



## **H. Mott Macdonald M65 Outline Drainage Strategy (35786/04/A)**



# **Cuerden**

## Outline Drainage Strategy

28 February 2017



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# Cuerden

## Outline Drainage Strategy

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## Executive summary

The proposed improvements to the highway network can be readily accommodated with minor adjustments to the existing drainage system.

The drainage strategy includes relocation of carrier drains and fin drains in the affected areas combined with a new drainage system for the new site access arm constructed on the existing roundabout.

The need for flow control and attenuation storage will be explored during the detailed design stage and appropriate parameters will be agreed with the approving bodies.

Collector systems will generally be new road gullies but within certain areas the existing gullies or kerb drainage blocks will be retained.

Flows will generally be routed to existing outfalls as shown on Drawing No. MMD-357876-C-DDR-00-0002.



# 1 Introduction

## 1.1 General

Maple Grove Developments Ltd intend to construct a mixed-use development adjacent to the Cuerden Roundabout on the M65/M6 junction south of Preston. The development will include a retail outlet, housing, offices, industrial units, and other elements. The main site entrance will be from the roundabout via the construction of a new roundabout arm (dual carriageway).

The Cuerden roundabout forms the link between the M65/M6 and a roundabout linking the A583/A6.

Implementation of the development will require highway improvements to the M65 approaches and to the dual carriageway link road from the Cuerden (M65 termination and site access) roundabout to the roundabout lying on the A583/A6. Minor modifications to the roundabout circulatory carriageway will also be needed (close to the new roundabout arm).

The highway improvements consist of:

- The widening (over approximately 550m) of the westbound approach carriageway to provide two additional lanes within the existing (two lanes plus two wide hatched areas) carriageway. An additional single lane is needed to allow the provision of four lanes plus a central dividing strip. The carriageway is sited on an embankment to the south side and at or around existing ground level to the north (central reserve). New carriageway will be at or around top of embankment level constructed on the existing verge. The verge will be converted to carriageway changing the runoff rates and quantities.
- The widening of the northbound carriageway linking Cuerden roundabout to the roundabout on the A583/A6 (single lane over approximately 450m) allows a full three lane northbound approach to the A583/A6 roundabout. The new carriageway will lie at or around existing ground level and be constructed on an existing verge. Verge will be converted to carriageway changing the runoff rates and quantities. The impermeable area added is reasonably small and the changes are expected to be minor.
- The widening of the eastbound carriageway from the Cuerden roundabout to the approaches to the M65/M6 slip roads (approximately 340m). Much of the widening will lie on existing hard shoulder which may need extending slightly. A verge will also be provided. The existing carriageway is bounded by a landscape mound and any new construction will be in cutting. The existing hard shoulder will be converted to carriageway with little increase in impermeable area hence changes to runoff should be minor.
- The construction of the main site access from the Cuerden roundabout comprising a two lane exit from the roundabout and a three lane entry to the roundabout. A length of cutting will be needed to breach the landscape mound separating the main site area from the roundabout. This area is currently grass/landscaping and new drainage will be required. Green areas will be converted to highway changing runoff characteristics.
- Minor modifications (widening) to the circulatory carriageway of the roundabout. Here green areas will be converted to carriageway but the effect of the change is considered to be small.

The modifications described will affect the existing highway drainage layout and will generate additional flow. The proposed layout is shown on Drawing No. MMD-357876-C-DDR-00-0002 included as Appendix A.

## 1.2 Highway and Outfall Administration Body

The highways under consideration are controlled and maintained by different authorities as outlined below:

### **Approach and Link from the Cuerden Roundabout to/from M65/M6**

This section of highway falls under the control of Highways England whose framework (Area 10) contractor (Balfour Beatty Mott MacDonald) are expected to undertake any review and acceptance of designs produced. Highways England may also consult with Lancashire County Council. Agreement from both bodies will be required.

