LOCHLUICHART WIND FARM EXTENSION II

APPENDIX 7.A

ABNORMAL LOAD ROUTE ASSESSMENT

DECEMBER 2018

Prepared By:

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TABLE OF CONTENTS

1 INTRODUCTION

Lochluichart Wind Farm Extension II is a proposed extension to the existing Lochluichart Wind Farm, located north of Garve in Easter Ross. 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 points of constraint (PCs) 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

Ordinance Survey (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 pinch points on the route. Topographical surveys may be required in order to undertake an assessment of vertical constraints.

2.2 Delivery Vehicle Specifications

A 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 67.0m

Table 2.2: Assumed delivery vehicles for Turbine Blade

	Data	**Source**
Blade Trailer	Vehicle length – 65.47m Blade overhang – 6.2m	Volvo Cab / TSR Trailer

2.3 Route to Site

This assessment considered delivery from the Port of Invergordon. The route to site would be as indicated on Figure 1, included in Appendix B, via the A9 and A835 to the existing Lochluichart Wind Farm site entrance by Loch Glascarnoch.

2.4 Tracking Methodology

Automatic rear wheel steering (RWS) has been utilised at all PCs, except where noted on the drawings at PCs where manual override was required to negotiate the PC in order to avoid fixed constraints or excessive overrun areas.

A 0.75 m offset has been indicated on all overrun and oversail areas from the extent of the vehicle swept path. This is to provide a factor of safety and to indicate the area which should be allowed for in order to provide a margin of error during delivery.

2.5 Pinch Point Severity

All PCs have been assigned an indicative severity rating according to the quantity and quality of works required. The following criteria have been applied:

- High Risk – Any PC which requires 3rd party land or major construction works for example a new watercourse crossing;
- Medium Risk – Any PC which requires minor construction works not in 3rd party land or significant street furniture removal/relocation; and
- Low Risk- Any other PC which may require oversail, not in 3rd party land, or isolated street furniture removal/relocation. Or any assessed PC which has no works required.

For the purposes of this assessment the works within the Port of Invergordon site entrance, and at the Lochluichart Wind Farm site entrance do not have 3rd party land areas indicated. It is assumed that the port and existing wind farm operator will be consulted at an early stage in order to secure the viability of this delivery route.

2.6 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, 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.

3 RESULT OF ASSESSMENT

Based upon swept path analysis of all PCs identified on the proposed delivery route, outcomes and mitigation requirements have been defined and are summarised in Table 3.1. Ten PCs were identified between the Port of Invergordon and the site entrance.

Table 3.1: Assessment of Constraints

Ref	Location	Assessment Outcome	Mitigation	Risk
PC/01	Port of Invergordon Entrance	Vehicle to overrun grass verge on inside bend and conflict with post and wire fence. Vehicle to conflict with fence on outside bend at entrance.	Load bearing surface to be laid in overrun area on inside bend and post and wire fence to be temporarily removed. Entrance gate to be widened.	Medium
PC/02	B817/A9 Junction	Trailer to overrun islands on entry and exit arms of roundabout and conflict with plastic bollards and lighting column. Trailer to overrun inside bend in third party land and conflict with post and wire fence, lighting columns and vegetation.	Load bearing surfaces to be laid in overrun areas on islands, steel plating may be sufficient, and within third party land area on inside bend. Plastic bollards and signposts to be mounted on demountable supports, lighting columns may need to be relocated.	High
PC/03	A9/A862 Roundabout	Load to oversail inside bend of roundabout approach and exit arms and conflict with lighting columns and signposts.	Lighting columns to be relocated. Signs may be mounted on demountable supports and lowered during delivery.	Low
PC/04	A9/A835 Roundabout	Blade tip to oversail outside bend of approach arm and conflict with lighting column. Vehicle to overrun approach and exit arm islands, and roundabout central island, and conflict with street furniture including pedestrian guardrails, lighting columns and signposts.	Load bearing surface to be laid in overrun areas. Lighting columns/bollards/street signs to be relocated or mounted on demountable supports where appropriate. Topographical survey recommended to establish clearance to street furniture.	Medium

