/1+2/2	566	507	-	-	-	11.0	33.7	-	44.7	284.6	14.8	33.7	48.6
3/1	557	490	-	-	-	11.5	37.3	-	48.8	315.6	22.6	37.3	59.9
4/1	203	203	-	-	-	2.7	1.4	-	4.1	72.6	6.4	1.4	7.8
4/2+4/3	125	125	-	-	-	1.6	0.3	-	1.8	53.0	3.1	0.3	3.4
5/1	716	716	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	428	428	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	308	308	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	411	411	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
<p>C1                      PRC for Signalled Lanes (%): -27.9                      Total Delay for Signalled Lanes (pcuHr): 155.22                      Cycle Time (s): 120                      PRC Over All Lanes (%): -27.9                      Total Delay Over All Lanes(pcuHr): 155.22</p>													

Full Input Data And Results

Scenario 3: Scenario 3 (FG3: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')

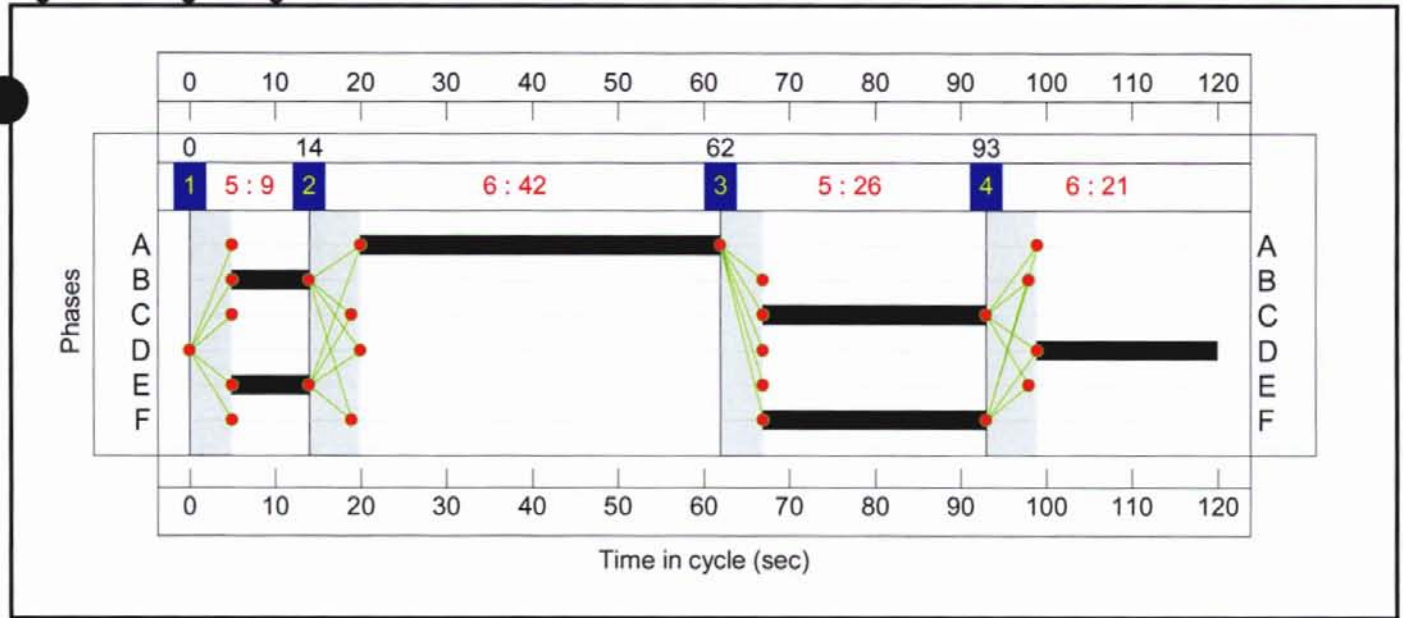
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	9	42	26	21
Change Point	0	14	62	93

Signal Timings Diagram



## Full Input Data And Results

**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	104.7
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	104.7
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	42	-	674	1812	649	103.8%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	26:9		559	1732:1868	545	102.6%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	21	-	349	1818	333	104.7%
4/1	R135 North Left	U	N/A	N/A	F		1	26	-	292	1730	389	75.0%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	26:9		204	1915:1741	526	38.8%
5/1		U	N/A	N/A	-		-	-	-	611	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	483	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	784	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	200	1	Inf	0.0%

Full Input Data And Results

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	28.8	52.2	0.0	81.1	-	-	-	-
Unnamed Junction	-	-	0	0	0	28.8	52.2	0.0	81.1	-	-	-	-
1/1	674	649	-	-	-	8.6	20.5	-	29.1	155.5	23.3	20.5	43.8
2/1+2/2	559	536	-	-	-	8.6	15.9	-	24.4	157.2	16.4	15.9	32.2
3/1	349	333	-	-	-	5.8	14.1	-	19.9	205.2	12.4	14.1	26.4
4/1	292	292	-	-	-	3.5	1.5	-	5.0	61.3	9.0	1.5	10.5
4/2+4/3	204	204	-	-	-	2.4	0.3	-	2.7	47.5	4.5	0.3	4.8
5/1	603	603	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	470	470	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	751	751	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	190	190	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1			PRC for Signalled Lanes (%):		-16.3	Total Delay for Signalled Lanes (pcuHr):		81.08					
			PRC Over All Lanes (%):		-16.3	Total Delay Over All Lanes (pcuHr):		81.08	Cycle Time (s): 120				

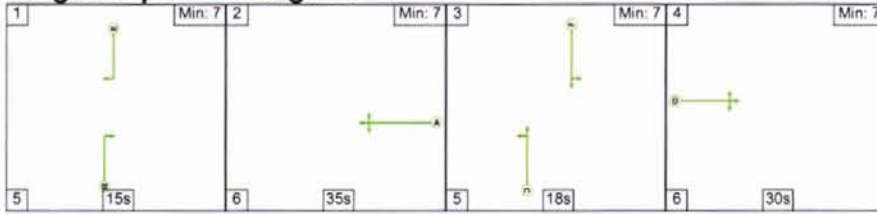
FINGAL COUNTY COUNCIL  
 PLANNING DEPARTMENT  
 11 FEB 2022  
 ADDITIONAL INFORMATION  
 REGISTRY



Full Input Data And Results

**Scenario 4: Scenario 4** (FG4: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')

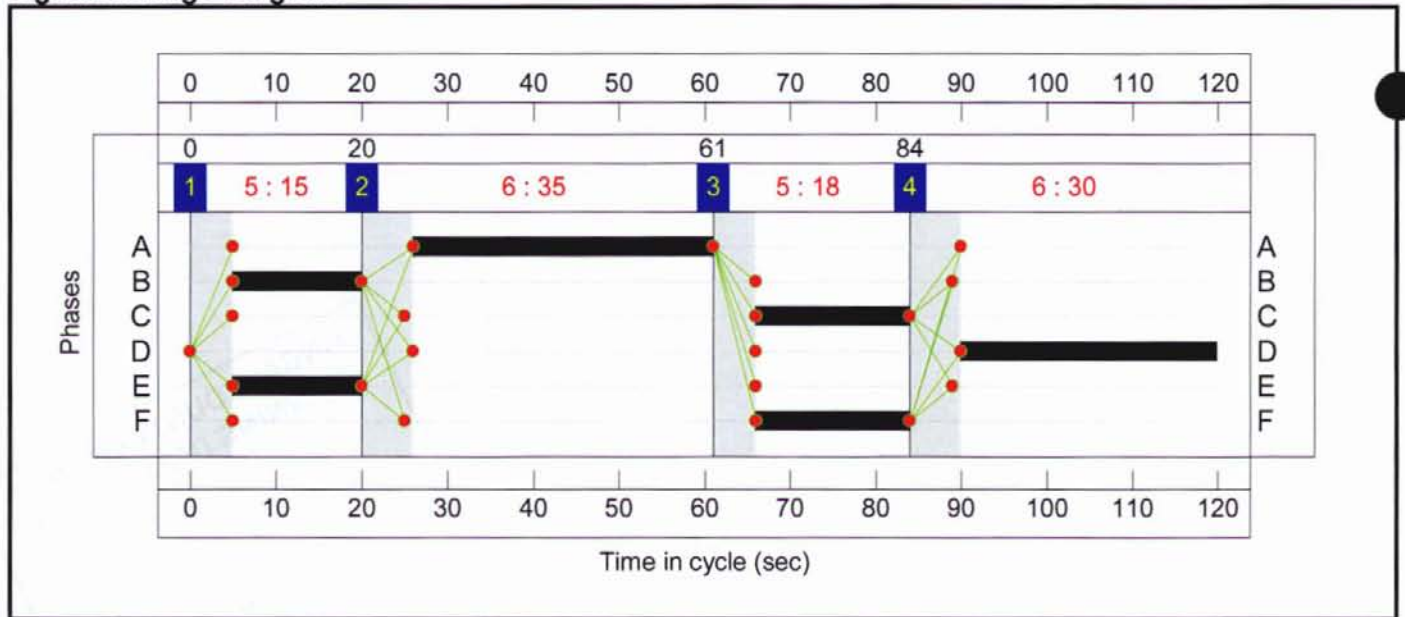
**Stage Sequence Diagram**



**Stage Timings**

Stage	1	2	3	4
Duration	15	35	18	30
Change Point	0	20	61	84

**Signal Timings Diagram**



**Network Results**

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat ( )
Network	-	-	-	-	-	-	-	-	-	-	-	-	118.7
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	118.7
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	35	-	621	1744	523	118.7%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	18:15		623	1823:1868	538	115.9%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	30	-	559	1837	475	117.8%
4/1	R135 North Left	U	N/A	N/A	F		1	18	-	203	1730	274	74.1%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	18:15		126	1915:1741	360	35.0%
5/1		U	N/A	N/A	-		-	-	-	793	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	479	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	366	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	494	1	Inf	0.0%

Full Input Data And Results

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	0	0	0	42.5	144.9	0.0	187.4	-	-	-	-
Unnamed Junction	-	-	0	0	0	42.5	144.9	0.0	187.4	-	-	-	-
1/1	621	523	-	-	-	12.5	51.9	-	64.4	373.5	24.0	51.9	75.9
2/1+2/2	623	538	-	-	-	12.8	46.0	-	58.8	340.0	19.0	46.0	65.0
3/1	559	475	-	-	-	12.8	45.3	-	58.1	374.5	23.8	45.3	69.1
4/1	203	203	-	-	-	2.7	1.4	-	4.1	72.6	6.4	1.4	7.8
4/2+4/3	126	126	-	-	-	1.6	0.3	-	1.8	52.8	3.1	0.3	3.4
5/1	736	736	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	422	422	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	304	304	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	402	402	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
<p>C1                      PRC for Signalled Lanes (%): -31.9                      Total Delay for Signalled Lanes (pcuHr): 187.35                      PRC Over All Lanes (%): -31.9                      Total Delay Over All Lanes(pcuHr): 187.35                      Cycle Time (s): 120</p>													

# Junctions 9

## PICADY 9 - Priority Intersection Module

Version: 9.0.1.4646 []  
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

Filename: 119216 PICADY Site Access- North Road.j9  
Path: I:\CST\119\201-250\119216\calcs\PICADY  
Report generation date: 30/04/2021 09:48:30

»2024 Do Something, AM  
»2024 Do Something, PM  
»2027 Do Something, PM  
»2032 Do Something, PM  
»2042 Do Something, PM  
»2027 Do Something, AM  
»2032 Do Something, AM  
»2042 Do Something, AM

### Summary of junction performance

	AM						PM					
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
<b>2024 Do Something</b>												
Stream B-AC	0.0	0.5	6.18	0.01	A	226 %	0.4	1.6	8.32	0.29	A	131 %
Stream C-AB	0.0	0.5	4.28	0.02	A	[Stream C-AB]	0.0	0.5	5.09	0.01	A	[Stream B-AC]
<b>2027 Do Something</b>												
Stream B-AC	0.0	0.5	6.24	0.02	A	210 %	0.4	1.7	8.40	0.29	A	127 %
Stream C-AB	0.0	0.5	4.24	0.02	A	[Stream C-AB]	0.0	0.5	5.08	0.01	A	[Stream B-AC]
<b>2032 Do Something</b>												
Stream B-AC	0.0	0.5	6.33	0.02	A	191 %	0.4	1.7	8.52	0.29	A	122 %
Stream C-AB	0.0	0.5	4.18	0.02	A	[Stream C-AB]	0.0	0.5	5.07	0.01	A	[Stream B-AC]
<b>2042 Do Something</b>												
Stream B-AC	0.0	0.5	6.41	0.02	A	172 %	0.4	1.7	8.65	0.29	A	117 %
Stream C-AB	0.0	0.5	4.11	0.02	A	[Stream C-AB]	0.0	0.5	5.06	0.01	A	[Stream B-AC]

*There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.*

*Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.*

### File summary

#### File Description

Title	Site Access/ North Road
Location	Huntstown, Co Dublin
Site number	
Date	19/03/2021
Version	
Status	TIA
Identifier	
Client	Microsoft
Jobnumber	119216
Enumerator	Donal
Description	

**Units**

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

**Analysis Options**

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

**Demand Set Summary**

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D2	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D3	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D4	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D5	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D7	2027 Do Something	AM	2027 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D8	2032 Do Something	AM	2032 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D9	2042 Do Something	AM	2042 Do Something AM	ONE HOUR	07:45	09:15	15	✓

**Analysis Set Details**

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

# 2024 Do Something, AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.14	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	226	Stream C-AB

## Arms

### Arms

Arm	Name	Description	Arm type
A	North Road		Major
B	Site Access		Minor
C	R135(NNW)		Major

### Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C - R135(NNW)	7.20			215.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

### Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B - Site Access	One lane	3.50	50	50

### Slope / Intercept / Capacity

#### Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	544	0.094	0.238	0.149	0.339
1	B-C	688	0.100	0.253	-	-
1	C-B	698	0.257	0.257	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.

Streams may be combined, in which case capacity will be adjusted.

Values are shown for the first time segment only; they may differ for subsequent time segments.

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

**Demand overview (Traffic)**

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	349	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	457	100.000

**Origin-Destination Data****Demand (PCU/hr)**

From	To			
	A - North Road	B - Site Access	C - R135(NNW)	
A - North Road	0	0	349	
B - Site Access	0	0	8	
C - R135(NNW)	449	8	0	

**Vehicle Mix****Heavy Vehicle Percentages**

From	To			
	A - North Road	B - Site Access	C - R135(NNW)	
A - North Road	0	0	0	
B - Site Access	0	0	0	
C - R135(NNW)	0	0	0	

**Results****Results Summary for whole modelled period**

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.01	6.18	0.0	0.5	A	7	11
C-AB	0.02	4.28	0.0	0.5	A	14	21
C-A						405	608
A-B						0	0
A-C						320	480

**Main Results for each time segment****07:45 - 08:00**

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	622	0.010	6	0.0	0.0	5.845	A
C-AB	10	2	851	0.012	10	0.0	0.0	4.282	A
C-A	334	84			334				
A-B	0	0			0				
A-C	263	66			263				

**08:00 - 08:15**

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	609	0.012	7	0.0	0.0	5.982	A
C-AB	13	3	883	0.015	13	0.0	0.0	4.138	A
C-A	398	99			398				
A-B	0	0			0				
A-C	314	78			314				

## 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	591	0.015	9	0.0	0.0	6.181	A
C-AB	19	5	930	0.020	19	0.0	0.0	3.952	A
C-A	484	121			484				
A-B	0	0			0				
A-C	384	96			384				

## 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	591	0.015	9	0.0	0.0	6.181	A
C-AB	19	5	930	0.020	19	0.0	0.0	3.952	A
C-A	484	121			484				
A-B	0	0			0				
A-C	384	96			384				

## 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	609	0.012	7	0.0	0.0	5.982	A
C-AB	13	3	883	0.015	13	0.0	0.0	4.140	A
C-A	398	99			398				
A-B	0	0			0				
A-C	314	78			314				

## 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	622	0.010	6	0.0	0.0	5.847	A
C-AB	10	3	851	0.012	10	0.0	0.0	4.284	A
C-A	334	84			334				
A-B	0	0			0				
A-C	263	66			263				

## Queue Variation Results for each time segment

## 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

## 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

## 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

## 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

## 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A



09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

# 2024 Do Something , PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.24	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	131	Stream B-AC

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	294	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	150	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	294
	B - Site Access	0	0	158
	C - R135(NNW)	145	5	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.32	0.4	1.6	A	145	217
C-AB	0.01	5.09	0.0	0.5	A	6	9
C-A						132	198
A-B						0	0
A-C						270	405

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	632	0.188	118	0.0	0.2	6.987	A
C-AB	4	1	712	0.006	4	0.0	0.0	5.087	A
C-A	108	27			108				
A-B	0	0			0				
A-C	221	55			221				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	621	0.229	142	0.2	0.3	7.502	A
C-AB	6	1	715	0.008	5	0.0	0.0	5.070	A
C-A	129	32			129				
A-B	0	0			0				
A-C	264	66			264				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	606	0.287	174	0.3	0.4	8.307	A
C-AB	7	2	721	0.010	7	0.0	0.0	5.045	A
C-A	158	40			158				
A-B	0	0			0				
A-C	324	81			324				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	606	0.287	174	0.4	0.4	8.324	A
C-AB	7	2	721	0.010	7	0.0	0.0	5.045	A
C-A	158	40			158				
A-B	0	0			0				
A-C	324	81			324				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	621	0.229	142	0.4	0.3	7.521	A
C-AB	6	1	715	0.008	6	0.0	0.0	5.073	A
C-A	129	32			129				
A-B	0	0			0				
A-C	264	66			264				

#### 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	632	0.188	119	0.3	0.2	7.022	A
C-AB	4	1	712	0.006	4	0.0	0.0	5.089	A
C-A	108	27			108				
A-B	0	0			0				
A-C	221	55			221				

## Queue Variation Results for each time segment

### 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.29	0.00	0.00	0.29	0.29			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

### 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.25	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

### 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.31	1.29	1.64			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

# 2027 Do Something, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.18	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	127	Stream B-AC

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	309	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	158	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	309
	B - Site Access	0	0	158
	C - R135(NNW)	153	5	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.40	0.4	1.7	A	145	217
C-AB	0.01	5.08	0.0	0.5	A	6	9
C-A						139	209
A-B						0	0
A-C						284	425

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	629	0.189	118	0.0	0.2	7.026	A
C-AB	4	1	713	0.006	4	0.0	0.0	5.079	A
C-A	114	29			114				
A-B	0	0			0				
A-C	233	58			233				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	618	0.230	142	0.2	0.3	7.556	A
C-AB	6	1	717	0.008	6	0.0	0.0	5.060	A
C-A	136	34			136				
A-B	0	0			0				
A-C	278	69			278				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	602	0.289	174	0.3	0.4	8.389	A
C-AB	7	2	722	0.010	7	0.0	0.0	5.032	A
C-A	167	42			167				
A-B	0	0			0				
A-C	340	85			340				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	602	0.289	174	0.4	0.4	8.405	A
C-AB	7	2	722	0.010	7	0.0	0.0	5.034	A
C-A	167	42			167				
A-B	0	0			0				
A-C	340	85			340				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	618	0.230	142	0.4	0.3	7.578	A
C-AB	6	1	717	0.008	6	0.0	0.0	5.063	A
C-A	136	34			136				
A-B	0	0			0				
A-C	278	69			278				

#### 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	629	0.189	119	0.3	0.2	7.058	A
C-AB	4	1	713	0.006	5	0.0	0.0	5.079	A
C-A	114	29			114				
A-B	0	0			0				
A-C	233	58			233				

**Queue Variation Results for each time segment****16:15 - 16:30**

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

**16:30 - 16:45**

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

**16:45 - 17:00**

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.25	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

**17:00 - 17:15**

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.31	1.29	1.66			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

**17:15 - 17:30**

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

**17:30 - 17:45**

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

# 2032 Do Something, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.10	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	122	Stream B-AC

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	330	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	169	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	330
	B - Site Access	0	0	158
	C - R135(NNW)	164	5	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0



## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.52	0.4	1.7	A	145	217
C-AB	0.01	5.07	0.0	0.5	A	6	9
C-A						149	224
A-B						0	0
A-C						303	454

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	625	0.190	118	0.0	0.2	7.081	A
C-AB	5	1	715	0.006	5	0.0	0.0	5.069	A
C-A	123	31			123				
A-B	0	0			0				
A-C	248	62			248				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	613	0.232	142	0.2	0.3	7.632	A
C-AB	6	1	719	0.008	6	0.0	0.0	5.047	A
C-A	146	37			146				
A-B	0	0			0				
A-C	297	74			297				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	596	0.292	174	0.3	0.4	8.505	A
C-AB	7	2	725	0.010	7	0.0	0.0	5.014	A
C-A	179	45			179				
A-B	0	0			0				
A-C	363	91			363				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	596	0.292	174	0.4	0.4	8.521	A
C-AB	7	2	725	0.010	7	0.0	0.0	5.016	A
C-A	179	45			179				
A-B	0	0			0				
A-C	363	91			363				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	613	0.232	142	0.4	0.3	7.655	A
C-AB	6	1	719	0.008	6	0.0	0.0	5.047	A
C-A	146	37			146				
A-B	0	0			0				
A-C	297	74			297				

#### 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	625	0.190	119	0.3	0.2	7.114	A
C-AB	5	1	715	0.006	5	0.0	0.0	5.071	A
C-A	123	31			123				
A-B	0	0			0				
A-C	248	62			248				

## Queue Variation Results for each time segment

### 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

### 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.41	0.03	0.26	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

### 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.41	0.03	0.31	1.30	1.70			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

# 2042 Do Something , PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.02	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	117	Stream B-AC

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	352	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	181	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	352
	B - Site Access	0	0	158
	C - R135(NNW)	176	5	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.65	0.4	1.7	A	145	217
C-AB	0.01	5.06	0.0	0.5	A	6	9
C-A						160	240
A-B						0	0
A-C						323	485

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	621	0.191	118	0.0	0.2	7.140	A
C-AB	5	1	717	0.006	5	0.0	0.0	5.055	A
C-A	132	33			132				
A-B	0	0			0				
A-C	265	66			265				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	608	0.234	142	0.2	0.3	7.711	A
C-AB	6	1	721	0.008	6	0.0	0.0	5.030	A
C-A	157	39			157				
A-B	0	0			0				
A-C	316	79			316				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	590	0.295	174	0.3	0.4	8.628	A
C-AB	8	2	728	0.010	7	0.0	0.0	4.993	A
C-A	192	48			192				
A-B	0	0			0				
A-C	388	97			388				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	590	0.295	174	0.4	0.4	8.647	A
C-AB	8	2	728	0.010	8	0.0	0.0	4.995	A
C-A	192	48			192				
A-B	0	0			0				
A-C	388	97			388				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	608	0.234	142	0.4	0.3	7.737	A
C-AB	6	1	721	0.008	6	0.0	0.0	5.031	A
C-A	157	39			157				
A-B	0	0			0				
A-C	316	79			316				

#### 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	621	0.191	119	0.3	0.2	7.176	A
C-AB	5	1	717	0.006	5	0.0	0.0	5.058	A
C-A	132	33			132				
A-B	0	0			0				
A-C	265	66			265				

## Queue Variation Results for each time segment

### 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

### 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.41	0.03	0.26	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

### 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.42	0.03	0.31	1.30	1.73			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.31	0.00	0.00	0.31	0.31			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

# 2027 Do Something, AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.14	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	210	Stream C-AB

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2027 Do Something	AM	2027 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	370	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	483	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	370
	B - Site Access	0	0	8
	C - R135(NNW)	475	8	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.24	0.0	0.5	A	7	11
C-AB	0.02	4.24	0.0	0.5	A	15	22
C-A						429	643
A-B						0	0
A-C						340	509

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	618	0.010	6	0.0	0.0	5.883	A
C-AB	10	3	860	0.012	10	0.0	0.0	4.236	A
C-A	353	88			353				
A-B	0	0			0				
A-C	279	70			279				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	604	0.012	7	0.0	0.0	6.029	A
C-AB	14	3	895	0.015	14	0.0	0.0	4.086	A
C-A	420	105			420				
A-B	0	0			0				
A-C	333	83			333				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	585	0.015	9	0.0	0.0	6.244	A
C-AB	20	5	944	0.021	20	0.0	0.0	3.893	A
C-A	512	128			512				
A-B	0	0			0				
A-C	407	102			407				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	585	0.015	9	0.0	0.0	6.244	A
C-AB	20	5	944	0.021	20	0.0	0.0	3.894	A
C-A	512	128			512				
A-B	0	0			0				
A-C	407	102			407				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	604	0.012	7	0.0	0.0	6.032	A
C-AB	14	3	895	0.015	14	0.0	0.0	4.088	A
C-A	420	105			420				
A-B	0	0			0				
A-C	333	83			333				

#### 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	618	0.010	6	0.0	0.0	5.883	A
C-AB	10	3	860	0.012	10	0.0	0.0	4.236	A
C-A	353	88			353				
A-B	0	0			0				
A-C	279	70			279				

## Queue Variation Results for each time segment

### 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

### 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

### 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A



# 2032 Do Something, AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.13	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	191	Stream C-AB

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2032 Do Something	AM	2032 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	397	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	517	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	397
	B - Site Access	0	0	8
	C - R135(NNW)	509	8	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.33	0.0	0.5	A	7	11
C-AB	0.02	4.18	0.0	0.5	A	15	23
C-A						459	688
A-B						0	0
A-C						364	546

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	613	0.010	6	0.0	0.0	5.933	A
C-AB	11	3	873	0.012	11	0.0	0.0	4.176	A
C-A	378	95			378				
A-B	0	0			0				
A-C	299	75			299				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	598	0.012	7	0.0	0.0	6.092	A
C-AB	14	4	910	0.016	14	0.0	0.0	4.018	A
C-A	450	113			450				
A-B	0	0			0				
A-C	357	89			357				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	578	0.015	9	0.0	0.0	6.326	A
C-AB	21	5	964	0.022	21	0.0	0.0	3.815	A
C-A	548	137			548				
A-B	0	0			0				
A-C	437	109			437				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	578	0.015	9	0.0	0.0	6.326	A
C-AB	21	5	964	0.022	21	0.0	0.0	3.819	A
C-A	548	137			548				
A-B	0	0			0				
A-C	437	109			437				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	598	0.012	7	0.0	0.0	6.095	A
C-AB	15	4	910	0.016	15	0.0	0.0	4.020	A
C-A	450	113			450				
A-B	0	0			0				
A-C	357	89			357				

#### 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	613	0.010	6	0.0	0.0	5.935	A
C-AB	11	3	873	0.012	11	0.0	0.0	4.176	A
C-A	378	95			378				
A-B	0	0			0				
A-C	299	75			299				

## Queue Variation Results for each time segment

### 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

### 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

### 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

# 2042 Do Something , AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.13	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	172	Stream C-AB

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D9	2042 Do Something	AM	2042 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	425	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	554	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	425
	B - Site Access	0	0	8
	C - R135(NNW)	546	8	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.41	0.0	0.5	A	7	11
C-AB	0.02	4.11	0.0	0.5	A	16	25
C-A						492	738
A-B						0	0
A-C						390	585

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	607	0.010	6	0.0	0.0	5.986	A
C-AB	11	3	887	0.013	11	0.0	0.0	4.111	A
C-A	406	101			406				
A-B	0	0			0				
A-C	320	80			320				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	592	0.012	7	0.0	0.0	6.158	A
C-AB	15	4	928	0.017	15	0.0	0.0	3.945	A
C-A	483	121			483				
A-B	0	0			0				
A-C	382	96			382				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	570	0.015	9	0.0	0.0	6.414	A
C-AB	23	6	986	0.023	23	0.0	0.0	3.734	A
C-A	587	147			587				
A-B	0	0			0				
A-C	468	117			468				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	570	0.015	9	0.0	0.0	6.414	A
C-AB	23	6	986	0.023	23	0.0	0.0	3.734	A
C-A	587	147			587				
A-B	0	0			0				
A-C	468	117			468				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	592	0.012	7	0.0	0.0	6.159	A
C-AB	15	4	928	0.017	15	0.0	0.0	3.947	A
C-A	483	121			483				
A-B	0	0			0				
A-C	382	96			382				

#### 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	607	0.010	6	0.0	0.0	5.988	A
C-AB	11	3	887	0.013	11	0.0	0.0	4.112	A
C-A	406	101			406				
A-B	0	0			0				
A-C	320	80			320				

## Queue Variation Results for each time segment

### 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

### 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

### 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

### 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

**FINGAL COUNTY COUNCIL  
 PLANNING DEPARTMENT**  
  
 11 FEB 2022  
  
**ADDITIONAL INFORMATION  
 REGISTRY**

# Junctions 9

## PICADY 9 - Priority Intersection Module

Version: 9.0.1.4646 []  
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Filename: 119216 PICADY Construction Access-North Road DF 2022.j9  
Path: I:\CST\119\201-250\119216\calcs\PICADY  
Report generation date: 30/07/2021 12:51:11

- »2022 Do Something , AM
- »2022 Do Something, PM
- »2024 Do Something , AM
- »2024 Do Something , PM

### Summary of junction performance

	AM						PM					
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
2022 Do Something												
Stream B-AC	0.1	0.5	7.02	0.06	A	151 %	0.1	0.5	6.92	0.07	A	383 %
Stream C-AB	0.3	1.3	4.61	0.12	A	[Stream C-AB]	0.0	0.5	5.15	0.03	A	[Stream B-AC]
2024 Do Something												
Stream B-AC	0.1	0.5	7.09	0.06	A	141 %	0.1	0.5	7.54	0.07	A	247 %
Stream C-AB	0.3	1.4	4.57	0.13	A	[Stream C-AB]	0.0	0.5	5.46	0.03	A	[Stream B-AC]

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

### File summary

#### File Description

Title	Site Access/ North Road
Location	Huntstown, Co Dublin
Site number	
Date	19/03/2021
Version	
Status	TIA
Identifier	
Client	Microsoft
Jobnumber	119216
Enumerator	Donal
Description	

### Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

### Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queuing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

**Demand Set Summary**

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D2	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D3	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D4	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

**Analysis Set Details**

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000



# 2022 Do Something , AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.74	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	151	Stream C-AB

## Arms

### Arms

Arm	Name	Description	Arm type
A	North Road		Major
B	Site Access		Minor
C	R135(NNW)		Major

### Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	7.20			215.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

### Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.00	10	10

## Slope / Intercept / Capacity

### Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	486	0.084	0.212	0.133	0.303
1	B-C	630	0.092	0.231	-	-
1	C-B	698	0.257	0.257	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.

Streams may be combined, in which case capacity will be adjusted.

Values are shown for the first time segment only; they may differ for subsequent time segments.