The drainage outfall for this section of carriageway is to a watercourse lying to the west of Cuerden Roundabout (This watercourse appears to discharge to the River Lostock to the North of the proposals). The outfall watercourse is not designated as main river but the River Lostock is.

Any changes to discharges to the watercourse and/or details of the outfall will need to be agreed with Highways England and Lancashire County Council (Highway Authority and as Lead Flood Authority).

### **Link from Cuerden Roundabout to Roundabout on A583/A6.**

This area is administered by Lancashire county Council who may consult with Highways England regarding any proposed work.

The location of the outfall to the drainage network is not known but is assumed to be to a watercourse in the area and this will ultimately discharge to the River Lostock to the north. Lancashire County Council are understood to be the Highway Authority and the Lead Flood Authority.

## 2 Existing Drainage Network

### 2.1 Westbound approach to Cuerden Roundabout.

Highway drainage is by gullies situated adjacent to the southern kerb line. Those gullies discharge to a carrier drain and manholes situated to the rear of that kerb line.

A fin drain is also sited to the rear of this kerb line.

In sections of widening the existing pipe diameter is shown as 300mm/375mm. The larger diameter pipe extends around the outside of Cuerden Roundabout to discharge to an outfall to the west. The pipe appears to cross an existing culvert feeding the open watercourse which crosses the central island to reach the joint outfall at the watercourse.

A ditch is also present in the south-east quadrant of the roundabout. This may need to be re-cut if affected by earthworks.

The proposed widening will lie above the existing carrier pipe and associated fin drain.

### 2.2 Northbound Carriageway linking Cuerden roundabout to A583/A6.

Drainage consists of kerb block drainage forming the western kerb line of the central reserve, this is assumed to connect to a drain situated behind the western kerb line of the dual carriageway (no connections are shown on the record drawings). Flow is routed northward toward the A583/A6 roundabout.

Pipe size is recorded as being 225mm diameter changing to 375mm close to the A583/A6 roundabout where flows from the eastern carriageway connect to the outfall.

Road widening will not affect the kerb block drain on the central reserve but will affect the 225mm diameter carrier drain.

### 2.3 Eastbound approach to M65/M6

Highway drainage consists of a short length of kerb drain (close to Cuerden Roundabout) drained to a surface water drain to the north side of the carriageway. The remainder of the area drains to gullies on the southern kerb line with a carrier pipe being situated behind that kerb. The pipe size is shown as being 225mm and 300mm in the affected area. A fin/filter drain is provided close to this pipe and one is also situated behind the northern kerb line.

The area is served by a pipe situated within the central reserve, this crosses the roundabout circulatory carriageway to reach the main outfall.

Widening takes place behind the northern kerb line affecting the existing fin/filter drain.

### 2.4 The proposed site entrance

No existing drainage is present serving the access but the existing 375mm carrier pipe and fin drain will pass beneath the proposed new carriageway and will require protection.

## **2.5 Circulatory carriageway extension.**

This additional area of carriageway replaces part of the grassed central island. The existing roundabout kerb line is drained via gullies and a fin drain, both discharge to a pipe which crosses the circulatory carriageway to connect to the main outfall.

## 3 Drainage Strategy

### 3.1 Westbound approach to Cuerden roundabout.

The existing 300mm pipe and fin drain will be affected by the carriageway extension. The strategy assumes that the carrier pipe is relocated to the south of the new kerblines. A new fin drain will be included to provide formation drainage.

The assumption is made on the basis that to leave the existing carrier drain and manholes operational would leave manholes within a high speed operational carriageway. This is considered to present a significant risk in terms of maintenance.

Gullies will be provided as collectors, broadly at a spacing to be determined in accordance with the Highway Design Manual HA 102/00. These will be provided adjacent to the southern kerb line and adjacent to the northern kerb line of the divider strip between the four westbound lanes.

