ARCUS

TORRANCE WIND FARM EXTENSION II

ABNORMAL LOAD ROUTE ASSESSMENT

DECEMBER 2022

Prepared By:

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TABLE OF CONTENTS

1 INTRODUCTION

The Torrance Wind Farm Extension II is a proposed extension to the existing wind farm located north of Harthill, and within approximately 5 km distance to the M8 slip roads to the east and west. This Abnormal Load Route Assessment (ALRA) provides an assessment of land based routes to the wind farm site for the delivery of wind turbine components.

2 METHODOLOGY

This ALRA is a desk based study which uses publically available Ordinance Survey (OS) mapping to conduct swept path analysis of pinch points on the proposed delivery route. Swept path analysis is conducted in AutoCAD using the Vehicle Tracking software and a bespoke delivery vehicle developed for this ALRA.

2.1 Mapping

OS Mastermap was used to conduct swept path analysis along the proposed delivery route. This mapping is two-dimensional; and therefore, the assessment only considers the horizontal geometry of points of constraint (PCs) on the route. Topographical surveys may be required in order to undertake an assessment of vertical constraints.

2.2 Delivery Vehicle Specifications

This assessment is based upon an SG170 candidate turbine. The vehicle data sheet is included in Appendix A. Dimensions of the blade and corresponding delivery vehicle specifications are provided in the following tables.

Table 2.1: Turbine Blade Data

	Data Used in Assessment
Blade	Length 85 m

Table 2.2: Assumed delivery vehicles for Turbine Blade

	Data	**Source**
Blade Trailer	Vehicle length – 81.12 m Blade overhang – 8.56 m	Arcus SG170 Blade 3 Axle Superwing Trailer

2.3 Route to Site

Wind turbine components will be delivered to King George V Dock, Glasgow for onward overland delivery to the Wind Farm Site. An overview plan of the routes assessed is provided in Figure 1 of Appendix A.

The primary route, which comprises Route Option A and Route Option B assessed for turbine components is as follows:

- Leave King George V Dock onto Kings Inch Drive;
- Continue on Kings Inch Drive until the junction connecting to the M8 slip road and turn left (**Option A**) or continue on Kings Inch Drive until the junction connecting to Kings Inch Road and turn left (**Option B**);
- Follow the M8 slip road until connecting with the M8 (**Option A**) or Follow Kings Inch Road until connecting onto the M8 at the Hillington Interchange via the 1st exit (**Option B**);
- Follow the M8 eastbound over the Kingston Bridge through Glasgow; and

- Exit at Harthill Services through the new access junction to be created within the services.

It should be noted that assessment of the Harthill Services off-slip and the Site Entrance junction has not been undertaken as design of this junction is being undertaken by a third party. This design process should consider ALV movements from the motorway into the Site Entrance.

At the time of preparing this report significant works are taking place on the M8 Woodside Viaduct to the north of Glasgow City Centre. As a result of these works it is likely that abnormal loads would be prevented from using this route, as such an alternative route, Route C, was considered using the M74 and M73 to continue onto the M8 bypassing the Woodside Viaduct. These works may be finished at the time of construction of the Wind Farm, in which case use of Route C may not be required.

It should be noted that no PCs were identified on Route A between Hillington Interchange and the Site Entrance.

Route Option C, if used, would depart from Route A at Junction 21 of the M8. The following route would then be taken as shown on Figure 1:

- Leave M8 at junction 21 to continue on M74;
- Follow the M74 until junction 4;
- Exit the M74 at the slip road on junction 4, connecting to the M73;
- Follow the M73 until the slip road connecting to the roundabout at junction 8;
- Exit the roundabout onto the M8 eastbound via the 3rd exit;
- Follow the M8 eastbound until the slip road connecting to Harthill Service Station;
- Follow the slip road into the Service Station until reaching the Site Entrance junction; and
- Turn left into Site.

Figure 1, included in Appendix B, indicates the assessed abnormal load route from King George V Dock.

2.4 Site Entrance Location

The Site Entrance will be located off the M8 at a new access junction created within Harthill Service Station, this location is indicated on Figure 1 of Appendix A. Further consideration of how ALVs will navigate the Site Entrance should be undertaken by the designer of this junction.

2.5 Assumptions

In order to keep the results of assessment as concise as possible, the following assumptions have been made at each PC:

- During transit, delivery vehicles will be accompanied by an escort vehicle and a police escort if required;
- At all locations where the delivery vehicle occupies the full road width, or is required to contraflow a junction, appropriate traffic management procedures will be implemented by the escort. This will usually involve temporary closure of the road or junction whilst the vehicle passes; and
- A detailed traffic management plan will be prepared prior to delivery to inform all relevant stakeholders of road closures and other procedures to be implemented during delivery.

2.6 Categorisation of Risk

Risk has been categorised to the following criteria:

- Impassable – PCs where it is not possible to pass without an alternative method of transportation;
- High Risk – PCs which require third party land either for oversail or overrun;
- Medium Risk – PCs which may require third party land depending on confirmation the exact positioning of land boundaries and fences or those which do not require third party land but do require the construction of overrun areas within the road verge or which require further investigation works to ensure safe passage; and
- Low risk – PCs which do not require third party land, do not require the construction of overrun areas and do not require further investigation works.

3 RESULTS OF ASSESSMENT

Based on swept path analysis of all PCs identified on the proposed delivery route, outcomes and mitigation requirements have been defined and are detailed in Table 3.1.

Table 3.1: Assessment of Constraints

Ref	Location	Assessment Outcome	Mitigation	Assessed Risk
PC/01	King George V Dock Entrance / Kings Inch Drive	While exiting the Docks, the vehicle will oversail on the inside of the bend, conflicting with the existing gate. Vehicle will overrun the centre of the roundabout, conflicting with existing street furniture.	Checks must be made to ensure that the entrance of the docks is sufficient enough to allow for vehicle oversail. If not, then modification works will be required. Conflicting street furniture appears to already be placed on demountable supports. All street furniture on the roundabout will be removed upon vehicles arrival.	Low
PC/02	Ikea Roundabout, Kings Inch Drive	Vehicle will overrun the central verge to the west upon exiting the roundabout. Vehicle will oversail in various locations as shown on 3959-D-ALRA-0002, conflicting with existing street furniture on the roundabout and the central verge to the west.	Load bearing capacity of central verge in area of vehicle overrun to be determined. If insufficient, then kerb ramps and steel plating will be required to allow for overrun. Conflicting street furniture to be placed on demountable supports, to allow for removal upon vehicles arrival.	Medium
PC/03	Diageo Shieldhall Roundabout, Kings Inch Drive	Vehicle will oversail the central reservation onto the opposite carriageway after exiting the roundabout. in various locations as shown on 3959-D-ALRA-0003, no conflicts have been found.	Kings Inch Drive to be closed to eastbound traffic during delivery.	Low
PC/04 (A)	Kings Inch Drive / M8 On-Slip	Vehicle will overrun in various locations as shown on 3959-D-ALRA-0004, creating conflict with existing road signs. Vehicle will oversail in various locations as shown on 3959-D-ALRA-0004, creating conflict with existing demountable traffic signals.	Load bearing capacity in areas of vehicle overrun to be determined. If insufficient, then kerb ramps and steel plating will be required to allow for overrun. Conflicting road signs in overrun area to be mounted on demountable supports and lowered on vehicles arrival. Existing traffic mounts appear to be mounted on demountable supports, signals to be lowered on vehicles arrival.	Medium