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

## Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	336	100.000
B		ONE HOUR	✓	29	100.000
C		ONE HOUR	✓	474	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	336
	B	0	0	29
	C	425	49	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.06	7.02	0.1	0.5	A	27	40
C-AB	0.12	4.61	0.3	1.3	A	83	125
C-A						352	528
A-B						0	0
A-C						308	462

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	572	0.038	22	0.0	0.0	6.543	A
C-AB	60	15	841	0.071	59	0.0	0.1	4.605	A
C-A	297	74			297				
A-B	0	0			0				
A-C	253	63			253				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	560	0.047	26	0.0	0.0	6.737	A
C-AB	79	20	871	0.090	78	0.1	0.2	4.544	A
C-A	347	87			347				
A-B	0	0			0				
A-C	302	76			302				

## 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	545	0.059	32	0.0	0.1	7.021	A
C-AB	111	28	915	0.121	111	0.2	0.3	4.479	A
C-A	411	103			411				
A-B	0	0			0				
A-C	370	92			370				

## 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	545	0.059	32	0.1	0.1	7.021	A
C-AB	111	28	915	0.121	111	0.3	0.3	4.484	A
C-A	411	103			411				
A-B	0	0			0				
A-C	370	92			370				

## 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	560	0.047	26	0.1	0.0	6.741	A
C-AB	79	20	872	0.090	79	0.3	0.2	4.550	A
C-A	347	87			347				
A-B	0	0			0				
A-C	302	76			302				

## 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	572	0.038	22	0.0	0.0	6.549	A
C-AB	60	15	841	0.071	60	0.2	0.1	4.612	A
C-A	297	74			297				
A-B	0	0			0				
A-C	253	63			253				

## Queue Variation Results for each time segment

## 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.12	0.00	0.00	0.12	0.12			N/A	N/A

## 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.18	0.00	0.00	0.18	0.18			N/A	N/A

## 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.27	0.03	0.27	0.49	1.32			N/A	N/A

## 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.27	0.00	0.00	0.27	0.27			N/A	N/A

## 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.18	0.00	0.00	0.18	0.18			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.13	0.00	0.00	0.13	0.13			N/A	N/A

# 2022 Do Something, PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.69	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	383	Stream B-AC

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	284	100.000
B		ONE HOUR	✓	34	100.000
C		ONE HOUR	✓	154	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	284
	B	0	0	34
	C	140	14	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.07	6.92	0.1	0.5	A	31	47
C-AB	0.03	5.15	0.0	0.5	A	16	24
C-A						126	188
A-B						0	0
A-C						261	391

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	581	0.044	25	0.0	0.0	6.481	A
C-AB	12	3	711	0.017	12	0.0	0.0	5.149	A
C-A	104	26			104				
A-B	0	0			0				
A-C	214	53			214				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	571	0.054	31	0.0	0.1	6.658	A
C-AB	15	4	715	0.021	15	0.0	0.0	5.147	A
C-A	123	31			123				
A-B	0	0			0				
A-C	255	64			255				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	558	0.067	37	0.1	0.1	6.916	A
C-AB	20	5	719	0.027	20	0.0	0.0	5.143	A
C-A	150	37			150				
A-B	0	0			0				
A-C	313	78			313				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	558	0.067	37	0.1	0.1	6.916	A
C-AB	20	5	719	0.027	20	0.0	0.0	5.145	A
C-A	150	37			150				
A-B	0	0			0				
A-C	313	78			313				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	571	0.054	31	0.1	0.1	6.662	A
C-AB	15	4	715	0.021	15	0.0	0.0	5.150	A
C-A	123	31			123				
A-B	0	0			0				
A-C	255	64			255				

#### 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	581	0.044	26	0.1	0.0	6.487	A
C-AB	12	3	711	0.017	12	0.0	0.0	5.152	A
C-A	104	26			104				
A-B	0	0			0				
A-C	214	53			214				

## Queue Variation Results for each time segment

### 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

### 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.03	0.03	0.25	0.45	0.48			N/A	N/A

### 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

# 2024 Do Something , AM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.72	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	141	Stream C-AB

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	357	100.000
B		ONE HOUR	✓	29	100.000
C		ONE HOUR	✓	498	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	357
	B	0	0	29
	C	449	49	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0



## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.06	7.09	0.1	0.5	A	27	40
C-AB	0.13	4.57	0.3	1.4	A	86	130
C-A						371	556
A-B						0	0
A-C						328	491

### Main Results for each time segment

#### 07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	568	0.038	22	0.0	0.0	6.587	A
C-AB	61	15	849	0.072	61	0.0	0.1	4.566	A
C-A	314	78			314				
A-B	0	0			0				
A-C	269	67			269				

#### 08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	566	0.047	26	0.0	0.0	6.793	A
C-AB	82	20	882	0.092	81	0.1	0.2	4.499	A
C-A	366	92			366				
A-B	0	0			0				
A-C	321	80			321				

#### 08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	539	0.059	32	0.0	0.1	7.095	A
C-AB	116	29	928	0.125	116	0.2	0.3	4.435	A
C-A	432	108			432				
A-B	0	0			0				
A-C	393	98			393				

#### 08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	539	0.059	32	0.1	0.1	7.095	A
C-AB	116	29	928	0.125	116	0.3	0.3	4.439	A
C-A	432	108			432				
A-B	0	0			0				
A-C	393	98			393				

#### 08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	566	0.047	26	0.1	0.0	6.797	A
C-AB	82	20	882	0.093	82	0.3	0.2	4.507	A
C-A	366	91			366				
A-B	0	0			0				
A-C	321	80			321				

#### 09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	568	0.038	22	0.0	0.0	6.593	A
C-AB	62	15	850	0.072	62	0.2	0.1	4.573	A
C-A	313	78			313				
A-B	0	0			0				
A-C	269	67			269				

## Queue Variation Results for each time segment

### 07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.13	0.00	0.00	0.13	0.13			N/A	N/A

### 08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.18	0.00	0.00	0.18	0.18			N/A	N/A

### 08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.28	0.03	0.27	0.49	1.37			N/A	N/A

### 08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.28	0.00	0.00	0.28	0.28			N/A	N/A

### 08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.19	0.00	0.00	0.19	0.19			N/A	N/A

### 09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.13	0.00	0.00	0.13	0.13			N/A	N/A

# 2024 Do Something , PM

## Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

## Junction Network

### Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.55	A

### Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	247	Stream B-AC

## Traffic Demand

### Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix source	PCU Factor for a HV (PCU)
PCU Factors	2.00

### Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	452	100.000
B		ONE HOUR	✓	34	100.000
C		ONE HOUR	✓	159	100.000

## Origin-Destination Data

### Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	452
	B	0	0	34
	C	145	14	0

## Vehicle Mix

### Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

## Results

### Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.07	7.54	0.1	0.5	A	31	47
C-AB	0.03	5.46	0.0	0.5	A	16	24
C-A						130	195
A-B						0	0
A-C						415	622

### Main Results for each time segment

#### 16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	551	0.046	25	0.0	0.0	6.842	A
C-AB	13	3	683	0.018	12	0.0	0.0	5.366	A
C-A	107	27			107				
A-B	0	0			0				
A-C	340	85			340				

#### 16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	536	0.057	31	0.0	0.1	7.119	A
C-AB	16	4	682	0.023	16	0.0	0.0	5.404	A
C-A	127	32			127				
A-B	0	0			0				
A-C	406	102			406				

#### 16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	515	0.073	37	0.1	0.1	7.536	A
C-AB	20	5	680	0.030	20	0.0	0.0	5.456	A
C-A	155	39			155				
A-B	0	0			0				
A-C	498	124			498				

#### 17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	515	0.073	37	0.1	0.1	7.536	A
C-AB	20	5	680	0.030	20	0.0	0.0	5.457	A
C-A	155	39			155				
A-B	0	0			0				
A-C	498	124			498				

#### 17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	536	0.057	31	0.1	0.1	7.123	A
C-AB	16	4	682	0.023	16	0.0	0.0	5.405	A
C-A	127	32			127				
A-B	0	0			0				
A-C	406	102			406				

#### 17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	551	0.046	26	0.1	0.0	6.846	A
C-AB	13	3	683	0.018	13	0.0	0.0	5.369	A
C-A	107	27			107				
A-B	0	0			0				
A-C	340	85			340				

## Queue Variation Results for each time segment

### 16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

### 16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.03	0.03	0.25	0.45	0.48			N/A	N/A

### 16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.08	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

### 17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.08	0.00	0.00	0.08	0.08			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

### 17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

### 17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

**APPENDIX 14.1**  
**PRE-CONNECTION ENQUIRY**

Prepared by

Irish Water

---



Philip Corr  
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 Castledawson Avenue  
 Blackrock  
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Uisce Éireann  
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[www.water.ie](http://www.water.ie)

31 March 2021

**Re: CDS20004468 pre-connection enquiry - Subject to contract Contract denied**  
**Connection for Business Connection of 3 units at Huntstown, Dublin, Co. Dublin**

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Huntstown, Dublin, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	<b>OUTCOME OF PRE-CONNECTION ENQUIRY</b> <u><b>THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.</b></u>
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
<b>SITE SPECIFIC COMMENTS</b>	
Water Connection	Approx. 1500m of new 450mm ID pipe main to replace the existing 6" uPVC main as shown below (red dashed line) will be required. This new 450mm will be connected to the existing 450mm DI main.





Upgrade of pumps at Balleycoolen Highlands Tower will be required.

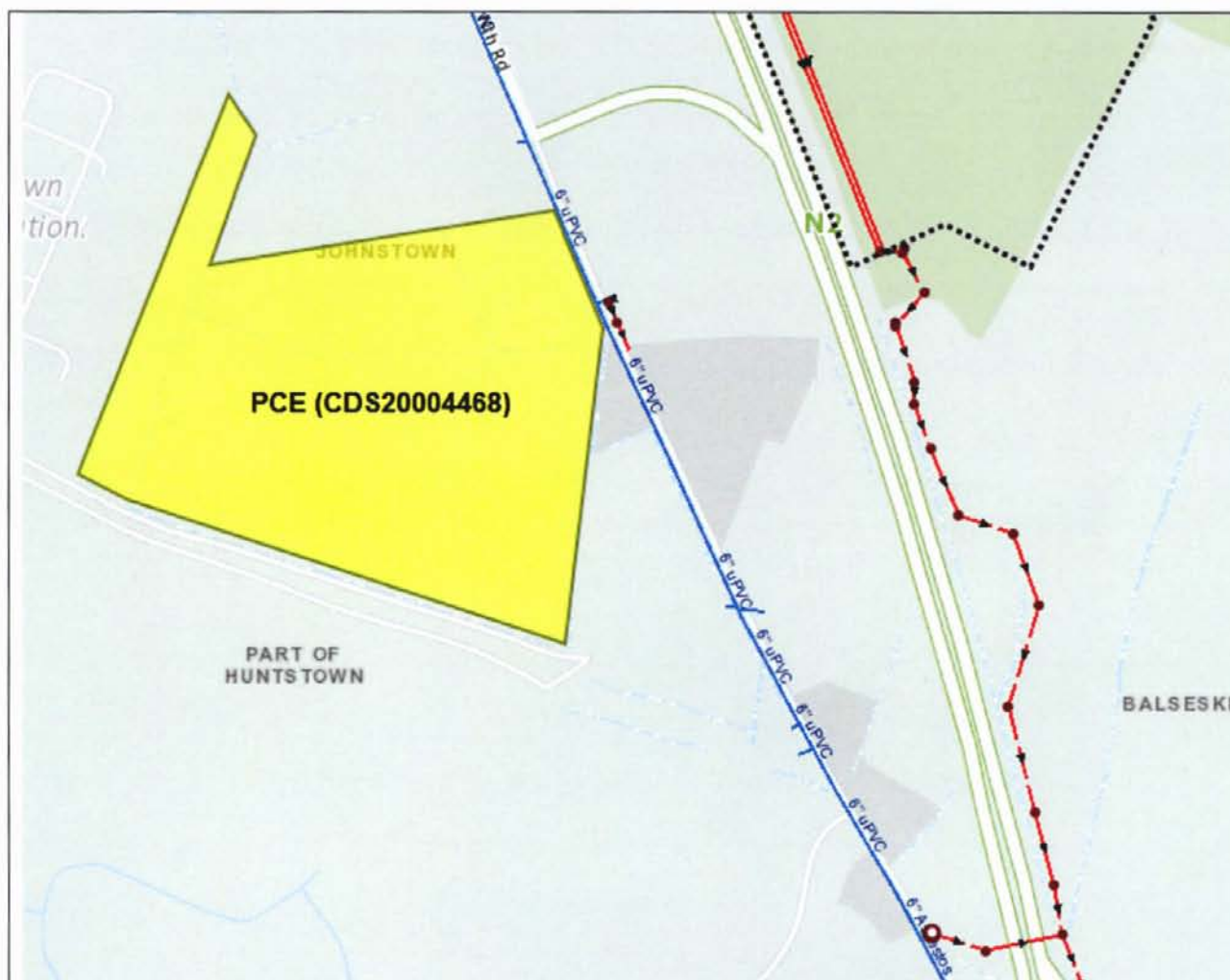
The Developer has to fund a portion of the upgrade works. That will be determined at a connection application stage, based on the peak flow and other connection applications in Hunstown SDZ at that time.

On-site water storage will be required for the average day peak week demand rate of the commercial section for 24-hour period with a re-fill time of 12 hours.

New bulk meter and associated telemetry system will be required to be installed along this connection main.

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



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Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.


#### General Notes:

- 1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
- 2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.

- 3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
- 4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at <https://www.water.ie/connections/get-connected/>
- 5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
- 6) Irish Water Connection Policy/ Charges can be found at <https://www.water.ie/connections/information/connection-charges/>
- 7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
- 8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
- 9) To access Irish Water Maps email [datarequests@water.ie](mailto:datarequests@water.ie)
- 10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email [mzbyrne@water.ie](mailto:mzbyrne@water.ie) For further information, visit [www.water.ie/connections](http://www.water.ie/connections).

Yours sincerely,



**Yvonne Harris**

**Head of Customer Operations**

**APPENDIX 14.2**

**ENGINEERING PLANNING REPORT - DRAINAGE  
AND WATER SERVICES**

Prepared by

Clifton Scannell Emerson Associates

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**Clifton Scannell Emerson**  
Associates

# Engineering Planning Report - Drainage and Water Services

## Huntstown Data Centre Facility

**energia**  
group

Client: Huntstown Power Company  
Ltd.

Date: 9<sup>th</sup> April 2021

Job Number: 20\_099

Civil  
Engineering

Structural  
Engineering

Transport  
Engineering

Environmental  
Engineering

Project  
Management

Health  
and Safety

CONSULTING ENGINEERS



## Document Control Sheet

Project Name: Huntstown Data Centre Facility

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Filename: 20\_099-CSE-00-XX-RP-C-005

Issue No.	Issue Status	Date	Prepared by	Checked by
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1.2	DRAFT	07/05/2021	CD	PM
1.3	PLANNING	04/08/2021	CD	PM

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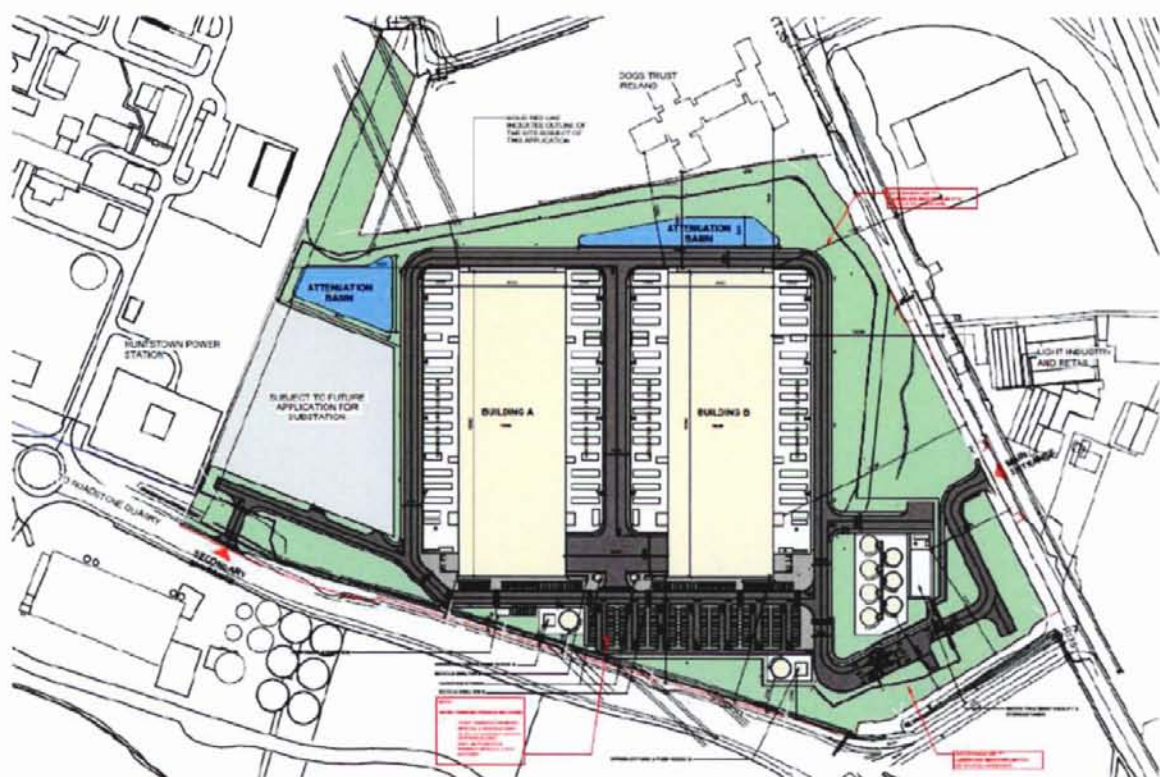
## 1 Introduction

This report is being submitted as part of the planning application for Energia Group for the proposed data storage facility and energy centre development on site at Huntstown, Dublin 11. The report outlines the proposals for drainage services, water supply and flood risk assessment for the development. The proposed development site is approximately 13.30 Hectares in size.

### 1.1 Development Description

The proposed development of a greenfield site of approximately 13.30 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Figure 1.1 below:-



**Figure 1.1 – Proposed Site Masterplan**

The proposed development is described as follows:

- Demolition of 2 no. existing residential dwellings to the east of the site (c. 344 sqm in area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;

- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m<sup>3</sup> c.6.35m high), 2 no. sprinkler tanks (c.670m<sup>3</sup> each and c.7.2m high) with 2 no. pump houses each (c.40sqm c.6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no bicycle spaces, 200 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.

## **1.2 Existing Land Use**

The existing site is a greenfield site which is currently used as agricultural land.

## 2 Surface Water Drainage

### 2.1 General

The proposed development will provide attenuation in compliance with the requirements of the Greater Dublin Strategic Drainage Study (GSDSDS) The following section outlines the surface water drainage proposals for the development. All SUDS elements have been designed as per the recommendation of the SuDS Manual 2015.

All surface water works including connections will be carried out in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

### 2.2 Drawings

The following drawings are provided in support of the planning application to surface water drainage

- Drawing No. 20\_099-CSE-00-XX-DR-C-2110 Proposed Overall Surface Water Drainage Layout
- Drawing No. 20\_099-CSE-00-XX-DR-C-2111- Proposed Surface Water Drainage Sheet 1
- Drawing No. 20\_099-CSE-00-XX-DR-C-2112- Proposed Surface Water Drainage Sheet 2
- Drawing No. 20\_099-CSE-00-XX-DR-C-2115 Surface Water Attenuation Basin 1 Plan and Sections
- Drawing No. 20\_099-CSE-00-XX-DR-C-2116 Surface Water Attenuation Basin 2 Plan and Sections
- Drawing No. 20\_099-CSE-00-XX-DR-C-2910 Standard Trench Details
- Drawing No. 20\_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 1
- Drawing No. 20\_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 2
- Drawing No. 20\_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 3

### 2.3 Existing Surface Water Network

There is no drainage system currently serving the site. The lands fall to the north west of the site and are bordered by a drainage ditch which flows to the Huntstown Stream which is a tributary of the Ward River. The ditch in question joins the Ward approximately 5 km north east of the site.

## 2.4 Proposed Surface Water Network

### 2.4.1 Overview

The proposed surface water networks for the development collect runoff from roofs, roads and other hard standing areas in a sealed system of pipes and gullies. There are two separate surface water drainage networks in the proposed development which flow to separate surface water attenuation basins (Refer to Drawing No s 20\_099-CSE-00-XX-DR-C-2115 and 20\_099-CSE-00-XX-DR-C-2116) from which attenuated flows are discharged, via carrier drains, to the adjacent ditch, described in Section 2.3, adjacent to the north west corner of the site.

### 2.4.2 Surface Water Network Design

The pipe network is designed in accordance with the requirement of Table 6.4 of the Greater Dublin Strategic Drainage Study (GSDSDS) See Fig 2.1 below.

Parameter	Surface Water Sewers
Minimum depth	1.2m cover under highways 0.9m elsewhere
Maximum depth	Normally 5m
Minimum sewer size	225mm
Runoff factors for pipe sizing	100% paved and roof surfaces 0% off pervious surfaces
Rainfall for initial pipe sizing	50mm/hr rainfall intensity
Minimum velocity (pipe full)	1.0m/s
Flooding	Checks made for adequate protection * No flooding for return period less than 30 years except where explicitly planned Simulation modelling is required for sites greater than 24ha**
Roughness – ks	0.6mm

Fig 2.1 – GSDSDS Pipe Design Criteria

In addition to the criteria outlined in Fig 2.1 no flooding of buildings will occur for return periods less than 100 years. Car parks and roadways may flood between 30-100 years. Simulation, drainage design and site levels should take account of this criteria.

Manholes shall be provided at junctions in the network, at changes of direction and gradient and at no more than 90m centres.

The surface water pipe network has been modelled using WinDes™ software and detailed calculations are provided in Appendix A.

### 2.4.3 Pollution Control Measures

It is proposed to provide a number of full retention hydrocarbon interceptors in the surface water drainage scheme.

Due to generator refuelling activities taking place on roads throughout the development it is proposed to provide a Class 1 full retention separators downstream of all roads and upstream of the proposed surface water attenuation basins in accordance with Section 20 of the Greater Dublin Regional Code of Practice. The full retention separator is designed to treat the full design flow that can be delivered in the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 50mm/hour.

There is potential for surface water and condensate to accumulate in the exhaust stacks which serve the generators. Gullies which serve the exhaust stacks will discharge to a dedicated surface water drainage pipe which will be connected to a Class 1 full retention separator. Two full retention interceptors will be required per building to serve the exhaust stacks.

Details of the full retention separator proposed are provided in Appendix B to this report and are outlined in Table 2.1 below.

Ref	Type	Class	Model Specification (by Klargestor or equivalent)	Design Flow Rate (l/s)	Oil Capacity (l)
PI-1	Full Retention	1	NSFP003	3	30
PI-2	Full Retention	1	NSFA200	200	2000
PI-3	Full Retention	1	NSFP003	3	30
PI-4	Full Retention	1	NSFA200	200	2000
PI-5	Full Retention	1	NSFP003	3	30
PI-6	Full Retention	1	NSFP003	3	30
PI-7	Bypass	1	NSBE020	20	300

**Table 2.1 – Petrol Interceptor Details**

In addition to the full retention separators two hydrodynamic solid separators will also be provided within the drainage network to screen rubbish, debris and sediment from the surface water runoff before it enters the attenuation pond.

Details of the hydrodynamic solid separator proposed are provided in Appendix C to this report.

#### **2.4.4 Proposed Permeable Paving**

It is proposed to provide permeable paving in the car parking areas to the south of the development in order to reduce the hard standing areas discharging to the surface water drainage network insofar as possible. Locations where permeable paving is being proposed is indicated on Drawing No. s 20\_099-CSE-00-XX-DR-C-2021 and 20\_099-CSE-00-XX-DR-C-2022 and details of the permeable paving system is indicated on Drawing No. s 20\_099-CSE-00-XX-DR-C-2900.

#### **2.4.5 Surface Water Attenuation**

The surface water network has been designed to provide sufficient capacity to contain and convey all surface water runoff associated with the 1 in 100 year event to the attenuation basins without any overland flooding. This complies with Criterion 3 of Table 6.3 of Volume 2 of the GSDSDS.

All calculations have allowed for an additional allowance of 10% in rainfall intensities to allow for climate change as per Table 6.1 of Volume 2 of the GSDSDS.

The allowable discharge rate from the site (QBAR) has been calculated in accordance with the following equation as per Section 6.3.1.2.2 of the GSDSDS. Calculations are provided D to this report.

The proposed development will have two attenuation basins, one located to the north of the site and a second basin located to the west of the site. The total allowable discharge from the site has been calculated as 28.26 l/s which has been split between the attenuation basins with 12.0 l/s discharging from the north basin and 16.26 l/s discharging from the west basin. Discharge from both basins will be controlled by hydrobrake vortex control units as outlined below and details are provided in Appendix E:-

- Attenuation Basin 1 (North) SHE-0143-1200-2000-1200
- Attenuation Basin 2 (West) - SHE-0174-1650-1600-1650

Analysis of the Windes™ results for the data storage facility's drainage network identified the 240 minute winter storm during the 1 in 100 year return period as the critical storm in terms of attenuation storage volume. The design information for both attenuation basins is outlined below. See Appendix A for details of the Windes™ calculations.

##### **Attenuation Basin 1 (North)**

- Basin Invert Level = 76.704m OD
- Proposed Ground Level at Basin = 79.00m approx.
- Discharge Rate = 12 l/s
- Design Head = 2.0m
- Critical Storm Event = 240 Minute Winter
- High Water Level during 1 in 100 year event = 78.704m

- Storage Volume required for proposed development = 1,233m<sup>3</sup>

#### **Attenuation Basin 2 (West)**

- Basin Invert Level = 75.800m OD
- Proposed Ground Level at Basin = 77.60m approx.
- Discharge Rate = 16.26 l/s
- Design Head = 1.6m
- Critical Storm Event = 240 Minute Winter
- High Water Level during 1 in 100 year event = 77.390m
- Storage Volume required for proposed development = 2,439m<sup>3</sup>

Attenuation Basin 2 has additional capacity to facilitate the development of the proposed GIS substation which is being carried out by others.

### **2.5 Rainwater Harvesting**

It is proposed to provide 6000 litre rainwater harvesting tanks to serve grey water usage in the Administration Area of both buildings. The roof downpipes serving the Administration Area will be connected upstream of the rainwater harvesting tanks and rainwater will be pumped into the building plumbing system to serve grey water usage purposes. An overflow will be provided to the main surface water drainage system.

It is possible that rainwater harvesting from the data hall roof of Building B could be used to augment the cooling water supply. This will be subject to a full cost benefit analysis and detailed design.

### **2.6 Surface Water Drainage Design Summary**

The proposed surface water drainage network has been designed in accordance with GSDSDS and Greater Dublin Regional Code of Practice. The proposed surface water network flows in a north westerly direction and is attenuated before discharging to the Huntstown Stream. The allowable discharge from the site is 28.26 l/s and the total attenuation storage volume provided is 3,672 m<sup>3</sup> in two attenuation basins. A number of petrol interceptors are provided throughout the network to manage water quality and permeable paving has been provided in car parking areas in order to minimise surface water runoff.

## 3 Foul Water Drainage

### 3.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 26<sup>th</sup> July 2020 which addressed water and wastewater demand for the development. The reference number for the Pre-Connection Enquiry is CDS 200004468. Irish Water subsequently provided a Confirmation of Feasibility (CoF) on 31<sup>st</sup> March 2021 (Refer to Appendix F for details) which indicated that it is feasible to connect foul water flows from the proposed development without any infrastructure upgrades by Irish Water. It is proposed to outfall the foul drainage from the site to the existing 225mm foul sewer in the R135 to the east of the development site.

### 3.2 Drawings

The following drawings are provided in support of the planning application to foul water drainage:-

- Drawing No. 20\_099-CSE-00-XX-DR-C-2210 Proposed Overall Foul Water Drainage Layout
- Drawing No. 20\_099-CSE-00-XX-DR-C-2211 - Proposed Foul Water Drainage Sheet 1
- Drawing No. 20\_099-CSE-00-XX-DR-C-2212 - Proposed Foul Water Drainage Sheet 2
- Drawing No. 20\_099-CSE-00-XX-DR-C-2910 Standard Trench Details
- Drawing No. 20\_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 1
- Drawing No. 20\_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 2
- Drawing No. 20\_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 3

### 3.3 Existing Infrastructure

An existing 225mm foul sewer located in the R135 Regional Road to the east of the site which has capacity to serve the development as noted in the Irish Water CoF referenced in Section 3.1 above.

### 3.4 Proposed Foul Water Drainage Network

#### 3.4.1 Overview

The proposed foul water drainage network collects domestic foul water flows from the administration block of the proposed Data Storage Facilities and the adjacent GIS substation. A gravity sewer will flow in an easterly direction where it will discharge to a proposed pumping station. It will be necessary to pump foul flows to a discharge manhole at the site boundary which will outfall by gravity to the existing 225mm sewer in the R135.



### 3.4.2 Foul Water Demand

Foul demand for the proposed development is a combination of domestic demand (admin area etc.) and industrial demand has been estimated as follows.

#### Domestic Demand

- Population (max) ( $P_E$ ) = 256
- Consumption ( $G_E$ ) = 50 litres per head per day (office/ Factory with Canteen) as per Appendix C of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03).
- Daily Demand ( $P_E G_E$ ) = 12,800 litres or  $12.8\text{m}^3$
- Infiltration ( $I$ ) = 10% of  $P_E G_E$  =  $1.28\text{m}^3$

#### Industrial Demand

We estimate that the peak discharge from the process systems will be approximately 19l/s with the site at full load. The process discharge will only occur during the extreme warm ambient days and as an estimate based on historical weather data for Dublin, the annual discharge will be approximately 24 hours per annum. However, this maybe more if re-entrainment of warm air occurs on the site, which could necessitate the requirement for additional evaporative cooling during the extreme warm ambient days. We are currently evaluating this through Computational Fluid Dynamic (CFD) simulations.

As part of the design intent, the peak discharge of circa 19l/s will be collected underground and retreated for re-use in the cooling process. We estimate that approximately 25-30% of this peak discharge (i.e. 19 l/s) will be of no use for the cooling process and will be discharged to waste drain. This flow corresponds to 4.75 l/s -5.70 l/s.

#### Dry Weather Flow

Dry Weather Flow (PG+I+E) from the proposed development is calculated as follows:-

- Typical working day = 8.00-17.00 (9 hours)
- Dry Weather Flow (Domestic) =  $(12.8+1.28)*1000 / 9*60*60 = 0.43$  litres/sec
- Dry Weather Flow (Industrial) =  $35.5*1000 / 24*60*60 = 0.41$  litres/sec

### 3.4.3 Foul Water Pipe Design

The network has been designed to ensure that the foul discharge maintains a self-cleansing velocity. The proposed network adheres to the minimum pipe gradients set out in Table 6 of the "Building Regulations Technical Guidance Document H". It is proposed to take all foul drainage from the buildings by means of 100mm pipes with minimum gradients of 1:60 which connect to 150mm pipes laid at minimum gradients of 1:100. The key design parameters are summarised as follows:-

- Minimum Self-Cleansing Velocity for Gravity Sewer = 0.75 m/s;

- Minimum gradient of gravity sewer = 1:100
- Roughness Co-efficient for Gravity Sewer ( $k_s$ ) = 1.5mm
- Design Flow = as per Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03).

### Calculation of Design Flow

Design Flow has been calculated based on the requirements of Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The parameters are outlined as follows:-

- Design Flow = Design Foul Flow + Surface Water Allowance (Commercial/Industrial) ( $SW_E$ ) where
- Design Foul Flow =  $P_{EGE} \times P_{f_{dom\ ind}} + I + E \times P_{f_{trade}}$  where
  - $P_{EGE} = 12.8m^3$  or 0.4 litres/sec (9 hour day)
  - $I = 10\%$  of  $P_{EGE} = 1.28m^3$  or 0.04 litres/sec
  - $E = 35.5 m^3$  or 0.41 litres/sec (24 hour day)
  - $P_{f_{dom\ ind}} = 4.5$
  - $P_{f_{trade}} = 3.0$
- $SW_E$  = Surface Water Allowance =  $Q = 2.78CiA$  (as per Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03) Section 2.2.10.2.2) where
  - Runoff Co-Efficient ( $C$ ) = 1.0
  - Rainfall Intensity ( $I$ ) = 50mm/hour
  - Area ( $A$ ) = 0.025 hectares (Estimate Misconnection of surface water is envisaged to be low as this is a new development).

Based on the above the design flow from the proposed development is as follows

Design Flow =>  $(0.4 \times 4.5) + 0.04 + (0.41 \times 3.0) + 2.78 (1.0 \times 50 \times 0.025)$  => **6.5 litres/sec.**

Foul sewer network calculations are outlined in Appendix G.

### 3.4.4 Foul Water Pumping Station

As noted in Section 3.3 and 3.4.1 a foul water pumping station will be required to serve the development due to site topography and the level of the existing 225mm foul sewer. The design will comply with the requirements of Part 5 of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The key design parameters are outlined below:-

- Storage Volume (24 hours) =  $20m^3$  provided ( $12.8 m^3$  required)
- Flow Rate ( $Q$ ) = 3.76 litres/sec (Flow required to achieve velocity of 0.75 m/s in 80mm - This is a higher flow than 6 x DWF (Domestic) ( $6 \times 0.43$  litres/sec = 2.58 litres/sec).
- Rising Main Diameter = 80mm
- Rising Main Length = 186m
- Rising Main Volume =  $0.93m^3$
- No. of times Rising Main empties per day = 1
- Mean Rising Main Velocity = 0.75 m/sec
- Roughness Value ( $K_s$ ) = 0.15mm
- Static Head = 3.891m
- Friction Head Loss (FHL) (Estimate based on Colebrook-White) = 1.77m
- Fitting (Estimate) = 0.177m (10% of FHL)
- Total Estimated Design Head = 5.838m approx. (Subject to Detailed Design).

### 3.4.5 Proposed Substation

It is proposed to provide a sleeve to facilitate a rising main connection from the proposed sub-station development (subject to a separate planning application).

### 3.4.6 Internal Cooling Water Drainage (CWD)

In addition to the domestic foul sewer an additional Cooling Water Drainage (CWD) drainage network is required. This sewer will collect discharge from the AHU units and flows in a northerly direction towards a site pumping station which will pump CWD flows to the Water Treatment Plant where it will be treated and re-used. Typically discharge to the CWD drainage will be approximately 17 litres/sec. CWD Network calculations are provided in Appendix G. The CWD pumping station has been designed based on the following criteria.

- Storage Volume = 20 m<sup>3</sup>
- Flow Rate (Q) = 5.89 litres/sec (Flow required to achieve velocity of 0.75 m/s in 100mm )
- Rising Main Diameter = 100mm
- Rising Main Length = 255m
- Rising Main Volume = 2.0m<sup>3</sup>
- No. of times Rising Main empties per day = 1
- Mean Rising Main Velocity = 0.75 m/sec
- Roughness Value (Ks) = 0.15mm
- Static Head = 6m
- Friction Head Loss (FHL) (Estimate based on Colebrook-White) = 1.78m
- Fitting (Estimate) = 0.178m (10% of FHL)
- Total Estimated Design Head = 7.96m approx. (Subject to Detailed Design).

## 3.5 Foul Drainage Design Summary

The proposed foul water drainage network has been designed in accordance with the requirements of Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The domestic foul sewer flows in a easterly direction towards a proposed pumping station which pumps to a discharge manhole adjacent to the existing Irish Water 225mm foul sewer in the R135 road to the east of the site. The proposed CWD drainage drains by gravity to a pumping station located to the northeast of Building B where it will be pumped to the Water Treatment Plant. Foul discharge from the Water Treatment Plant Building will discharge by gravity to the Irish Water Network. Irish Water have provided a Confirmation of Feasibility for the proposed water supply connection (Ref CDS 200004468).

## 4 Water Supply

### 4.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 26<sup>th</sup> July 2020 which addressed water and wastewater demand for the development. The reference number for the Pre-Connection Enquiry is CDS 200004468. Irish Water subsequently provided a Confirmation of Feasibility (CoF) on 31<sup>st</sup> March 2021 (refer to Appendix F for details) which indicated that it is feasible to provide supply to the site subject to upgrades. The upgrade works involve the replacement of approx. 1500m of new 450mm pipe main to replace the existing 6" uPVC main in the R135 and the upgrade of pumps at Ballycoolen Highlands Tower. The CoF notes that the developer is to fund a portion of the upgrade works.

### 4.2 Drawings

The following drawings are provided in support of the planning application to water supply:-

- Drawing No. 20\_099-CSE-00-XX-DR-C-2310 Proposed Overall Water Supply Layout Plan
- Drawing No. 20\_099-CSE-00-XX-DR-C-2311- Proposed Water Supply Layout Plan Sheet 1
- Drawing No. 20\_099-CSE-00-XX-DR-C-2312- Proposed Water Supply Layout Plan Sheet 2
- Drawing No. 20\_099-CSE-00-XX-DR-C-2910 Standard Trench Details

### 4.3 Existing Infrastructure

There is an existing 150mm water main located in the R1135. Irish Water are proposing updates to the network which will serve the development. As noted in Section 4.1 this watermain is to be upgraded with a new 450mm watermain.

### 4.4 Proposed Water Supply

It is proposed to connect a 200mm watermain to this upgraded 450mm pipe in the R135.

It is proposed to provide connections from the 200mm incoming water supply main to the admin area of the data centre buildings, the water treatment plant room, the two no sprinkler storage tanks and to the adjacent GIS Substation (being designed by others).

#### 4.4.1 Domestic Water Demand

Domestic water supply demand for the proposed development has been estimated as follows (As per Section 3.7.2 of the Irish Water Code of Practice (IW-CDS-5020-03) .

- Population = 256
- Consumption = 45 litres per person per day
- Daily Demand = 11,520 litres per day
- Average Flow = 0.13 litres/sec
- Average Day/Peak Week Demand =  $1.25 \times 0.13 = 0.17$  litres/sec
- Peak Demand =  $5.0 \times 0.17$  litres/sec = 0.85 litres/sec

#### 4.4.2 Process Water Demand

We estimate that the peak process water demand will be approximately 56l/s with the site at full load. This estimate excludes periodic flushing and washdown. The peak process water demand will only occur during the extreme warm ambient days and as an estimate based on historical weather data for Dublin, this should be approximately 24 hours per annum. However, this maybe more if re-entrainment of warm air occurs on the site, which could necessitate the requirement for additional evaporative cooling during the extreme warm ambient days. We are currently evaluating this through Computational Fluid Dynamic (CFD) simulations.