Ref	Location	Assessment Outcome	Mitigation	Risk
PC/05	A835/A862 Roundabout	Trailer to overrun pedestrian footway on outside bend of approach arm, possible conflict between blade tip and lighting column. Vehicle to overrun island on roundabout approach arm, roundabout central island and island on roundabout exit arm. Load to oversail pedestrian guard rails on exit.	Load bearing surface to be laid in overrun areas. Lighting column/bollard/street sign to be relocated or mounted on demountable supports where appropriate. Clearance height from pedestrian guard rails to load to be established.	Medium
PC/06	A835 at Contin	Vehicle to overrun pavement on outside of bend. Low clearance to lighting column on outside bend.	Load bearing surface to be laid in overrun area on pavement, steel plating likely to be sufficient. Dry run or topographical survey recommended to establish clearance to lighting column.	Medium
PC/07	A835 at Achilty Hotel	Load to oversail inside and outside bend above pedestrian footway.	No mitigation required.	Low
PC/08	A835 North of Achilty	Trailer to overrun inside bend and conflict with plastic bollards and vegetation.	Load bearing surface to be laid in overrun area, plastic bollards to be relocated and vegetation to be cleared.	Medium
PC/09	A835/Loch Garve	Vehicle to overrun inside bend, ground slopes up steeply from carriageway edge.	Load bearing surface to be laid in overrun area. Topographical survey recommended to establish clearance from load.	Medium

Ref	Location	Assessment Outcome	Mitigation	Risk
PC/10	A835/Site entrance	Minor vehicle overrun on bends on approach to entrance junction. Vehicle to overrun slightly beyond existing widening area at site entrance junction.	Load bearing surfaces to be laid in overrun areas on approach bends. Entrance junction overrun area to be enlarged.	Medium

4 CONCLUSION

4.1 Summary

The delivery route was assessed for the candidate wind turbine blade vehicle. Ten PCs are detailed within this report where swept path analysis has been conducted of which one was identified as 'high risk', seven as 'medium risk' and two as 'low risk'.

The high risk PC/02 is a junction and mini roundabout which connects the B817 and A9 at Alness. This PC will require construction works within 3rd party land.

PC/04 and PC/05 are rated as medium risk although should be considered as the most severe of the medium risk pinch points owing to significant amounts of construction required within the roundabout central islands and a large amount of street furniture removal/relocation. 3rd party land is not believed to be required for these PCs.

The remaining medium risk PCs have only minor construction works required, not in third party land. At many of these PCs the use of steel plating in order to protect verges and pedestrian footways may prove sufficient to enable delivery, thus removing any requirement for construction works.

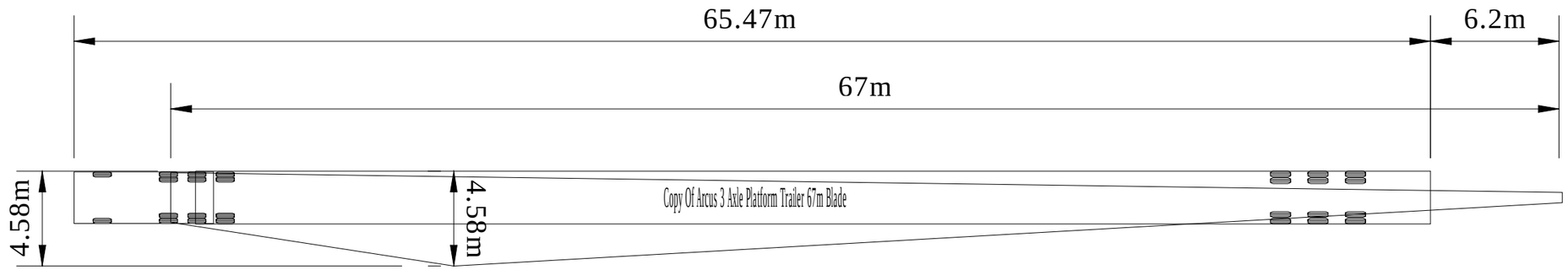
It is recommended that topographical survey work is undertaken at PC/09 due to the steeply sloping ground on the inside of the bend. Indicated clearance at this PC is quite low, although marginally above the factor of safety. Identification of conflict between the load and the ground on the inside of this bend could result in complex mitigation works due to the difficult topography on either side of the road.