PC/04 (B)	Old Govan Road / Kings Inch Road Junction	Vehicle will both overrun and oversail in various locations as shown on 3959-D-ALRA-0005, creating conflict with existing sign posts and traffic signals. Vehicle will overrun onto eastbound carriageway of Kings Inch Road.	Load bearing capacity in areas of vehicle overrun to be determined. If insufficient, then kerb ramps and steel plating will be required to allow for overrun. Conflicting street furniture in overrun and oversail areas to be mounted on demountable supports and lowered on vehicles arrival. Traffic exiting the M8 from junction 25A to be halted in a suitable location to allow for vehicle overrun onto eastbound carriageway during periods of delivery.	Medium
PC/05 (A)	Bend Under Renfrew Road Overbridge	Vehicle to oversail safety barrier on both sides while navigating the bend. Low clearance parapets of underbridge.	Topographical survey or dry run to be undertaken to determine clearance to bridge. Vertical clearance to underside of bridge and parapets to be confirmed.	Medium
PC/05 (B)	Roundabouts on Kings Inch Road / Hillington Road	Vehicle will overrun the central verge while exiting the roundabout from Kings Inch Road. Vehicle will oversail in various locations as shown on 3959-D-ALRA-0007, creating conflict with existing sign posts and traffic signals.	Load bearing capacity in areas of vehicle overrun to be determined. If insufficient, then kerb ramps and steel plating will be required to allow for overrun. Conflicting street furniture in overrun and oversail areas to be mounted on demountable supports and lowered on vehicles arrival. Exit arm of the Hillington Interchange to be closed for northbound traffic onto Hillington Road during periods of delivery.	Medium
PC/06	M74 / M73 Junction 4	Drawing 3959-ALRA-D-0008 provided for confirmation that the vehicle can successfully navigate this PC without issue.	N/A	Low

PC/07	M73 / M8 Junction 8 Roundabout	Vehicle will overrun the island to the northeast while navigating the roundabout. Vehicle will oversail in various locations as shown on 3959-D-ALRA-0009, conflicting with existing road signs.	Load bearing capacity in areas of vehicle overrun to be determined. If insufficient, then kerb ramps and steel plating will be required to allow for overrun. Conflicting road signs in oversail areas to be mounted on demountable supports and lowered on vehicles arrival.	Medium

4 CONCLUSION

4.1 Summary

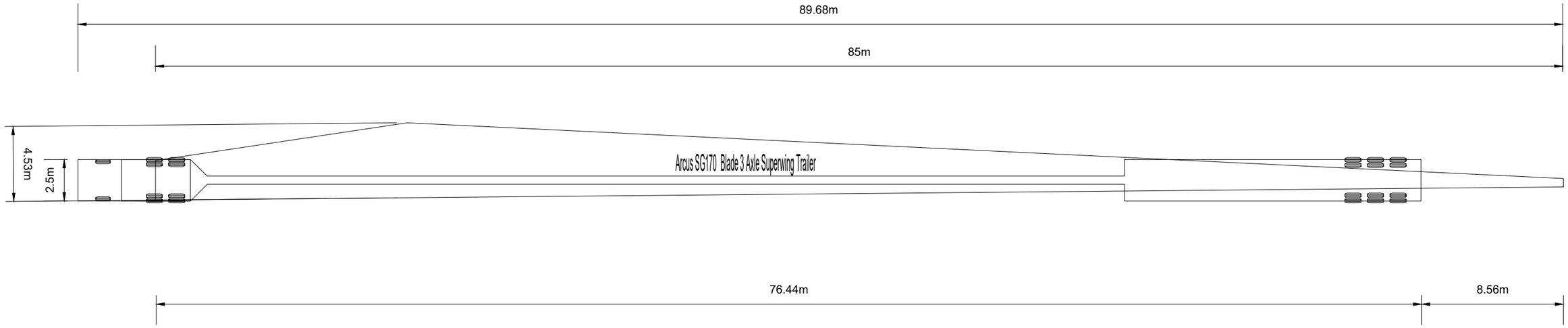
The delivery routes were assessed for the candidate wind turbine blade delivery vehicle and nine pinch points were identified between King George V Docks and the Site Entrance. Swept path analysis was conducted at each pinch point and details of required improvement works are presented in the drawings.

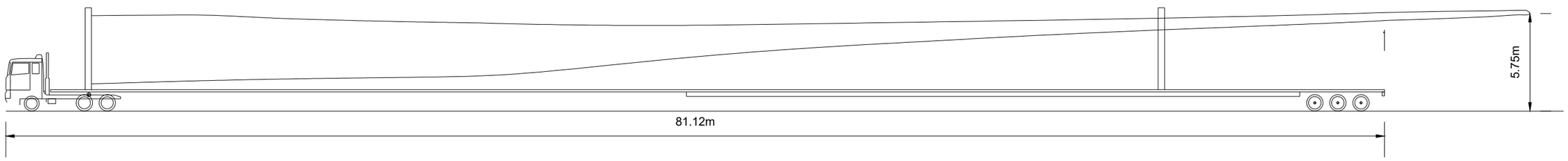
A total of three 'low risk' PC was identified where no works will be required, and six 'medium risk' PCs were identified where works will be required within the public road boundary. No 'high risk' or 'impassable' PCs were found along the route.

4.2 Recommendations for Further Work

Structural surveys may need to be undertaken at structures along the route in order to establish weight limits. An abnormal indivisible loads application should be submitted to the relevant authority which will initiate consultations with all relevant parties and identify areas where further review is required. A review of works on the Woodside Viaduct should be undertaken closer to the time of delivery to establish if these have been finished and if this route will be available for use or of Route Option C will be required.