Both sets of gullies will be connected to the re-located carrier drain which will be upsized as appropriate following design checks on capacity of the existing 375mm diameter carrier pipe extending to the outfall.

Flows will increase, an approximate calculation would suggest that the increased impermeable area is approximately 1900 sq. m. This area would produce approximately 26 l/sec based on a flat rate rainfall of 50mm/hour (rational method).

As a comparison, a 375mm diameter pipe can deliver 141l/sec at a gradient of 1 in 200 and 166 l/sec at a gradient of 1 in 150 (Roughness factor 0.6).

It should also be noted that the existing system will not have been designed to current standards. No attenuation features are present and it is likely that no allowance for climate change will have been made when assessing discharges/pipe sizes.

Discussions with the highway Authorities and the Lead Flood Authority will be required to determine what parameters are to be used and whether any flow control will be required.

If necessary, this could be accommodated by:

Applying flow control at the connection of the new relocated carrier pipe to the existing 375mm diameter outfall pipe by means of a hydrobrake. Attenuation could be provided upstream in upsized pipes or modular storage units.

If attenuation was required, then only flows from the increased areas should be attenuated leaving existing flows un-attenuated. Hence the storage provided would only cater for flows from the carriageway extension as follows.

Existing Flow = say  $X$  l/sec (un-attenuated)

Revised total Flow =  $X$  plus flow from extended carriageway say 24 l/sec =  $X + 24$  l/sec

Pass forward flow for carriageway extension 5 l/sec with 19 l/sec held (at peak, based on smallest reasonable hydrobrake orifice diameter)

Hydrobrake pass forward flow would be  $X$  plus 5 l/sec.

Exact figures would need to be agreed with the approving bodies but we are of the opinion that this is an equitable approach as it sizes any required storage at a reasonable level bearing in mind the current situation (No attenuation for all carriageway areas).

### **3.2 Northbound Carriageway linking Cuerden roundabout to A582/A6.**

The situation here is that verge is converted to carriageway. The existing carrier drain would need to be relocated for the reasons outlined above. The collector system, kerb drainage blocks on the central reserve would be retained after cleaning.

Capacity checks would be required to determine whether a relocated 225mm diameter pipe could accommodate the small increases in flow for approximately 650m<sup>2</sup> of extended carriageway.

This extended carriageway would generate a peak flow of approximately 9 l/sec. A 225mm dia. pipe could accommodate 36.5 l/sec or 42 l/sec at 1 in 200 or 1 in 150 respectively.

The outfall point is a 375mm diameter sewer close to the roundabout on the A583/A6.

If, because of discussions with the Lead Flood Authority and Highway Authority flow control and storage was required then the principles outlined in section 3.1 are considered reasonable and here, the original flow plus 5l/sec would constitute the pass forward flow from the hydrobrake. Storage would be provided in oversized pipes or in modular units.

### **3.3 Eastbound approach to M65/M6**

Although an additional 650m<sup>2</sup> of carriageway is provided this, in the main, constitutes existing hard shoulder which is currently impermeable. Only a small increase in flow may arise from any minor carriageway extension into the existing verge.

The change is minimal and as the area currently drains toward gullies situated adjacent to the existing central reserve, (with a small section draining to the northern kerb line close to the roundabout) no changes are proposed to the central reserve carrier drain but the northern fin/filter drain will need to be relocated and re-connected.

### **3.4 The proposed site entrance**

A new drainage system including gullies and carrier pipes will be required for the proposed site entrance. Gully positions, spacing and the location of the carrier drain will be determined once road levels are fixed.

The additional area of pavement (approximately 2100m<sup>2</sup>) will generate approximately 29l/sec, this will be carried by a new highway drain to the existing outfall point. The connection will be direct to the existing watercourse via a new headwall.

This drainage will ultimately (when onsite highways are constructed and adopted) be maintained by the Highway Authority and as it is new will be controlled, discharges being limited to Green Field Flow (in this case 5 l/sec because of the small area under consideration).