On-site storage will be provided as part of the development. Water storage (2590m<sup>3</sup>) will be provided for the evaporative cooling hours required in the worst case summer 48 hour period. The water fill from the Irish Water main can be adjusted to fill the system over this time period.

Process water supply demand for the proposed development has been estimated in the Table below.

DUB DC	Water Requirement (m <sup>3</sup> /year)	Cumulative (m <sup>3</sup> /year)	Projected Timeframe
COLO 1	346	-	July 2023
COLO 2	346	691.2	October 2023
COLO 3	346	1037.2	December 2023
COLO 4	346	1383.3	February 2024
COLO 5	346	1729.2	April 2024
COLO 6	346	2075.2	July 2024
COLO 7	346	2421.2	September 2024
Building A	2,421.2		December 2024
Building B	2,421.2		January 2025
<b>Total</b>		<b>4,842.4</b>	

**Table 4.1 – Proposed Water Demand Estimate**

#### **4.5 Fire Hydrant Main**

The proposed development will be served by a 250mm fire hydrant main which is connected to two proposed sprinkler tanks (Each tank has a capacity of 670m<sup>3</sup>) and associated pump houses. The fire hydrants will be provided at appropriate locations in accordance with the specialist fire protection contractors design and Fingal County Council requirements.

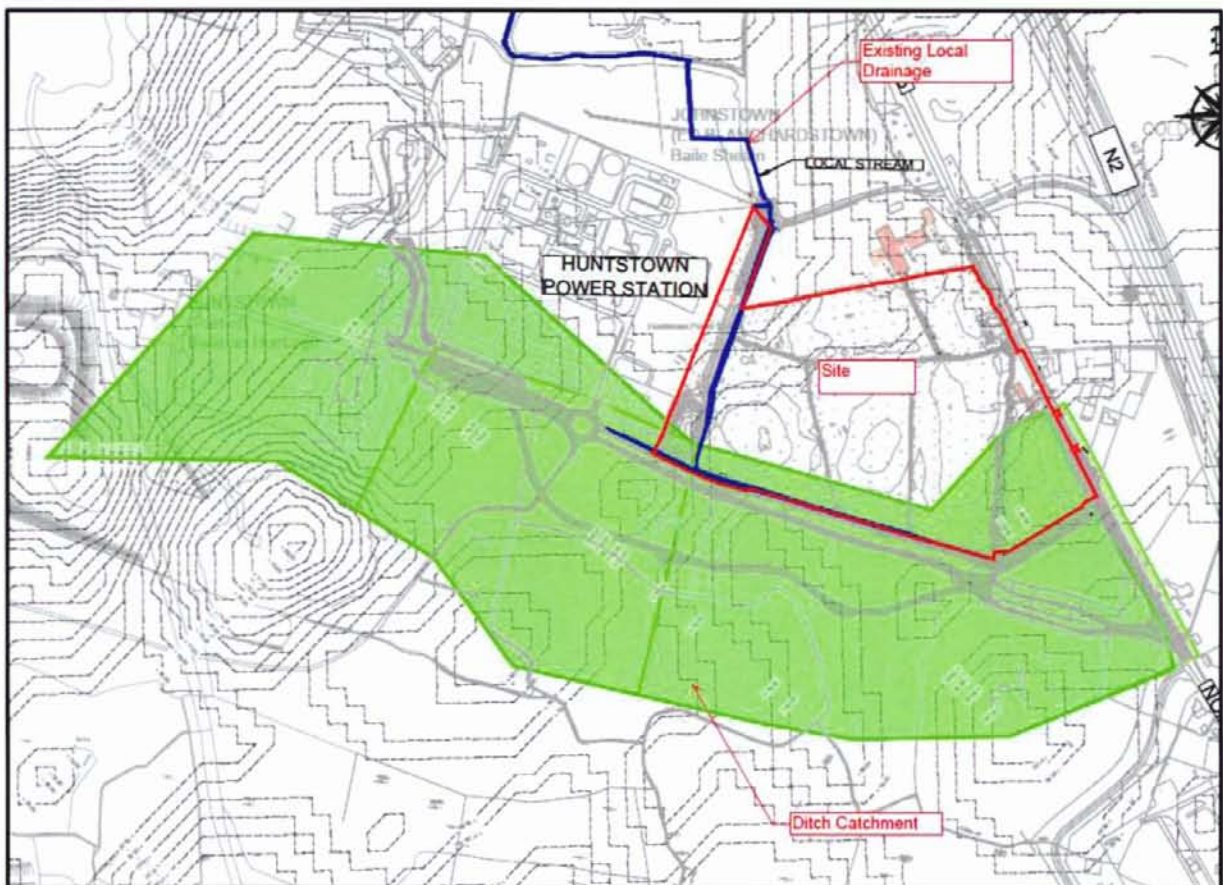
#### **4.6 Water Supply Summary**

The proposed Water Supply Network will comprise of a 200mm which will be connected to the Irish Water supply network in the R135 which is to be upgraded to 400mm . The water main will serve the proposed buildings, water treatment plant, sprinkler tanks and proposed substation. A separate fire hydrant main will be provided to serve the fire hydrants which will be feed from the sprinkler tanks. Irish Water have provided a Confirmation of Feasibility for the proposed water supply connection (Ref CDS 200004468).

## 5 Ditch Diversion

### 5.1 Catchment Study

As noted in section the proposed development site is traversed by an existing ditch which forms the Huntstown Stream. In order to facilitate the development of the site it is necessary to remove a section of the ditch and replace with a new 900mm pipe (minimum size required by OPW Guidelines for the Construction, Replacement or Alteration of Bridges and Culverts (OPW Guidelines)) which will traverse the western section of the site. The catchment area draining to the ditch is estimated using contour mapping to be 0.4 km<sup>2</sup> (see Fig 5.1 below catchment highlighted in green).



**Table 5.1 – Catchment Mapping**

The catchment area is determined to be 30.77 Hectares (highlighted in green) and the percentage impermeable area (highlighted grey on attached map) is estimated to be 10%.

The catchment map is included in Appendix H of this report.

## **5.2 Ditch Diversion Design Parameters**

The proposed ditch diversion is required to take account of the requirements of OPW Guidelines for the Construction, Replacement or Alteration of Bridges and Culverts (OPW Guidelines)) which are outline below:-

- Diversion pipe to be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100 year flow without significantly chaging the hydraulic characteristics of the watercourse;
- Diversion pipe to maintain a freeboard of 300mm;
- Diversion pipe capable of operating under the above design conditions without causing a hydraulic loss of no more than 300mm;
- Diameter must not be less than 900mm;
- All calculations have allowed for an additional allowance of 10% in rainfall intensities to allow for climate change as per Table 6.1 of Volume 2 of the GSDSDS.

## **5.3 Calculations**

The proposed ditch diversion has been simulated using Civil 3D and WinDes™ software. Calculations are provided in Appendix I of this report.

## **5.4 Drawings**

The following drawings are provided in support of the planning application for the ditch diversion.

- Drawing No. 20\_099-CSE-00-XX-DR-C-2117 Ditch Diversion Layout Plan and Longitudinal Sections.

## **5.5 Design Summary**

The proposed ditch diversion has been designed as a 900mm at gradient of 1:479. The pre-development water level upstream of the ditch diversion has been assessed at the start of the proposed diversion works at Nodes ST 1 and ST2 indicated on Drawing No. 20\_099-CSE-00-XX-DR-C-2117. The water Levels are outlined in Table 5.1 overleaf:-



Node	Pre-Development Water Level (mOD)	Post-Development Water Level (mOD)	Difference (m)
ST 1	76.794	76.888	+0.094
ST 2	77.277	77.154	-0.123

**Table 5.1 – Pre and Post Development Water Levels**


As noted above there is an increase in water level of 0.094m or 94mm at ST 1 to the west of the diversion and a decrease 0.123m or 123mm at ST 2 to the east of the diversion. The minimum freeboard is 307mm. The above information is outlined in the Windes calculations included in Appendix I.

The proposed ditch diversion complies with the OPW Guidelines in terms of capable to pass the required return period of the 1 in 100 year event. A minimum freeboard of 307mm has been provided, in excess of the 300mm required by the OPW Guidelines and hydraulic loss across the diversion route are calculated to be below the 300mm allowed by the OPW Guidelines.

## **5.6 Environmental Summary**

The existing onsite drainage ditches have been assessed by the project ecologist and hydrologist in respect of the applicability of the Objective WQ05 within the Fingal County Development Plan 2017-2023. Objective WQ05 requires the establishment of a riparian corridors free from new development along all significant watercourses and streams in the County. Chapter 7 (Hydrology) of the EIAR notes that these are existing manmade ditches with intermittent or ephemeral characteristics are not considered to be a significant watercourse or stream, therefore Objective WQ05 is not considered to apply to any of the local drainage ditches on the site. Furthermore, Chapter 8 (Biodiversity) of the EIAR has assessed these onsite ditches for ecological value and concluded that due to their ephemeral nature have and they have no fisheries value and are also unfavourable for amphibians.

## Appendix A – Surface Water Drainage Calculations

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	25	PIMP (%)	100
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Network 1






Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.010	4-8	1.163	8-12	1.588	12-16	0.255	16-20	0.003

Total Area Contributing (ha) = 3.019

Total Pipe Volume (m³) = 147.103


Network Design Table for Network 1

« - Indicates pipe capacity < flow
















PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	16.964	0.085	199.6	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	13.677	0.068	201.1	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	46.642	0.155	300.9	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	12.681	0.042	301.9	0.100	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	40.946	0.136	301.1	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.31	78.624	0.017	0.0	0.0	0.0	0.92	36.7	2.3
1.001	50.00	5.55	78.539	0.041	0.0	0.0	0.0	0.92	36.5	5.6
1.002	50.00	6.42	78.396	0.058	0.0	0.0	0.0	0.90	63.7	7.8
1.003	50.00	6.65	78.241	0.158	0.0	0.0	0.0	0.90	63.6	21.4
1.004	50.00	7.41	78.199	0.181	0.0	0.0	0.0	0.90	63.7	24.6


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Network Design Table for Network 1













PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	21.396	0.107	200.0	0.030	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	40.880	0.102	400.8	0.047	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	20.017	0.050	400.3	0.101	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	33.574	0.084	399.7	0.071	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	52.436	0.131	400.3	0.222	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	37.955	0.190	199.8	0.147	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	64.358	0.161	399.7	0.240	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	40.080	0.100	400.8	0.130	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.011	24.280	0.049	495.5	0.257	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.012	29.641	0.059	502.4	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.013	65.828	0.132	498.7	0.157	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	60.127	0.200	300.6	0.057	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.014	13.518	0.027	500.7	0.099	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	40.474	0.135	299.8	0.115	5.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	43.937	0.146	300.9	0.131	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	5.39	78.248	0.030	0.0	0.0	0.0	0.92	36.6	4.1
1.005	50.00	8.09	77.913	0.259	0.0	0.0	0.0	1.01	160.5	35.1
1.006	50.00	8.42	77.811	0.360	0.0	0.0	0.0	1.01	160.6	48.7
1.007	50.00	8.97	77.761	0.431	0.0	0.0	0.0	1.01	160.7	58.4
1.008	50.00	9.83	77.677	0.653	0.0	0.0	0.0	1.01	160.6	88.4
3.000	50.00	5.69	77.959	0.147	0.0	0.0	0.0	0.92	36.6	19.9
1.009	50.00	10.90	77.544	1.040	0.0	0.0	0.0	1.01	160.7	140.8
1.010	50.00	11.56	77.383	1.170	0.0	0.0	0.0	1.01	160.5	158.4
1.011	50.00	11.93	77.133	1.427	0.0	0.0	0.0	1.09	307.4	193.2
1.012	50.00	12.39	77.084	1.427	0.0	0.0	0.0	1.08	305.2	193.2
1.013	50.00	13.40	77.025	1.584	0.0	0.0	0.0	1.08	306.4	214.5
4.000	50.00	6.11	77.381	0.057	0.0	0.0	0.0	0.90	63.7	7.8
1.014	50.00	13.61	76.781	1.741	0.0	0.0	0.0	1.08	305.8	235.7
5.000	50.00	5.75	78.366	0.115	0.0	0.0	0.0	0.90	63.8	15.5
5.001	50.00	6.56	78.231	0.246	0.0	0.0	0.0	0.90	63.7	33.3


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Network Design Table for Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.002	50.000	0.167	299.4	0.145	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.003	33.783	0.113	299.0	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.000	40.474	0.135	299.8	0.115	5.00	0.0	0.600	o	300	Pipe/Conduit	
6.001	43.937	0.146	300.9	0.131	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.002	50.000	0.167	299.4	0.145	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.003	33.783	0.113	299.0	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.004	70.309	0.234	300.5	0.080	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.004	36.054	0.120	300.5	0.080	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.015	93.160	0.466	199.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.016	63.465	0.317	200.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.017	69.205	0.384	180.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.018	5.054	0.033	153.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	


Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.002	50.00	7.48	78.085	0.390	0.0	0.0	0.0	0.90	63.9	52.8
5.003	50.00	8.02	77.843	0.559	0.0	0.0	0.0	1.04	115.2	75.7
6.000	50.00	5.75	78.268	0.115	0.0	0.0	0.0	0.90	63.8	15.5
6.001	50.00	6.56	78.133	0.245	0.0	0.0	0.0	0.90	63.7	33.2
6.002	50.00	7.48	77.987	0.390	0.0	0.0	0.0	0.90	63.9	52.9
6.003	50.00	8.02	77.745	0.559	0.0	0.0	0.0	1.04	115.2	75.7
6.004	50.00	9.15	77.632	0.639	0.0	0.0	0.0	1.04	114.9	86.5
5.004	50.00	9.73	77.398	1.278	0.0	0.0	0.0	1.04	114.9	173.0
1.015	50.00	15.01	76.750	3.019	0.0	0.0	0.0	1.11	78.3	408.8
1.016	50.00	15.96	76.284	3.019	0.0	0.0	0.0	1.11	78.3	408.8
1.017	50.00	16.95	75.967	3.019	0.0	0.0	0.0	1.17	82.6	408.8
1.018	50.00	17.02	75.583	3.019	0.0	0.0	0.0	1.27	89.6	408.8
















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Manhole Schedules for Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S 1.0	80.043	1.419	Open Manhole	1200	1.000	78.624	225				
S 1.1	79.974	1.435	Open Manhole	1200	1.001	78.539	225	1.000	78.539	225	
S 1.2	79.910	1.514	Open Manhole	1350	1.002	78.396	300	1.001	78.471	225	
S 1.3	79.712	1.471	Open Manhole	1350	1.003	78.241	300	1.002	78.241	300	
S 1.4	79.672	1.473	Open Manhole	1350	1.004	78.199	300	1.003	78.199	300	
S 2.0	79.663	1.415	Open Manhole	1200	2.000	78.248	225				
S 1.5	79.433	1.520	Open Manhole	1200	1.005	77.913	450	1.004	78.063	300	
								2.000	78.141	225	3
S 1.6	79.108	1.297	Open Manhole	1500	1.006	77.811	450	1.005	77.811	450	
S 1.7	79.068	1.307	Open Manhole	1500	1.007	77.761	450	1.006	77.761	450	
S 1.8	79.138	1.461	Open Manhole	1500	1.008	77.677	450	1.007	77.677	450	
S 3.0	79.452	1.493	Open Manhole	1200	3.000	77.959	225				
S 1.9	79.128	1.584	Open Manhole	1350	1.009	77.544	450	1.008	77.546	450	2
								3.000	77.769	225	
S 1.10	79.207	1.824	Open Manhole	1650	1.010	77.383	450	1.009	77.383	450	
S 1.11	79.207	2.074	Open Manhole	1650	1.011	77.133	600	1.010	77.283	450	
S 1.12	79.330	2.246	Open Manhole	1500	1.012	77.084	600	1.011	77.084	600	
S 1.13	79.330	2.305	Open Manhole	1650	1.013	77.025	600	1.012	77.025	600	
S 4.0	79.000	1.619	Open Manhole	1200	4.000	77.381	300				
S 1.14	79.818	3.037	Open Manhole	1950	1.014	76.781	600	1.013	76.893	600	112
								4.000	77.181	300	100
S 5.0	79.867	1.501	Open Manhole	1200	5.000	78.366	300				
S 5.1	79.857	1.626	Open Manhole	1200	5.001	78.231	300	5.000	78.231	300	
S 5.2	79.845	1.760	Open Manhole	1350	5.002	78.085	300	5.001	78.085	300	
S 5.3	79.831	1.988	Open Manhole	1350	5.003	77.843	375	5.002	77.918	300	
S 6.0	79.823	1.555	Open Manhole	1200	6.000	78.268	300				
S 6.1	79.824	1.691	Open Manhole	1200	6.001	78.133	300	6.000	78.133	300	
S 6.2	79.824	1.837	Open Manhole	1350	6.002	77.987	300	6.001	77.987	300	
S 6.3	79.823	2.078	Open Manhole	1350	6.003	77.745	375	6.002	77.820	300	
S 6.4	79.569	1.937	Open Manhole	1350	6.004	77.632	375	6.003	77.632	375	
S 5.4	79.573	2.175	Open Manhole	1500	5.004	77.398	375	5.003	77.730	375	332
								6.004	77.398	375	
S 1.15	79.000	2.250	Open Manhole	2100	1.015	76.750	300	1.014	76.754	600	304
								5.004	77.278	375	603
S 1.16	78.963	2.679	Open Manhole	2100	1.016	76.284	300	1.015	76.284	300	
S 1.17	77.991	2.024	Open Manhole	2100	1.017	75.967	300	1.016	75.967	300	
S 1.18	77.551	1.968	Open Manhole	2250	1.018	75.583	300	1.017	75.583	300	
MH80	77.451	1.901	Open Manhole	1500		OUTFALL		1.018	75.550	300	
















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Manhole Schedules for Network 1


MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 1.0	711876.988	741371.323	711876.988	741371.323	Required	
S 1.1	711862.418	741362.634	711862.531	741362.548	Required	
S 1.2	711858.853	741349.430	711858.957	741349.439	Required	
S 1.3	711879.102	741307.413	711878.998	741307.401	Required	
S 1.4	711876.368	741295.030	711876.286	741295.095	Required	
S 2.0	711849.858	741258.554	711849.858	741258.554	Required	
S 1.5	711839.478	741277.263	711839.478	741277.263	Required	
S 1.6	711802.647	741259.524	711802.628	741259.628	Required	
S 1.7	711782.708	741261.287	711782.785	741261.358	Required	
S 1.8	711782.708	741294.861	711782.813	741294.861	Required	
S 3.0	711820.658	741347.297	711820.658	741347.297	Required	
S 1.9	711782.702	741347.297	711782.702	741347.297	Required	
S 1.10	711782.700	741411.655	711782.670	741411.655	Required	
S 1.11	711782.701	741451.735	711782.596	741451.735	Required	
S 1.12	711782.702	741476.015	711782.522	741476.016	Required	

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Manhole Schedules for Network 1


MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 1.13	711782.702	741505.657	711782.628	741505.583	Required	
S 4.0	711656.747	741505.657	711656.747	741505.657	Required	
S 1.14	711716.874	741505.657	711716.874	741505.657	Required	
S 5.0	711682.023	741339.449	711682.023	741339.449	Required	
S 5.1	711682.023	741379.923	711682.203	741379.923	Required	
S 5.2	711682.023	741423.860	711682.128	741423.860	Required	
S 5.3	711682.023	741473.860	711682.166	741473.860	Required	
S 6.0	711752.332	741339.449	711752.332	741339.449	Required	
S 6.1	711752.332	741379.923	711752.512	741379.923	Required	
S 6.2	711752.332	741423.860	711752.437	741423.860	Required	
S 6.3	711752.332	741473.860	711752.474	741473.860	Required	
S 6.4	711752.332	741507.644	711752.231	741507.543	Required	
S 5.4	711682.023	741507.644	711682.023	741507.644	Required	
S 1.15	711716.189	741519.157	711716.189	741519.157	Required	
S 1.16	711623.037	741520.297	711623.037	741520.297	Required	



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Manhole Schedules for Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 1.17	711559.632	741517.531	711559.632	741517.531	Required	
S 1.18	711490.437	741516.384	711490.437	741516.384	Required	
MH80	711487.406	741520.429			No Entry	

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PIPELINE SCHEDULES for Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	S 1.0	80.043	78.624	1.194	Open Manhole	1200
1.001	o	225	S 1.1	79.974	78.539	1.210	Open Manhole	1200
1.002	o	300	S 1.2	79.910	78.396	1.214	Open Manhole	1350
1.003	o	300	S 1.3	79.712	78.241	1.171	Open Manhole	1350
1.004	o	300	S 1.4	79.672	78.199	1.173	Open Manhole	1350
2.000	o	225	S 2.0	79.663	78.248	1.190	Open Manhole	1200
1.005	o	450	S 1.5	79.433	77.913	1.070	Open Manhole	1200
1.006	o	450	S 1.6	79.108	77.811	0.847	Open Manhole	1500
1.007	o	450	S 1.7	79.068	77.761	0.857	Open Manhole	1500
1.008	o	450	S 1.8	79.138	77.677	1.011	Open Manhole	1500
3.000	o	225	S 3.0	79.452	77.959	1.268	Open Manhole	1200
1.009	o	450	S 1.9	79.128	77.544	1.134	Open Manhole	1350
1.010	o	450	S 1.10	79.207	77.383	1.374	Open Manhole	1650
1.011	o	600	S 1.11	79.207	77.133	1.474	Open Manhole	1650
1.012	o	600	S 1.12	79.330	77.084	1.646	Open Manhole	1500
1.013	o	600	S 1.13	79.330	77.025	1.705	Open Manhole	1650

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.964	199.6	S 1.1	79.974	78.539	1.210	Open Manhole	1200
1.001	13.677	201.1	S 1.2	79.910	78.471	1.214	Open Manhole	1350
1.002	46.642	300.9	S 1.3	79.712	78.241	1.171	Open Manhole	1350
1.003	12.681	301.9	S 1.4	79.672	78.199	1.173	Open Manhole	1350
1.004	40.946	301.1	S 1.5	79.433	78.063	1.070	Open Manhole	1200
2.000	21.396	200.0	S 1.5	79.433	78.141	1.067	Open Manhole	1200
1.005	40.880	400.8	S 1.6	79.108	77.811	0.847	Open Manhole	1500
1.006	20.017	400.3	S 1.7	79.068	77.761	0.857	Open Manhole	1500
1.007	33.574	399.7	S 1.8	79.138	77.677	1.011	Open Manhole	1500
1.008	52.436	400.3	S 1.9	79.128	77.546	1.132	Open Manhole	1350
3.000	37.955	199.8	S 1.9	79.128	77.769	1.134	Open Manhole	1350
1.009	64.358	399.7	S 1.10	79.207	77.383	1.374	Open Manhole	1650
1.010	40.080	400.8	S 1.11	79.207	77.283	1.474	Open Manhole	1650
1.011	24.280	495.5	S 1.12	79.330	77.084	1.646	Open Manhole	1500
1.012	29.641	502.4	S 1.13	79.330	77.025	1.705	Open Manhole	1650
1.013	65.828	498.7	S 1.14	79.818	76.893	2.325	Open Manhole	1950

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PIPELINE SCHEDULES for Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	300	S 4.0	79.000	77.381	1.319	Open Manhole	1200
1.014	o	600	S 1.14	79.818	76.781	2.437	Open Manhole	1950
5.000	o	300	S 5.0	79.867	78.366	1.201	Open Manhole	1200
5.001	o	300	S 5.1	79.857	78.231	1.326	Open Manhole	1200
5.002	o	300	S 5.2	79.845	78.085	1.460	Open Manhole	1350
5.003	o	375	S 5.3	79.831	77.843	1.613	Open Manhole	1350
6.000	o	300	S 6.0	79.823	78.268	1.255	Open Manhole	1200
6.001	o	300	S 6.1	79.824	78.133	1.391	Open Manhole	1200
6.002	o	300	S 6.2	79.824	77.987	1.537	Open Manhole	1350
6.003	o	375	S 6.3	79.823	77.745	1.703	Open Manhole	1350
6.004	o	375	S 6.4	79.569	77.632	1.562	Open Manhole	1350
5.004	o	375	S 5.4	79.573	77.398	1.800	Open Manhole	1500
1.015	o	300	S 1.15	79.000	76.750	1.950	Open Manhole	2100
1.016	o	300	S 1.16	78.963	76.284	2.379	Open Manhole	2100
1.017	o	300	S 1.17	77.991	75.967	1.724	Open Manhole	2100
1.018	o	300	S 1.18	77.551	75.583	1.668	Open Manhole	2250


Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	60.127	300.6	S 1.14	79.818	77.181	2.337	Open Manhole	1950
1.014	13.518	500.7	S 1.15	79.000	76.754	1.646	Open Manhole	2100
5.000	40.474	299.8	S 5.1	79.857	78.231	1.326	Open Manhole	1200
5.001	43.937	300.9	S 5.2	79.845	78.085	1.460	Open Manhole	1350
5.002	50.000	299.4	S 5.3	79.831	77.918	1.613	Open Manhole	1350
5.003	33.783	299.0	S 5.4	79.573	77.730	1.468	Open Manhole	1500
6.000	40.474	299.8	S 6.1	79.824	78.133	1.391	Open Manhole	1200
6.001	43.937	300.9	S 6.2	79.824	77.987	1.537	Open Manhole	1350
6.002	50.000	299.4	S 6.3	79.823	77.820	1.703	Open Manhole	1350
6.003	33.783	299.0	S 6.4	79.569	77.632	1.562	Open Manhole	1350
6.004	70.309	300.5	S 5.4	79.573	77.398	1.800	Open Manhole	1500
5.004	36.054	300.5	S 1.15	79.000	77.278	1.347	Open Manhole	2100
1.015	93.160	199.9	S 1.16	78.963	76.284	2.379	Open Manhole	2100
1.016	63.465	200.2	S 1.17	77.991	75.967	1.724	Open Manhole	2100
1.017	69.205	180.2	S 1.18	77.551	75.583	1.668	Open Manhole	2250
1.018	5.054	153.2	MH80	77.451	75.550	1.601	Open Manhole	1500

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Area Summary for Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Roads	100	0.017	0.017	0.017
1.001	Classification	Roads	100	0.013	0.013	0.013
	Classification	Grass	30	0.039	0.012	0.024
1.002	Classification	Roads	100	0.017	0.017	0.017
1.003	Classification	Roads	100	0.100	0.100	0.100
1.004	Classification	Roads	100	0.024	0.024	0.024
2.000	Classification	Roads	100	0.030	0.030	0.030
1.005	Classification	Roads	100	0.047	0.047	0.047
1.006	Classification	Roads	100	0.101	0.101	0.101
1.007	Classification	Roads	100	0.025	0.025	0.025
	Classification	Roof	100	0.041	0.041	0.066
	Classification	Grass	30	0.017	0.005	0.071
1.008	Classification	Roads	100	0.111	0.111	0.111
	Classification	Grass	30	0.020	0.006	0.117
	Classification	Roads	100	0.105	0.105	0.222
3.000	Classification	Roads	100	0.034	0.034	0.034
	Classification	Roads	100	0.105	0.105	0.138
	Classification	Grass	30	0.028	0.008	0.147
1.009	Classification	Roads	100	0.233	0.233	0.233
	Classification	Grass	30	0.024	0.007	0.240
1.010	Classification	Roads	100	0.120	0.120	0.120
	Classification	Grass	30	0.035	0.011	0.130
1.011	Classification	Roads	100	0.242	0.242	0.242
	Classification	Grass	30	0.050	0.015	0.257
1.012	-	-	100	0.000	0.000	0.000
1.013	Classification	Roads	100	0.125	0.125	0.125
	Classification	Grass	30	0.037	0.011	0.136
	Classification	Grass	30	0.070	0.021	0.157
4.000	Classification	Roads	100	0.057	0.057	0.057
1.014	Classification	Roads	100	0.099	0.099	0.099
5.000	Classification	Roof	100	0.115	0.115	0.115
5.001	Classification	Roof	100	0.131	0.131	0.131
5.002	Classification	Roof	100	0.145	0.145	0.145
5.003	Classification	Roof	100	0.169	0.169	0.169
6.000	Classification	Roof	100	0.115	0.115	0.115
6.001	Classification	Roof	100	0.131	0.131	0.131
6.002	Classification	Roof	100	0.145	0.145	0.145
6.003	Classification	Roof	100	0.169	0.169	0.169
6.004	Classification	Roof	100	0.080	0.080	0.080
5.004	Classification	Roof	100	0.080	0.080	0.080
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
1.018	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.243	3.019	3.019


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Network Classifications for Network 1

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S 1.0	225	1.194	1.210	Unclassified	1200	0	1.194	Unclassified
1.001	S 1.1	225	1.210	1.214	Unclassified	1200	0	1.210	Unclassified
1.002	S 1.2	300	1.171	1.214	Unclassified	1350	0	1.214	Unclassified
1.003	S 1.3	300	1.171	1.173	Unclassified	1350	0	1.171	Unclassified
1.004	S 1.4	300	1.070	1.173	Unclassified	1350	0	1.173	Unclassified
2.000	S 2.0	225	1.067	1.190	Unclassified	1200	0	1.190	Unclassified
1.005	S 1.5	450	0.847	1.070	Unclassified	1200	0	1.070	Unclassified
1.006	S 1.6	450	0.847	0.857	Unclassified	1500	0	0.847	Unclassified
1.007	S 1.7	450	0.857	1.011	Unclassified	1500	0	0.857	Unclassified
1.008	S 1.8	450	1.011	1.132	Unclassified	1500	0	1.011	Unclassified
3.000	S 3.0	225	1.134	1.268	Unclassified	1200	0	1.268	Unclassified
1.009	S 1.9	450	1.134	1.374	Unclassified	1350	0	1.134	Unclassified
1.010	S 1.10	450	1.374	1.474	Unclassified	1650	0	1.374	Unclassified
1.011	S 1.11	600	1.474	1.646	Unclassified	1650	0	1.474	Unclassified
1.012	S 1.12	600	1.646	1.705	Unclassified	1500	0	1.646	Unclassified
1.013	S 1.13	600	1.705	2.325	Unclassified	1650	0	1.705	Unclassified
4.000	S 4.0	300	1.319	2.337	Unclassified	1200	0	1.319	Unclassified
1.014	S 1.14	600	1.646	2.437	Unclassified	1950	0	2.437	Unclassified
5.000	S 5.0	300	1.201	1.326	Unclassified	1200	0	1.201	Unclassified
5.001	S 5.1	300	1.326	1.460	Unclassified	1200	0	1.326	Unclassified
5.002	S 5.2	300	1.460	1.613	Unclassified	1350	0	1.460	Unclassified
5.003	S 5.3	375	1.468	1.613	Unclassified	1350	0	1.613	Unclassified
6.000	S 6.0	300	1.255	1.391	Unclassified	1200	0	1.255	Unclassified
6.001	S 6.1	300	1.391	1.537	Unclassified	1200	0	1.391	Unclassified
6.002	S 6.2	300	1.537	1.703	Unclassified	1350	0	1.537	Unclassified
6.003	S 6.3	375	1.562	1.703	Unclassified	1350	0	1.703	Unclassified
6.004	S 6.4	375	1.562	1.800	Unclassified	1350	0	1.562	Unclassified
5.004	S 5.4	375	1.347	1.800	Unclassified	1500	0	1.800	Unclassified
1.015	S 1.15	300	1.950	2.379	Unclassified	2100	0	1.950	Unclassified
1.016	S 1.16	300	1.724	2.379	Unclassified	2100	0	2.379	Unclassified
1.017	S 1.17	300	1.668	1.724	Unclassified	2100	0	1.724	Unclassified
1.018	S 1.18	300	1.601	1.668	Unclassified	2250	0	1.668	Unclassified

Free Flowing Outfall Details for Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.018	MH80	77.451	75.550	0.000	1500	0


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Simulation Criteria for Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000	
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000	
Hot Start (mins)	0	Inlet Coefficient	0.800	
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	
Number of Input Hydrographs		0	Number of Storage Structures	1
Number of Online Controls		1	Number of Time/Area Diagrams	0
Number of Offline Controls		0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	25	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

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Online Controls for Network 1


Hydro-Brake® Optimum Manhole: S 1.15, DS/PN: 1.015, Volume (m³): 14.8

Unit Reference	MD-SHE-0144-1200-1950-1200
Design Head (m)	1.950
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	144
Invert Level (m)	76.750
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.950	12.0
Flush-Flo™	0.566	12.0
Kick-Flo®	1.177	9.5
Mean Flow over Head Range	-	10.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.2	1.200	9.5	3.000	14.7	7.000	22.1
0.200	10.1	1.400	10.3	3.500	15.8	7.500	22.8
0.300	11.2	1.600	10.9	4.000	16.9	8.000	23.5
0.400	11.7	1.800	11.6	4.500	17.9	8.500	24.2
0.500	11.9	2.000	12.1	5.000	18.8	9.000	24.9
0.600	12.0	2.200	12.7	5.500	19.7	9.500	25.6
0.800	11.7	2.400	13.2	6.000	20.5		
1.000	11.0	2.600	13.7	6.500	21.3		

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Storage Structures for Network 1

Tank or Pond Manhole: S 1.15, DS/PN: 1.015


Invert Level (m) 76.750

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	329.0	2.250	1292.0

Manhole Headloss for Network 1

PN	US/MH Name	US/MH Headloss
1.000	S 1.0	0.500
1.001	S 1.1	0.500
1.002	S 1.2	0.500
1.003	S 1.3	0.500
1.004	S 1.4	0.500
2.000	S 2.0	0.500
1.005	S 1.5	0.500
1.006	S 1.6	0.500
1.007	S 1.7	0.500
1.008	S 1.8	0.500
3.000	S 3.0	0.500
1.009	S 1.9	0.500
1.010	S 1.10	0.500
1.011	S 1.11	0.500
1.012	S 1.12	0.500
1.013	S 1.13	0.500
4.000	S 4.0	0.500
1.014	S 1.14	0.500
5.000	S 5.0	0.500
5.001	S 5.1	0.500
5.002	S 5.2	0.500
5.003	S 5.3	0.500
6.000	S 6.0	0.500
6.001	S 6.1	0.500
6.002	S 6.2	0.500
6.003	S 6.3	0.500
6.004	S 6.4	0.500
5.004	S 5.4	0.500
1.015	S 1.15	0.500
1.016	S 1.16	0.500
1.017	S 1.17	0.500
1.018	S 1.18	0.500



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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 1

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000


Number of Input Hydrographs 0    Number of Storage Structures 1  
Number of Online Controls 1    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.750  
M5-60 (mm)    16.500 Cv (Winter) 0.840  
Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON


Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S 1.0	15 Winter	1	+10%					78.662
1.001	S 1.1	15 Winter	1	+10%					78.597
1.002	S 1.2	15 Winter	1	+10%	100/15 Winter				78.462
1.003	S 1.3	15 Winter	1	+10%	100/15 Summer				78.357
1.004	S 1.4	15 Winter	1	+10%	100/15 Summer				78.314
2.000	S 2.0	15 Winter	1	+10%	100/15 Summer				78.299
1.005	S 1.5	15 Winter	1	+10%	100/15 Summer				78.054
1.006	S 1.6	15 Winter	1	+10%	30/15 Winter				77.986
1.007	S 1.7	15 Winter	1	+10%	30/15 Winter				77.943
1.008	S 1.8	15 Winter	1	+10%	30/15 Summer				77.880
3.000	S 3.0	15 Winter	1	+10%	30/15 Summer				78.077
1.009	S 1.9	15 Winter	1	+10%	30/15 Summer				77.792
1.010	S 1.10	15 Winter	1	+10%	30/15 Summer				77.648
1.011	S 1.11	480 Winter	1	+10%	30/60 Summer				77.571
1.012	S 1.12	480 Winter	1	+10%	30/30 Winter				77.570
1.013	S 1.13	480 Winter	1	+10%	30/30 Winter				77.569
4.000	S 4.0	480 Winter	1	+10%	30/60 Summer				77.567
1.014	S 1.14	480 Winter	1	+10%	1/120 Summer				77.567
5.000	S 5.0	15 Winter	1	+10%	30/15 Summer				78.467
5.001	S 5.1	15 Winter	1	+10%	30/15 Summer				78.375
5.002	S 5.2	15 Winter	1	+10%	30/15 Summer				78.266

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 1


PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S 1.0	-0.187	0.000	0.06			2.1	OK	
1.001	S 1.1	-0.167	0.000	0.15			4.7	OK	
1.002	S 1.2	-0.234	0.000	0.11			6.3	OK	
1.003	S 1.3	-0.184	0.000	0.31			16.2	OK	
1.004	S 1.4	-0.185	0.000	0.31			18.5	OK	
2.000	S 2.0	-0.174	0.000	0.11			3.8	OK	
1.005	S 1.5	-0.309	0.000	0.18			25.6	OK	
1.006	S 1.6	-0.275	0.000	0.26			33.6	OK	
1.007	S 1.7	-0.268	0.000	0.28			39.1	OK	
1.008	S 1.8	-0.247	0.000	0.38			55.3	OK	
3.000	S 3.0	-0.107	0.000	0.54			18.7	OK	
1.009	S 1.9	-0.202	0.000	0.57			84.8	OK	
1.010	S 1.10	-0.185	0.000	0.64			91.4	OK	
1.011	S 1.11	-0.162	0.000	0.11			27.3	OK	
1.012	S 1.12	-0.114	0.000	0.11			26.5	OK	
1.013	S 1.13	-0.056	0.000	0.10			28.3	OK	
4.000	S 4.0	-0.114	0.000	0.02			1.1	OK	
1.014	S 1.14	0.186	0.000	0.17			27.6	SURCHARGED	
5.000	S 5.0	-0.199	0.000	0.24			14.2	OK	
5.001	S 5.1	-0.156	0.000	0.45			26.9	OK	
5.002	S 5.2	-0.119	0.000	0.65			39.4	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	S 5.3	15	Winter	1	+10%	30/15	Summer		78.037
6.000	S 6.0	15	Winter	1	+10%	30/15	Summer		78.369
6.001	S 6.1	15	Winter	1	+10%	30/15	Summer		78.277
6.002	S 6.2	15	Winter	1	+10%	30/15	Summer		78.168
6.003	S 6.3	15	Winter	1	+10%	30/15	Summer		77.939
6.004	S 6.4	15	Winter	1	+10%	30/15	Summer		77.840
5.004	S 5.4	15	Winter	1	+10%	30/15	Summer		77.773
1.015	S 1.15	480	Winter	1	+10%	1/15	Summer		77.566
1.016	S 1.16	480	Winter	1	+10%				76.364
1.017	S 1.17	480	Winter	1	+10%				76.044
1.018	S 1.18	360	Summer	1	+10%				75.674

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	S 5.3	-0.181	0.000	0.52		54.0	OK	
6.000	S 6.0	-0.199	0.000	0.24		14.2	OK	
6.001	S 6.1	-0.156	0.000	0.45		26.9	OK	
6.002	S 6.2	-0.119	0.000	0.66		39.5	OK	
6.003	S 6.3	-0.181	0.000	0.52		53.7	OK	
6.004	S 6.4	-0.167	0.000	0.53		57.6	OK	
5.004	S 5.4	0.000	0.000	1.02		105.0	OK	
1.015	S 1.15	0.516	0.000	0.16		11.9	SURCHARGED	
1.016	S 1.16	-0.220	0.000	0.16		11.9	OK	
1.017	S 1.17	-0.223	0.000	0.15		11.9	OK	
1.018	S 1.18	-0.209	0.000	0.20		11.9	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 1

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0                      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0                      Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0      Number of Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model                      FSR      Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.750  
M5-60 (mm)                              16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS Status      ON


Profile(s)                              Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)                              1, 30, 100  
Climate Change (%)                              10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S 1.0	15 Winter	30	+10%					78.681
1.001	S 1.1	15 Winter	30	+10%					78.635
1.002	S 1.2	15 Winter	30	+10%	100/15 Winter				78.511
1.003	S 1.3	15 Winter	30	+10%	100/15 Summer				78.453
1.004	S 1.4	15 Winter	30	+10%	100/15 Summer				78.408
2.000	S 2.0	15 Winter	30	+10%	100/15 Summer				78.325
1.005	S 1.5	960 Winter	30	+10%	100/15 Summer				78.311
1.006	S 1.6	960 Winter	30	+10%	30/15 Winter				78.312
1.007	S 1.7	960 Winter	30	+10%	30/15 Winter				78.311
1.008	S 1.8	960 Winter	30	+10%	30/15 Summer				78.310
3.000	S 3.0	15 Winter	30	+10%	30/15 Summer				78.317
1.009	S 1.9	960 Winter	30	+10%	30/15 Summer				78.309
1.010	S 1.10	960 Winter	30	+10%	30/15 Summer				78.307
1.011	S 1.11	960 Winter	30	+10%	30/60 Summer				78.305
1.012	S 1.12	960 Winter	30	+10%	30/30 Winter				78.304
1.013	S 1.13	960 Winter	30	+10%	30/30 Winter				78.303
4.000	S 4.0	960 Winter	30	+10%	30/60 Summer				78.301
1.014	S 1.14	960 Winter	30	+10%	1/120 Summer				78.301
5.000	S 5.0	15 Winter	30	+10%	30/15 Summer				78.766
5.001	S 5.1	15 Winter	30	+10%	30/15 Summer				78.728
5.002	S 5.2	15 Winter	30	+10%	30/15 Summer				78.593

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 1


PN	US/MH Name	Surcharged		Flooded	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)						
1.000	S 1.0	-0.168	0.000	0.14			4.7	OK	
1.001	S 1.1	-0.129	0.000	0.37			11.8	OK	
1.002	S 1.2	-0.185	0.000	0.27			16.0	OK	
1.003	S 1.3	-0.088	0.000	0.83			43.0	OK	
1.004	S 1.4	-0.091	0.000	0.80			47.5	OK	
2.000	S 2.0	-0.148	0.000	0.25			8.3	OK	
1.005	S 1.5	-0.052	0.000	0.04			6.1	OK	
1.006	S 1.6	0.051	0.000	0.06			8.4	SURCHARGED	
1.007	S 1.7	0.100	0.000	0.07			10.0	SURCHARGED	
1.008	S 1.8	0.183	0.000	0.10			14.9	SURCHARGED	
3.000	S 3.0	0.133	0.000	1.07			37.2	SURCHARGED	
1.009	S 1.9	0.315	0.000	0.15			22.7	SURCHARGED	
1.010	S 1.10	0.474	0.000	0.17			23.6	SURCHARGED	
1.011	S 1.11	0.572	0.000	0.12			28.4	SURCHARGED	
1.012	S 1.12	0.620	0.000	0.11			27.8	SURCHARGED	
1.013	S 1.13	0.678	0.000	0.11			31.2	SURCHARGED	
4.000	S 4.0	0.620	0.000	0.02			1.2	SURCHARGED	
1.014	S 1.14	0.920	0.000	0.21			34.5	SURCHARGED	
5.000	S 5.0	0.100	0.000	0.47			27.8	SURCHARGED	
5.001	S 5.1	0.197	0.000	0.92			55.0	SURCHARGED	
5.002	S 5.2	0.208	0.000	1.37			82.6	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	S 5.3	960	Winter	30	+10%	30/15	Summer		78.305
6.000	S 6.0	15	Winter	30	+10%	30/15	Summer		78.877
6.001	S 6.1	15	Winter	30	+10%	30/15	Summer		78.845
6.002	S 6.2	15	Winter	30	+10%	30/15	Summer		78.764
6.003	S 6.3	15	Winter	30	+10%	30/15	Summer		78.540
6.004	S 6.4	15	Winter	30	+10%	30/15	Summer		78.433
5.004	S 5.4	960	Winter	30	+10%	30/15	Summer		78.304
1.015	S 1.15	960	Winter	30	+10%	1/15	Summer		78.300
1.016	S 1.16	960	Winter	30	+10%				76.364
1.017	S 1.17	960	Winter	30	+10%				76.044
1.018	S 1.18	1440	Summer	30	+10%				75.674

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	S 5.3	0.087	0.000	0.13			13.2	SURCHARGED	
6.000	S 6.0	0.309	0.000	0.44			26.0	SURCHARGED	
6.001	S 6.1	0.412	0.000	0.78			46.3	SURCHARGED	
6.002	S 6.2	0.477	0.000	1.19			71.8	SURCHARGED	
6.003	S 6.3	0.420	0.000	0.97			100.2	SURCHARGED	
6.004	S 6.4	0.426	0.000	0.99			107.0	SURCHARGED	
5.004	S 5.4	0.531	0.000	0.27			27.7	SURCHARGED	
1.015	S 1.15	1.250	0.000	0.16			11.9	SURCHARGED	
1.016	S 1.16	-0.220	0.000	0.16			11.9	OK	
1.017	S 1.17	-0.223	0.000	0.15			11.9	OK	
1.018	S 1.18	-0.209	0.000	0.20			11.9	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 1  
Number of Online Controls 1    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.750  
M5-60 (mm)    16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S 1.0	15 Winter	100	+10%					78.754
1.001	S 1.1	15 Winter	100	+10%					78.746
1.002	S 1.2	15 Winter	100	+10%	100/15 Winter				78.733
1.003	S 1.3	15 Winter	100	+10%	100/15 Summer				78.718
1.004	S 1.4	15 Winter	100	+10%	100/15 Summer				78.693
2.000	S 2.0	15 Winter	100	+10%	100/15 Summer				78.656
1.005	S 1.5	15 Winter	100	+10%	100/15 Summer				78.642
1.006	S 1.6	960 Winter	100	+10%	30/15 Winter				78.638
1.007	S 1.7	960 Winter	100	+10%	30/15 Winter				78.638
1.008	S 1.8	960 Winter	100	+10%	30/15 Summer				78.637
3.000	S 3.0	15 Winter	100	+10%	30/15 Summer				78.721
1.009	S 1.9	960 Winter	100	+10%	30/15 Summer				78.635
1.010	S 1.10	960 Winter	100	+10%	30/15 Summer				78.632
1.011	S 1.11	960 Winter	100	+10%	30/60 Summer				78.630
1.012	S 1.12	960 Winter	100	+10%	30/30 Winter				78.629
1.013	S 1.13	960 Winter	100	+10%	30/30 Winter				78.628
4.000	S 4.0	960 Winter	100	+10%	30/60 Summer				78.626
1.014	S 1.14	960 Winter	100	+10%	1/120 Summer				78.626
5.000	S 5.0	15 Winter	100	+10%	30/15 Summer				79.352
5.001	S 5.1	15 Winter	100	+10%	30/15 Summer				79.308
5.002	S 5.2	15 Winter	100	+10%	30/15 Summer				79.151

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Surcharged Flooded		Half Drain Pipe		Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Time (mins)			
1.000	S 1.0	-0.095	0.000	0.19		6.1	OK	
1.001	S 1.1	-0.018	0.000	0.48		15.2	OK	
1.002	S 1.2	0.037	0.000	0.32		18.8	SURCHARGED	
1.003	S 1.3	0.177	0.000	0.93		48.3	SURCHARGED	
1.004	S 1.4	0.194	0.000	0.85		50.7	SURCHARGED	
2.000	S 2.0	0.183	0.000	0.29		9.6	SURCHARGED	
1.005	S 1.5	0.279	0.000	0.50		72.0	SURCHARGED	
1.006	S 1.6	0.377	0.000	0.08		9.8	SURCHARGED	
1.007	S 1.7	0.427	0.000	0.08		11.5	SURCHARGED	
1.008	S 1.8	0.510	0.000	0.11		16.8	SURCHARGED	
3.000	S 3.0	0.537	0.000	1.25		43.4	SURCHARGED	
1.009	S 1.9	0.641	0.000	0.17		25.2	SURCHARGED	
1.010	S 1.10	0.799	0.000	0.20		28.0	SURCHARGED	
1.011	S 1.11	0.897	0.000	0.15		35.0	SURCHARGED	
1.012	S 1.12	0.945	0.000	0.14		34.8	SURCHARGED	
1.013	S 1.13	1.003	0.000	0.14		39.0	SURCHARGED	
4.000	S 4.0	0.945	0.000	0.02		1.5	SURCHARGED	
1.014	S 1.14	1.245	0.000	0.27		43.0	SURCHARGED	
5.000	S 5.0	0.686	0.000	0.53		31.7	SURCHARGED	
5.001	S 5.1	0.777	0.000	1.04		62.0	SURCHARGED	
5.002	S 5.2	0.766	0.000	1.59		95.7	SURCHARGED	




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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	S 5.3	15 Winter	100	+10%	30/15 Summer				78.736
6.000	S 6.0	15 Winter	100	+10%	30/15 Summer				79.603
6.001	S 6.1	15 Winter	100	+10%	30/15 Summer				79.562
6.002	S 6.2	15 Winter	100	+10%	30/15 Summer				79.431
6.003	S 6.3	15 Winter	100	+10%	30/15 Summer				79.091
6.004	S 6.4	15 Winter	100	+10%	30/15 Summer				78.931
5.004	S 5.4	960 Winter	100	+10%	30/15 Summer				78.628
1.015	S 1.15	960 Winter	100	+10%	1/15 Summer				78.625
1.016	S 1.16	960 Summer	100	+10%					76.364
1.017	S 1.17	960 Winter	100	+10%					76.044
1.018	S 1.18	960 Winter	100	+10%					75.674

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	S 5.3	0.518	0.000	1.32			135.7	SURCHARGED	
6.000	S 6.0	1.035	0.000	0.49			29.2	FLOOD RISK	
6.001	S 6.1	1.129	0.000	0.93			55.3	FLOOD RISK	
6.002	S 6.2	1.144	0.000	1.41			84.9	SURCHARGED	
6.003	S 6.3	0.971	0.000	1.18			122.1	SURCHARGED	
6.004	S 6.4	0.924	0.000	1.24			134.1	SURCHARGED	
5.004	S 5.4	0.855	0.000	0.32			33.3	SURCHARGED	
1.015	S 1.15	1.575	0.000	0.16			11.9	SURCHARGED	
1.016	S 1.16	-0.220	0.000	0.16			11.9	OK	
1.017	S 1.17	-0.223	0.000	0.15			11.9	OK	
1.018	S 1.18	-0.209	0.000	0.20			11.9	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	25	PIMP (%)	100
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Network 2






Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.175	4-8	3.082	8-12	0.741	12-16	0.008

Total Area Contributing (ha) = 5.006

Total Pipe Volume (m³) = 199.417


Network Design Table for Network 2

« - Indicates pipe capacity < flow



















PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.000	41.093	0.137	299.9	0.120	5.00	0.0	0.600	o	300	Pipe/Conduit	
7.001	43.607	0.145	300.7	0.186	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.002	49.818	0.142	350.8	0.155	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.003	31.126	0.089	349.7	0.103	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.004	69.850	0.200	349.3	0.071	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.000	50.00	5.76	77.889	0.120	0.0	0.0	0.0	0.90	63.8	16.3
7.001	50.00	6.57	77.752	0.307	0.0	0.0	0.0	0.90	63.7	41.5
7.002	50.00	7.43	77.532	0.462	0.0	0.0	0.0	0.96	106.2	62.6
7.003	50.00	7.97	77.390	0.565	0.0	0.0	0.0	0.96	106.4	76.5
7.004	50.00	9.18	77.301	0.636	0.0	0.0	0.0	0.96	106.4	86.1


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Network Design Table for Network 2

















PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
8.000	40.587	0.135	300.6	0.120	5.00	0.0	0.600	o	300	Pipe/Conduit		
8.001	44.112	0.147	300.1	0.186	0.00	0.0	0.600	o	300	Pipe/Conduit		
8.002	49.149	0.140	351.1	0.155	0.00	0.0	0.600	o	375	Pipe/Conduit		
8.003	31.795	0.091	349.4	0.102	0.00	0.0	0.600	o	375	Pipe/Conduit		
7.005	29.103	0.058	501.8	0.071	0.00	0.0	0.600	o	600	Pipe/Conduit		
7.006	14.203	0.028	507.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit		
7.007	14.976	0.030	499.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit		
9.000	36.000	0.120	300.0	0.220	5.00	0.0	0.600	o	300	Pipe/Conduit		
9.001	36.000	0.120	300.0	0.229	0.00	0.0	0.600	o	300	Pipe/Conduit		
9.002	26.554	0.076	349.4	0.198	0.00	0.0	0.600	o	375	Pipe/Conduit		
9.003	45.446	0.114	398.6	0.225	0.00	0.0	0.600	o	450	Pipe/Conduit		
9.004	31.125	0.078	399.0	0.229	0.00	0.0	0.600	o	450	Pipe/Conduit		
9.005	18.750	0.038	493.4	0.120	0.00	0.0	0.600	o	600	Pipe/Conduit		
9.006	45.587	0.091	501.0	0.053	0.00	0.0	0.600	o	600	Pipe/Conduit		
9.007	65.811	0.132	498.6	0.086	0.00	0.0	0.600	o	600	Pipe/Conduit		
9.008	20.815	0.042	495.6	0.081	0.00	0.0	0.600	o	600	Pipe/Conduit		
10.000	29.283	0.098	298.8	0.034	5.00	0.0	0.600	o	300	Pipe/Conduit		
10.001	39.204	0.131	299.3	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	50.00	5.75	77.690	0.120	0.0	0.0	0.0	0.90	63.7	16.3
8.001	50.00	6.57	77.555	0.307	0.0	0.0	0.0	0.90	63.8	41.5
8.002	50.00	7.42	77.333	0.462	0.0	0.0	0.0	0.96	106.2	62.6
8.003	50.00	7.97	77.193	0.564	0.0	0.0	0.0	0.96	106.4	76.4
7.005	50.00	9.62	76.876	1.271	0.0	0.0	0.0	1.08	305.4	172.1
7.006	50.00	9.84	76.818	1.271	0.0	0.0	0.0	1.07	303.8	172.1
7.007	50.00	10.07	76.790	1.271	0.0	0.0	0.0	1.08	306.2	172.1
9.000	50.00	5.66	77.034	0.220	0.0	0.0	0.0	0.90	63.8	29.8
9.001	50.00	6.33	76.914	0.449	0.0	0.0	0.0	0.90	63.8	60.8
9.002	50.00	6.79	76.719	0.648	0.0	0.0	0.0	0.96	106.4	87.7
9.003	50.00	7.54	76.568	0.872	0.0	0.0	0.0	1.01	161.0	118.1
9.004	50.00	8.05	76.454	1.101	0.0	0.0	0.0	1.01	160.9	149.1
9.005	50.00	8.34	76.226	1.221	0.0	0.0	0.0	1.09	308.0	165.4
9.006	50.00	9.04	76.188	1.274	0.0	0.0	0.0	1.08	305.7	172.5
9.007	50.00	10.05	76.097	1.360	0.0	0.0	0.0	1.08	306.4	184.2
9.008	50.00	10.37	75.965	1.441	0.0	0.0	0.0	1.09	307.4	195.1
10.000	50.00	5.54	77.291	0.034	0.0	0.0	0.0	0.90	63.9	4.6
10.001	50.00	6.26	77.193	0.087	0.0	0.0	0.0	0.90	63.9	11.7


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Network Design Table for Network 2


PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
10.002	39.682	0.099	400.8	0.081	0.00	0.0	0.600	o	375	Pipe/Conduit		
10.003	59.279	0.148	400.5	0.132	0.00	0.0	0.600	o	375	Pipe/Conduit		
10.004	50.432	0.126	400.3	0.109	0.00	0.0	0.600	o	375	Pipe/Conduit		
10.005	30.298	0.076	398.7	0.073	0.00	0.0	0.600	o	375	Pipe/Conduit		
10.006	16.896	0.042	402.3	0.072	0.00	0.0	0.600	o	450	Pipe/Conduit		
11.000	16.777	0.056	299.6	0.011	5.00	0.0	0.600	o	300	Pipe/Conduit		
12.000	17.025	0.085	200.3	0.038	5.00	0.0	0.600	o	225	Pipe/Conduit		
11.001	68.443	0.228	300.2	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit		
11.002	18.602	0.062	300.0	0.035	0.00	0.0	0.600	o	300	Pipe/Conduit		
11.003	18.450	0.062	297.6	0.021	0.00	0.0	0.600	o	300	Pipe/Conduit		
10.007	38.835	0.097	400.4	0.104	0.00	0.0	0.600	o	450	Pipe/Conduit		
10.008	38.104	0.095	401.1	0.125	0.00	0.0	0.600	o	450	Pipe/Conduit		
10.009	37.063	0.074	500.9	0.146	0.00	0.0	0.600	o	600	Pipe/Conduit		
10.010	39.876	0.080	498.5	0.088	0.00	0.0	0.600	o	600	Pipe/Conduit		
9.009	12.624	0.025	505.0	0.132	0.00	0.0	0.600	o	600	Pipe/Conduit		
13.000	34.249	0.086	398.2	0.998	5.00	0.0	0.600	o	450	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
10.002	50.00	7.00	76.987	0.167	0.0	0.0	0.0	0.90	99.3	22.6
10.003	50.00	8.10	76.888	0.300	0.0	0.0	0.0	0.90	99.3	40.6
10.004	50.00	9.03	76.740	0.408	0.0	0.0	0.0	0.90	99.3	55.3
10.005	50.00	9.59	76.614	0.481	0.0	0.0	0.0	0.90	99.5	65.2
10.006	50.00	9.87	76.463	0.553	0.0	0.0	0.0	1.01	160.2	74.9
11.000	50.00	5.31	77.203	0.011	0.0	0.0	0.0	0.90	63.8	1.6
12.000	50.00	5.31	77.307	0.038	0.0	0.0	0.0	0.92	36.6	5.2
11.001	50.00	6.57	77.147	0.092	0.0	0.0	0.0	0.90	63.8	12.5
11.002	50.00	6.92	76.919	0.128	0.0	0.0	0.0	0.90	63.8	17.3
11.003	50.00	7.26	76.857	0.149	0.0	0.0	0.0	0.91	64.1	20.1
10.007	50.00	10.51	76.421	0.805	0.0	0.0	0.0	1.01	160.6	109.1
10.008	50.00	11.14	76.324	0.931	0.0	0.0	0.0	1.01	160.5	126.0
10.009	50.00	11.71	76.079	1.076	0.0	0.0	0.0	1.08	305.7	145.8
10.010	50.00	12.33	76.005	1.165	0.0	0.0	0.0	1.08	306.5	157.7
9.009	50.00	12.52	75.925	2.737	0.0	0.0	0.0	1.08	304.5	370.7
13.000	50.00	5.56	75.986	0.998	0.0	0.0	0.0	1.01	161.0	135.2


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Network Design Table for Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.008	39.382	0.150	262.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.008	50.00	13.20	75.800	5.006	0.0	0.0	0.0	0.97	68.3x	677.9

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Manhole Schedules for Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdro (mm)
S 7.0	79.389	1.500	Open Manhole	1200	7.000	77.889	300				
S 7.1	79.374	1.622	Open Manhole	1200	7.001	77.752	300	7.000	77.752	300	
S 7.2	79.362	1.830	Open Manhole	1200	7.002	77.532	375	7.001	77.607	300	
S 7.3	79.349	1.959	Open Manhole	1200	7.003	77.390	375	7.002	77.390	375	
S 7.4	79.146	1.845	Open Manhole	1200	7.004	77.301	375	7.003	77.301	375	
S 8.0	79.333	1.643	Open Manhole	1200	8.000	77.690	300				
S 8.1	79.331	1.776	Open Manhole	1200	8.001	77.555	300	8.000	77.555	300	
S 8.2	79.331	1.998	Open Manhole	1200	8.002	77.333	375	8.001	77.408	300	
S 8.3	79.332	2.139	Open Manhole	1200	8.003	77.193	375	8.002	77.193	375	
S 7.5	79.142	2.266	Open Manhole	1200	7.005	76.876	600	7.004	77.101	375	
								8.003	77.102	375	
S 7.6	78.684	1.866	Open Manhole	1200	7.006	76.818	600	7.005	76.818	600	
S 7.7	78.757	1.967	Open Manhole	1200	7.007	76.790	600	7.006	76.790	600	
S 9.0	79.116	2.082	Open Manhole	1200	9.000	77.034	300				
S 9.1	79.192	2.278	Open Manhole	1200	9.001	76.914	300	9.000	76.914	300	
S 9.2	79.154	2.435	Open Manhole	1350	9.002	76.719	375	9.001	76.794	300	
S 9.3	79.127	2.559	Open Manhole	1350	9.003	76.568	450	9.002	76.643	375	
S 9.4	79.080	2.626	Open Manhole	1350	9.004	76.454	450	9.003	76.454	450	
S 9.5	79.001	2.775	Open Manhole	1500	9.005	76.226	600	9.004	76.376	450	
S 9.6	78.955	2.767	Open Manhole	1200	9.006	76.188	600	9.005	76.188	600	
S 9.7	78.842	2.745	Open Manhole	1350	9.007	76.097	600	9.006	76.097	600	
S 9.8	78.406	2.441	Open Manhole	1500	9.008	75.965	600	9.007	75.965	600	
S 10.0	79.326	2.035	Open Manhole	1200	10.000	77.291	300				
S 10.1	79.230	2.037	Open Manhole	1200	10.001	77.193	300	10.000	77.193	300	
S 10.2	79.228	2.241	Open Manhole	1200	10.002	76.987	375	10.001	77.062	300	
S 10.3	79.162	2.274	Open Manhole	1200	10.003	76.888	375	10.002	76.888	375	
S 10.4	78.778	2.038	Open Manhole	1200	10.004	76.740	375	10.003	76.740	375	
S 10.5	78.977	2.363	Open Manhole	1200	10.005	76.614	375	10.004	76.614	375	
S 10.6	78.610	2.147	Open Manhole	1200	10.006	76.463	450	10.005	76.538	375	
S 11.0	79.073	1.870	Open Manhole	1200	11.000	77.203	300				
S 12.0	78.732	1.425	Open Manhole	1200	12.000	77.307	225				
S 11.1	78.976	1.829	Open Manhole	1200	11.001	77.147	300	11.000	77.147	300	
								12.000	77.222	225	
S 11.2	78.643	1.724	Open Manhole	1200	11.002	76.919	300	11.001	76.919	300	
S 11.3	78.553	1.696	Open Manhole	1200	11.003	76.857	300	11.002	76.857	300	
S 10.7	78.671	2.250	Open Manhole	1200	10.007	76.421	450	10.006	76.421	450	
								11.003	76.795	300	
S 10.8	78.697	2.373	Open Manhole	1200	10.008	76.324	450	10.007	76.324	450	


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Manhole Schedules for Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdr. (mm)
S 10.9	78.705	2.626	Open Manhole	1200	10.009	76.079	600	10.008	76.229	450	
S 10.10	78.672	2.667	Open Manhole	1200	10.010	76.005	600	10.009	76.005	600	
S 9.9	78.721	2.798	Open Manhole	1200	9.009	75.925	600	9.008	75.923	600	
								10.010	75.925	600	
S 13.0	79.000	3.014	Open Manhole	2550	13.000	75.986	450				
S 7.8	77.600	1.800	Open Manhole	1200	7.008	75.800	300	7.007	76.760	600	12
								9.009	75.900	600	4
								13.000	75.900	450	2
MH145	77.000	1.350	Open Manhole	1800		OUTFALL		7.008	75.650	300	


MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 7.0	711621.162	741339.449	711621.162	741339.449	Required	●
S 7.1	711621.162	741380.541	711621.162	741380.541	Required	●
S 7.2	711621.162	741424.149	711621.162	741424.149	Required	●
S 7.3	711621.162	741473.966	711621.162	741473.966	Required	●
S 7.4	711621.189	741505.093	711621.189	741505.093	Required	●
S 8.0	711551.339	741339.449	711551.339	741339.449	Required	●
S 8.1	711551.339	741380.036	711551.339	741380.036	Required	●
S 8.2	711551.339	741424.149	711551.339	741424.149	Required	●
S 8.3	711551.339	741473.298	711551.339	741473.298	Required	●

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Manhole Schedules for Network 2


MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 7.5	711551.339	741505.093	711551.339	741505.093	Required	
S 7.6	711522.236	741505.093	711522.236	741505.093	Required	
S 7.7	711522.236	741490.889	711522.236	741490.889	Required	
S 9.0	711648.669	741325.241	711648.669	741325.241	Required	
S 9.1	711648.669	741361.241	711648.669	741361.241	Required	
S 9.2	711648.669	741397.241	711648.669	741397.241	Required	
S 9.3	711648.669	741423.795	711648.669	741423.795	Required	
S 9.4	711648.669	741469.241	711648.669	741469.241	Required	
S 9.5	711648.669	741500.366	711648.669	741500.366	Required	
S 9.6	711631.390	741507.644	711631.390	741507.644	Required	
S 9.7	711585.803	741507.644	711585.803	741507.644	Required	
S 9.8	711519.992	741507.644	711519.992	741507.644	Required	
S 10.0	711758.694	741294.046	711758.694	741294.046	Required	
S 10.1	711729.411	741294.046	711729.411	741294.046	Required	
S 10.2	711690.208	741294.046	711690.208	741294.046	Required	





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Manhole Schedules for Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 10.3	711650.525	741294.046	711650.525	741294.046	Required	
S 10.4	711591.247	741294.046	711591.247	741294.046	Required	
S 10.5	711540.815	741294.046	711540.815	741294.046	Required	
S 10.6	711519.992	741316.055	711519.992	741316.055	Required	
S 11.0	711407.140	741364.493	711407.140	741364.493	Required	
S 12.0	711414.847	741343.041	711414.847	741343.041	Required	
S 11.1	711422.675	741358.159	711422.675	741358.159	Required	
S 11.2	711486.026	741332.252	711486.026	741332.252	Required	
S 11.3	711503.244	741325.211	711503.244	741325.211	Required	
S 10.7	711519.992	741332.951	711519.992	741332.951	Required	
S 10.8	711519.992	741371.786	711519.992	741371.786	Required	
S 10.9	711519.992	741409.889	711519.992	741409.889	Required	
S 10.10	711519.992	741446.953	711519.992	741446.953	Required	
S 9.9	711519.992	741486.828	711519.992	741486.828	Required	
S 13.0	711481.160	741466.479	711481.160	741466.479	Required	

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Manhole Schedules for Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 7.8	711507.467	741488.408	711507.467	741488.408	Required	
MH145	711483.271	741519.480			No Entry	

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PIPELINE SCHEDULES for Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	o	300	S 7.0	79.389	77.889	1.200	Open Manhole	1200
7.001	o	300	S 7.1	79.374	77.752	1.322	Open Manhole	1200
7.002	o	375	S 7.2	79.362	77.532	1.455	Open Manhole	1200
7.003	o	375	S 7.3	79.349	77.390	1.584	Open Manhole	1200
7.004	o	375	S 7.4	79.146	77.301	1.470	Open Manhole	1200
8.000	o	300	S 8.0	79.333	77.690	1.343	Open Manhole	1200
8.001	o	300	S 8.1	79.331	77.555	1.476	Open Manhole	1200
8.002	o	375	S 8.2	79.331	77.333	1.623	Open Manhole	1200
8.003	o	375	S 8.3	79.332	77.193	1.764	Open Manhole	1200
7.005	o	600	S 7.5	79.142	76.876	1.666	Open Manhole	1200
7.006	o	600	S 7.6	78.684	76.818	1.266	Open Manhole	1200
7.007	o	600	S 7.7	78.757	76.790	1.367	Open Manhole	1200
9.000	o	300	S 9.0	79.116	77.034	1.782	Open Manhole	1200
9.001	o	300	S 9.1	79.192	76.914	1.978	Open Manhole	1200
9.002	o	375	S 9.2	79.154	76.719	2.060	Open Manhole	1350
9.003	o	450	S 9.3	79.127	76.568	2.109	Open Manhole	1350
9.004	o	450	S 9.4	79.080	76.454	2.176	Open Manhole	1350
9.005	o	600	S 9.5	79.001	76.226	2.175	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	41.093	299.9	S 7.1	79.374	77.752	1.322	Open Manhole	1200
7.001	43.607	300.7	S 7.2	79.362	77.607	1.455	Open Manhole	1200
7.002	49.818	350.8	S 7.3	79.349	77.390	1.584	Open Manhole	1200
7.003	31.126	349.7	S 7.4	79.146	77.301	1.470	Open Manhole	1200
7.004	69.850	349.3	S 7.5	79.142	77.101	1.666	Open Manhole	1200
8.000	40.587	300.6	S 8.1	79.331	77.555	1.476	Open Manhole	1200
8.001	44.112	300.1	S 8.2	79.331	77.408	1.623	Open Manhole	1200
8.002	49.149	351.1	S 8.3	79.332	77.193	1.764	Open Manhole	1200
8.003	31.795	349.4	S 7.5	79.142	77.102	1.665	Open Manhole	1200
7.005	29.103	501.8	S 7.6	78.684	76.818	1.266	Open Manhole	1200
7.006	14.203	507.3	S 7.7	78.757	76.790	1.367	Open Manhole	1200
7.007	14.976	499.2	S 7.8	77.600	76.760	0.240	Open Manhole	1200
9.000	36.000	300.0	S 9.1	79.192	76.914	1.978	Open Manhole	1200
9.001	36.000	300.0	S 9.2	79.154	76.794	2.060	Open Manhole	1350
9.002	26.554	349.4	S 9.3	79.127	76.643	2.109	Open Manhole	1350
9.003	45.446	398.6	S 9.4	79.080	76.454	2.176	Open Manhole	1350
9.004	31.125	399.0	S 9.5	79.001	76.376	2.175	Open Manhole	1500
9.005	18.750	493.4	S 9.6	78.955	76.188	2.167	Open Manhole	1200