APPENDIX A – VEHICLE DATA SHEET





Arcus SG170 Blade 3 Axle Superwing Trailer

Overall Length	89.680m
Overall Width	4.530m
Overall Body Height	3.436m
Min Body Ground Clearance	0.360m
Max Track Width	2.740m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	6.600m

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
TURBINE BLADE TIP DELIVERY
VEHICLE DATA SHEET

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.: 3959
Scale @ A3: 1:250
Date: 13/12/22

Drawing Number: 3959-ALRA-SK-0001
Rev: -

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Plot Date : 13 December 2022 11:58:49
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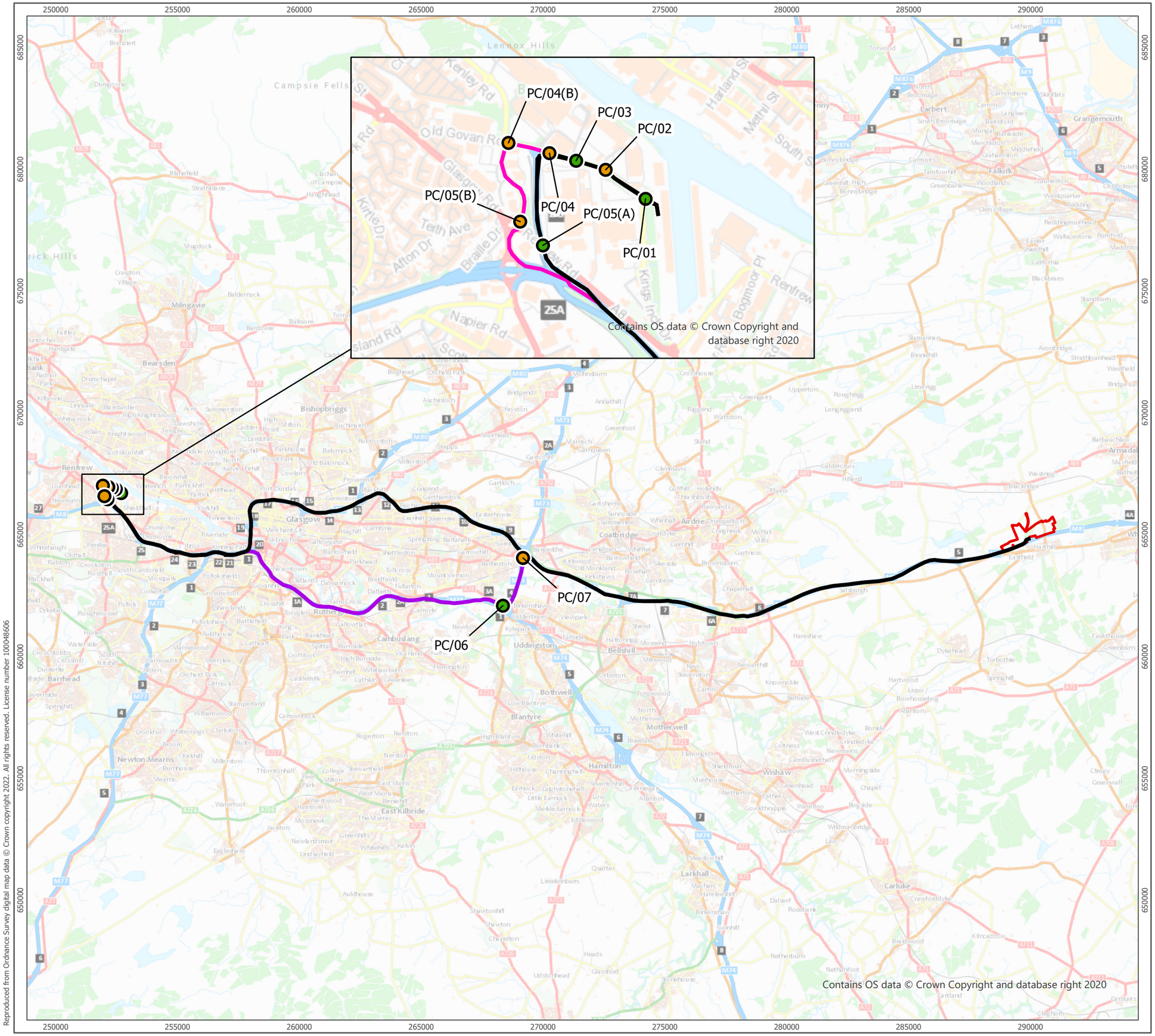
APPENDIX B – ROUTE TO SITE



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- Site Boundary
- Route Option A
- Route Option B
- Route Option C

1:150,000 Scale @ A3

0 2,500 5,000 m

NORTH

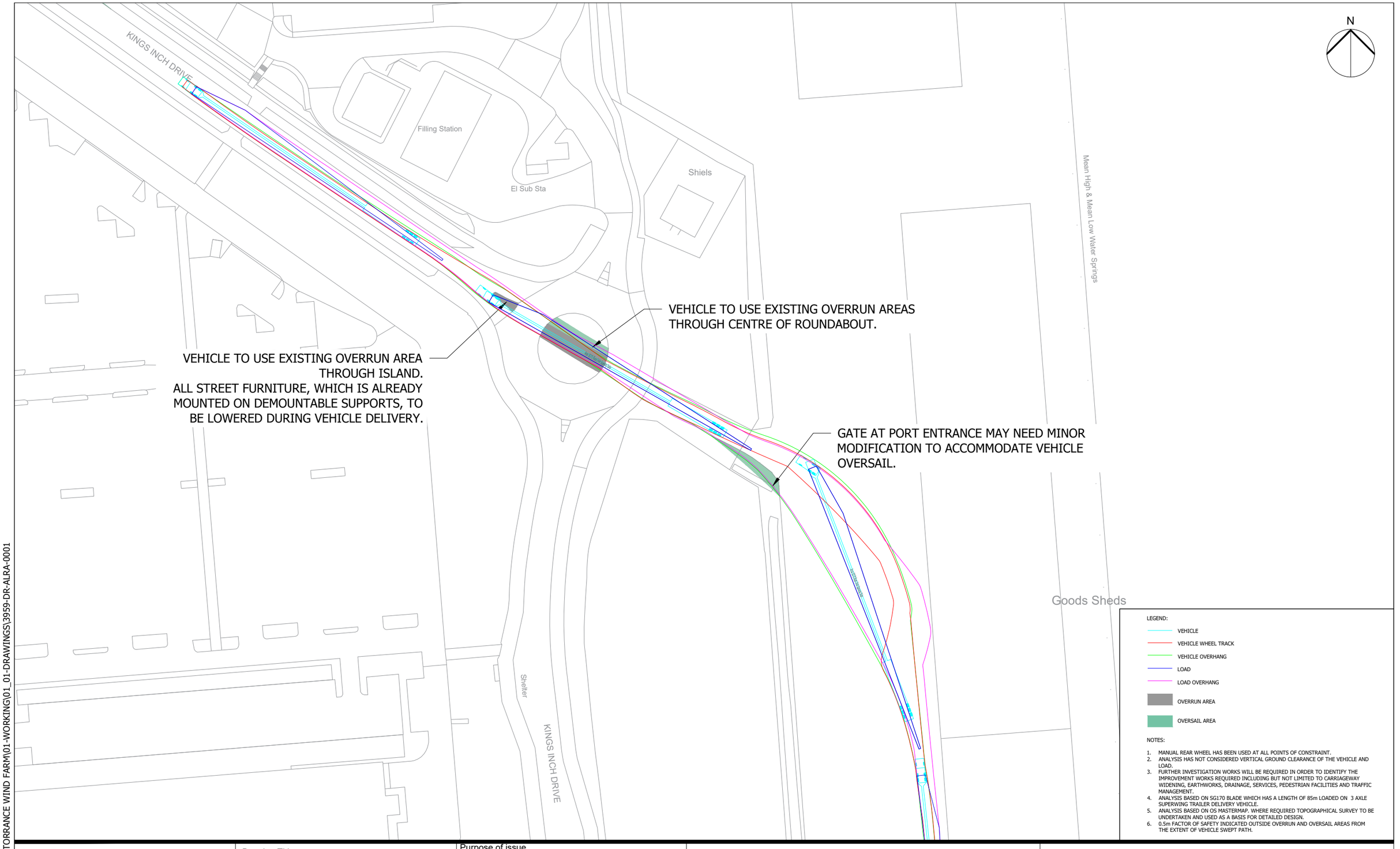
Produced By: CR	Ref: 3959-REP-055
Checked By: KL	Date: 22/12/2022