Storage will be required in the form of oversized pipes or modular units and a bypass petrol interceptor will be needed prior to the outfall.

Pipe size would be of the order of 225mm or 300mm dependent on gradient available and whether oversized pipes are to be used. Storage required would be of the order of 100 to 130 m<sup>3</sup> calculated using the tools on the UK Sustainable Drainage website.

### 3.5 Circulatory carriageway extension.

The existing 225mm diameter pipe carrier drain and associated fin drain will require diversion to the rear of the new kerb line. New gullies and connections will be provided to serve the extended carriageway.

The increased impermeable area is small, of the order of 300m<sup>2</sup> which would generate approximately 4l/sec. This increased flow is assumed to be discharged to the existing system with no alteration, other than the diversion of the existing drain.

No attenuation is proposed (subject to discussions with the approving bodies).

All work described in the above sections is shown on drawing No MMD-357876-C-DDR-00-0002 included as Appendix B.

## 4 Drainage Design Standards and Specification

Drainage design will follow the guidance set down in the Design Manual for Roads and Bridges Volume 4 Section 2 Drainage. The design will, if required, be certified in accordance with HD 50/16.

Subject to agreement design parameters will be in accordance with HD 33/16:

- No surcharge 1 in 1 year
- No flooding 1 in 5 year
- 1 in 100-year check on flood risk of the receiving waterbody.
- Factors for climate change to be agreed (if required under the circumstances possibly 20% increase in rainfall intensity) for extended areas only, as the original system will not have been designed for climate change.

Drainage details will generally comply with the Highway Construction Details or other appropriate guidance such as Sewers for Adoption.

The specification for drainage systems will be “The Specification for Highway Works” or other appropriate documents such as Sewers for Adoption or the Civil Engineering Specification for the Water Industry.

Design parameters will, due to the nature of the work (minor adjustments to existing major highways) must be agreed with the approving bodies, the design does not generally constitute a standard highway drainage design.

In this instance capacity and flow generation from the existing carriageway significantly exceeds the changes proposed.

It would (in our view) be inequitable to apply current standards, in effect retrospectively to an existing situation particularly in respect of flow control and storage.



## 5 Surveys and Future Investigations

It is recommended that all manholes affected by the proposed work be inspected as part of a comprehensive CCTV survey of the associated pipework including those pipelines extending to the outfall headwall or manhole.

The survey will inform future design stages and will need to record cover levels, invert levels manhole layout/connectivity and condition.