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PIPELINE SCHEDULES for Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.006	o	600	S 9.6	78.955	76.188	2.167	Open Manhole	1200
9.007	o	600	S 9.7	78.842	76.097	2.145	Open Manhole	1350
9.008	o	600	S 9.8	78.406	75.965	1.841	Open Manhole	1500
10.000	o	300	S 10.0	79.326	77.291	1.735	Open Manhole	1200
10.001	o	300	S 10.1	79.230	77.193	1.737	Open Manhole	1200
10.002	o	375	S 10.2	79.228	76.987	1.866	Open Manhole	1200
10.003	o	375	S 10.3	79.162	76.888	1.899	Open Manhole	1200
10.004	o	375	S 10.4	78.778	76.740	1.663	Open Manhole	1200
10.005	o	375	S 10.5	78.977	76.614	1.988	Open Manhole	1200
10.006	o	450	S 10.6	78.610	76.463	1.697	Open Manhole	1200
11.000	o	300	S 11.0	79.073	77.203	1.570	Open Manhole	1200
12.000	o	225	S 12.0	78.732	77.307	1.200	Open Manhole	1200
11.001	o	300	S 11.1	78.976	77.147	1.529	Open Manhole	1200
11.002	o	300	S 11.2	78.643	76.919	1.424	Open Manhole	1200
11.003	o	300	S 11.3	78.553	76.857	1.396	Open Manhole	1200
10.007	o	450	S 10.7	78.671	76.421	1.800	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.006	45.587	501.0	S 9.7	78.842	76.097	2.145	Open Manhole	1350
9.007	65.811	498.6	S 9.8	78.406	75.965	1.841	Open Manhole	1500
9.008	20.815	495.6	S 9.9	78.721	75.923	2.198	Open Manhole	1200
10.000	29.283	298.8	S 10.1	79.230	77.193	1.737	Open Manhole	1200
10.001	39.204	299.3	S 10.2	79.228	77.062	1.866	Open Manhole	1200
10.002	39.682	400.8	S 10.3	79.162	76.888	1.899	Open Manhole	1200
10.003	59.279	400.5	S 10.4	78.778	76.740	1.663	Open Manhole	1200
10.004	50.432	400.3	S 10.5	78.977	76.614	1.988	Open Manhole	1200
10.005	30.298	398.7	S 10.6	78.610	76.538	1.697	Open Manhole	1200
10.006	16.896	402.3	S 10.7	78.671	76.421	1.800	Open Manhole	1200
11.000	16.777	299.6	S 11.1	78.976	77.147	1.529	Open Manhole	1200
12.000	17.025	200.3	S 11.1	78.976	77.222	1.529	Open Manhole	1200
11.001	68.443	300.2	S 11.2	78.643	76.919	1.424	Open Manhole	1200
11.002	18.602	300.0	S 11.3	78.553	76.857	1.396	Open Manhole	1200
11.003	18.450	297.6	S 10.7	78.671	76.795	1.576	Open Manhole	1200
10.007	38.835	400.4	S 10.8	78.697	76.324	1.923	Open Manhole	1200

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PIPELINE SCHEDULES for Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
10.008	o	450	S 10.8	78.697	76.324	1.923	Open Manhole	1200
10.009	o	600	S 10.9	78.705	76.079	2.026	Open Manhole	1200
10.010	o	600	S 10.10	78.672	76.005	2.067	Open Manhole	1200
9.009	o	600	S 9.9	78.721	75.925	2.196	Open Manhole	1200
13.000	o	450	S 13.0	79.000	75.986	2.564	Open Manhole	2550
7.008	o	300	S 7.8	77.600	75.800	1.500	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
10.008	38.104	401.1	S 10.9	78.705	76.229	2.026	Open Manhole	1200
10.009	37.063	500.9	S 10.10	78.672	76.005	2.067	Open Manhole	1200
10.010	39.876	498.5	S 9.9	78.721	75.925	2.196	Open Manhole	1200
9.009	12.624	505.0	S 7.8	77.600	75.900	1.100	Open Manhole	1200
13.000	34.249	398.2	S 7.8	77.600	75.900	1.250	Open Manhole	1200
7.008	39.382	262.5	MH145	77.000	75.650	1.050	Open Manhole	1800

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Area Summary for Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
7.000	Classification	Roof	100	0.120	0.120	0.120
7.001	Classification	Roof	100	0.186	0.186	0.186
7.002	Classification	Roof	100	0.155	0.155	0.155
7.003	Classification	Roof	100	0.103	0.103	0.103
7.004	Classification	Roof	100	0.071	0.071	0.071
8.000	Classification	Roof	100	0.120	0.120	0.120
8.001	Classification	Roof	100	0.186	0.186	0.186
8.002	Classification	Roof	100	0.155	0.155	0.155
8.003	Classification	Roof	100	0.102	0.102	0.102
7.005	Classification	Roof	100	0.071	0.071	0.071
7.006	-	-	100	0.000	0.000	0.000
7.007	-	-	100	0.000	0.000	0.000
9.000	Classification	Roads	100	0.220	0.220	0.220
9.001	Classification	Roads	100	0.229	0.229	0.229
9.002	Classification	Roads	100	0.198	0.198	0.198
9.003	Classification	Roads	100	0.225	0.225	0.225
9.004	Classification	Roads	100	0.229	0.229	0.229
9.005	Classification	Roads	100	0.120	0.120	0.120
9.006	Classification	Roads	100	0.053	0.053	0.053
9.007	Classification	Roads	100	0.086	0.086	0.086
9.008	Classification	Roads	100	0.081	0.081	0.081
10.000	Classification	Roads	100	0.034	0.034	0.034
10.001	Classification	Roads	100	0.052	0.052	0.052
10.002	Classification	Roads	100	0.081	0.081	0.081
10.003	Classification	Roads	100	0.086	0.086	0.086
	Classification	Roof	100	0.046	0.046	0.132
10.004	Classification	Roads	100	0.109	0.109	0.109
10.005	Classification	Roads	100	0.073	0.073	0.073
10.006	Classification	Roads	100	0.072	0.072	0.072
11.000	Classification	Roads	100	0.011	0.011	0.011
12.000	Classification	Roads	100	0.038	0.038	0.038
11.001	Classification	Roads	100	0.042	0.042	0.042
11.002	Classification	Roads	100	0.035	0.035	0.035
11.003	Classification	Roads	100	0.021	0.021	0.021
10.007	Classification	Roads	100	0.104	0.104	0.104
10.008	Classification	Roads	100	0.125	0.125	0.125
10.009	Classification	Roads	100	0.146	0.146	0.146
10.010	Classification	Roads	100	0.088	0.088	0.088
9.009	Classification	Roads	100	0.132	0.132	0.132
13.000	Classification	Roof	100	0.113	0.113	0.113
	Classification	Roof	100	0.205	0.205	0.318
	Classification	Roads	100	0.229	0.229	0.546
	Classification	Roads	100	0.068	0.068	0.615
	Classification	Grass	30	0.191	0.057	0.672
	Classification	Gravel	75	0.104	0.078	0.750
	Classification	Roof	100	0.037	0.037	0.788
	Classification	Gravel	75	0.076	0.057	0.844
	Classification	Gravel	75	0.205	0.154	0.998
7.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				5.236	5.006	5.006

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Network Classifications for Network 2

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
7.000	S 7.0	300	1.200	1.322	Unclassified	1200	0	1.200	Unclassified
7.001	S 7.1	300	1.322	1.455	Unclassified	1200	0	1.322	Unclassified
7.002	S 7.2	375	1.455	1.584	Unclassified	1200	0	1.455	Unclassified
7.003	S 7.3	375	1.470	1.584	Unclassified	1200	0	1.584	Unclassified
7.004	S 7.4	375	1.470	1.666	Unclassified	1200	0	1.470	Unclassified
8.000	S 8.0	300	1.343	1.476	Unclassified	1200	0	1.343	Unclassified
8.001	S 8.1	300	1.476	1.623	Unclassified	1200	0	1.476	Unclassified
8.002	S 8.2	375	1.623	1.764	Unclassified	1200	0	1.623	Unclassified
8.003	S 8.3	375	1.665	1.764	Unclassified	1200	0	1.764	Unclassified
7.005	S 7.5	600	1.266	1.666	Unclassified	1200	0	1.666	Unclassified
7.006	S 7.6	600	1.266	1.367	Unclassified	1200	0	1.266	Unclassified
7.007	S 7.7	600	0.240	1.367	Unclassified	1200	0	1.367	Unclassified
9.000	S 9.0	300	1.782	1.978	Unclassified	1200	0	1.782	Unclassified
9.001	S 9.1	300	1.978	2.060	Unclassified	1200	0	1.978	Unclassified
9.002	S 9.2	375	2.060	2.109	Unclassified	1350	0	2.060	Unclassified
9.003	S 9.3	450	2.109	2.176	Unclassified	1350	0	2.109	Unclassified
9.004	S 9.4	450	2.175	2.176	Unclassified	1350	0	2.176	Unclassified
9.005	S 9.5	600	2.167	2.175	Unclassified	1500	0	2.175	Unclassified
9.006	S 9.6	600	2.145	2.167	Unclassified	1200	0	2.167	Unclassified
9.007	S 9.7	600	1.841	2.145	Unclassified	1350	0	2.145	Unclassified
9.008	S 9.8	600	1.841	2.198	Unclassified	1500	0	1.841	Unclassified
10.000	S 10.0	300	1.735	1.737	Unclassified	1200	0	1.735	Unclassified
10.001	S 10.1	300	1.737	1.866	Unclassified	1200	0	1.737	Unclassified
10.002	S 10.2	375	1.866	1.899	Unclassified	1200	0	1.866	Unclassified
10.003	S 10.3	375	1.663	1.899	Unclassified	1200	0	1.899	Unclassified
10.004	S 10.4	375	1.663	1.988	Unclassified	1200	0	1.663	Unclassified
10.005	S 10.5	375	1.697	1.988	Unclassified	1200	0	1.988	Unclassified
10.006	S 10.6	450	1.697	1.800	Unclassified	1200	0	1.697	Unclassified
11.000	S 11.0	300	1.529	1.570	Unclassified	1200	0	1.570	Unclassified
12.000	S 12.0	225	1.200	1.529	Unclassified	1200	0	1.200	Unclassified
11.001	S 11.1	300	1.424	1.529	Unclassified	1200	0	1.529	Unclassified
11.002	S 11.2	300	1.396	1.424	Unclassified	1200	0	1.424	Unclassified
11.003	S 11.3	300	1.396	1.576	Unclassified	1200	0	1.396	Unclassified
10.007	S 10.7	450	1.800	1.923	Unclassified	1200	0	1.800	Unclassified
10.008	S 10.8	450	1.923	2.026	Unclassified	1200	0	1.923	Unclassified
10.009	S 10.9	600	2.026	2.067	Unclassified	1200	0	2.026	Unclassified
10.010	S 10.10	600	2.067	2.196	Unclassified	1200	0	2.067	Unclassified
9.009	S 9.9	600	1.100	2.196	Unclassified	1200	0	2.196	Unclassified
13.000	S 13.0	450	1.250	2.564	Unclassified	2550	0	2.564	Unclassified
7.008	S 7.8	300	1.050	1.500	Unclassified	1200	0	1.500	Unclassified

Free Flowing Outfall Details for Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
7.008	MH145	77.000	75.650	0.000	1800	0

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Simulation Criteria for Network 2

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	25	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		



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Online Controls for Network 2


Hydro-Brake® Optimum Manhole: S 7.8, DS/PN: 7.008, Volume (m³): 14.3

Unit Reference	MD-SHE-0173-1600-1500-1600
Design Head (m)	1.500
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	173
Invert Level (m)	75.800
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	16.0
Flush-Flo™	0.442	16.0
Kick-Flo®	0.961	13.0
Mean Flow over Head Range	-	13.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	14.4	3.000	22.3	7.000	33.5
0.200	14.4	1.400	15.5	3.500	24.0	7.500	34.6
0.300	15.6	1.600	16.5	4.000	25.6	8.000	35.7
0.400	16.0	1.800	17.4	4.500	27.0	8.500	36.7
0.500	15.9	2.000	18.3	5.000	28.4	9.000	37.8
0.600	15.7	2.200	19.2	5.500	29.8	9.500	38.8
0.800	14.9	2.400	20.0	6.000	31.1		
1.000	13.2	2.600	20.8	6.500	32.3		


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Storage Structures for Network 2

Tank or Pond Manhole: S 7.8, DS/PN: 7.008


Invert Level (m) 75.800

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	1264.0	1.800	1873.0

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Manhole Headloss for Network 2

PN	US/MH Name	US/MH Headloss
7.000	S 7.0	0.500
7.001	S 7.1	0.500
7.002	S 7.2	0.500
7.003	S 7.3	0.500
7.004	S 7.4	0.500
8.000	S 8.0	0.500
8.001	S 8.1	0.500
8.002	S 8.2	0.500
8.003	S 8.3	0.500
7.005	S 7.5	0.500
7.006	S 7.6	0.500
7.007	S 7.7	0.500
9.000	S 9.0	0.500
9.001	S 9.1	0.500
9.002	S 9.2	0.500
9.003	S 9.3	0.500
9.004	S 9.4	0.500
9.005	S 9.5	0.500
9.006	S 9.6	0.500
9.007	S 9.7	0.500
9.008	S 9.8	0.500
10.000	S 10.0	0.500
10.001	S 10.1	0.500
10.002	S 10.2	0.500
10.003	S 10.3	0.500
10.004	S 10.4	0.500
10.005	S 10.5	0.500
10.006	S 10.6	0.500
11.000	S 11.0	0.500
12.000	S 12.0	0.500
11.001	S 11.1	0.500
11.002	S 11.2	0.500
11.003	S 11.3	0.500
10.007	S 10.7	0.500
10.008	S 10.8	0.500
10.009	S 10.9	0.500
10.010	S 10.10	0.500
9.009	S 9.9	0.500
13.000	S 13.0	0.500
7.008	S 7.8	0.500

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 1  
Number of Online Controls 1    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.750  
M5-60 (mm)    16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON


Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
7.000	S 7.0	15 Winter	1	+10%	30/15 Summer				77.993
7.001	S 7.1	15 Winter	1	+10%	30/15 Summer				77.915
7.002	S 7.2	15 Winter	1	+10%	30/15 Summer				77.719
7.003	S 7.3	15 Winter	1	+10%	30/15 Summer				77.597
7.004	S 7.4	15 Winter	1	+10%	30/15 Summer				77.511
8.000	S 8.0	15 Winter	1	+10%	30/15 Summer				77.794
8.001	S 8.1	15 Winter	1	+10%	30/15 Summer				77.718
8.002	S 8.2	15 Winter	1	+10%	30/15 Summer				77.520
8.003	S 8.3	15 Winter	1	+10%	30/15 Summer				77.400
7.005	S 7.5	15 Winter	1	+10%	30/15 Winter				77.234
7.006	S 7.6	15 Winter	1	+10%	30/15 Summer				77.190
7.007	S 7.7	15 Winter	1	+10%	100/15 Winter				77.146
9.000	S 9.0	15 Winter	1	+10%	30/15 Summer				77.185
9.001	S 9.1	15 Winter	1	+10%	30/15 Summer				77.130
9.002	S 9.2	15 Winter	1	+10%	30/15 Summer				76.960
9.003	S 9.3	15 Winter	1	+10%	30/15 Summer				76.832
9.004	S 9.4	15 Winter	1	+10%	30/15 Summer				76.747
9.005	S 9.5	30 Winter	1	+10%	30/15 Winter				76.562
9.006	S 9.6	30 Winter	1	+10%	30/15 Winter				76.528
9.007	S 9.7	30 Winter	1	+10%	30/15 Summer				76.497
9.008	S 9.8	30 Winter	1	+10%	30/15 Summer				76.472

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2


PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )					
7.000	S 7.0	-0.196	0.000	0.25		14.8	OK	
7.001	S 7.1	-0.137	0.000	0.56		33.3	OK	
7.002	S 7.2	-0.188	0.000	0.48		47.0	OK	
7.003	S 7.3	-0.168	0.000	0.58		54.9	OK	
7.004	S 7.4	-0.165	0.000	0.58		58.4	OK	
8.000	S 8.0	-0.196	0.000	0.25		14.9	OK	
8.001	S 8.1	-0.137	0.000	0.56		33.3	OK	
8.002	S 8.2	-0.188	0.000	0.48		47.1	OK	
8.003	S 8.3	-0.168	0.000	0.58		55.0	OK	
7.005	S 7.5	-0.242	0.000	0.45		112.6	OK	
7.006	S 7.6	-0.228	0.000	0.68		110.5	OK	
7.007	S 7.7	-0.244	0.000	0.66		109.9	OK	
9.000	S 9.0	-0.149	0.000	0.46		27.0	OK	
9.001	S 9.1	-0.084	0.000	0.84		49.7	OK	
9.002	S 9.2	-0.134	0.000	0.73		67.6	OK	
9.003	S 9.3	-0.186	0.000	0.60		86.3	OK	
9.004	S 9.4	-0.157	0.000	0.75		104.0	OK	
9.005	S 9.5	-0.264	0.000	0.52		104.4	OK	
9.006	S 9.6	-0.260	0.000	0.40		104.8	OK	
9.007	S 9.7	-0.200	0.000	0.36		100.6	OK	
9.008	S 9.8	-0.093	0.000	0.43		92.0	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.000	S 10.0	15	Winter	1	+10%			
10.001	S 10.1	15	Winter	1	+10%			
10.002	S 10.2	15	Winter	1	+10%	100/15	Winter	
10.003	S 10.3	15	Winter	1	+10%	100/15	Summer	
10.004	S 10.4	15	Winter	1	+10%	100/15	Summer	
10.005	S 10.5	15	Winter	1	+10%	30/15	Winter	
10.006	S 10.6	15	Winter	1	+10%	30/15	Winter	
11.000	S 11.0	15	Winter	1	+10%			
12.000	S 12.0	15	Winter	1	+10%			
11.001	S 11.1	15	Winter	1	+10%			
11.002	S 11.2	15	Winter	1	+10%	100/30	Winter	
11.003	S 11.3	15	Winter	1	+10%	100/15	Winter	
10.007	S 10.7	15	Winter	1	+10%	30/15	Winter	
10.008	S 10.8	30	Winter	1	+10%	30/15	Winter	
10.009	S 10.9	30	Winter	1	+10%	30/15	Winter	
10.010	S 10.10	30	Winter	1	+10%	30/15	Summer	
9.009	S 9.9	30	Winter	1	+10%	30/15	Summer	
13.000	S 13.0	960	Winter	1	+10%	30/15	Summer	
7.008	S 7.8	960	Winter	1	+10%	1/60	Summer	

PN	US/MH Name	Water			Surcharged		Flooded		Half Drain		Pipe Flow (l/s)	Status
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)					
10.000	S 10.0	77.346	-0.245	0.000	0.07					4.3	OK	
10.001	S 10.1	77.275	-0.218	0.000	0.16					9.6	OK	
10.002	S 10.2	77.105	-0.257	0.000	0.19					17.6	OK	
10.003	S 10.3	77.035	-0.228	0.000	0.31					29.2	OK	
10.004	S 10.4	76.908	-0.207	0.000	0.41					37.3	OK	
10.005	S 10.5	76.797	-0.192	0.000	0.47					41.8	OK	
10.006	S 10.6	76.682	-0.231	0.000	0.40					46.1	OK	
11.000	S 11.0	77.247	-0.256	0.000	0.03					1.4	OK	
12.000	S 12.0	77.365	-0.167	0.000	0.15					4.8	OK	
11.001	S 11.1	77.232	-0.215	0.000	0.17					10.2	OK	
11.002	S 11.2	77.021	-0.198	0.000	0.24					13.5	OK	
11.003	S 11.3	76.965	-0.192	0.000	0.28					15.4	OK	
10.007	S 10.7	76.643	-0.228	0.000	0.46					65.7	OK	
10.008	S 10.8	76.554	-0.220	0.000	0.51					73.0	OK	
10.009	S 10.9	76.485	-0.194	0.000	0.30					76.2	OK	
10.010	S 10.10	76.471	-0.134	0.000	0.28					73.0	OK	
9.009	S 9.9	76.455	-0.070	0.000	1.03					162.6	OK	
13.000	S 13.0	76.382	-0.054	0.000	0.08					11.9	OK	
7.008	S 7.8	76.380	0.280	0.000	0.25					15.9	SURCHARGED	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2

PN	US/MH Name	Level Exceeded
10.000	S 10.0	
10.001	S 10.1	
10.002	S 10.2	
10.003	S 10.3	
10.004	S 10.4	
10.005	S 10.5	
10.006	S 10.6	
11.000	S 11.0	
12.000	S 12.0	
11.001	S 11.1	
11.002	S 11.2	
11.003	S 11.3	
10.007	S 10.7	
10.008	S 10.8	
10.009	S 10.9	
10.010	S 10.10	
9.009	S 9.9	
13.000	S 13.0	
7.008	S 7.8	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 1  
Number of Online Controls 1    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.750  
M5-60 (mm)    16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
7.000	S 7.0	15 Winter	30	+10%	30/15 Summer				78.257
7.001	S 7.1	15 Winter	30	+10%	30/15 Summer				78.218
7.002	S 7.2	15 Winter	30	+10%	30/15 Summer				78.030
7.003	S 7.3	15 Winter	30	+10%	30/15 Summer				77.896
7.004	S 7.4	15 Winter	30	+10%	30/15 Summer				77.770
8.000	S 8.0	15 Winter	30	+10%	30/15 Summer				78.055
8.001	S 8.1	15 Winter	30	+10%	30/15 Summer				78.014
8.002	S 8.2	15 Winter	30	+10%	30/15 Summer				77.782
8.003	S 8.3	15 Winter	30	+10%	30/15 Summer				77.615
7.005	S 7.5	15 Winter	30	+10%	30/15 Winter				77.481
7.006	S 7.6	15 Winter	30	+10%	30/15 Summer				77.430
7.007	S 7.7	30 Summer	30	+10%	100/15 Winter				77.390
9.000	S 9.0	15 Winter	30	+10%	30/15 Summer				77.999
9.001	S 9.1	15 Winter	30	+10%	30/15 Summer				77.900
9.002	S 9.2	15 Winter	30	+10%	30/15 Summer				77.510
9.003	S 9.3	15 Winter	30	+10%	30/15 Summer				77.308
9.004	S 9.4	15 Winter	30	+10%	30/15 Summer				77.083
9.005	S 9.5	960 Winter	30	+10%	30/15 Winter				77.067
9.006	S 9.6	960 Winter	30	+10%	30/15 Winter				77.066
9.007	S 9.7	960 Winter	30	+10%	30/15 Summer				77.065
9.008	S 9.8	1440 Winter	30	+10%	30/15 Summer				77.064



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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2


PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap.	Flow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )						
7.000	S 7.0	0.068	0.000	0.50			30.0	SURCHARGED	
7.001	S 7.1	0.166	0.000	1.22			72.9	SURCHARGED	
7.002	S 7.2	0.123	0.000	0.99			97.4	SURCHARGED	
7.003	S 7.3	0.131	0.000	1.18			111.6	SURCHARGED	
7.004	S 7.4	0.094	0.000	1.16			116.9	SURCHARGED	
8.000	S 8.0	0.065	0.000	0.51			30.4	SURCHARGED	
8.001	S 8.1	0.159	0.000	1.23			73.5	SURCHARGED	
8.002	S 8.2	0.074	0.000	1.05			102.8	SURCHARGED	
8.003	S 8.3	0.047	0.000	1.25			117.9	SURCHARGED	
7.005	S 7.5	0.005	0.000	0.94			232.2	SURCHARGED	
7.006	S 7.6	0.012	0.000	1.42			231.0	SURCHARGED	
7.007	S 7.7	0.000	0.000	1.30			216.6	OK	
9.000	S 9.0	0.665	0.000	0.92			54.4	SURCHARGED	
9.001	S 9.1	0.686	0.000	1.77			104.1	SURCHARGED	
9.002	S 9.2	0.416	0.000	1.59			147.8	SURCHARGED	
9.003	S 9.3	0.290	0.000	1.35			195.4	SURCHARGED	
9.004	S 9.4	0.179	0.000	1.74			241.7	SURCHARGED	
9.005	S 9.5	0.241	0.000	0.14			27.8	SURCHARGED	
9.006	S 9.6	0.278	0.000	0.11			28.3	SURCHARGED	
9.007	S 9.7	0.368	0.000	0.10			28.6	SURCHARGED	
9.008	S 9.8	0.499	0.000	0.10			21.5	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.000	S 10.0	15	Winter	30	+10%			
10.001	S 10.1	15	Winter	30	+10%			
10.002	S 10.2	15	Winter	30	+10%	100/15	Winter	
10.003	S 10.3	15	Winter	30	+10%	100/15	Summer	
10.004	S 10.4	15	Winter	30	+10%	100/15	Summer	
10.005	S 10.5	960	Winter	30	+10%	30/15	Winter	
10.006	S 10.6	960	Winter	30	+10%	30/15	Winter	
11.000	S 11.0	15	Winter	30	+10%			
12.000	S 12.0	15	Winter	30	+10%			
11.001	S 11.1	15	Winter	30	+10%			
11.002	S 11.2	15	Winter	30	+10%	100/30	Winter	
11.003	S 11.3	1440	Winter	30	+10%	100/15	Winter	
10.007	S 10.7	1440	Winter	30	+10%	30/15	Winter	
10.008	S 10.8	1440	Winter	30	+10%	30/15	Winter	
10.009	S 10.9	1440	Winter	30	+10%	30/15	Winter	
10.010	S 10.10	1440	Winter	30	+10%	30/15	Summer	
9.009	S 9.9	1440	Winter	30	+10%	30/15	Summer	
13.000	S 13.0	1440	Winter	30	+10%	30/15	Summer	
7.008	S 7.8	1440	Winter	30	+10%	1/60	Summer	

PN	US/MH Name	Water			Surcharged		Flooded		Flow / Overflow Cap.	Half Drain Time (mins)	Pipe Flow (l/s)	Status
		Level (m)	Depth (m)	Volume (m³)	Flow (l/s)	Overflow (l/s)						
10.000	S 10.0	77.379	-0.212	0.000	0.16					9.5	OK	
10.001	S 10.1	77.329	-0.164	0.000	0.40					23.9	OK	
10.002	S 10.2	77.205	-0.157	0.000	0.48					43.7	OK	
10.003	S 10.3	77.153	-0.110	0.000	0.78					72.6	OK	
10.004	S 10.4	77.087	-0.028	0.000	0.91					83.4	OK	
10.005	S 10.5	77.069	0.080	0.000	0.13					11.3	SURCHARGED	
10.006	S 10.6	77.068	0.155	0.000	0.11					12.9	SURCHARGED	
11.000	S 11.0	77.291	-0.212	0.000	0.06					3.2	OK	
12.000	S 12.0	77.397	-0.135	0.000	0.33					10.7	OK	
11.001	S 11.1	77.285	-0.162	0.000	0.39					24.0	OK	
11.002	S 11.2	77.091	-0.128	0.000	0.58					31.9	OK	
11.003	S 11.3	77.068	-0.089	0.000	0.05					2.6	OK	
10.007	S 10.7	77.067	0.196	0.000	0.10					14.0	SURCHARGED	
10.008	S 10.8	77.066	0.292	0.000	0.11					15.6	SURCHARGED	
10.009	S 10.9	77.065	0.386	0.000	0.07					17.3	SURCHARGED	
10.010	S 10.10	77.064	0.459	0.000	0.07					18.0	SURCHARGED	
9.009	S 9.9	77.063	0.538	0.000	0.26					40.8	SURCHARGED	
13.000	S 13.0	77.064	0.628	0.000	0.12					17.1	SURCHARGED	
7.008	S 7.8	77.062	0.962	0.000	0.25					15.9	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Network 2

PN	US/MH Name	Level Exceeded
10.000	S	10.0
10.001	S	10.1
10.002	S	10.2
10.003	S	10.3
10.004	S	10.4
10.005	S	10.5
10.006	S	10.6
11.000	S	11.0
12.000	S	12.0
11.001	S	11.1
11.002	S	11.2
11.003	S	11.3
10.007	S	10.7
10.008	S	10.8
10.009	S	10.9
10.010	S	10.10
9.009	S	9.9
13.000	S	13.0
7.008	S	7.8

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 1  
Number of Online Controls 1    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.750  
M5-60 (mm)    16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON


Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
7.000	S 7.0	15 Winter	100	+10%	30/15 Summer				78.801
7.001	S 7.1	15 Winter	100	+10%	30/15 Summer				78.755
7.002	S 7.2	15 Winter	100	+10%	30/15 Summer				78.476
7.003	S 7.3	15 Winter	100	+10%	30/15 Summer				78.268
7.004	S 7.4	15 Winter	100	+10%	30/15 Summer				78.058
8.000	S 8.0	15 Winter	100	+10%	30/15 Summer				78.467
8.001	S 8.1	15 Winter	100	+10%	30/15 Summer				78.414
8.002	S 8.2	15 Winter	100	+10%	30/15 Summer				78.057
8.003	S 8.3	15 Winter	100	+10%	30/15 Summer				77.788
7.005	S 7.5	15 Winter	100	+10%	30/15 Winter				77.545
7.006	S 7.6	15 Winter	100	+10%	30/15 Summer				77.453
7.007	S 7.7	15 Winter	100	+10%	100/15 Winter				77.392
9.000	S 9.0	15 Winter	100	+10%	30/15 Summer				78.720
9.001	S 9.1	15 Winter	100	+10%	30/15 Summer				78.570
9.002	S 9.2	15 Winter	100	+10%	30/15 Summer				78.026
9.003	S 9.3	15 Winter	100	+10%	30/15 Summer				77.776
9.004	S 9.4	15 Winter	100	+10%	30/15 Summer				77.511
9.005	S 9.5	1440 Winter	100	+10%	30/15 Winter				77.396
9.006	S 9.6	1440 Winter	100	+10%	30/15 Winter				77.395
9.007	S 9.7	1440 Winter	100	+10%	30/15 Summer				77.394
9.008	S 9.8	1440 Winter	100	+10%	30/15 Summer				77.392

Clifton Scannell Emerson Associates		Page 28
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Huntstown data centre facility	
Date 06/05/2021 File DUB040 SW Network-2.mdx	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2


PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
7.000	S 7.0	0.612	0.000	0.59		35.0	SURCHARGED	
7.001	S 7.1	0.703	0.000	1.38		82.4	SURCHARGED	
7.002	S 7.2	0.569	0.000	1.24		121.7	SURCHARGED	
7.003	S 7.3	0.503	0.000	1.54		145.2	SURCHARGED	
7.004	S 7.4	0.382	0.000	1.51		152.0	SURCHARGED	
8.000	S 8.0	0.477	0.000	0.65		38.4	SURCHARGED	
8.001	S 8.1	0.559	0.000	1.53		91.5	SURCHARGED	
8.002	S 8.2	0.349	0.000	1.36		133.1	SURCHARGED	
8.003	S 8.3	0.220	0.000	1.66		157.2	SURCHARGED	
7.005	S 7.5	0.069	0.000	1.25		309.1	SURCHARGED	
7.006	S 7.6	0.035	0.000	1.91		310.1	SURCHARGED	
7.007	S 7.7	0.002	0.000	1.85		310.0	SURCHARGED	
9.000	S 9.0	1.386	0.000	1.12		65.9	SURCHARGED	
9.001	S 9.1	1.356	0.000	2.14		126.0	SURCHARGED	
9.002	S 9.2	0.932	0.000	1.92		178.0	SURCHARGED	
9.003	S 9.3	0.758	0.000	1.63		236.3	SURCHARGED	
9.004	S 9.4	0.607	0.000	2.13		295.5	SURCHARGED	
9.005	S 9.5	0.570	0.000	0.12		24.2	SURCHARGED	
9.006	S 9.6	0.607	0.000	0.09		24.8	SURCHARGED	
9.007	S 9.7	0.697	0.000	0.10		26.3	SURCHARGED	
9.008	S 9.8	0.827	0.000	0.13		27.9	SURCHARGED	

Clifton Scannell Emerson Associates		Page 29
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Huntstown data centre facility	
Date 06/05/2021 File DUB040 SW Network-2.mdx	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.000	S 10.0	15 Winter	100	+10%				
10.001	S 10.1	15 Winter	100	+10%				
10.002	S 10.2	15 Winter	100	+10%	100/15 Winter			
10.003	S 10.3	15 Winter	100	+10%	100/15 Summer			
10.004	S 10.4	15 Winter	100	+10%	100/15 Summer			
10.005	S 10.5	1440 Winter	100	+10%	30/15 Winter			
10.006	S 10.6	1440 Winter	100	+10%	30/15 Winter			
11.000	S 11.0	1440 Winter	100	+10%				
12.000	S 12.0	15 Winter	100	+10%				
11.001	S 11.1	1440 Winter	100	+10%				
11.002	S 11.2	1440 Winter	100	+10%	100/30 Winter			
11.003	S 11.3	1440 Winter	100	+10%	100/15 Winter			
10.007	S 10.7	1440 Winter	100	+10%	30/15 Winter			
10.008	S 10.8	1440 Winter	100	+10%	30/15 Winter			
10.009	S 10.9	1440 Winter	100	+10%	30/15 Winter			
10.010	S 10.10	1440 Winter	100	+10%	30/15 Summer			
9.009	S 9.9	1440 Winter	100	+10%	30/15 Summer			
13.000	S 13.0	1440 Winter	100	+10%	30/15 Summer			
7.008	S 7.8	1440 Winter	100	+10%	1/60 Summer			

PN	US/MH Name	Water			Surcharged		Flooded		Half Drain		Pipe Flow (l/s)	Status
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)					
10.000	S 10.0	77.500	-0.091	0.000	0.21					12.2	OK	
10.001	S 10.1	77.491	-0.002	0.000	0.49					28.9	OK	
10.002	S 10.2	77.481	0.119	0.000	0.54					48.7	SURCHARGED	
10.003	S 10.3	77.461	0.198	0.000	0.83					77.1	SURCHARGED	
10.004	S 10.4	77.403	0.288	0.000	0.99					91.5	SURCHARGED	
10.005	S 10.5	77.398	0.409	0.000	0.12					10.1	SURCHARGED	
10.006	S 10.6	77.397	0.484	0.000	0.10					11.3	SURCHARGED	
11.000	S 11.0	77.397	-0.106	0.000	0.00					0.3	OK	
12.000	S 12.0	77.411	-0.121	0.000	0.43					13.9	OK	
11.001	S 11.1	77.397	-0.050	0.000	0.03					2.0	OK	
11.002	S 11.2	77.397	0.178	0.000	0.05					2.8	SURCHARGED	
11.003	S 11.3	77.397	0.240	0.000	0.06					3.3	SURCHARGED	
10.007	S 10.7	77.396	0.525	0.000	0.11					16.2	SURCHARGED	
10.008	S 10.8	77.395	0.621	0.000	0.13					17.9	SURCHARGED	
10.009	S 10.9	77.393	0.714	0.000	0.08					20.5	SURCHARGED	
10.010	S 10.10	77.392	0.787	0.000	0.09					22.3	SURCHARGED	
9.009	S 9.9	77.392	0.867	0.000	0.33					52.6	SURCHARGED	
13.000	S 13.0	77.392	0.956	0.000	0.15					21.1	SURCHARGED	
7.008	S 7.8	77.390	1.290	0.000	0.26					16.4	FLOOD RISK	