Pinch Point Location Plan
Figure 1

Torrance Wind Farm II Extension
ALRA

Y:\GIS\Transport\3959 Torrance WF II Extension\3959 Torrance WF II Extension.aprx\3959-REP-091 Fig01 Pinch Point Location Pkan

APPENDIX C – SWEPT PATH ANALYSIS DRAWING



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Client: INFINERGY Ltd a BORALEX company		Designed: CR / Drawn: CR / Checked: KL / Approved: FO	
		Arcus Internal Project No.: 3959	Date: 13/12/22
		Scale @ A3: 1:1000	

Drawing Number	Rev
3959-ALRA-D-0001	-

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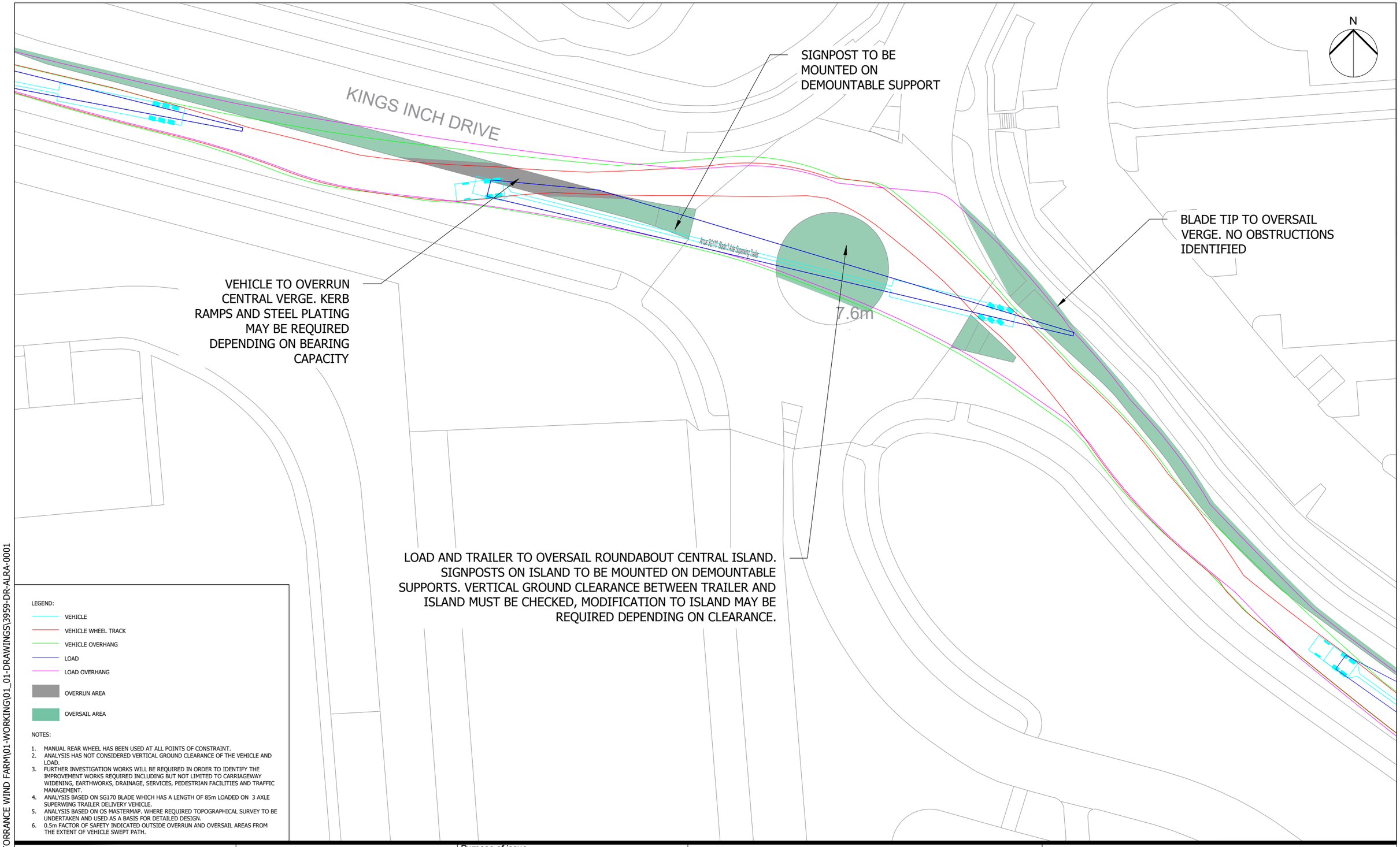

LOAD AND TRAILER TO OVERSAIL ROUNDABOUT CENTRAL ISLAND. SIGNPOSTS ON ISLAND TO BE MOUNTED ON DEMOUNTABLE SUPPORTS. VERTICAL GROUND CLEARANCE BETWEEN TRAILER AND ISLAND MUST BE CHECKED, MODIFICATION TO ISLAND MAY BE REQUIRED DEPENDING ON CLEARANCE.