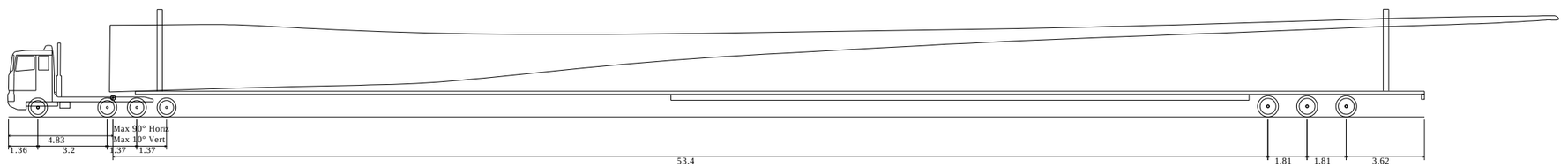
4.2 Recommendations for Further Work

Topographic surveys should be undertaken to confirm the viability of all PCs especially at those locations identified where clearance is low or the position of street furniture/trees is unknown.

Structural surveys should 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.

APPENDIX A – VEHICLE DATA SHEET





Arcus 3 Axle Platform Trailer 67m Blade

Overall Length	71.670m
Overall Width	2.550m
Overall Body Height	4.580m
Min Body Ground Clearance	0.331m
Max Track Width	2.550m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	6.600m

Project Title
LOCHLUICHART EXTENSION II
ABNORMAL LOAD
ROUTE ASSESSMENT

Client
INFINERGY

Drawing Title
VEHICLE DATA SHEET

Purpose of issue
FOR INFORMATION

Designed	Drawn	Checked	Approved
KL	KB	KL	TAT

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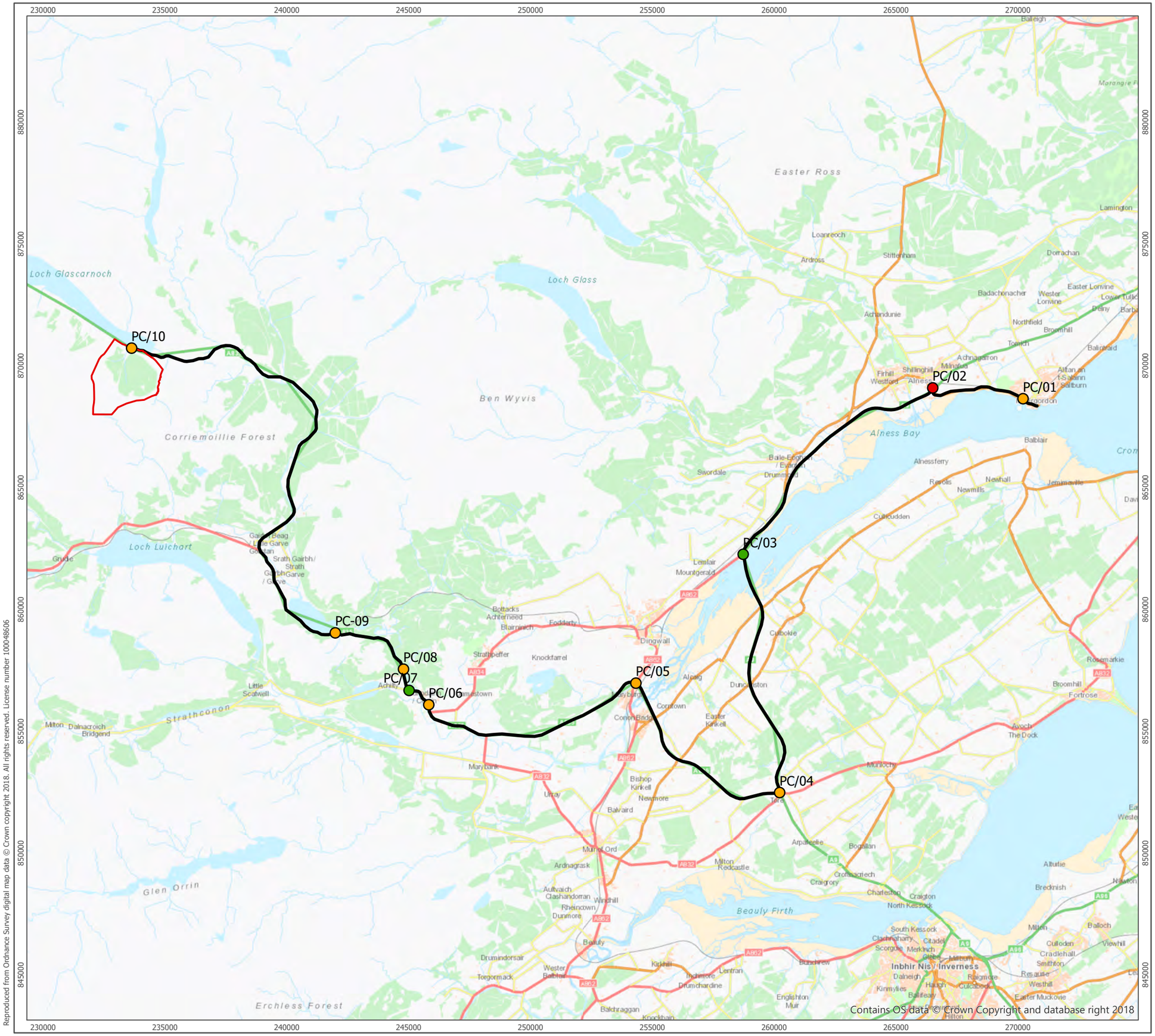
APPENDIX B – ROUTE TO SITE