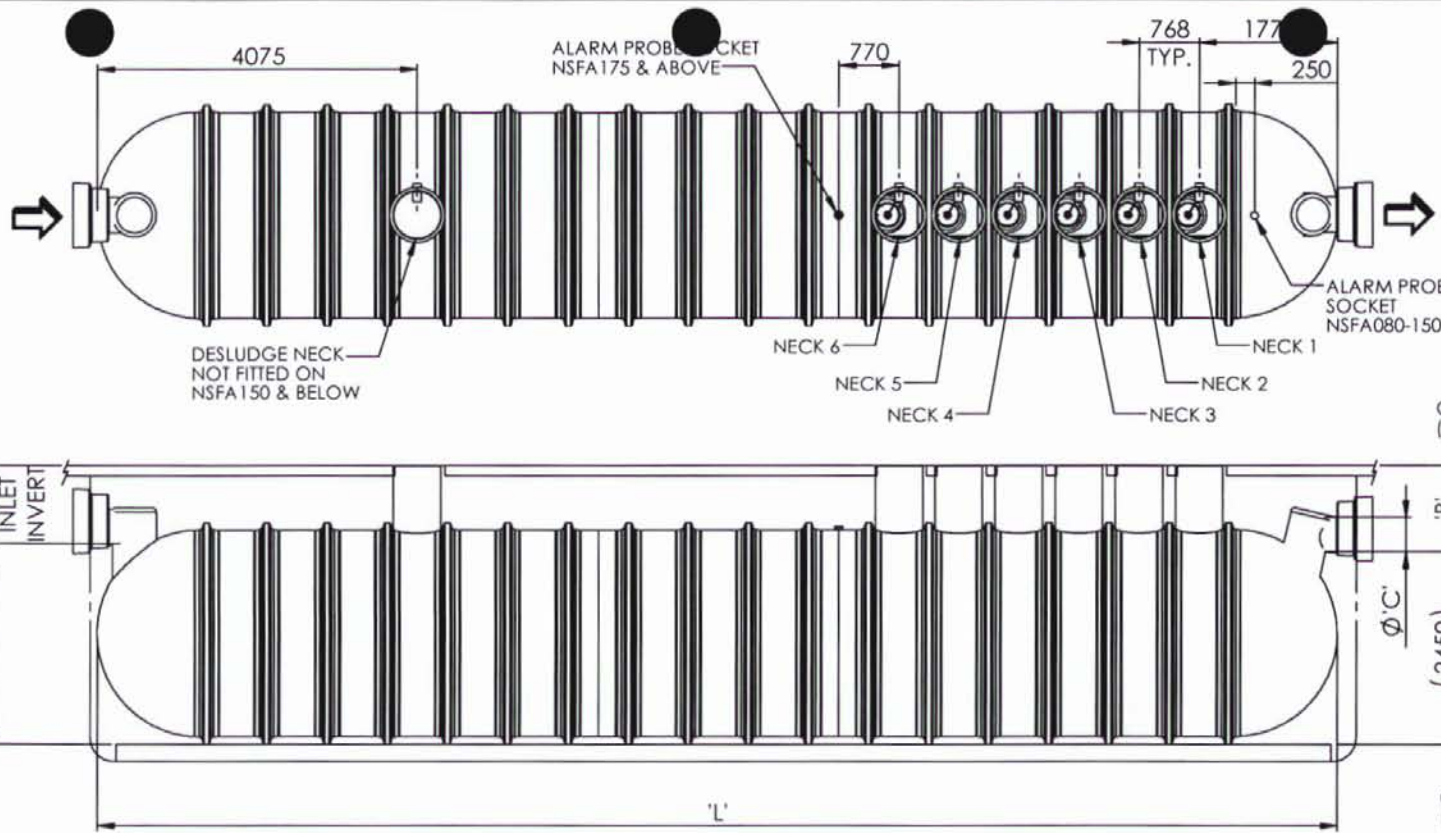
Clifton Scannell Emerson Associates		Page 30
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Huntstown data centre facility	
Date 06/05/2021 File DUB040 SW Network-2.mdx	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

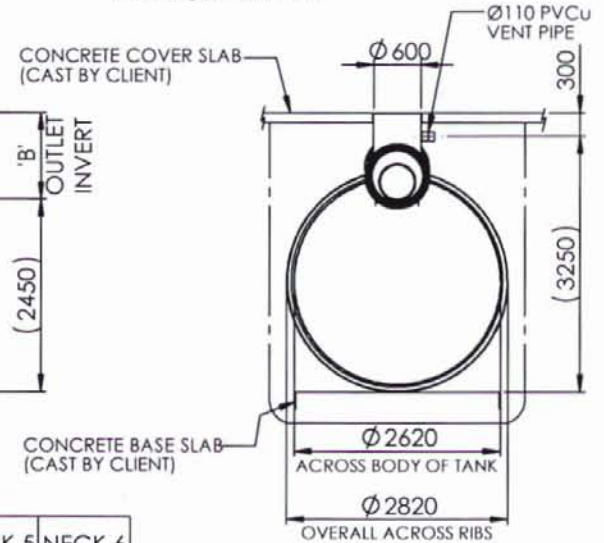
PN	US/MH Name	Level Exceeded
10.000	S	10.0
10.001	S	10.1
10.002	S	10.2
10.003	S	10.3
10.004	S	10.4
10.005	S	10.5
10.006	S	10.6
11.000	S	11.0
12.000	S	12.0
11.001	S	11.1
11.002	S	11.2
11.003	S	11.3
10.007	S	10.7
10.008	S	10.8
10.009	S	10.9
10.010	S	10.10
9.009	S	9.9
13.000	S	13.0
7.008	S	7.8

## Appendix B – Hydrocarbon Interceptor Details





- NOTES**
1. BS EN 858 STATES MINIMUM CONNECTION UNITS ORDERED WITH DIFFERENT SIZE CONNECTIONS ARE NOT FULLY COMPLIANT WITH THE STANDARD. ALTERNATIVE CONNECTORS MAY BE ORDERED.
  2. EXTENSION NECKS FOR DEEPER INVERTS CAN BE PROVIDED IN 0.5m INCREMENTS FOR ON SITE ASSEMBLY. MAX 2.0m INVERT RECOMMENDED.
  3. ALL UNITS REQUIRE APPROPRIATE COVER & FRAME TO SUIT APPLIED LOADINGS.
  4. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY. IT IS ESSENTIAL THAT THIS DRAWING IS READ IN CONJUNCTION WITH INSTALLATION GUIDELINES SUPPLIED WITH THE UNIT (COPIES ARE AVAILABLE FROM OUR SALES DEPT.).
  5. STANDARD PIPE ORIENTATION SHOWN. FOR OTHER AVAILABLE OPTIONS SEE IDS0033.
  6. THIS DRAWING IS ALSO AVAILABLE ON OUR WEBSITE [www.kingspanenv.com](http://www.kingspanenv.com)

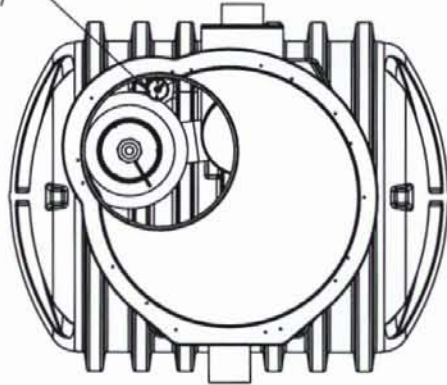


UNIT REF.	UNIT CLASS	NOMINAL FLOW RATE (L/s)	APPROX. EMPTY WEIGHT (kg)	'L' OVERALL LENGTH	'A' BASE TO INLET INVERT	'B' OUTLET INVERT	'C' STD. PIPE DIA. (GRP)	NECK 1 FITTED	NECK 2 FITTED	NECK 3 FITTED	NECK 4 FITTED	NECK 5 FITTED	NECK 6 FITTED
NSFA080	1	80	1250	5744	2500	1050	300	✓	✓				
NSFA100	1	100	1350	6200	2500	1050	375/400	✓	✓				
NSFA125	1	125	1700	7365	2500	1050	450	✓	✓	✓			
NSFA150	1	150	2000	8675	2550	1100	500/525	✓	✓	✓			
NSFA175	1	175	2400	9975	2550	1100	500/525	✓	✓	✓	✓		
NSFA200	1	200	2700	11280	2550	1100	600	✓	✓	✓	✓		
NSFA210	1	210	2900	11994	2550	1100	600	✓	✓	✓	✓	✓	
NSFA225	1	225	3100	12766	2550	1100	600	✓	✓	✓	✓	✓	✓
NSFA240	1	240	3300	13582	2550	1100	600	✓	✓	✓	✓	✓	✓
NSFA255	1	255	3450	14300	2550	1100	600	✓	✓	✓	✓	✓	✓
NSFA270	1	270	3600	15071	2550	1100	600	✓	✓	✓	✓	✓	✓
NSFA285	1	285	3800	15833	2550	1100	600	✓	✓	✓	✓	✓	✓

Please check with Kingspan Environmental For The Latest Issue Of This Drawing				Material : n/a	Tolerance : n/a	<b>Drawing : DS0896P</b>	Page 1 of 1
Issue	Date	Drawn by	Description	Finish : n/a	Thickness : n/a		
04	11.03.19	T.Kelly	CC1444 - Units now built to 1.0m Invert First Fix	Weight : n/a	Surface Area : n/a		
03	03.04.18	T.Kelly	CC1425 - Units 210 to 285 Added : Class 2 Reference Deleted			<b>NSFA080 - NSFA285 Full Retention Separators</b>	

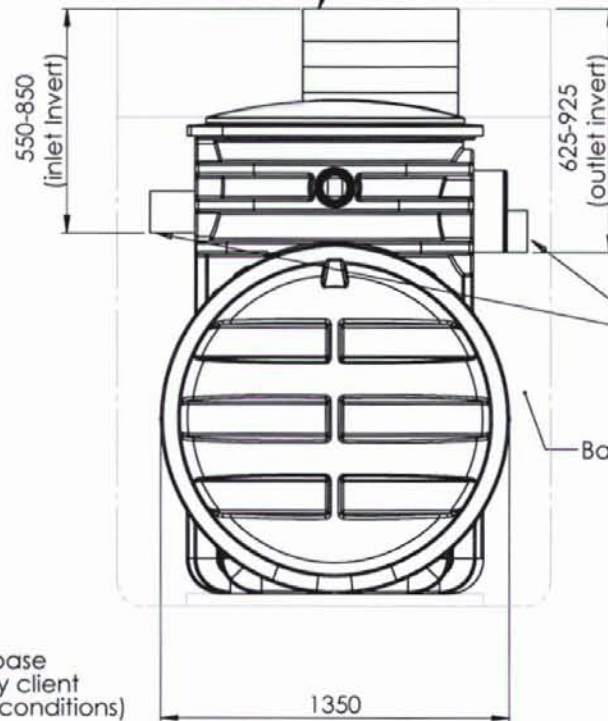
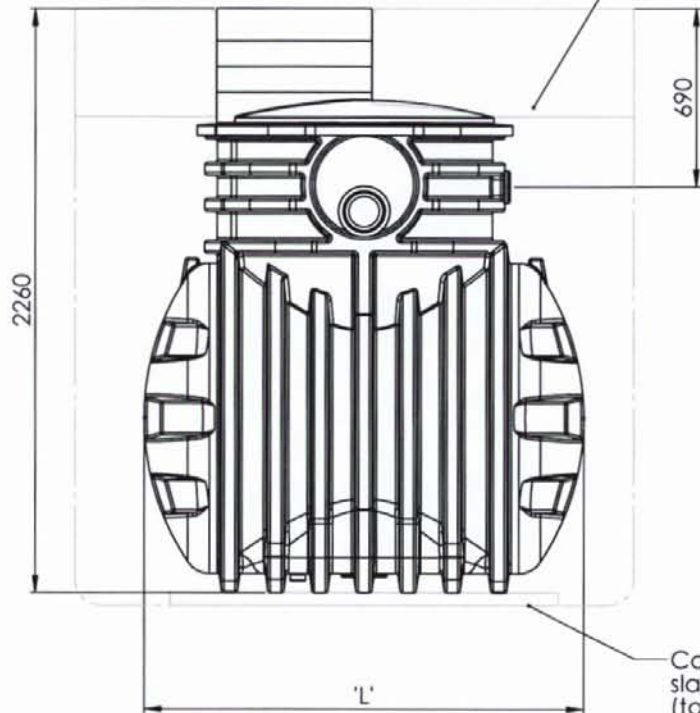
All dimensions in mm	Scale: Not to scale	Kingspan reserve the right to alter the details of this drawing without prior notice. This drawing is copyright and may not be reproduced or used without the written permission of Kingspan.	
<small>E:\Drawing Data\02 - Sales Drawings\DS\DS - 08\DS0896P NSFA080-285 Full Retention Separators</small>			

Alarm Probe Tube  
(see note 7)



Concrete cover slab cast by client  
(to suit wet site conditions)

Neck can be trimmed  
down to required invert



Ø160 mm inlet/outlet plain pipe

Backfill (see note 8)

Concrete base  
slab cast by client  
(to suit site conditions)

Unit Ref No	Nominal Flow	Dim L (mm)	Approx Empty Weight (kgs)	Fall across unit
NSFP003	3 L/s	1700	180	75
NSFP006	6 L/s	1700	180	75

Notes:-

1. Inlet/Outlet pipes are plain pipe Ø 160 mm PVCu. The standard EN 858 states minimum connection sizes, units ordered with different sized connections are not fully compliant with the standard.

2. Extension necks for deeper inverts can be provided. These can be cut in 200 mm sections. Max 2.0m invert recommended. Please ask our sales department for further details.

3. All units require appropriate cover and frame to suit applied loadings.

4. This drawing should be used for dimensional information only. It is essential that this drawing is read in conjunction with the installation guidelines supplied with the unit. (Copies are available from our sales dept.).

5. This drawing is also available on our website [www.kingspanenv.com](http://www.kingspanenv.com).

6. A Ø76 mm tube (internal) is supplied to house an oil alarm probe.

7. Wet site conditions - Concrete Backfill  
Dry site conditions - Pea Shingle Backfill

Please refer to installation manual for details of correct backfilling.

Please check with Kingspan Environmental that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description
04	15/12/10	S.Gill		CC934
03	24/02/10	S.Gill		CC794
02	23/09/09	S.Gill		Drawing Description Changed/Table Corrected
01	19/03/09	S.Gill		Initial Release

Material: n/a  
Finish: n/a  
Weight: Kgs n/a

Tolerance: n/a  
Thickness: n/a  
Surface Area: n/a

Drawing: NSFP 003-006 Sales Drawing

Page 1 of 1

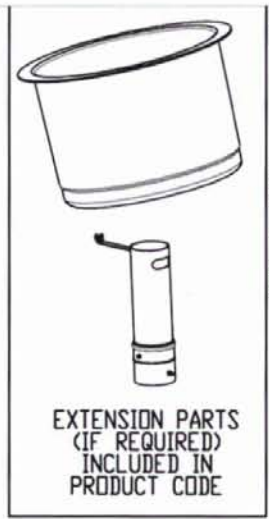
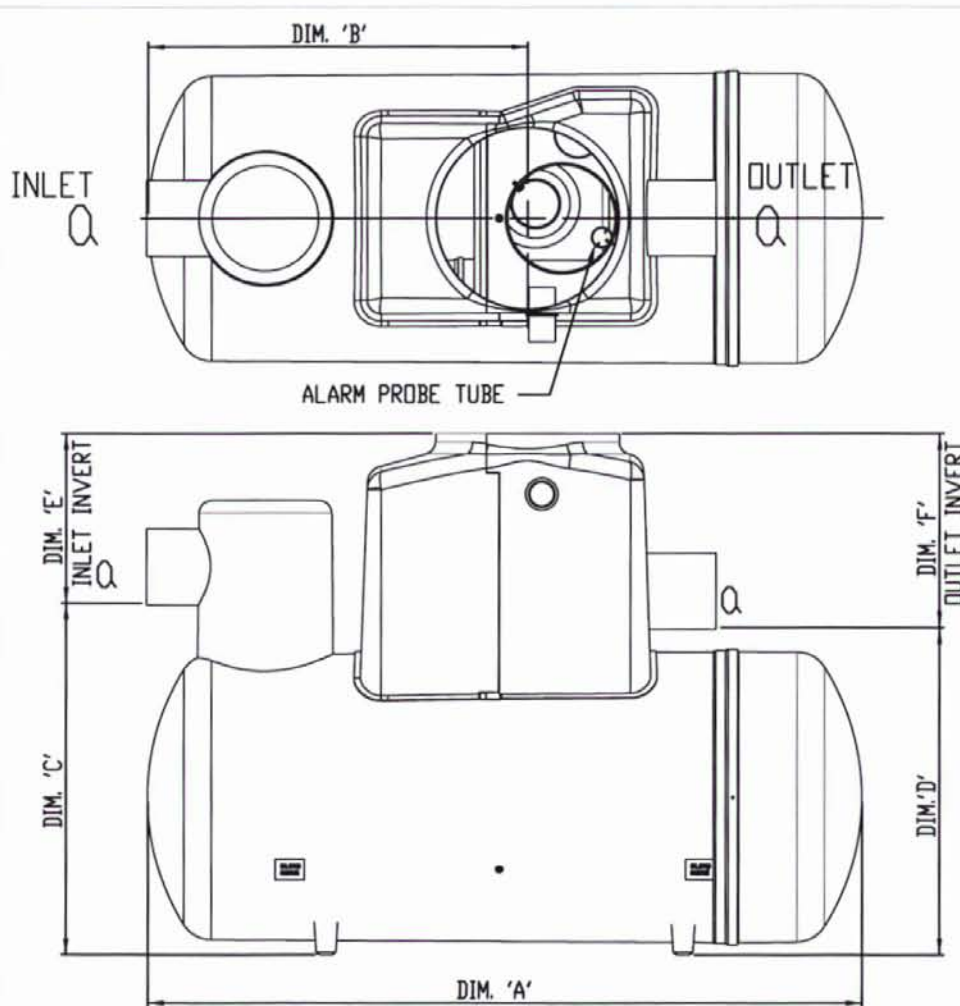
Drg No - DSO992

All dimensions in mm

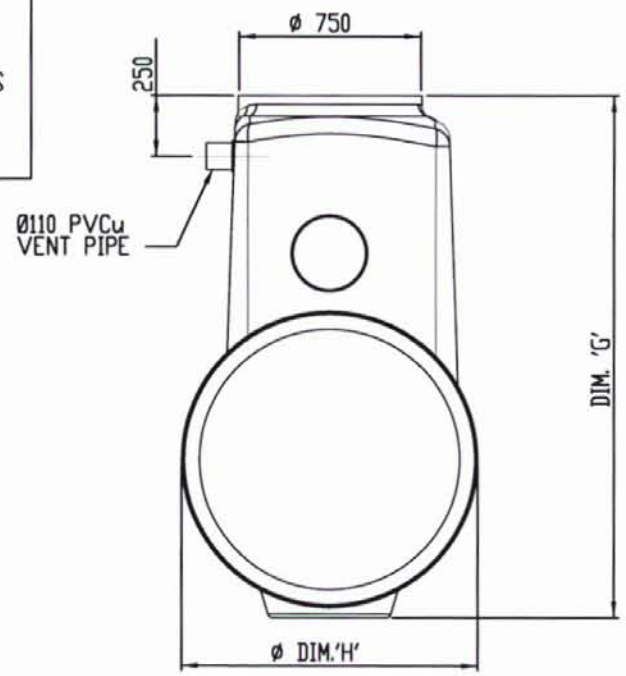
Scale: Not to scale

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- NOTES**
1. UNITS ARE SUPPLIED WITH THE STANDARD (MINIMUM) PIPEWORK SIZE, AND ORIENTATION SHOWN ON THE DRAWING. THE STANDARD EN858-1 STATES MINIMUM CONNECTION SIZES, UNITS ORDERED WITH DIFFERENT SIZE CONNECTIONS MAY NOT BE FULLY COMPLIANT WITH THE STANDARD. PLEASE CONSULT OUR SALES DEPARTMENT FOR DETAILS OF AVAILABLE OPTIONS, BUT PLEASE NOTE WE DO NOT ALTER INTERNAL PIPEWORK.
  2. ALL UNITS SUPPLIED ARE CLASS 1 AND INCLUDE A COALESCER.
  3. EXTENSION PARTS FOR DEEPER INVERTS CAN BE PROVIDED FOR ON SITE ASSEMBLY.
  4. ALL UNITS REQUIRE APPROPRIATE CONCRETE BASE, COVER AND FRAME TO SUIT APPLIED LOADINGS.
  5. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY.
  6. A Ø76mm TUBE IS SUPPLIED TO HOUSE AN OIL ALARM PROBE.



UNIT	NOMINAL FLOW (l/sec)	DIM.'A'	DIM.'B'	DIM.'C'	DIM.'D'	DIM.'E'	DIM.'F'	DIM.'G'	DIM.'H'	STD. PIPE Ø	APPROX. EMPTY WEIGHT (kg)	FALL ACROSS UNIT
NSBE010	10.0	2069	1096	1450	1350	700	800	2150	1220	315	160	100
NSBE015	15.0	2947	1560	1450	1350	700	800	2150	1220	315	200	100
NSBE020	20.0	3893	2016	1450	1350	700	800	2150	1220	375	220	100

Please check with Kingspan Environmental that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description	Material	Tolerance	Weight	Surface Area
03	14/09/12	T.Kelly		CC1081 - Inlet neck added & Std pipe for NSBE020 375 was 315	Various	n/a		
02	20/08/12	CS		CC981 - Pipe work up date from 160 & 200 to 315dia				
01	27/07/11	T.Kelly		CC981 - Initial Release				

Material: Various  
 Finish: n/a  
 Tolerance: n/a  
 Surface Area: n/a

Drawing: DS1155  
 NSBE010 - NSBE020 Bypass Separators

All dimensions in mm  
 Scale: Not to scale

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Page 1 of 2

K:\Engineering\Drawings\Basis\02 - Sales Drawings\DS1155 - DS1155 NSBE010-020 Bypass Separators

## Appendix C – Solid Separator Details

## S Dimensions (mm)

	CDS10404	CDS0604	CDS0606	CDS0804	CDS0806	CDS0808	CDS1010	CDS1012	CDS1015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

## Selection Table — CDS Polypropylene Manhole Units

Model Reference	Hydraulic Peak Flow Rate l/s	Treatment Flow Rate l/s	Drainage Area — Impermeable m <sup>2</sup>	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
CDS 0404	30	12.5	2,000	900	150/225
CDS 0604	70	23	5,000	1200	225
CDS 0606/01	140	38	10,000	1200	225-375
CDS 0606/02	200	38	15,000	1200	225-375
CDS 0806	350	49	25,000	1500	450
CDS 0808	400	72	30,000	1500	450
CDS 1010	480	116	35,000	2000	450
CDS 1012	550	152	40,000	2000	450/750
CDS 1015	700	211	50,000	2000	450/750
CDS 0804	275	31	20,000	1500	300

## In-Line CDS

For small catchment, these units are used within the drainage system in-line and are supplied as BBA Approved\* complete manhole polypropylene units from the selection table above.

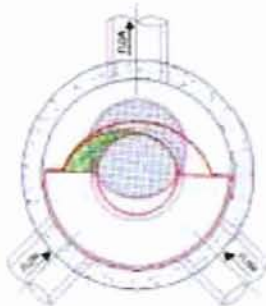
## Off-Line CDS

Larger catchment areas and retrofit projects designed with larger surface runoff conveyance capacity can receive treatment using a CDS unit placed adjacent to the storm pipeline. Water is channeled to these offline CDS configurations using a diversion structure. The diversion structure and

weir send the water quality flow to the offline CDS unit and also ensure larger flow events from less frequent storm events properly bypass the offline unit without cause flooding upstream of the unit.

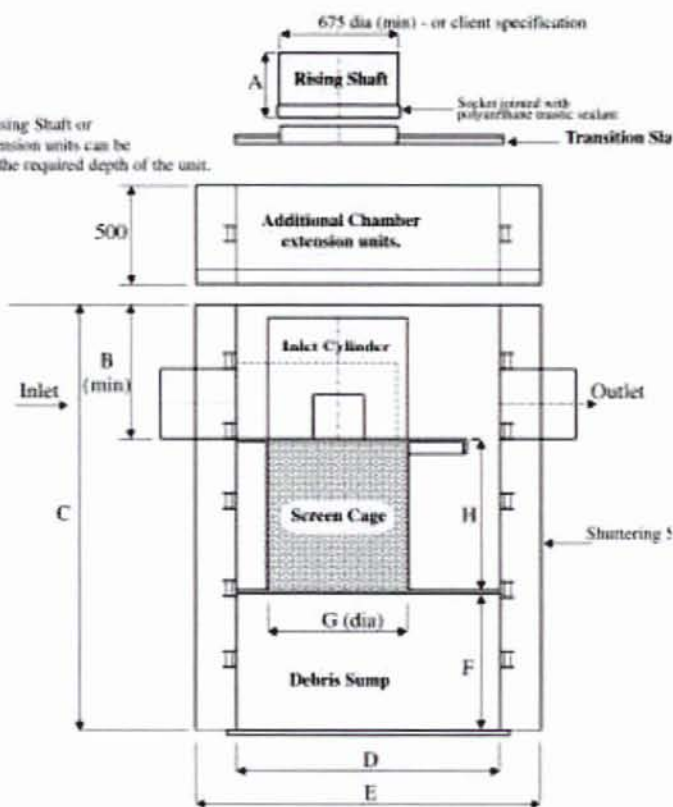
## Model Designation

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a CDS screen for installation into standard commercially available pre-fabricated manhole chambers. Example: CDS 0806 designates a separation screen dia. 0.8 m and screen height of 0.6m.



Proposed Peak Flow Rate for each model calculated using Rational Lloyd Davis with a rainfall intensity of 50mm/hr. For greater flows — special design/ construction required.

Note:  
Additional Rising Shaft or Chamber extension units can be added to suit the required depth of the unit.



## Support

- Drawings and specifications are available at [contechstormwater.com](http://contechstormwater.com).
- Site-specific design support is available from our engineers.

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Nothing in this catalog should be construed as an expressed warranty or an implied warranty of merchantability or fitness for any particular purpose. See the CONTECH standard quotation or acknowledgment for applicable warranties and other terms and conditions of sale.

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,535; 6,649,848; 6,991,114; 6,998,038; 7,186,858; 7,296,692; 7,297,266 related foreign patents or other patents pending.

CDS is a trademark of CONTECH Construction Products Inc.

800.338.1122

[contechstormwater.com](http://contechstormwater.com)

## Appendix D – QBAR Calculations

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

## Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Runoff estimation approach

## Site characteristics

Total site area (ha):

## Methodology

Q<sub>BAR</sub> estimation method:

SPR estimation method:

## Soil characteristics

SOIL type:

Default	Edited
2	2

HOST class:

N/A	N/A
-----	-----

SPR/SPRHOST:

0.3	0.3
-----	-----

## Hydrological characteristics

SAAR (mm):

Default	Edited
935	822

Hydrological region:

12	12
----	----

Growth curve factor 1 year:

0.85	0.85
------	------

Growth curve factor 30 years:

2.13	2.13
------	------

Growth curve factor 100 years:

2.61	2.61
------	------

Growth curve factor 200 years:

2.86	2.86
------	------

## Notes

### (1) Is Q<sub>BAR</sub> < 2.0 l/s/ha?

When Q<sub>BAR</sub> is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

### (2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

### (3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

## Greenfield runoff rates

	Default	Edited
Q <sub>BAR</sub> (l/s):	32.86	28.26
1 in 1 year (l/s):	27.93	24.02
1 in 30 years (l/s):	69.99	60.2
1 in 100 year (l/s):	85.76	73.76
1 in 200 years (l/s):	93.97	80.83

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

## Appendix E – Flow Control Device Details



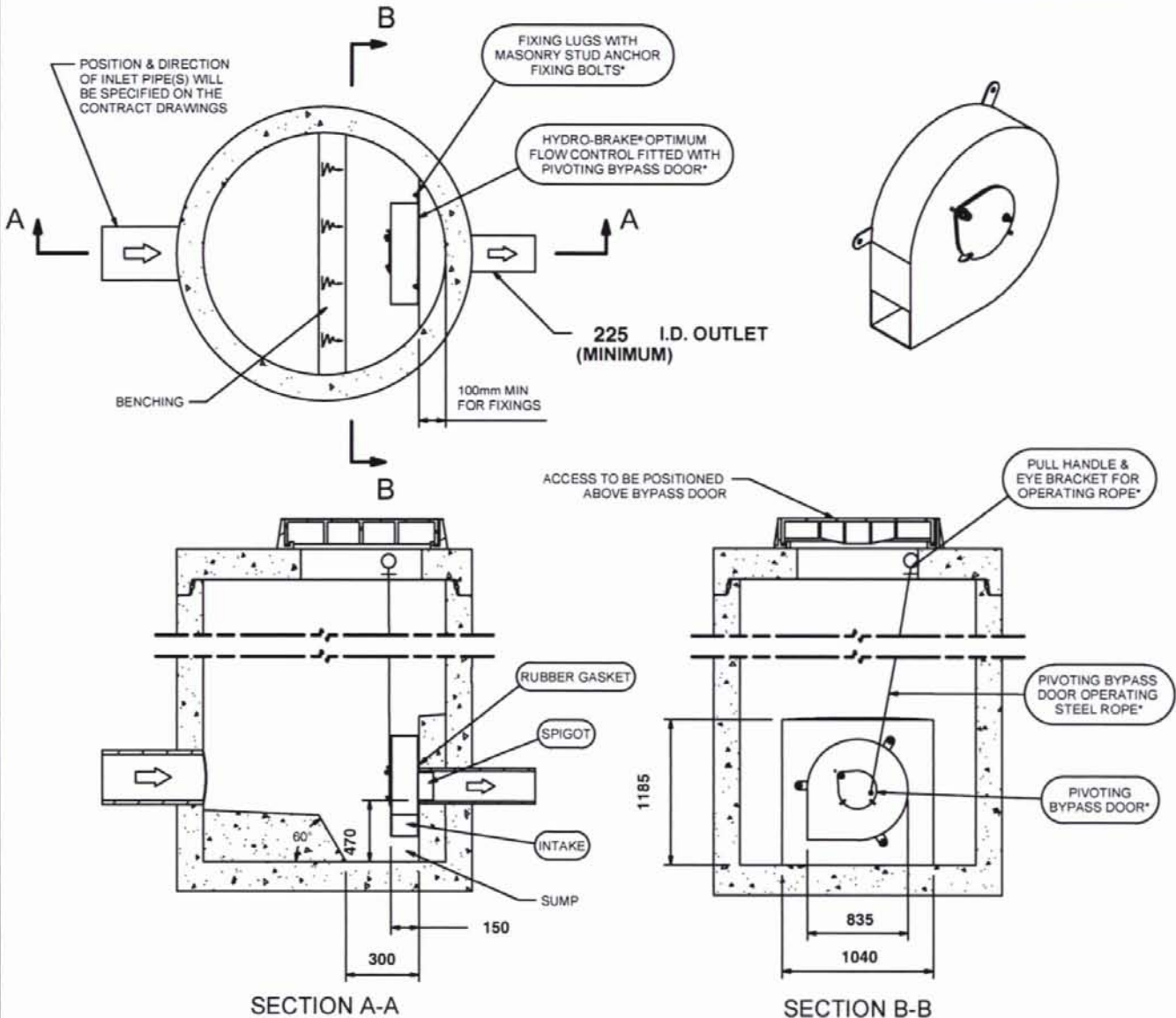


## Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	11.988
Flush-Flo™	0.583	11.986
Kick-Flo®	1.209	9.456
Mean Flow		10.499

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet



**IMPORTANT:** ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY  
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS  
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL  
 ALL CIVIL AND INSTALLATION WORK BY OTHERS  
 \* WHERE SUPPLIED  
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW  
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

**THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.**

### DESIGN ADVICE



The head/flow characteristics of this SHE-0143-1200-2000-1200 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.  
**The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

**Hydro  
International**

DATE 04/03/2021 09:26:45

SITE

DESIGNER Debbie Henry

REF Hydrobrake 1

SHE-0143-1200-2000-1200

Hydro-Brake® Optimum

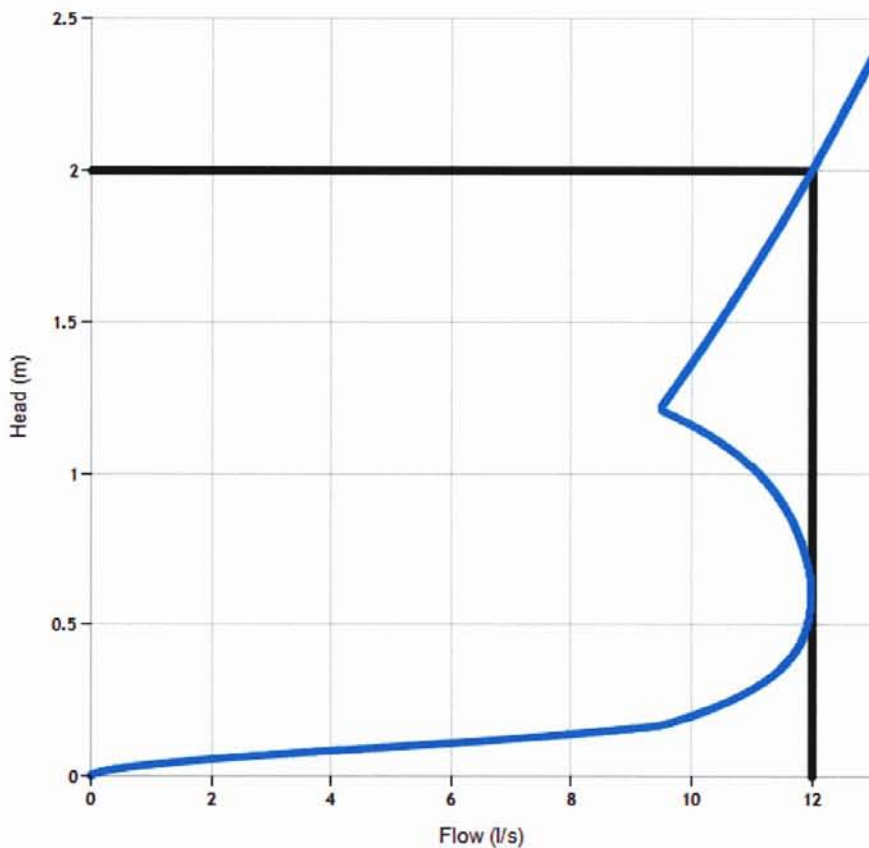
## Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	11.988
Flush-Flo™	0.583	11.986
Kick-Flo®	1.209	9.456
Mean Flow		10.499