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- OVERRUN AREA
- OVERSAIL AREA

NOTES:

1. MANUAL REAR WHEEL HAS BEEN USED AT ALL POINTS OF CONSTRAINT.
2. ANALYSIS HAS NOT CONSIDERED VERTICAL GROUND CLEARANCE OF THE VEHICLE AND LOAD.
3. FURTHER INVESTIGATION WORKS WILL BE REQUIRED IN ORDER TO IDENTIFY THE IMPROVEMENT WORKS REQUIRED INCLUDING BUT NOT LIMITED TO CARRIAGEWAY WIDENING, EARTHWORKS, DRAINAGE, SERVICES, PEDESTRIAN FACILITIES AND TRAFFIC MANAGEMENT.
4. ANALYSIS BASED ON SG170 BLADE WHICH HAS A LENGTH OF 85m LOADED ON 3 AXLE SUPERWING TRAILER DELIVERY VEHICLE.
5. ANALYSIS BASED ON OS MASTERMAP. WHERE REQUIRED TOPOGRAPHICAL SURVEY TO BE UNDERTAKEN AND USED AS A BASIS FOR DETAILED DESIGN.
6. 0.5m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH.

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/02
IKEA ROUNDABOUT
KINGS INCH DRIVE

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

Date
13/12/22

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1:500

Drawing Number
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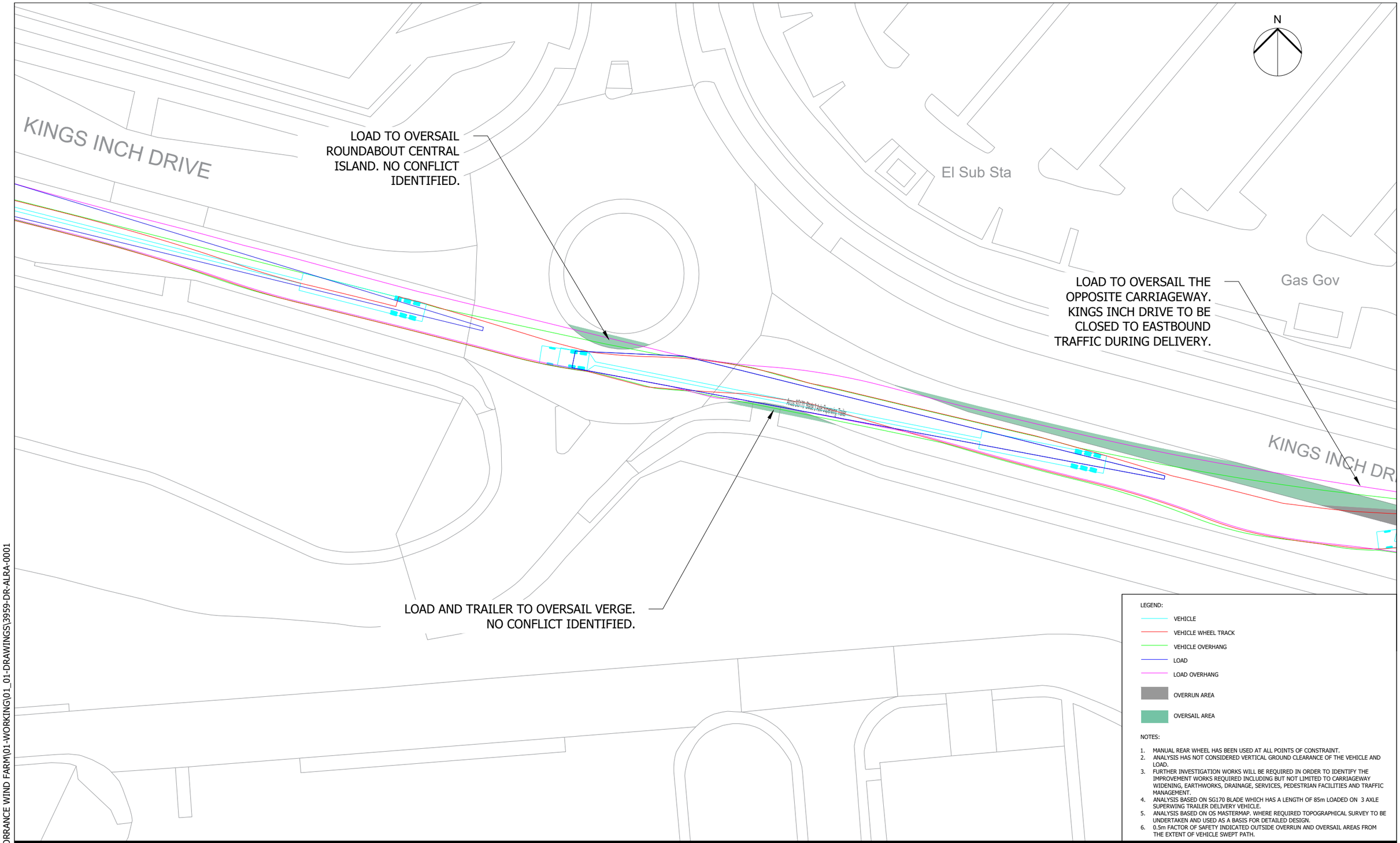

NOTES:

1. MANUAL REAR WHEEL HAS BEEN USED AT ALL POINTS OF CONSTRAINT.
2. ANALYSIS HAS NOT CONSIDERED VERTICAL GROUND CLEARANCE OF THE VEHICLE AND LOAD.
3. FURTHER INVESTIGATION WORKS WILL BE REQUIRED IN ORDER TO IDENTIFY THE IMPROVEMENT WORKS REQUIRED INCLUDING BUT NOT LIMITED TO CARRIAGEWAY WIDENING, EARTHWORKS, DRAINAGE, SERVICES, PEDESTRIAN FACILITIES AND TRAFFIC MANAGEMENT.
4. ANALYSIS BASED ON SG170 BLADE WHICH HAS A LENGTH OF 85m LOADED ON 3 AXLE SUPERWING TRAILER DELIVERY VEHICLE.
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6. 0.5m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH.