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- Low Risk Pinch Point
- Medium Risk Pinch Point
- High Risk Pinch Point
- Site Boundaries
- Abnormal Load Route

1:150,000 Scale @ A3

0 2.5 5 km

NORTH

Produced By: KB	Ref: 2414-REP-037
Checked By: KL	Date: 16/10/2018

Pinch Point Location Plan
Figure 1

Lochluichart
Wind Farm Extension II

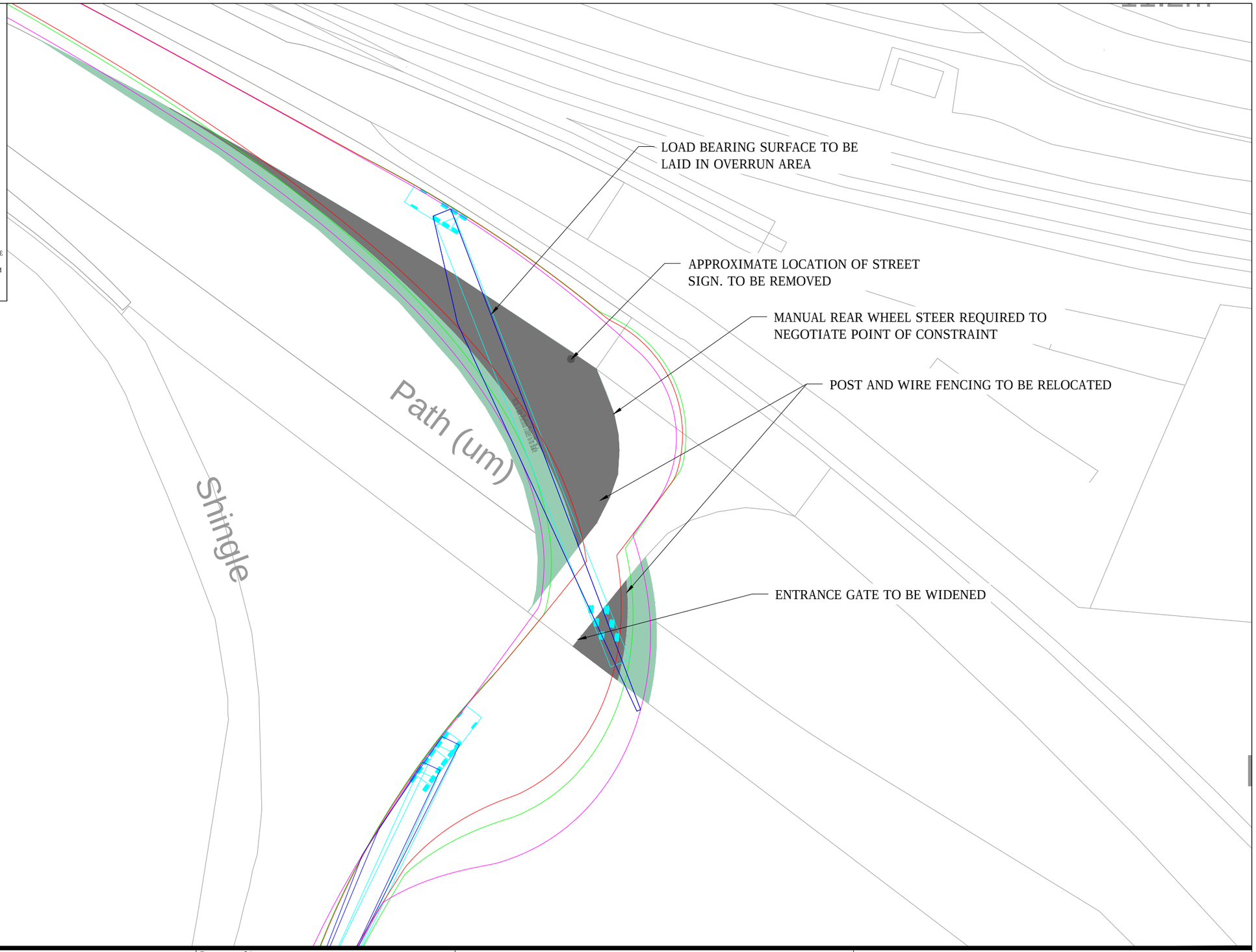
APPENDIX C – SWEPT PATH ANALYSIS DRAWINGS

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

1. AUTOMATIC REAR WHEEL STEERING USED UNLESS OTHERWISE INDICATED.
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 67.0m BLADE DELIVERY VEHICLE
5. ANALYSIS BASED ON OS MASTERMAP. WHERE REQUIRED TOPOGRAPHICAL SURVEY TO BE UNDERTAKEN AND USED AS A BASIS FOR DETAILED DESIGN.
6. A 0.75m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH. THIS IS TO PROVIDE A FACTOR OF SAFETY AND TO INDICATE THE AREA WHICH SHOULD BE ALLOWED FOR IN ORDER TO PROVIDE A MARGIN OF ERROR DURING DELIVERY.



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Project Title
LOCHLUICHART EXTENSION II
ABNORMAL LOAD
ROUTE ASSESSMENT

Client
INFINERGY

Drawing Title
PC/01
PORT OF INVERGORDON
ENTRANCE

Purpose of issue
FOR INFORMATION

Designed	Drawn	Checked	Approved
KL	KB	KL	TAT

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LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- THIRD PARTY LAND
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

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APPROXIMATE LOCATION OF LIGHTING COLUMN. TO BE RELOCATED.

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA. STEEL PLATING MAY BE SUFFICIENT

APPROXIMATE LOCATION OF LIGHTING COLUMN. TO BE RELOCATED.