PT/329/0412

Head (m)	Flow (l/s)
0.000	0.000
0.069	2.789
0.138	7.861
0.207	10.108
0.276	10.912
0.345	11.425
0.414	11.738
0.483	11.909
0.552	11.979
0.621	11.978
0.690	11.924
0.759	11.829
0.828	11.693
0.897	11.509
0.966	11.259
1.034	10.921
1.103	10.466
1.172	9.864
1.241	9.575
1.310	9.821
1.379	10.061
1.448	10.294
1.517	10.522
1.586	10.745
1.655	10.963
1.724	11.176
1.793	11.385
1.862	11.589
1.931	11.790
2.000	11.988



### DESIGN ADVICE



The head/flow characteristics of this SHE-0143-1200-2000-1200 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.  
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

**Hydro**  
International

DATE 04/03/2021 09:26:45

SITE

DESIGNER Debbie Henry

REF Hydrobrake 1

SHE-0143-1200-2000-1200

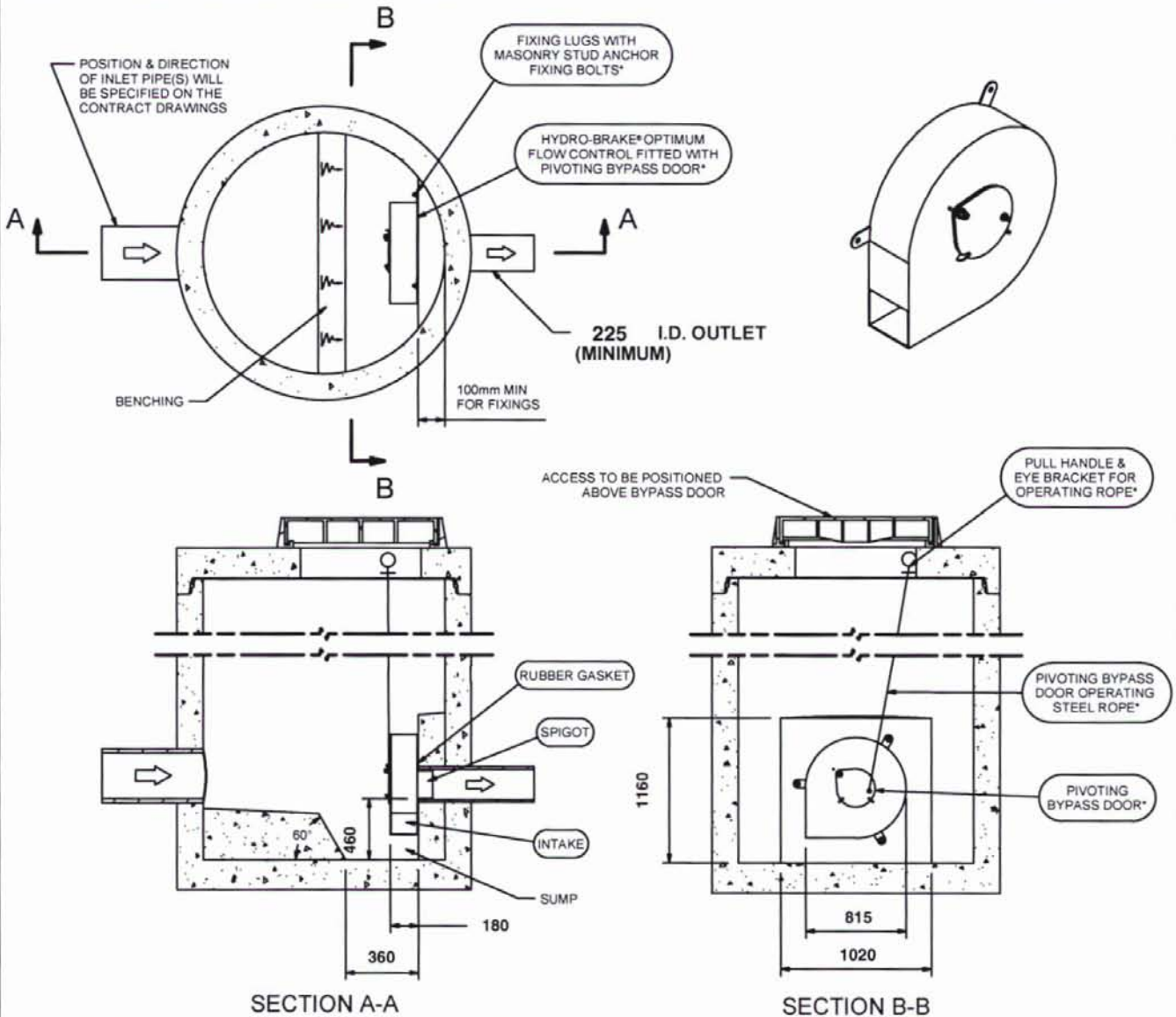
Hydro-Brake Optimum®

## Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.600	16.456
Flush-Flo™	0.474	16.466
Kick-Flo®	1.020	13.299
Mean Flow		14.303

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet



**IMPORTANT:** ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY  
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS  
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL  
 ALL CIVIL AND INSTALLATION WORK BY OTHERS  
 \* WHERE SUPPLIED  
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW  
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

**THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.**

### DESIGN ADVICE



The head/flow characteristics of this SHE-0174-1650-1600-1650 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.  
**The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

**Hydro**  
International

DATE 04/03/2021 09:28:21

SITE

DESIGNER Debbie Henry

REF Hydrobrake 2

SHE-0174-1650-1600-1650

Hydro-Brake® Optimum

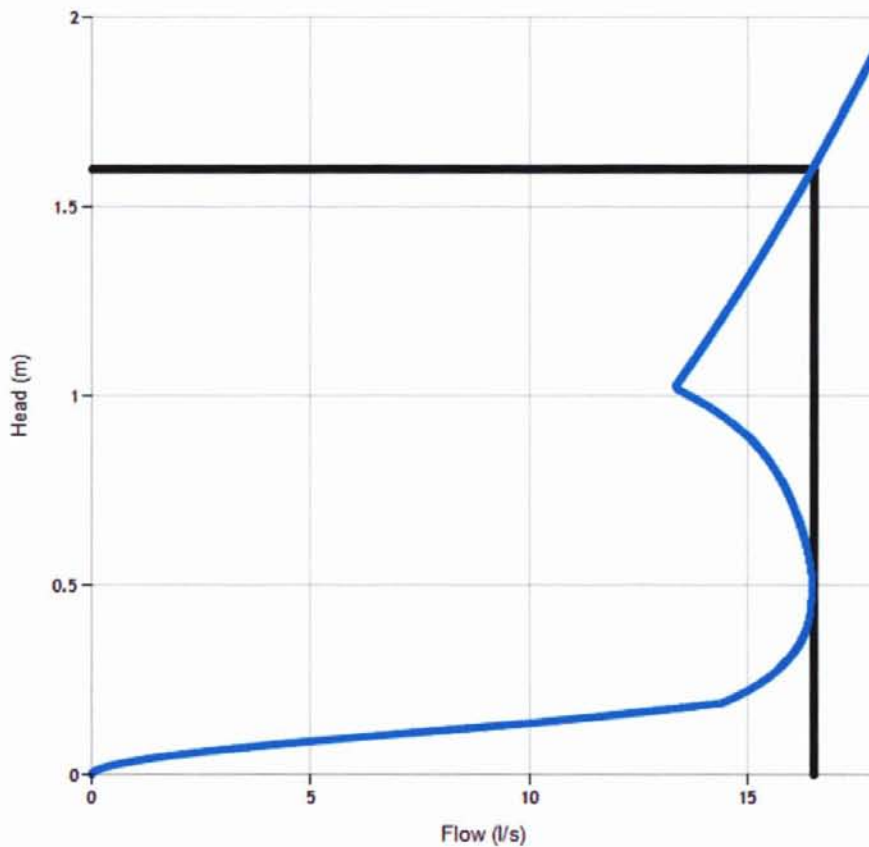
## Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.600	16.456
Flush-Flo™	0.474	16.466
Kick-Flo®	1.020	13.299
Mean Flow		14.303



PT/329/0412

Head (m)	Flow (l/s)
0.000	0.000
0.055	2.122
0.110	7.230
0.166	12.589
0.221	14.961
0.276	15.666
0.331	16.101
0.386	16.344
0.441	16.450
0.497	16.460
0.552	16.404
0.607	16.303
0.662	16.165
0.717	15.990
0.772	15.766
0.828	15.468
0.883	15.065
0.938	14.514
0.993	13.774
1.048	13.471
1.103	13.801
1.159	14.123
1.214	14.437
1.269	14.743
1.324	15.043
1.379	15.337
1.434	15.625
1.490	15.907
1.545	16.184
1.600	16.456



### DESIGN ADVICE



The head/flow characteristics of this SHE-0174-1650-1600-1650 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.  
**The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**



DATE 04/03/2021 09:28:21

SITE

DESIGNER Debbie Henry

REF Hydrobrake 2

SHE-0174-1650-1600-1650

Hydro-Brake Optimum®



## **Appendix F – Irish Water Confirmation of Feasibility**

Philip Corr  
Seafort Lodge  
Castledawson Avenue  
Blackrock  
Co. Dublin  
A94P768

31 March 2021

**Re: CDS20004468 pre-connection enquiry - Subject to contract Contract denied**  
**Connection for Business Connection of 3 units at Huntstown, Dublin, Co. Dublin**

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Huntstown, Dublin, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	<p style="text-align: center;"><b>OUTCOME OF PRE-CONNECTION ENQUIRY</b></p> <p style="text-align: center;"><b><u>THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.</u></b></p>
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
<b>SITE SPECIFIC COMMENTS</b>	
Water Connection	Approx. 1500m of new 450mm ID pipe main to replace the existing 6" uPVC main as shown below (red dashed line) will be required. This new 450mm will be connected to the existing 450mm DI main.



Upgrade of pumps at Balleycoolen Highlands Tower will be required.

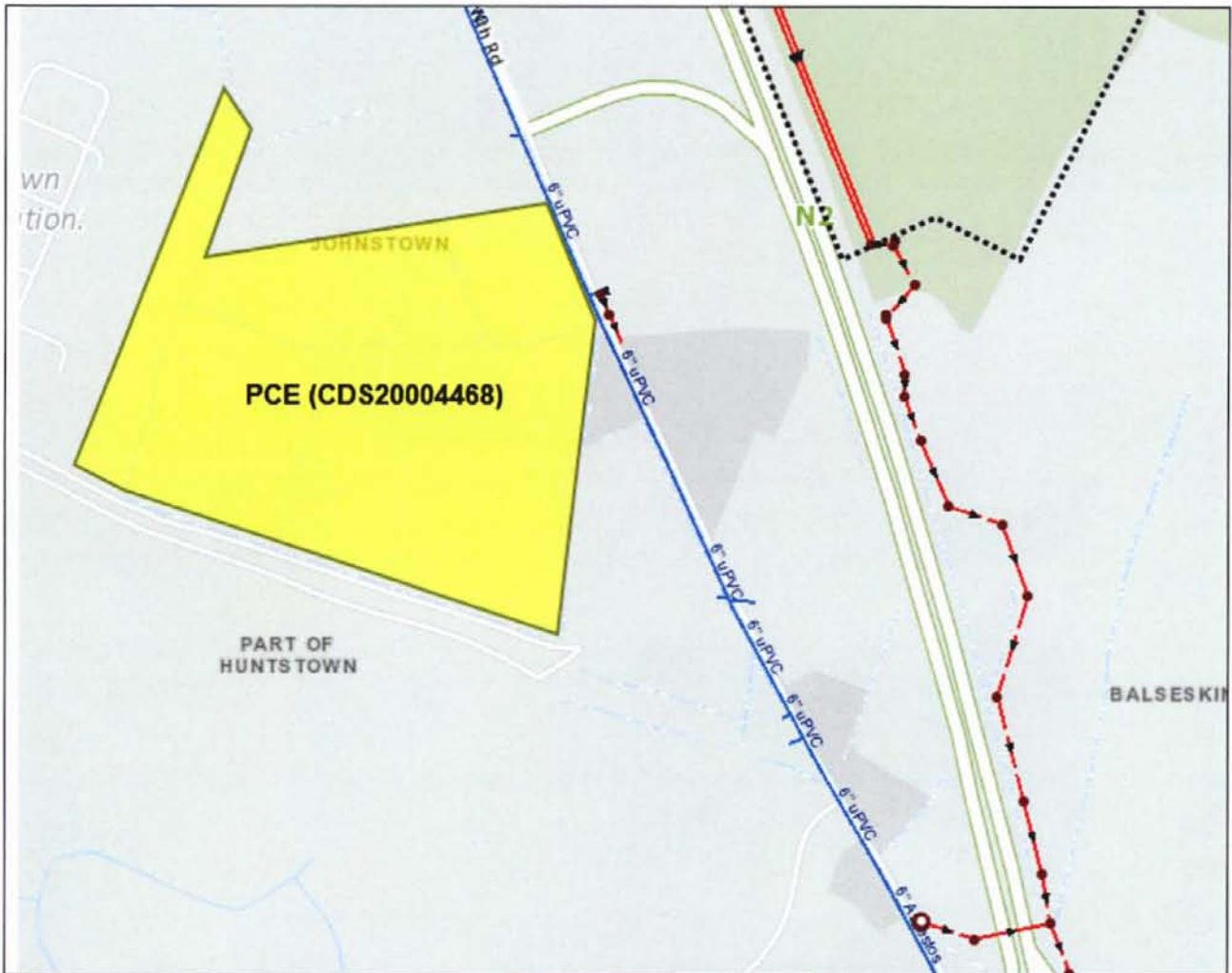
The Developer has to fund a portion of the upgrade works. That will be determined at a connection application stage, based on the peak flow and other connection applications in Hunstown SDZ at that time.

On-site water storage will be required for the average day peak week demand rate of the commercial section for 24-hour period with a re-fill time of 12 hours.

New bulk meter and associated telemetry system will be required to be installed along this connection main.

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

#### General Notes:

- 1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
- 2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.



- 3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
- 4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at <https://www.water.ie/connections/get-connected/>
- 5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
- 6) Irish Water Connection Policy/ Charges can be found at <https://www.water.ie/connections/information/connection-charges/>
- 7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
- 8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
- 9) To access Irish Water Maps email [datarequests@water.ie](mailto:datarequests@water.ie)
- 10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email [mzbyrne@water.ie](mailto:mzbyrne@water.ie) For further information, visit [www.water.ie/connections](http://www.water.ie/connections).


Yours sincerely,



**Yvonne Harris**

**Head of Customer Operations**

## Appendix G – Foul Drainage Calculations

TITLE										Project Number		Revision		Date
Project										20_099		Planning		07/05/2021
SUBJECT										 <b>CLIFTON SCANNELL EMERSON ASSOCIATES</b> Consulting Engineers E-mail: <a href="mailto:info@csea.ie">info@csea.ie</a> Web: <a href="http://www.csea.ie">www.csea.ie</a>				
Public Gravity Sewer Capacity Check Irish Water Code of Practice for Wastewater Infrastructure (IW_CDS-5030-03)														
Note:														
k <sub>s</sub> =	0.0015	m												
Pipe Section	Dist (m)	Slope (1/X)	Piezo Gradient	Pipe Dia (mm)	Pipe Dia (m)	Flow (l/s)	Full Cap (l/s)	Adequate Capacity?	Full Vel (m/s)	Prop Discharge <0.8	Prop Vel (m/s)	Actual Vel (m/s)	Self Cleansing >0.75m/s	Notes
<b>Domestic Foul</b>														
F1.1-F1.3	135.0	80.0	0.013	150.0	0.150	3.70	17.309	✓	0.98	0.21	0.77	0.76	✓	
F1.3-F1.4	76.0	100.0	0.010	150.0	0.150	5.32	15.470	✓	0.88	0.34	0.90	0.79	✓	
F2.0-F2.5	50.0	80.0	0.013	100.0	0.100	4.75	5.839	✓	0.74	0.81	1.10	0.82	✓	**
<b>CWD Drainage</b>														
CWD	76.0	200.0	0.005	225.0	0.225	19.00	32.193	✓	0.81	0.59	1.04	0.84	✓	
<b>Notes:</b>														
Proportional Discharge = Actual Discharge/Full Bore Discharge														
Proportional Velocity = Actual Velocity/Full Bore Velocity														
k <sub>s</sub> = Pipe Roughness Factor														
Design Flow based on Equation 2 of Sectio 2.2 of Appendix B to IW-CDS-5030-03														
** As per Section 3.6.6 of IW-CDS-5030-03)														

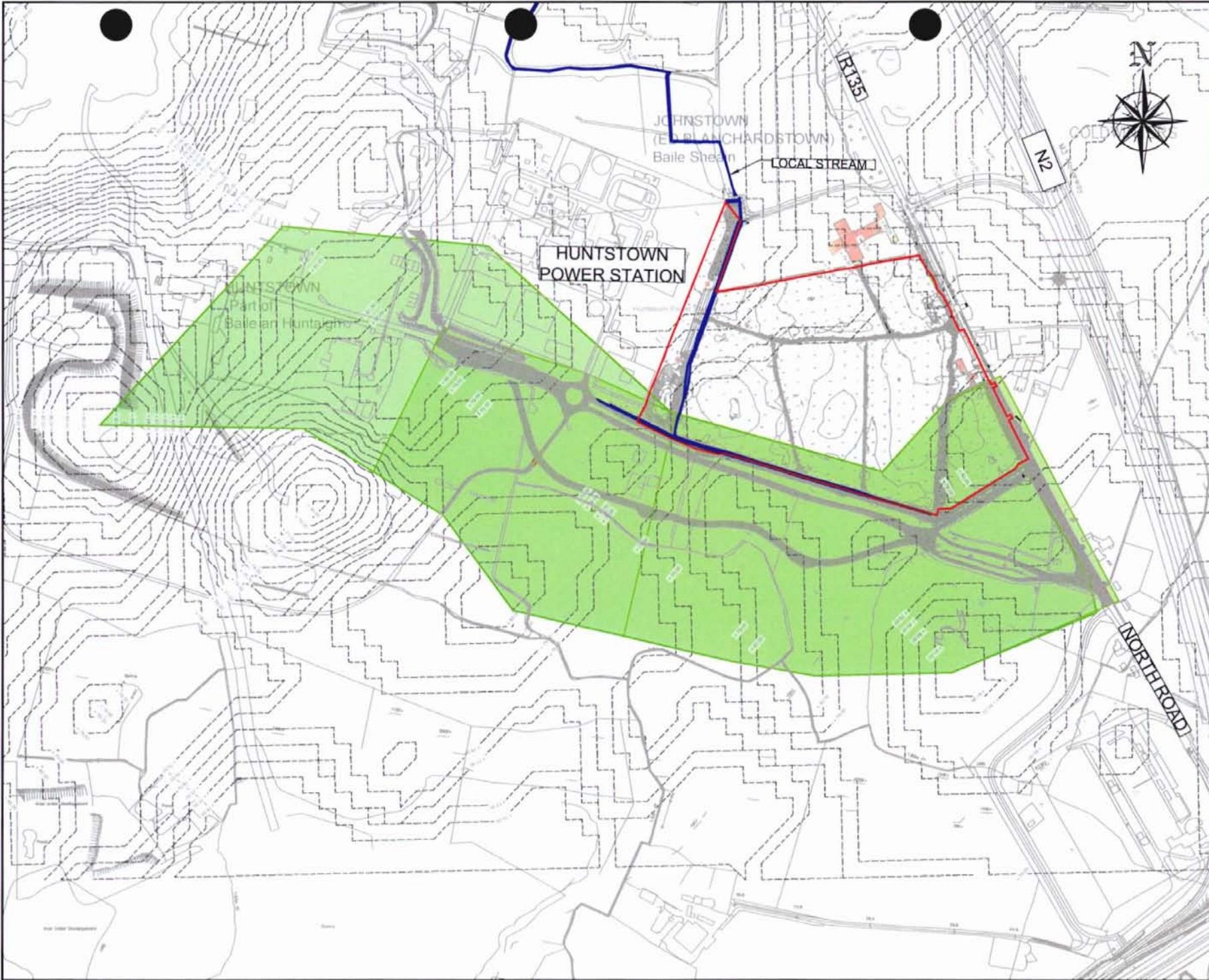
Project Number: 20\_099

Project: Huntstown Data Centre Facility

Title: Engineering Planning Report - Drainage and Water Services

---

## Appendix H – Ditch Diversion Catchment Map



**LEGEND:**

- OUTLINE OF SITE SUBJECT TO THIS APPLICATION
- EXISTING CONTOURS
- EXISTING LEVELS
- CATCHMENT AREA
- ROAD AREA
- EXISTING DRAINS

PH	ISSUED FOR PLANNING	DM	CD	04-08-2021
PH	FOR INFORMATION	PH	CD	08-04-2021
PH	FOR INFORMATION	PH	CD	08-04-2021

**Clifton Scannell Emerson Associates Ltd**  
 Consulting Engineers, Surveyors, Quantity Surveyors, Environmental Engineers, Planning Consultants, GIS Professionals, JIB PPS  
 1-904-736-0399  
 1-904-732-9977  
 clifton@cses.ie  
 www.cses.ie

Client: HUNSTOWN POWER COMPANY LTD  
 Project: HUNSTOWN DATA CENTRE FACILITY

Design Title: PROPOSED DITCH DIVERSION CATCHMENT AREA


Drawn By:	PH	Date:	08-04-2021	Scale:	1:500 @ A3	CDSEA Job No.:	20_099
Checked By:	CD	Scale:	1:500 @ A3	CDSEA Job No.:			

20\_099 - CSE - 00 - XX - DR - C - 1011

S2	FOR INFORMATION
PH	PLANNING

## Appendix I – Ditch Diversion Calculations



Clifton Scannell Emerson Associates		Page 1
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Project: Huntstown data centre facility	
Date 06/05/2021 File Existing watercourse.MDX	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	PIMP (%)	10
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.175
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.480	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits





Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.653	8-12	2.042	16-20	5.595	24-28	3.921	32-36	1.984
4-8	2.042	12-16	5.387	20-24	5.595	28-32	3.553		

Total Area Contributing (ha) = 30.770


Total Pipe Volume (m<sup>3</sup>) = 3252.257

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	233.000	0.110	2118.2	1.954	22.00	0.0	0.030	\	-1	Pipe/Conduit	
1.001	136.000	0.059	2305.1	0.000	0.00	0.0	0.030	\	-1	Pipe/Conduit	
2.000	99.000	0.560	176.8	1.123	22.00	0.0	0.030	\	-3	Pipe/Conduit	
1.002	224.000	0.910	246.2	0.000	0.00	0.0	0.030	\	-2	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	17.99	28.48	77.110	1.954	0.0	0.0	0.0	0.60	2367.2	60.9
1.001	17.44	30.00	77.000	1.954	0.0	0.0	0.0	0.57	2269.2	60.9
2.000	20.40	22.91	77.120	1.123	0.0	0.0	0.0	1.81	4855.2	39.7
1.002	17.44	30.00	76.560	3.077	0.0	0.0	0.0	2.06	14083.3	93.0

Clifton Scannell Emerson Associates		Page 2
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Project: Huntstown data centre facility	
Date 06/05/2021 File Existing watercourse.MDX	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	


Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m <sup>2</sup> )
-1	\/	3368	1626			3.012	3.949
-2	\/	3800	2572			3.825	6.829
-3	\/	2681	1456			2.457	2.680




Clifton Scannell Emerson Associates		Page 3
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland		
Date 06/05/2021 File Existing watercourse.MDX		
Project: Huntstown data centre facility		
Designed by ZS Checked by CD		
Innovyze		Network 2020.1.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out			Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	
1	78.950	1.840	Junction		1.000	77.110	-1				
ST2	78.575	1.575	Junction		1.001	77.000	-1	1.000	77.000	-1	
2	78.650	1.530	Junction		2.000	77.120	-3				
ST1	78.200	1.640	Junction		1.002	76.560	-2	1.001	76.941	-1	1907
	77.300	1.650	Open Manhole	0		OUTFALL		2.000	76.560	-3	
								1.002	75.650	-2	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	-363.296	185.463			No Entry	
ST2	-586.420	118.347			No Entry	
2	-814.011	60.037			No Entry	
ST1	-717.705	82.977			No Entry	
	-778.113	298.678			No Entry	

Clifton Scannell Emerson Associates		Page 4
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Project: Huntstown data centre facility	
Date 06/05/2021 File Existing watercourse.MDX	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	


PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	\/	-1	1	78.950	77.110	1.740	Junction	
1.001	\/	-1	ST2	78.575	77.000	-0.051	Junction	
2.000	\/	-3	2	78.650	77.120	1.430	Junction	
1.002	\/	-2	ST1	78.200	76.560	1.540	Junction	


Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	233.000	2118.2	ST2	78.575	77.000	1.475	Junction	
1.001	136.000	2305.1	ST1	78.200	76.941	-0.367	Junction	
2.000	99.000	176.8	ST1	78.200	76.560	1.540	Junction	
1.002	224.000	246.2		77.300	75.650	1.550	Open Manhole	0

Clifton Scannell Emerson Associates		Page 5
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Project: Huntstown data centre facility	
Date 06/05/2021 File Existing watercourse.MDX	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	10	19.540	1.954	1.954
1.001	-	-	10	0.000	0.000	0.000
2.000	-	-	10	11.230	1.123	1.123
1.002	-	-	10	0.000	0.000	0.000
				Total	Total	Total
				30.770	3.077	3.077

Clifton Scannell Emerson Associates		Page 6
Seefort Lodge Castledawson Avenue, Blackrock Dublin, Ireland	Project: Huntstown data centre facility	
Date 06/05/2021 File Existing watercourse.MDX	Designed by ZS Checked by CD	
Innovyze	Network 2020.1.3	

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Depth (m)	Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	1	-1	1.475	1.740	Unclassified					Junction
1.001	ST2	-1	-0.051	-0.051	Unclassified					Junction
2.000	2	-3	1.430	1.540	Unclassified					Junction
1.002	ST1	-2	1.540	1.550	Unclassified					Junction

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		77.300	75.650	75.650	0	0

Simulation Criteria for Storm


Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	1	0.000
1.001	ST2	0.000
2.000	2	0.000
1.002	ST1	0.000

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.480
M5-60 (mm)		Cv (Winter)	0.480
Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep		Fine Inertia Status	OFF
DTS Status			ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	1	+10%					77.289
1.001	ST2	60 Summer	1	+10%					77.148
2.000	2	60 Summer	1	+10%					77.182
1.002	ST1	60 Summer	1	+10%					76.644

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Pipe Flow (l/s)	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Time (mins)	Status		
1.000	1	-1.447	0.000	0.02		70.0	OK	
1.001	ST2	-1.478	0.000	0.02		65.8	OK	
2.000	2	-1.394	0.000	0.01		40.5	OK	
1.002	ST1	-2.488	0.000	0.01		98.7	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 0  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.480  
M5-60 (mm)    16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level Act. (m)
1.000	1	60 Summer	30	+10%				77.388
1.001	ST2	60 Summer	30	+10%				77.238
2.000	2	60 Summer	30	+10%				77.255
1.002	ST1	60 Summer	30	+10%				76.742

PN	US/MH Name	Depth (m)	Surcharged Volume (m <sup>3</sup> )	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Level Exceeded Status
1.000	1	-1.348	0.000	0.04		148.4	OK
1.001	ST2	-1.388	0.000	0.04		140.8	OK
2.000	2	-1.321	0.000	0.02		88.4	OK
1.002	ST1	-2.390	0.000	0.02		215.0	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.480
M5-60 (mm)		Cv (Winter)	0.480
Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep		Fine Inertia Status	OFF
DTS Status			ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level Act.	Water Level (m)
1.000	1	60 Summer	100	+10%					77.433
1.001	ST2	60 Summer	100	+10%					77.277
2.000	2	60 Summer	100	+10%					77.281
1.002	ST1	60 Summer	100	+10%					76.794

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Time (mins)	Pipe Flow (l/s)	
1.000	1	-1.303	0.000	0.06		191.7	OK
1.001	ST2	-1.349	0.000	0.05		182.1	OK
2.000	2	-1.295	0.000	0.02		114.8	OK
1.002	ST1	-2.338	0.000	0.02		275.7	OK

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	PIMP (%)	10
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.175
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.480	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	8-12	4.246	16-20	4.358	24-28	4.358	32-36	0.915
4-8	4.561	12-16	4.358	20-24	4.358	28-32	3.615		

Total Area Contributing (ha) = 30.770

Total Pipe Volume (m³) = 1768.069


Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	233.000	0.110	2118.2	1.954	22.00	0.0		0.030	\	-1	Pipe/Conduit	5
1.001	65.000	0.540	120.4	0.000	0.00	0.0		0.030	\	-1	Pipe/Conduit	5
2.000	67.000	0.339	197.6	0.443	22.00	0.0		0.030	\	-3	Pipe/Conduit	5
2.001	25.000	0.126	198.4	0.165	0.00	0.0	0.600		o	-4	Pipe/Conduit	5
2.002	7.000	0.095	73.7	0.515	0.00	0.0		0.030	\	-3	Pipe/Conduit	5







Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	17.99	28.48	77.110	1.954	0.0	0.0	0.0	0.60	2367.2	60.9
1.001	17.83	28.91	77.000	1.954	0.0	0.0	0.0	2.51	9930.3	60.9
2.000	20.53	22.65	77.120	0.443	0.0	0.0	0.0	1.71	4591.9	15.8
2.001	20.43	22.84	76.781	0.608	0.0	0.0	0.0	2.22	1412.9	21.5
2.002	20.41	22.88	76.655	1.123	0.0	0.0	0.0	2.81	7520.5	39.7



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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.003	71.000	0.100	710.0	0.000	0.00	0.0		0.030	\/	-3	Pipe/Conduit	
1.002	6.000	0.010	600.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.003	155.200	0.324	479.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.004	60.300	0.126	479.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.005	34.000	0.071	479.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.006	38.000	0.079	479.0	0.000	0.00	0.0		0.030	o	-4	Pipe/Conduit	

Network Results Table


PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.003	19.77	24.19	76.560	1.123	0.0	0.0	0.0	0.90	2422.7	39.7
1.002	17.80	28.99	76.460	3.077	0.0	0.0	0.0	1.27	809.1	94.9
1.003	17.44	30.00	76.250	3.077	0.0	0.0	0.0	1.42	906.5	94.9
1.004	17.44	30.00	75.926	3.077	0.0	0.0	0.0	1.42	906.5	94.9
1.005	17.44	30.00	75.800	3.077	0.0	0.0	0.0	1.42	906.5	94.9
1.006	17.44	30.00	75.729	3.077	0.0	0.0	0.0	0.56	358.4	94.9

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.