Project Title
TORRANCE WIND FARM EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd a BORALEX company

Drawing Title
PC/03
DIAGEO SHIELDHALL ROUNDABOUT
KINGS INCH DRIVE

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

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Drawing Number
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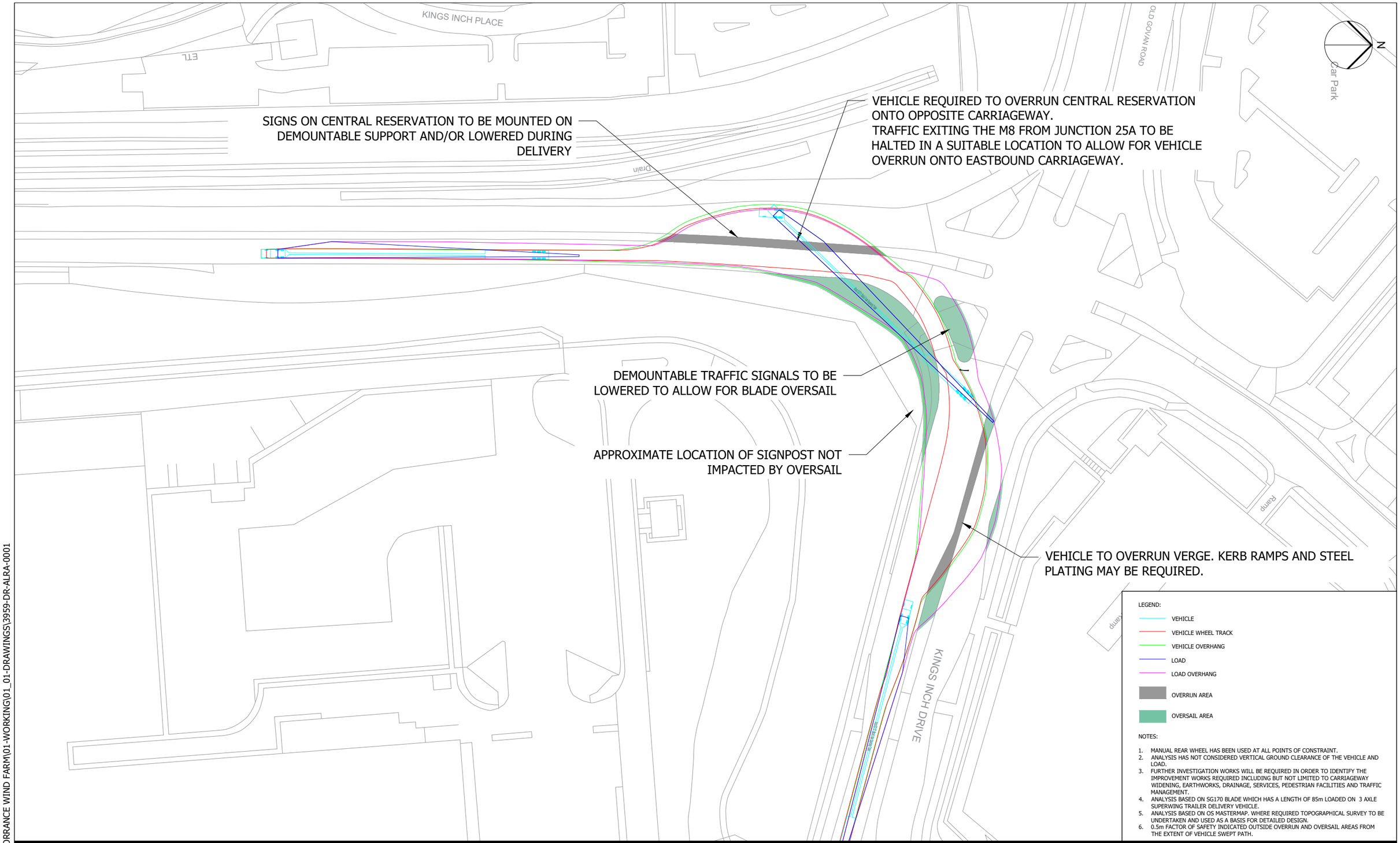

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/04 (A)
KINGS INCH DRIVE
M8 ON-SLIP

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

Scale @ A3
1:1000

Date
13/12/22

Drawing Number
3959-ALRA-D-0004

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LOAD TO OVERSAIL GRASS VERGE AND FOOTWAY. NO CONFLICT IDENTIFIED.

LOAD TO OVERSAIL CENTRAL RESERVATION. NO CONFLICT IDENTIFIED.

VEHICLE WILL BE REQUIRED TO OVERRUN THE CENTRAL RESERVATION ONTO THE OPPOSITE CARRIAGEWAY.

PEDESTRIAN GUARDRAILS TO BE REMOVED DURING DELIVERY.

KERB RAMPS AND STEEL PLATING MAY NEED TO BE INSTALLED WHERE VEHICLE OVERRUNS ISLAND.

SIGNPOST TO BE MOUNTED ON DEMOUNTABLE SUPPORTS AND LOWERED DURING DELIVERY.

TRAFFIC SIGNALS TO BE MOUNTED ON DEMOUNTABLE SUPPORTS AND LOWERED DURING DELIVERY.

VEHICLE TO OVERSAIL OPPOSITE CARRIAGEWAY.
NORTHBOUND TRAFFIC TO BE HALTED IN A SUITABLE LOCATION TO ALLOW FOR VEHICLE OVERSAIL.

SIGNPOST TO BE MOUNTED ON DEMOUNTABLE SUPPORTS AND LOWERED DURING DELIVERY.

TRAFFIC SIGNALS TO BE MOUNTED ON DEMOUNTABLE SUPPORTS AND LOWERED DURING DELIVERY.

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- OVERRUN AREA
- OVERSAIL AREA

NOTES:

1. MANUAL REAR WHEEL HAS BEEN USED AT ALL POINTS OF CONSTRAINT.
2. ANALYSIS HAS NOT CONSIDERED VERTICAL GROUND CLEARANCE OF THE VEHICLE AND LOAD.
3. FURTHER INVESTIGATION WORKS WILL BE REQUIRED IN ORDER TO IDENTIFY THE IMPROVEMENT WORKS REQUIRED INCLUDING BUT NOT LIMITED TO CARRIAGEWAY WIDENING, EARTHWORKS, DRAINAGE, SERVICES, PEDESTRIAN FACILITIES AND TRAFFIC MANAGEMENT.
4. ANALYSIS BASED ON SG170 BLADE WHICH HAS A LENGTH OF 85m LOADED ON 3 AXLE SUPERWING TRAILER DELIVERY VEHICLE.
5. ANALYSIS BASED ON OS MASTERMAP. WHERE REQUIRED TOPOGRAPHICAL SURVEY TO BE UNDERTAKEN AND USED AS A BASIS FOR DETAILED DESIGN.
6. 0.5m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH.