POST AND WIRE FENCE. TO BE RELOCATED

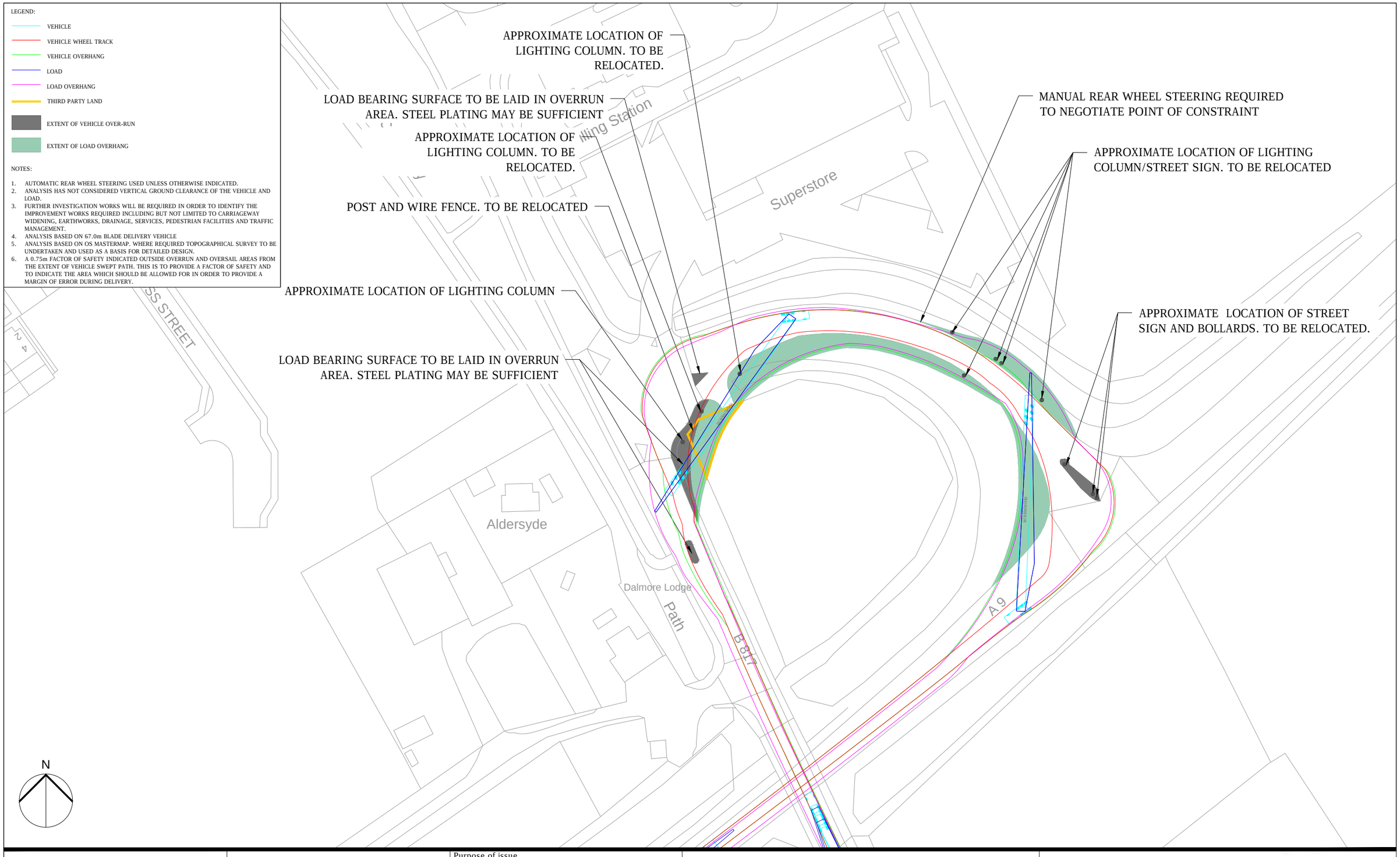
APPROXIMATE LOCATION OF LIGHTING COLUMN

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA. STEEL PLATING MAY BE SUFFICIENT

MANUAL REAR WHEEL STEERING REQUIRED TO NEGOTIATE POINT OF CONSTRAINT

APPROXIMATE LOCATION OF LIGHTING COLUMN/STREET SIGN. TO BE RELOCATED

APPROXIMATE LOCATION OF STREET SIGN AND BOLLARDS. TO BE RELOCATED.



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LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

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LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

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Drain

Torwood

APPROXIMATE LOCATION OF LIGHTING COLUMN/STREET SIGN/BOLLARD. TO BE REMOVED

APPROXIMATE LOCATION OF STREET SIGN. TOPOGRAPHICAL SURVEY TO ESTABLISH EXACT LOCATION

Ibank

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA

APPROXIMATE LOCATION OF PEDESTRIAN GUARD RAILS. TO BE RELOCATED

APPROXIMATE LOCATION OF LIGHTING COLUMN/STREET SIGN/BOLLARD. TO BE REMOVED

3m

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA

A 835

N

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LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

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APPROXIMATE LOCATION OF LIGHTING COLUMN/BOLLARD/STREET SIGN. TO BE REMOVED

APPROXIMATE LOCATION OF LIGHTING COLUMN/BOLLARD/SIGN. TO BE REMOVED

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA

APPROXIMATE LOCATION OF PEDESTRIAN GUARD RAIL. CLEARANCE HEIGHT FROM LOAD TO BE ESTABLISHED

APPROXIMATE LOCATION OF LIGHTING COLUMN. TOPOGRAPHICAL SURVEY TO ESTABLISH EXACT POSITION.

12.0m
CG
A 862
Cycle Path
Posts
A 835
DONALD CAMERON COURT
Gas Gov
Torwood
Path (um)
N

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LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