Section numbers < 0 are taken from user conduit table


Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m <sup>2</sup> )
-1	\/	3368	1626			3.012	3.949
-3	\/	2681	1456			2.457	2.680
-4	o	900	900			0.900	0.636

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Manhole Schedules for Storm


MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)	
1	78.950	1.840	Junction		1.000	77.110	-1					
ST2	78.725	1.725	Junction		1.001	77.000	-1	1.000	77.000		-1	
2	78.650	1.530	Junction		2.000	77.120	-3					
HW-10	78.610	1.829	Junction		2.001	76.781	-4	2.000	76.781		-3	
HW-11	78.520	1.865	Junction		2.002	76.655	-3	2.001	76.655		-4	
ST1	78.510	1.950	Junction		2.003	76.560	-3	2.002	76.560		-3	
HW-8	78.500	2.040	Junction		1.002	76.460	-4	1.001	76.460		-1	
								2.003	76.460		-3	
DIV-01	78.441	2.191	Open Manhole	3000	1.003	76.250	-4	1.002	76.450		-4	200
DIV-02	77.550	1.624	Open Manhole	3000	1.004	75.926	-4	1.003	75.926		-4	
DIV-03	77.702	1.902	Open Manhole	3000	1.005	75.800	-4	1.004	75.800		-4	
DIV-04	77.629	1.900	Open Manhole	3000	1.006	75.729	-4	1.005	75.729		-4	
	77.300	1.650	Open Manhole	0		OUTFALL		1.006	75.650		-4	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	-437.033	133.145			No Entry	
ST2	-669.625	146.923			No Entry	
2	-903.933	150.334			No Entry	
HW-10	-836.933	150.204			No Entry	
HW-11	-811.937	149.812			No Entry	
ST1	-804.937	149.846			No Entry	
HW-8	-734.123	154.987			No Entry	
DIV-01	-735.111	160.905	-735.111	160.905	Required	

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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
DIV-02	-758.780	314.290	-758.780	314.290	Required	
DIV-03	-806.723	350.863	-806.723	350.863	Required	
DIV-04	-791.871	381.447	-791.871	381.447	Required	
	-760.405	402.752			No Entry	

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	10	19.540	1.954	1.954
1.001	-	-	10	0.000	0.000	0.000
2.000	-	-	10	4.430	0.443	0.443
2.001	-	-	10	1.650	0.165	0.165
2.002	-	-	10	5.150	0.515	0.515
2.003	-	-	10	0.000	0.000	0.000
1.002	-	-	10	0.000	0.000	0.000
1.003	-	-	10	0.000	0.000	0.000
1.004	-	-	10	0.000	0.000	0.000
1.005	-	-	10	0.000	0.000	0.000
1.006	-	-	10	0.000	0.000	0.000
				Total	Total	Total
				30.770	3.077	3.077

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	1	-1	1.625	1.740	Unclassified				Junction
1.001	ST2	-1	1.625	1.940	Unclassified				Junction
2.000	2	-3	1.430	1.729	Unclassified				Junction
2.001	HW-10	-4	1.729	1.765	Unclassified				Junction
2.002	HW-11	-3	1.765	1.850	Unclassified				Junction
2.003	ST1	-3	1.850	1.940	Unclassified				Junction
1.002	HW-8	-4	1.891	1.940	Unclassified				Junction
1.003	DIV-01	-4	1.524	2.091	Unclassified	3000	0	2.091	Unclassified
1.004	DIV-02	-4	1.524	1.802	Unclassified	3000	0	1.524	Unclassified
1.005	DIV-03	-4	1.800	1.802	Unclassified	3000	0	1.802	Unclassified
1.006	DIV-04	-4	1.550	1.800	Unclassified	3000	0	1.800	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.006		77.300	75.650	75.650	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

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Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	1	0.000
1.001	ST2	0.000
2.000	2	0.000
2.001	HW-10	0.000
2.002	HW-11	0.000
2.003	ST1	0.000
1.002	HW-8	0.000
1.003	DIV-01	0.500
1.004	DIV-02	0.500
1.005	DIV-03	0.500
1.006	DIV-04	0.500

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 0  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.480  
M5-60 (mm)    16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	1	+10%					77.272
1.001	ST2	60 Summer	1	+10%					77.055
2.000	2	60 Summer	1	+10%					77.146
2.001	HW-10	30 Summer	1	+10%					76.851
2.002	HW-11	30 Summer	1	+10%					76.753
2.003	ST1	30 Summer	1	+10%					76.746
1.002	HW-8	60 Summer	1	+10%					76.662
1.003	DIV-01	60 Summer	1	+10%					76.444
1.004	DIV-02	60 Summer	1	+10%					76.176
1.005	DIV-03	60 Summer	1	+10%					76.088
1.006	DIV-04	60 Summer	1	+10%					76.051


PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Time (mins)	Pipe Flow (l/s)	
1.000	1	-1.464	0.000	0.02		70.2	OK
1.001	ST2	-1.571	0.000	0.01		70.1	OK
2.000	2	-1.430	0.000	0.00		16.0	OK
2.001	HW-10	-0.830	0.000	0.03		23.9	OK*

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Cap.	(l/s)	Time (mins)	Flow (l/s)		
2.002	HW-11	-1.358	0.000	0.01			56.8	OK	
2.003	ST1	-1.270	0.000	0.02			55.7	OK	
1.002	HW-8	-0.698	0.000	0.11			102.1	OK*	
1.003	DIV-01	-0.706	0.000	0.12			100.6	OK	
1.004	DIV-02	-0.650	0.000	0.13			97.1	OK	
1.005	DIV-03	-0.612	0.000	0.14			96.1	OK	
1.006	DIV-04	-0.578	0.000	0.28			95.9	OK	



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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 0  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.480  
M5-60 (mm)    16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	30	+10%					77.360
1.001	ST2	60 Summer	30	+10%					77.119
2.000	2	60 Summer	30	+10%					77.176
2.001	HW-10	30 Summer	30	+10%					76.904
2.002	HW-11	30 Summer	30	+10%					76.850
2.003	ST1	30 Summer	30	+10%					76.844
1.002	HW-8	60 Summer	30	+10%					76.747
1.003	DIV-01	60 Summer	30	+10%					76.556
1.004	DIV-02	60 Summer	30	+10%					76.339
1.005	DIV-03	60 Summer	30	+10%					76.266
1.006	DIV-04	60 Summer	30	+10%					76.231

PN	US/MH Name	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.376	0.000	0.04			153.8	OK	
1.001	ST2	-1.507	0.000	0.02			152.5	OK	
2.000	2	-1.400	0.000	0.01			34.9	OK	
2.001	HW-10	-0.777	0.000	0.06			54.2	OK*	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Cap.	(l/s)	Time (mins)	Flow (l/s)		
2.002	HW-11	-1.261	0.000	0.02			130.1	OK	
2.003	ST1	-1.172	0.000	0.05			124.5	OK	
1.002	HW-8	-0.613	0.000	0.23			217.8	OK*	
1.003	DIV-01	-0.594	0.000	0.26			214.7	OK	
1.004	DIV-02	-0.487	0.000	0.27			204.0	OK	
1.005	DIV-03	-0.434	0.000	0.29			202.5	OK	
1.006	DIV-04	-0.398	0.000	0.59			202.2	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 0  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model    FSR    Ratio R 0.300  
Region Scotland and Ireland Cv (Summer) 0.480  
M5-60 (mm)    16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status    ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years)    1, 30, 100  
Climate Change (%)    10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	100	+10%					77.404
1.001	ST2	60 Summer	100	+10%					77.154
2.000	2	60 Summer	100	+10%					77.193
2.001	HW-10	30 Summer	100	+10%					76.931
2.002	HW-11	30 Summer	100	+10%					76.893
2.003	ST1	30 Summer	100	+10%					76.888
1.002	HW-8	60 Summer	100	+10%					76.776
1.003	DIV-01	60 Summer	100	+10%					76.600
1.004	DIV-02	60 Summer	100	+10%					76.425
1.005	DIV-03	60 Summer	100	+10%					76.358
1.006	DIV-04	60 Summer	100	+10%					76.322

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Time (mins)	Flow (l/s)	
1.000	1	-1.332	0.000	0.06		199.9	OK
1.001	ST2	-1.472	0.000	0.02		197.6	OK
2.000	2	-1.383	0.000	0.01		45.3	OK
2.001	HW-10	-0.750	0.000	0.07		70.1	OK*

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )			Time (mins)	Flow (l/s)		
2.002	HW-11	-1.218	0.000	0.03			168.1	OK	
2.003	ST1	-1.128	0.000	0.07			160.5	OK	
1.002	HW-8	-0.584	0.000	0.29			275.5	OK*	
1.003	DIV-01	-0.550	0.000	0.33			273.4	OK	
1.004	DIV-02	-0.401	0.000	0.34			261.3	OK	
1.005	DIV-03	-0.343	0.000	0.38			259.3	OK	
1.006	DIV-04	-0.307	0.000	0.76			259.0	OK	

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**APPENDIX 15.1**

**CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN**

Prepared by

AWN Consulting

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# APPENDIX 15.1 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN

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Technical Report Prepared For  
**Huntstown Power Company Ltd**

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Report Prepared By  
**Jonathan Gauntlett, Environmental  
Consultant**

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Our Reference  
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## 1.0 INTRODUCTION

AWN Consulting Ltd (AWN) has prepared this Construction and Demolition (C&D) Waste Management Plan (WMP) for the proposed demolition of two residential properties fronting the R135 (North Road), and the development of two no. data facility buildings arranged over 3 storeys and associated structures and infrastructure.

This C&D WMP includes information on the legal and policy framework for C&D waste management in Ireland, estimates of the type and quantity of waste to be generated by the proposed development and makes recommendations for management of different waste streams.

The purpose of this report is to provide information necessary to ensure that the management of C&D waste at the site is undertaken in accordance with current legal and industry standards including the *Waste Management Acts 1996-2011* and associated Regulations<sup>1</sup>, *Protection of the Environment Act 2003* as amended<sup>2</sup>, *Litter Pollution Act 1997* as amended<sup>3</sup> and the *Eastern-Midlands Region Waste Management Plan 2015-2021*<sup>4</sup>. In particular, this report aims to ensure maximum recycling, re-use and recovery of waste with diversion from landfill, where possible. It also seeks to provide guidance on the appropriate collection and transport of waste to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil or water resources).

In the preparation of this report consideration has been given to the requirements of National and Regional waste policy, legislation, and other guidelines (referred to in Section 2.0). However, in determining the structure and content of the document, the following two publications have been referenced in particular:

- Department of the Environment, Heritage and Local Government (DoEHLG), *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006)<sup>5</sup>.
- FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and Site Managers*, (2002)<sup>6</sup>.

The above 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.

## 2.0 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT IN IRELAND

### 2.1 NATIONAL LEVEL

The Irish Government issued a policy statement in September 1998 titled as '*Changing Our Ways*<sup>7</sup>' which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for C&D waste in this Strategy was to recycle at least 50% of C&D waste within a five-year period (by 2003), with a progressive increase to at least 85% over fifteen years (by 2013).

In response to the *Changing Our Ways* report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction

Industry, released a report titled *Recycling of Construction and Demolition Waste*<sup>8</sup> concerning the development and implementation of a voluntary construction industry programme to meet the governments objectives for the recovery of construction and demolition waste.

In September 2020 the government released a new policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan '*A Waste Action Plan for a Circular Economy*<sup>9</sup>' was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to a new economy, where climate and environmental challenges are turned into opportunities, replacing the previous national waste management plan "A Resource Opportunity (2012)".

It aims to fulfil the commitment in the Programme for Government to publish and start implementing a new National Waste Action Plan. It is intended that this new national waste policy will inform and give direction to waste planning and management in Ireland over the coming years. It will be followed later this year by an All of Government Circular Economy Strategy. The policy document shifts focus away from waste disposal and moves it back up the production chain. To support the policy, regulation is already being used (Circular Economy Legislative Package) or in the pipeline (Single Use Plastics Directive). The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection & Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

The National Construction and Demolition Waste Council (NCDWC) was launched in June 2002, as one of the recommendations of the Forum for the Construction Industry, in the Task Force B4 final report. The NCDWC subsequently produced *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* in July 2006 in conjunction with the Department of the Environment, Heritage and Local Government (DoEHLG).

The guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion. These guidelines have been followed in the preparation of this document and include the following elements:

- Predicted construction and demolition wastes;
- Procedures to prevent and minimise wastes;
- Options for reuse/recycling/recovery/disposal of construction and demolition wastes;
- Provision of training for Waste Manager and site crew;
- Details of proposed record keeping system;
- Details of waste audit procedures and plan; and
- Details of proposed consultation with relevant bodies i.e. waste recycling companies, Local Authority, etc.

Section 3 of the Guidelines identifies thresholds above which there is a requirement for the preparation of a C&D Waste Management Plan for developments. This development requires a C&D WMP under the following criterion:

- New developments other than (1) above, including institutional, educational, health and other public facilities, with an aggregate floor area in excess of 1,250 m<sup>2</sup>; and
- Demolition/renovation/refurbishment projects generating in excess of 100m<sup>3</sup> in volume, of C&D waste

Other guidelines followed 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 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 LEVEL

The proposed development is located in the Local Authority area of Fingal County Council (FCC).

The *EMR Waste Management Plan 2015 – 2021* is the regional waste management plan for the SDCC area published in May 2015. The regional plan sets out the following strategic targets for waste management in the region:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

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 specified in the *Waste Management (Landfill Levy) Regulations 2015*.

The *Fingal County Council Development Plan 2017 – 2023<sup>10</sup>* sets out a number of objectives and actions for the South Dublin area in line with the objectives of the waste management plan.

Waste objectives and actions with a particular relevance to the proposed development are as follows:

### Objectives:

- **Objective WM03** Implement the provisions of the Eastern Midlands Region Waste Management Plan 2015 -2021 or any subsequent Waste Management Plan applicable within the lifetime of the Development Plan. All prospective developments in the County will be expected to take account of the provisions of the Regional Waste Management Plan and adhere to the requirements of that Plan.
- **Objective WM05** Prevent and minimise the generation of waste in accordance with the Eastern Midlands Region Waste Management Plan 2015 -2021 (or any subsequent plans).
- **Objective WM09** Promote increased recycling of waste in accordance with the Eastern Midlands Region Waste Management Plan 2015 -2021 (or any subsequent plan).
- With regard to C&D waste specifically the Development Plan requires that the 'Construction and Demolition Waste Management Plan, as a minimum, should include provision for the management of all construction and

demolition waste arising on site, and make provision for the reuse of said material and / or the recovery or disposal of this waste to authorised facilities by authorised collectors.<sup>1</sup> It also requires that where appropriate, excavated material from development sites should be reused on the subject site.

In terms of physical waste infrastructure, three municipal solid waste landfills remain operational in the Eastern Midlands Region (EMR) and are all operated by the private sector. There are a number of other licensed and permitted facilities in operation in the EMR including waste transfer stations, hazardous waste facilities and integrated waste management facilities. There are two existing thermal treatment facilities, one in Duleek, Co. Meath and a second facility in Poolbeg in Dublin.

## 2.3 LEGISLATIVE REQUIREMENTS

The primary legislative instruments that govern waste management in Ireland and applicable to the project are:

- Waste Management Act 1996 (No. 10 of 1996) as amended, as well as subordinate legislation<sup>1</sup>.
- Environmental Protection Act 1992 (No. 7 of 1992) as amended<sup>2</sup>.
- Litter Pollution Act 1997 (No. 12 of 1997) as amended<sup>3</sup>.
- Planning and Development Act 2000 (No. 30 of 2000) as amended.

These Acts and subordinate Regulations enable the transposition of relevant European Union Policy and Directives into Irish law.

One of the guiding principles of European waste legislation, which has in turn been incorporated into the Waste Management Acts 1996 – 2011 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 through until its legal reuse, recycling, recovery and/or disposal (including its method of reuse, recycling, recovery and/or 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 destination, waste contractors will be employed to physically transport waste to the final waste reuse, recycling, recovery and/or disposal site. Following on from this is the concept of “*Polluter Pays*” whereby the waste producer is liable to be prosecuted for pollution incidents, which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the appointed construction contractor(s) are legally compliant with respect to waste transportation, reuse, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and reuse/recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended, or a waste or Industrial Emissions (IE) licence granted by the EPA. The

COR/permit/licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

### **3.0 DESCRIPTION OF THE PROJECT**

#### **3.1 LOCATION, SIZE AND SCALE OF THE DEVELOPMENT**

A detailed description of the development is provided in Chapter 2 (Characteristics of the Proposed Development) of the EIA Report. The Proposed Development comprises the demolition of two residential properties fronting the R135 (North Road), and the development of two no. data facility buildings arranged over 3 storeys and associated structures and infrastructure including water treatment facility, sprinkler tanks, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works. The total gross floor area of the data halls and ancillary structures is 75,775 sqm.

The development works include the demolition of the two existing single residential properties fronting the R135 (North Road). The total gross floor area of demolition is c. 344sqm.

#### **3.2 OVERVIEW OF THE NON-HAZARDOUS WASTES TO BE PRODUCED**

There will be waste materials generated from the demolition of some of the existing buildings, hardstanding areas on site, as well as from the excavation of the building foundations. The volume of waste generated from demolition will be more difficult to segregate than waste generated from the construction phase, as many of the building materials will be bonded together or integrated i.e. plasterboard on timber ceiling joists, steel embedded in concrete etc.

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services will generate c. 35,614 m<sup>3</sup> of excavated topsoil, subsoil and stones, with an additional c. 12,045 m<sup>3</sup> associated with the future substation development located within the site boundary. These estimates will be refined prior to commencement of construction. It is envisaged that the majority of this material will be reused on site as back fill and in landscaping berms.

The main buildings at the site will be constructed from structural steel. It is expected that throughout the construction phase, waste will be produced from surplus steel and other metal materials and broken/off-cuts of timber, plasterboard, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials are also likely to be generated. The contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

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 Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided onsite 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.



### **3.3 POTENTIAL HAZARDOUS WASTES ARISING**

#### **3.3.1 Contaminated Soil**

Geotechnical and environmental site investigations (SI) were carried out by IGSL and AWN Consulting in May and June 2020. The SI works included ten (10) no. trial pits were excavated using a 15-ton tracked excavator. The five (5) boreholes drilled using a rotaryrig to a depth between 20.0 mbgl and 21.7 mbgl. Environmental analysis was carried out on ten (10) soil samples and all were below the inert threshold concentration for waste as per Waste Acceptance Criteria (WAC) specified in the *European Communities (EC) Council Decision 2003/33/EC*<sup>11</sup> which establishes the criteria for the acceptance of waste at landfills. The ground investigation report shows there was no evidence of subsurface contamination encountered during the site investigation works. Further details on the soil quality at the site is provided in Chapter 6 (Land, Soils, Geology and Hydrogeology) of the EIAR.

No asbestos was identified in the soil samples collected. If, however asbestos or asbestos containing material (ACMs) are identified in any further soil samples or during excavation, the removal will only be carried out by a suitably permitted waste contractor, in accordance with *S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010*. All asbestos will be taken to a suitably licensed or permitted facility.

All excavations should still be carefully monitored by a suitably qualified person to ensure that, if encountered, potentially contaminated soil is identified and segregated from clean/inert material. In the event that any potentially contaminated material is encountered, it will need to be tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous*<sup>12</sup> using the *HazWasteOnline* application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *Decision 2003/33/EC*.

Excavation works will be carefully monitored by a suitably qualified person to ensure any potentially contaminated soil is identified and segregated in accordance with the above procedure.

#### **3.3.2 Fuel/Oils**

As fuels and oils are classed as hazardous materials, any on-site storage of fuel/oil, all storage tanks and all draw-off points will be bunded and located in a dedicated, secure area of the site. Provided that these requirements are adhered to and the site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel/oil waste generated at the site.

#### **3.3.3 Invasive Species**

Ecological habitat site surveys have been undertaken by Moore Group at this site and in the surrounding area as part of the site ecological assessment. This included walkover surveys of the entire site and the perimeter of the site. There were no Schedule 3 non-native invasive species were recorded during baseline surveys.

### 3.3.4 Other Known Hazardous Substances

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas. They will generally be present in small volumes only and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor.

In addition, waste electrical and electronic equipment (WEEE) containing hazardous components, printer/toner cartridges and batteries (Lead, Ni-Cd or Mercury) may be generated from the temporary site offices during construction works. These wastes will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor.

## 3.4 MAIN CONSTRUCTION AND DEMOLITION WASTE CATEGORIES

The main non-hazardous and hazardous waste streams that may typically be generated by the construction activities at the proposed site are presented in Table 1. The List of Waste code (also referred to as the European Waste code or EWC) for each waste stream is also shown.

**Table 3.1** Typical waste types generated and LoW codes

Waste Material	List of Waste Code
Concrete, bricks, tiles, ceramics	17 01 01-03 & 07
Wood, glass and plastic	17 02 01-03
Treated wood, glass, plastic, containing hazardous substances	17-02-04*
Bituminous mixtures, coal tar and tarred products	17 03 01*, 02 & 03*
Metals (including their alloys) and cable	17 04 01-11
Soil and stones	17 05 03* & 04
Gypsum-based construction material	17 08 01* & 02
Paper and cardboard	20 01 01
Mixed C&D waste	17 09 04
Green waste	20 02 01
Electrical and electronic components	20 01 35 & 36
Batteries and accumulators	20 01 33 & 34
Liquid fuels	13 07 01-10
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13, 19, 27-30
Insulation materials	17 06 04
Organic (food) waste	20 01 08
Mixed Municipal Waste	20 03 01

\* individual waste type may contain hazardous substances

## 4.0 ESTIMATED WASTE ARISING

### 4.1 DEMOLITION WASTE GENERATION

Demolition works at the site will involve the demolition of existing structures on site. Demolition figures published by the EPA in the 'National Waste Reports'<sup>13</sup> and data from previous projects have been used to estimate the approximate break-down for

indicative reuse (offsite), recycling and disposal targets of demolition waste. This breakdown is shown in Table 4.1.

**Table 4.1** Estimated off-site reuse, recycle and disposal rates for demolition waste

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Glass	18.6	0	0.0	85	15.8	15	2.8
Concrete, Bricks, Tiles, Ceramics	105.3	30	31.6	65	68.4	5	5.3
Plasterboard	8.3	30	2.5	60	5.0	10	0.8
Asphalts	2.1	0	0.0	25	0.5	75	1.5
Metals	31.0	5	1.5	80	24.8	15	4.6
Slate	16.5	0	0.0	85	14.0	15	2.5
Timber	24.8	10	2.5	60	14.9	30	7.4
<b>Total</b>	<b>206.4</b>		<b>38.1</b>		<b>143.3</b>		<b>25.0</b>

The appointed demolition contractor will be required to prepare a detailed demolition management plan prior to work commencing which should refine the above estimated waste figures.

## 4.2 CONSTRUCTION WASTE GENERATION

The below Table 4.2 shows the breakdown of C&D waste types produced on a typical site based on data from the EPA *National Waste Reports*, the *GMIT*<sup>14</sup> and other research reports.

**Table 4.2** Waste materials generated on a typical Irish construction site

Waste Types	%
Mixed C&D	33
Timber	28
Plasterboard	10
Metals	8
Concrete	6
Other	15
<b>Total</b>	<b>100</b>

An assessment has been undertaken to estimate the quantity of construction waste likely to be generated from the proposed development.

Table 3 below shows the estimated construction waste generation for the development based on the gross floor area of construction and other information available to date, along with indicative targets for management of the waste streams. The estimated on and off-site reuse, recycle and disposal rates for the main waste types (with the exception of soils and stones) are based on an average large-scale development waste generation rate per m<sup>2</sup>, using the waste breakdown rates shown in Table 4.2.

**Table 4.3** Predicted reuse, recycle and disposal rates for construction waste

Waste Type	Tonnes	Reuse/Recovery	Recycle	Disposal
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		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D Waste	1488	10	149	80	1190	10	149
Timber	1262	40	505	55	694	5	63
Plasterboard	451	30	135	60	271	10	45
Metals	361	5	18	90	325	5	18
Concrete	271	30	81	65	176	5	14
Other (includes cabling, ducting, conduits, packaging and plastics)	676	20	135	60	406	20	135
<b>Total</b>	<b>4509</b>		<b>1023</b>		<b>3061</b>		<b>424</b>

In addition, as noted in Section 3.2, the quantity of excavated material that will be generated has been estimated to be c. 37,981 m<sup>3</sup> of topsoil, subsoil and stones. It is currently proposed that all the excavated material will be reused on site.

It should be noted that until final materials and detailed construction methodologies have been confirmed, it is difficult to predict 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.

All waste arising during the construction phase will be transported off-site by an approved waste contractor holding a current waste collection permit. All waste arising requiring reuse, recycling, recovery or disposal off-site will be brought to facilities holding the appropriate COR, licence or permit, as required.

### 4.3 PROPOSED WASTE MANAGEMENT OPTIONS

#### 4.3.1 Waste Management Options for Excavated Materials

The Waste Management Hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. Any excavations carried out will be required to facilitate construction works. However, it is currently proposed that all the excavated material will be reused on site and therefore will not require removal from site and therefore the preferred option of waste prevention is proposed for the excavated material.

In the event that any excavated material is removed off-site for reuse as a by-product (and not as a waste), it will be done in accordance with Article 27 of the *European Communities (Waste Directive) Regulations 2011*. Article 27 requires that certain conditions are met and that by-product decisions are made to the EPA via their online notification form. However, it is not currently anticipated that any excavated material will be removed offsite for reuse as a by-product. Similarly, if any soils/stones are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27.

If any excavated material requires removal from site and is deemed to be a waste, then removal and reuse/recycling/ recovery/disposal of the material will be carried out in accordance with the *Waste Management Acts 1996 – 2011* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended.

The volume of waste removed will dictate whether a COR, permit or licence is required by the receiving waste facility. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

In the unlikely event that contaminated material is encountered and subsequently classified as hazardous, this material will be stored separately to any non-hazardous material. It will require off-site treatment at a suitable facility or disposal abroad via Transfrontier Shipment of Wastes (TFS).

#### **4.3.2 Waste Management Options for other Construction Wastes**

Waste materials generated will be segregated on-site, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arisings requiring reuse, recycling, recovery or disposal off-site will be transferred to a facility holding the appropriate COR, permit or licence, as required.

Mixed C&D waste (classified under the List of Waste code 17 09 04) is permitted for acceptance at a number of waste facilities in the region including Integrated Material Solutions landfill in north Dublin and a number of waste transfer stations.

Written records will be maintained by the contractor detailing the waste arising throughout the construction phase, the classification of each waste type, the contact details and waste collection permit number of all waste contractors who collect waste from the site and the end destination details for all waste removed and disposed offsite.

Dedicated storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc., as required. The containers used for storing hazardous liquids will be appropriately banded or will be stored on suitably sized spill pallets.

It should be noted that until the main contractor is appointed, it is not possible to provide information on the specific destinations of each waste stream. Prior to commencement construction of the proposed development and removal of any waste off-site, details of the proposed destination of each waste stream will be provided to the local authority.

The management of the main construction waste streams are detailed as follows:

##### Concrete Blocks, Bricks, Tiles & Ceramics

The majority of concrete blocks, bricks, tiles and ceramics generated as part of the construction works are expected to be clean, inert material and should be recycled, where possible.

### Hard Plastic

As hard plastic is a highly recyclable material, much of the plastic generated will be primarily from material off-cuts. All recyclable plastic will be segregated and recycled, where possible.

### Timber

Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc., will be placed into a dedicated skip and recycled off-site. Clean timber is typically recycled as chipboard.

### Metal

Metals will be segregated and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

### Plasterboard

Plasterboard from the construction phase will be stored in a separate skip, pending collection for recycling. The site manager and project engineers will ensure that oversupply of new plasterboard is carefully monitored to minimise waste.

### Glass

Glass materials will be segregated for recycling, where possible.

### Waste Electrical and Electronic Equipment

Waste electrical and electronic equipment (WEEE) will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling off site.

### 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 offsite.

### Non-Recyclable Waste

Construction waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some 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 a member of the waste team (see Section 7.0) 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.

### Hazardous Wastes

On-site storage of any hazardous wastes produced (i.e. contaminated soil in the unlikely event that it is encountered and/or waste fuels) 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.

#### 4.4 TRACKING AND DOCUMENTATION PROCEDURES FOR OFF-SITE WASTE

All waste will be documented prior to leaving the site. Waste will be weighed by the waste contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the contractor.

All movement of waste and the use of waste contractors will be undertaken in accordance with the Waste Management Acts 1996 – 2011 as amended, Waste Management (Collection Permit) Regulations 2007 as amended and Waste Management (Facility Permit & Registration) Regulations 2007 as amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project Waste Manager will maintain a copy of all waste collection permits on-site.

If the waste is being transported to another site, a copy of the Local Authority COR, waste permit or EPA Waste/IE Licence for that site will be provided to the nominated project Waste Manager. If the waste is being shipped abroad, a copy of the TFS document will be obtained from Dublin City Council (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination (permits, licences etc.). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

If any surplus soil or stone is being removed from the site for reuse on another construction site as a by-product, this will need to be done in accordance with Article 27 of the *EC (Waste Directive) Regulations, 2011*. Similarly, if any soil or stone are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27. It is not currently envisaged the Article 27 will be used for this development.

All information will be entered in a waste management recording system to be maintained on site.

#### 5.0 ESTIMATED COST OF WASTE MANAGEMENT

An outline of the costs associated with different aspects of waste management is provided below. The total cost of construction waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

##### 5.1 REUSE

By reusing materials on site, there will be a reduction in the transport and offsite recycling/recovery/disposal costs associated with the requirement for a waste contractor to take the material away to landfill.

Clean and inert excavated material which cannot be reused on site may be used as capping material for landfill sites, or for the reinstatement of quarries, etc. as previously discussed. This material is often taken free of charge for such purposes, reducing final waste disposal costs. However, it is not currently anticipated that there will be surplus excavated material.

## 5.2 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 typically charge less to take segregated wastes, such as recyclable waste, from a site than mixed waste streams.

## 5.3 DISPOSAL

Landfill charges in the Eastern-Midlands region are currently at around €130-150 per tonne (which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*). In addition to disposal costs, waste contractors will also charge a fee for provision and collection of skips.

Collection of segregated construction waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a registered, permitted or licensed facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill.

## 6.0 DEMOLITION PROCEDURES

The demolition stage will involve the removal of the existing buildings and hard standing areas. A formal demolition plan including safety procedures will be prepared by the demolition contractor; however, in general, the following sequence of works should be followed during the demolition stage.

### Check for Hazards

Prior to commencing works, buildings and structures to be demolished will be checked for any likely hazards including asbestos, asbestos-containing Materials, electric power lines or cables, gas reticulation systems, telecommunications, unsafe structures and fire and explosion hazards, e.g. combustible dust, chemical hazards, oil, fuels and contamination.

### Removal of Components

All hazardous materials will be removed first. All components from within the buildings that can be salvaged will be removed next. This will primarily include metal however may also include timbers, doors, windows, wiring and metal ducting, etc.

### Removal of Roofing

Steel roof supports, beams etc. will be dismantled and taken away for recycling/salvage.

### Excavation of Services, Demolition of Walls and Concrete

Services will be removed from the ground and the breakdown of walls will be carried out once all salvageable or reusable materials have been taken from the buildings. Finally, any existing foundations and hard standing areas will be excavated.



## 7.0 TRAINING PROVISIONS

A member of the construction team will be appointed as the Waste Manager to ensure commitment, operational efficiency and accountability during the construction phase of the project.

### 7.1 WASTE MANAGER TRAINING AND RESPONSIBILITIES

The nominated Waste Manager will be given responsibility and 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 Manager will have overall responsibility to oversee, record and provide feedback to the Project Manager on everyday waste management at the site. Authority will be given to the Waste Manager to delegate responsibility to subcontractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

The Waste Manager 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 Manager 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 this C&D WMP.

### 7.2 SITE CREW TRAINING

Training of the site crew is the responsibility of the Waste Manager and, as such, a waste training program should be organised. A basic awareness course will be held for all site crew to outline the C&D WMP 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 course will describe the materials to be segregated, the storage methods and the location of the waste storage areas. A sub-section on hazardous wastes will be incorporated into the training program and the particular dangers of each hazardous waste will be explained.

## 8.0 RECORD KEEPING

Records should be kept for all waste material which leaves the site, either for reuse on another site, recycling or disposal. A recording system will be put in place to record the waste arising's on site.

A waste tracking log should be used to track each waste movement from the site. On exit from the site the waste collection vehicle driver should stop at the site office and sign out as a visitor and provide the security personnel or waste manager with a waste docket (or WTF for hazardous waste) for the waste load collected. At this time, the security personnel should complete and sign the Waste Tracking Register with the following information:

- Date
- Time
- Waste Contractor

- Company waste contractor appointed by e.g. Contractor or subcontractor name
- Collection Permit No.
- Vehicle Reg.
- Driver Name
- Docket No.
- Waste Type
- EWC/LoW

The waste transfer dockets will be transferred to the site waste manager on a weekly basis and can be placed in the Waste Tracking Log file. This information will be forwarded onto the SDCC Waste Regulation Unit when requested.

Alternatively, each subcontractor that has engaged their own waste contractor will be required to maintain a similar waste tracking log with the waste dockets/WTF maintained on file and available for inspection on site by the main contractor as required.

A copy of the Waste Collection Permits, CORs, Waste Facility Permits and Waste Licences will be maintained on site at all times. Subcontractors who have engaged their own waste contractors, should provide the main contractor with a copy of the waste collection permits and COR/permit/licence for the receiving waste facilities and maintain a copy on file available for inspection on site as required.

## **9.0 OUTLINE WASTE AUDIT PROCEDURE**

### **9.1 RESPONSIBILITY FOR WASTE AUDIT**

The appointed waste manager will be responsible for conducting a waste audit at the site during the C&D phase of the development.

### **9.2 REVIEW OF RECORDS AND IDENTIFICATION OF CORRECTIVE ACTIONS**

A review of all the records for the waste generated and transported off-site should be undertaken mid-way through the project. If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. The waste records will be compared with the established recovery/reuse/recycling targets for the site.

Each material type will be examined, in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved.

Upon completion of the C&D phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total recycling/reuse/recovery figures for the development.

## **10.0 CONSULTATION WITH RELEVANT BODIES**

### **10.1 LOCAL AUTHORITY**

Once the main contractor has been appointed and prior to removal of any waste materials offsite, details of the proposed destination of each waste stream will be provided to the local authority for their approval.

The local authority will also be consulted, as required, throughout the construction phase in order to ensure that all available waste reduction, reuse and recycling opportunities are identified and utilised and that compliant waste management practices are carried out.

### **10.2 RECYCLING/SALVAGE COMPANIES**

Companies that specialise in C&D waste management will be contacted to determine their suitability for engagement. Where a waste contractor is engaged, each company will be audited in order to ensure that relevant and up-to-date waste collection permits and facility COR/permits/licences are held. In addition, information regarding individual construction materials will be obtained, including the feasibility of recycling each material, the costs of recycling/reclamation, the means by which the wastes will be collected and transported off-site and the recycling/reclamation process each material will undergo off site.

## 11.0 REFERENCES

1 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). Subordinate and associated legislation includes:

- European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended 2011 (S.I. No. 323 of 2011)
- Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended 2008 (S.I. No. 87 of 2008) and 2016 (S.I. No. 24 of 2016)
- Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821 of 2007) as amended 2008 (S.I. No. 86 of 2008), 2014 (S.I. No. 310 and S.I. No. 546 of 2014) and 2015 (S.I. No. 198 of 2015)
- Waste Management (Licensing) Regulations 2000 (S.I. No. 185 of 2000) as amended 2004 (S.I. No. 395 of 2004) and 2010 (S.I. No. 350 of 2010)
- Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended 1998 (S.I. No. 164 of 1998), 2001 (S.I. No. 356 of 2002) and 2011 (S.I. No. 126 and No. 192 of 2011)
- Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
- European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
- Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended 2015 (S.I. No. 190 of 2015)
- European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015)
- European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended 2015 (S.I. No. 542 of 2015)
- European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
- European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended 2014 (S.I. No. 349 of 2014) and 2015 (S.I. No. 347 of 2015)
- Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended 2000 (S.I. No. 73 of 2000)
- Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended by European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
- The European Communities (Trans frontier Shipment of Hazardous Waste) Regulations 1988 (S.I. No. 248 of 1988) o European Union (Properties of Waste Which Render It Hazardous) Regulations 2015 (S.I. No. 233 of 2015)

2 Environmental Protection Act 1992 (Act No. 7 of 1992) as amended by the Protection of the Environment Act 2003 (Act No. 27 and S.I. No. 413 of 2003) and amended by the Planning and Development Act 2000 (Act No. 30 of 2000) as amended.

3 Litter Pollution Act 1997 (Act No. 12 of 1997) as amended by the Litter Pollution Regulations 1999 (S.I. No. 359 of 1999) and Protection of the Environment Act 2003, as amended.

4 Eastern-Midlands Waste Region, Eastern-Midlands Region Waste Management Plan 2015 – 2021 (2015).

5 Department of the Environment, Heritage and Local Government (DoEHLG), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, (2006).

6 FÁS and the Construction Industry Federation (CIF), Construction and Demolition Waste Management – a handbook for Contractors and Site Managers, (2002).

7 Department of Environment and Local Government (DoELG) Waste Management – Changing Our Ways, A Policy Statement (1998).

8 Forum for the Construction Industry, Recycling of Construction and Demolition Waste (1999).

9 Department of Communications, Climate Action and Environment (DCCA), Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025 (Sept 2020).

10 Fingal County Council (FCC), Development Plan 2017-2023 (2017). <https://www.fingal.ie/fingal-development-plan-2017-2023>

11 Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

12 EPA, Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous (2015)

13 Environmental Protection Agency (EPA), National Waste Database Reports 1998 – 2012.

14 EPA and Galway-Mayo Institute of Technology (GMIT), EPA Research Report 146 – A Review of Design and Construction Waste Management Practices in Selected Case Studies – Lessons Learned (2015).