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/04 (B)
OLD GOVAN ROAD/
KINGS INCH ROAD JUNCTION

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
KL	KL	FO	FO

Arcus Internal Project No.
3959

Scale @ A3
1:1000

Date
13/12/22

Drawing Number
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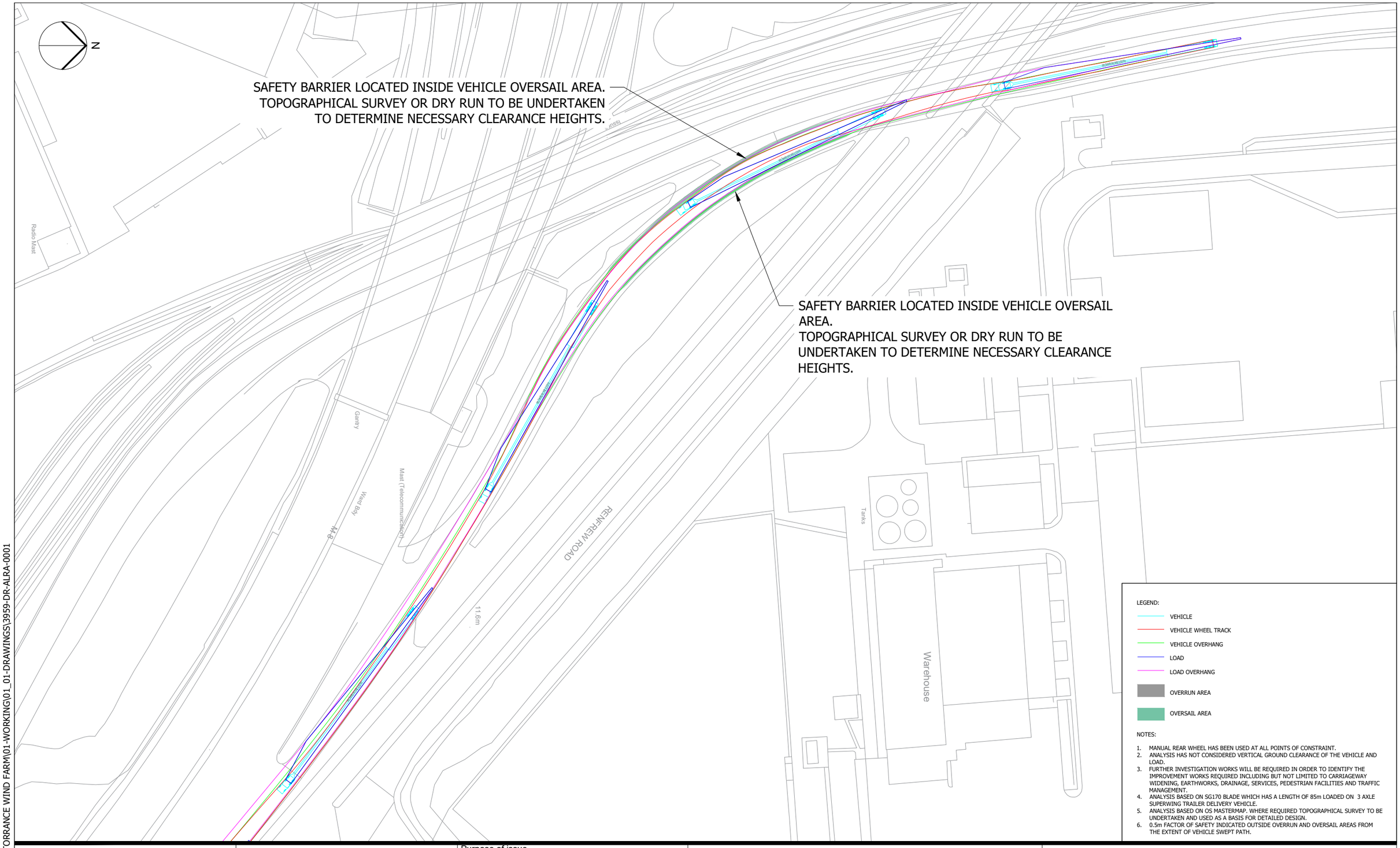

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/04
BEND UNDER
RENFREW ROAD OVERBRIDGE

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

Scale @ A3
1:1250

Date
13/12/22

Drawing Number
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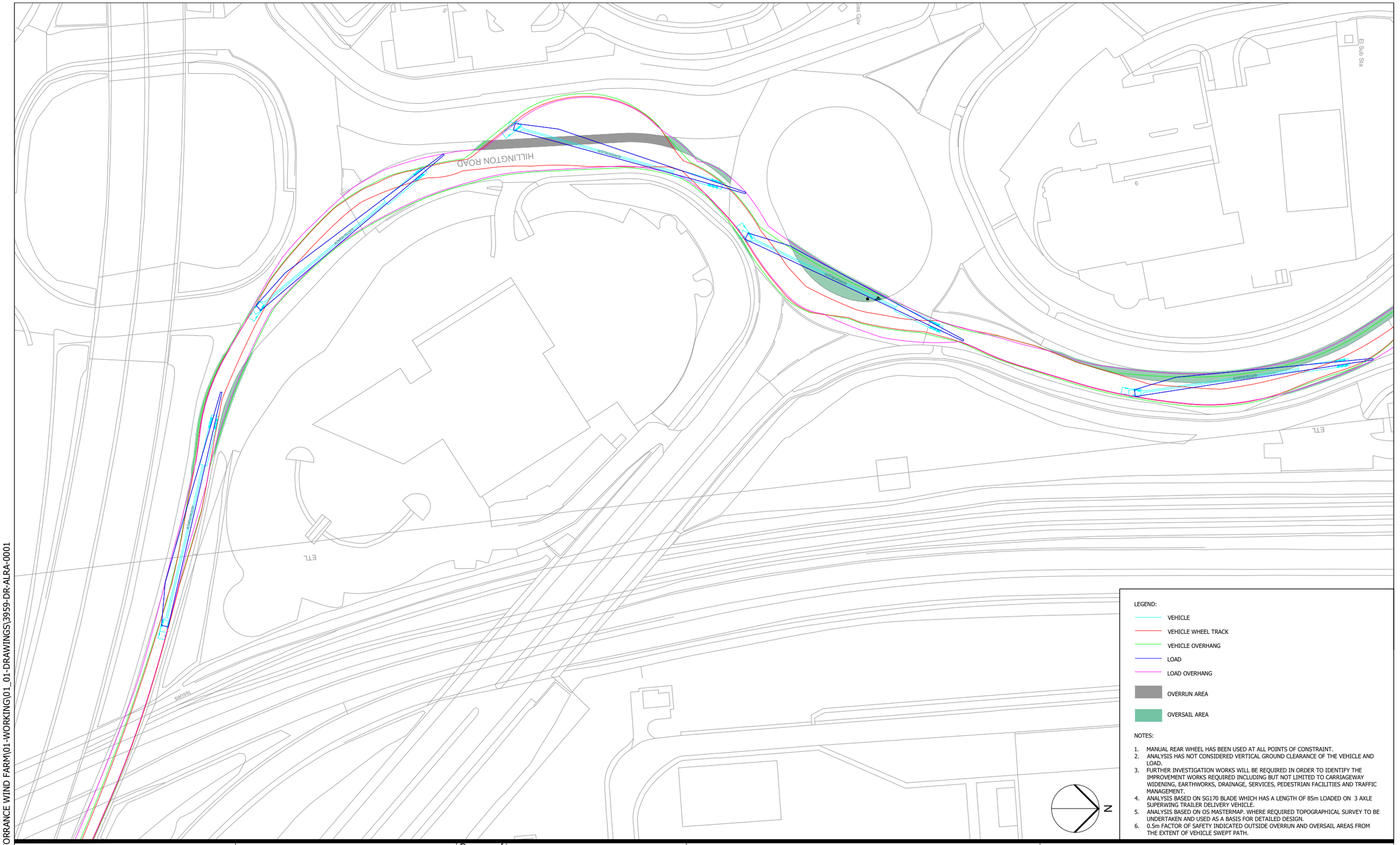