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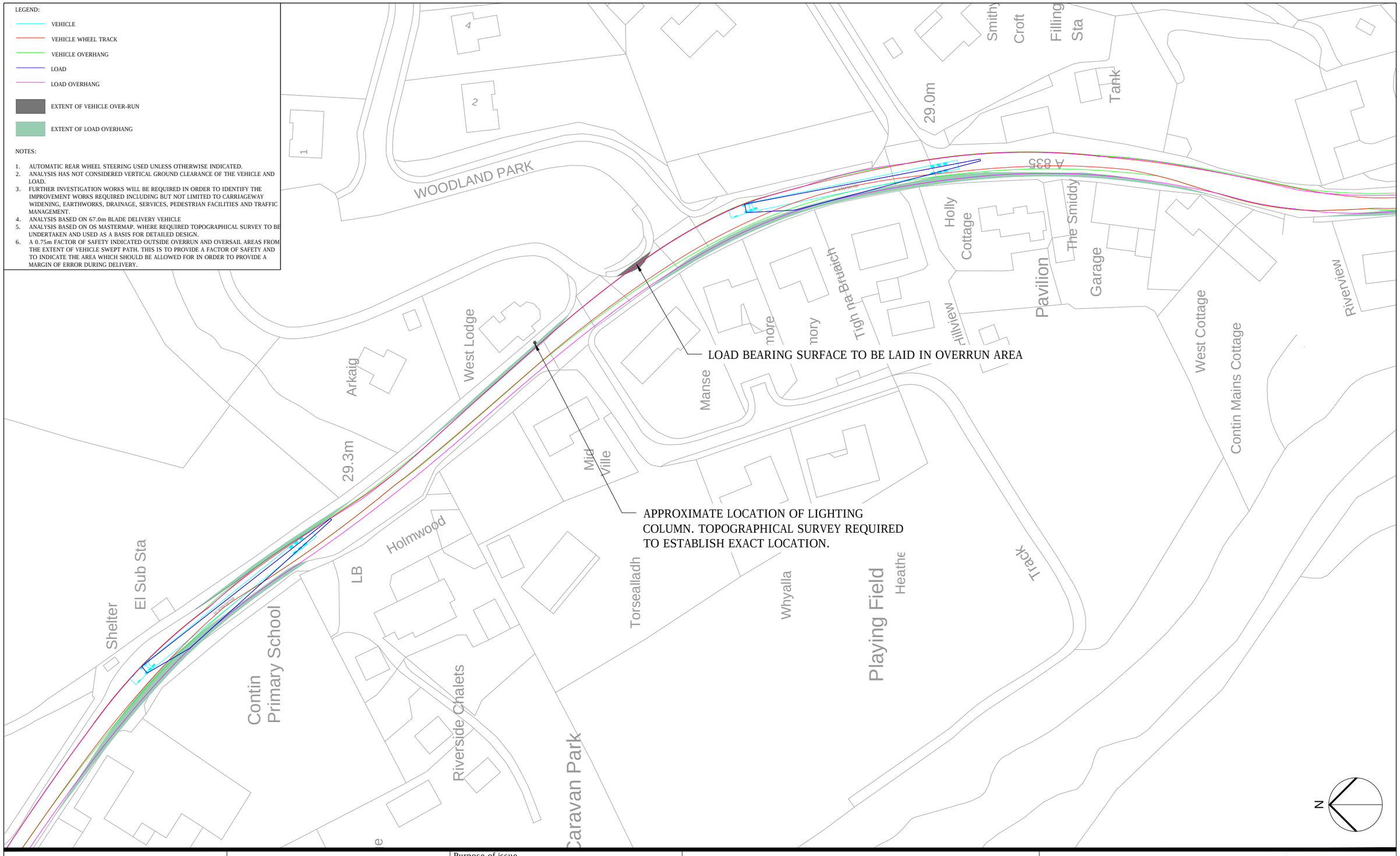

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		Scale @ A3: 1:1000	

Drawing Number: 2414_DR_ALR_0006 | Rev: -

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ARCUS

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

1. AUTOMATIC REAR WHEEL STEERING USED UNLESS OTHERWISE INDICATED.
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 67.0m BLADE DELIVERY VEHICLE
5. ANALYSIS BASED ON OS MASTERMAP. WHERE REQUIRED TOPOGRAPHICAL SURVEY TO BE UNDERTAKEN AND USED AS A BASIS FOR DETAILED DESIGN.
6. A 0.75m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH. THIS IS TO PROVIDE A FACTOR OF SAFETY AND TO INDICATE THE AREA WHICH SHOULD BE ALLOWED FOR IN ORDER TO PROVIDE A MARGIN OF ERROR DURING DELIVERY.