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Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/05 (B)
ROUNDABOUTS ON KINGS
INCH ROAD / HILLINGTON ROAD

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

Date
13/12/22

Scale @ A3
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ARCUS

N

Club House

40.2m

Roundknowe Farm

GLASGOW ROAD

M 73

Burgh Const & UA Bdy

Co Const Bdy

CR

Gantry

Maryville

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- OVERRUN AREA
- OVERSAIL AREA

NOTES:

1. MANUAL REAR WHEEL HAS BEEN USED AT ALL POINTS OF CONSTRAINT.
2. ANALYSIS HAS NOT CONSIDERED VERTICAL GROUND CLEARANCE OF THE VEHICLE AND LOAD.
3. FURTHER INVESTIGATION WORKS WILL BE REQUIRED IN ORDER TO IDENTIFY THE IMPROVEMENT WORKS REQUIRED INCLUDING BUT NOT LIMITED TO CARRIAGEWAY WIDENING, EARTHWORKS, DRAINAGE, SERVICES, PEDESTRIAN FACILITIES AND TRAFFIC MANAGEMENT.
4. ANALYSIS BASED ON SG170 BLADE WHICH HAS A LENGTH OF 85m LOADED ON 3 AXLE SUPERWING TRAILER DELIVERY VEHICLE.
5. ANALYSIS BASED ON OS MASTERMAP. WHERE REQUIRED TOPOGRAPHICAL SURVEY TO BE UNDERTAKEN AND USED AS A BASIS FOR DETAILED DESIGN.
6. 0.5m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH.

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/06
M74 / M73
JUNCTION 4

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

Date
13/12/22

Scale @ A3
1:1250

Drawing Number
3959-ALRA-D-0008

Rev
-

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ARCUS

Plot Date : 22 December 2022 10:10:18
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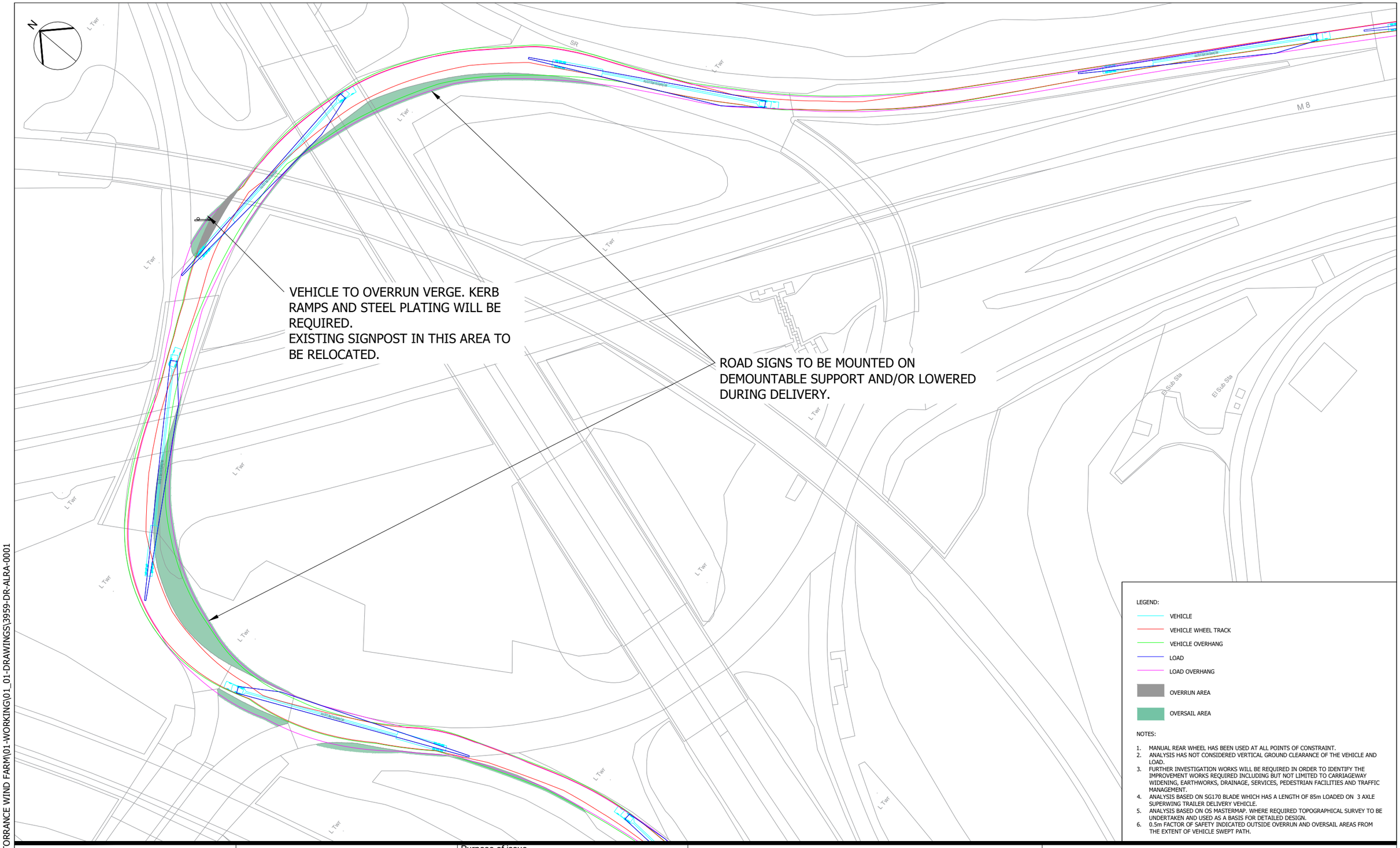

Project Title
TORRANCE WIND FARM
EXTENSION II
ABNORMAL LOAD ROUTE ASSESSMENT

Client
INFINERGY Ltd
a BORALEX company

Drawing Title
PC/07
M73 /M8
JUNCTION 8 ROUNDABOUT

Purpose of issue
PRELIMINARY

Designed	Drawn	Checked	Approved
CR	CR	KL	FO

Arcus Internal Project No.
3959

Scale @ A3
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Plot Date : 22 December 2022 10:10:28
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