Plot Date : 16 October 2018 15:49:10
File Name :P:\PROJECTS\2414 LOCHLUICHART EXTENSION II EIA\CAD\01-WORKING\01_01-DRAWINGS\2414_DR_ALR_0001

Project Title: LOCHLUICHART EXTENSION II ABNORMAL LOAD ROUTE ASSESSMENT	Drawing Title: PC/07 A835 ACHILTY HOTEL	Purpose of issue: FOR INFORMATION	
Client: INFINERGY		Designed: KL / Drawn: KB / Checked: KL / Approved: TAT	
		Arcus Internal Project No.: 2414	Date: 01/10/18
		Scale @ A3: 1:1000	

Drawing Number: 2414_DR_ALR_0007
Rev: -

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ARCUS

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

1. AUTOMATIC REAR WHEEL STEERING USED UNLESS OTHERWISE INDICATED.
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 67.0m BLADE DELIVERY VEHICLE
5. ANALYSIS BASED ON OS MASTERMAP. WHERE REQUIRED TOPOGRAPHICAL SURVEY TO BE UNDERTAKEN AND USED AS A BASIS FOR DETAILED DESIGN.
6. A 0.75m FACTOR OF SAFETY INDICATED OUTSIDE OVERRUN AND OVERSAIL AREAS FROM THE EXTENT OF VEHICLE SWEPT PATH. THIS IS TO PROVIDE A FACTOR OF SAFETY AND TO INDICATE THE AREA WHICH SHOULD BE ALLOWED FOR IN ORDER TO PROVIDE A MARGIN OF ERROR DURING DELIVERY.

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA.

APPROXIMATE LOCATION OF PLASTIC BOLLARDS. TO BE RELOCATED

Black Water

Craigdarroch Cottages

Track

Track

Heap (dis)

rkings (dis)

33.8m

N

Plot Date : 16 October 2018 15:49:16
File Name :P:\PROJECTS\2414 LOCHLUICHART EXTENSION II EIA\CAD\01-WORKING\01_01-DRAWINGS\2414_DR_ALR_0008

Project Title: LOCHLUICHART EXTENSION II ABNORMAL LOAD ROUTE ASSESSMENT	Drawing Title: PC/08 NORTH OF ACHILTY	Purpose of issue: FOR INFORMATION	
Client: INFINERGY		Designed: KL; Drawn: KB; Checked: KL; Approved: TAT	
		Arcus Internal Project No.: 2414	Date: 01/10/18
		Scale @ A3: 1:1000	

Drawing Number: 2414_DR_ALR_0008	Rev: -

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LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

1. AUTOMATIC REAR WHEEL STEERING USED UNLESS OTHERWISE INDICATED.
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 67.0m BLADE DELIVERY VEHICLE
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Blackwater Cottages

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA

A 835

GROUND STEEPLY SLOPING UP FROM CARRIAGEWAY EDGE. TOPOGRAPHICAL SURVEY RECOMMENDED TO ESTABLISH CLEARANCE FROM LOAD.

N

Project Title
LOCHLUICHART EXTENSION II
ABNORMAL LOAD
ROUTE ASSESSMENT

Client
INFINERGY

Drawing Title
PC/09
A835/LOCH GARVE

Purpose of issue
FOR INFORMATION

Designed	Drawn	Checked	Approved
KL	KB	KL	TAT

Arcus Internal Project No.
2414

Date
01/10/18

Scale @ A3
1:1000

Drawing Number
2414_DR_ALR_0009

Rev
-

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Plot Date : 16 October 2018 15:49:23
File Name :P:\PROJECTS\2414 LOCHLUICHART EXTENSION II EIA\CAD\01-WORKING\01_01-DRAWINGS\2414_DR_ALR_0001

LOAD BEARING SURFACE TO BE LAID IN OVERRUN AREA

MANUAL REAR WHEEL STEERING REQUIRED TO NEGOTIATE POINT OF CONSTRAINT.

261m

CG

N

LEGEND:

- VEHICLE
- VEHICLE WHEEL TRACK
- VEHICLE OVERHANG
- LOAD
- LOAD OVERHANG
- EXTENT OF VEHICLE OVER-RUN
- EXTENT OF LOAD OVERHANG

NOTES:

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Project Title
LOCHLUICHART EXTENSION II
ABNORMAL LOAD
ROUTE ASSESSMENT

Client
INFINERGY

Drawing Title
PC/10
A835/SITE ENTRANCE

Purpose of issue
FOR INFORMATION

Designed	Drawn	Checked	Approved
KL	KB	KL	TAT

Arcus Internal Project No.
2414

Date
01/10/18

Scale @ A3
1:1000

Drawing Number
2414_DR_ALR_0010

Rev
-

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Plot Date : 16 October 2018 15:49:29
File Name :P:\PROJECTS\2414 LOCHLUICHART EXTENSION II EIA\CAD\01-WORKING\01_01-DRAWINGS\2414_DR_ALR_0001