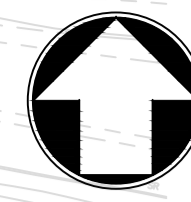
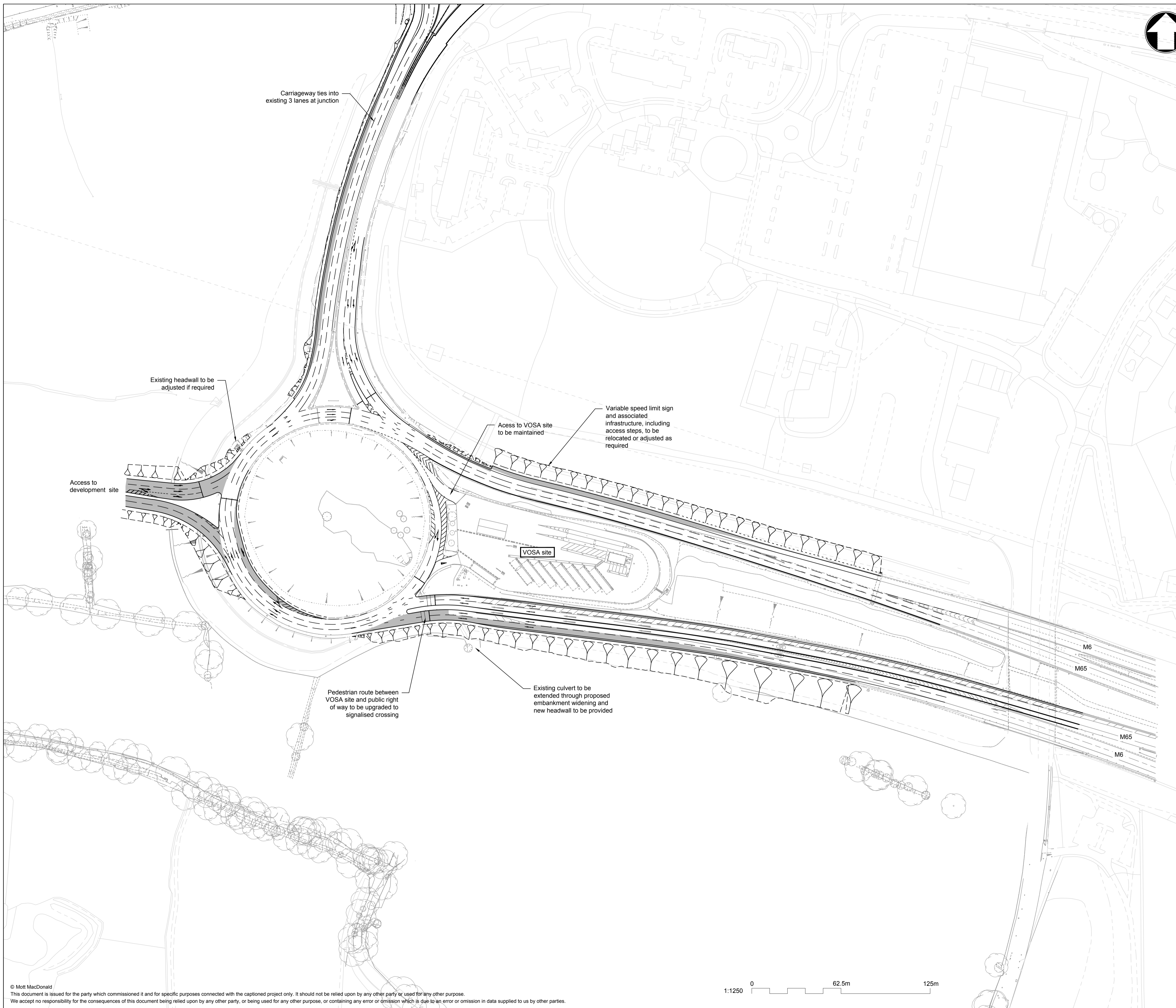
The extents of the survey required will be confirmed at a later date.

# Appendices

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## A. Appendix A Proposed Site Layout





- Notes
1. All units are in metres unless specified.
  2. All earthworks slopes shown at 1 in 3. Earthworks profile may be reduced subject to ground conditions.
  3. Drawing based on topographic survey by Premier Surveys Ltd, September 2014.
  4. Indicative road markings are shown. Lane allocation and road marking layout to be developed in conjunction with signing strategy.

Key to symbols

- Carriageway Widening
- Top of embankment
- Base of embankment

Reference drawings

P2	13.12.2016	TB	Single Option Shown	KR	MB
P1	23.11.2016	TB	First Issue	KR	MB
Rev	Date	Drawn	Description	Ch'k'd	App'd

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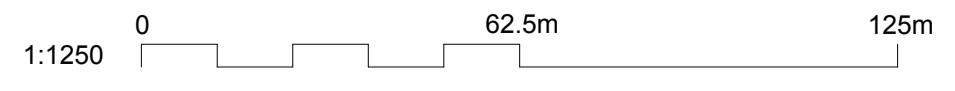
Maple Grove Developments Ltd  
Sceptre House  
Sceptre Way  
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Preston  
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Title

**Cuerden  
Proposed Site Layout  
General Arrangement Overview**

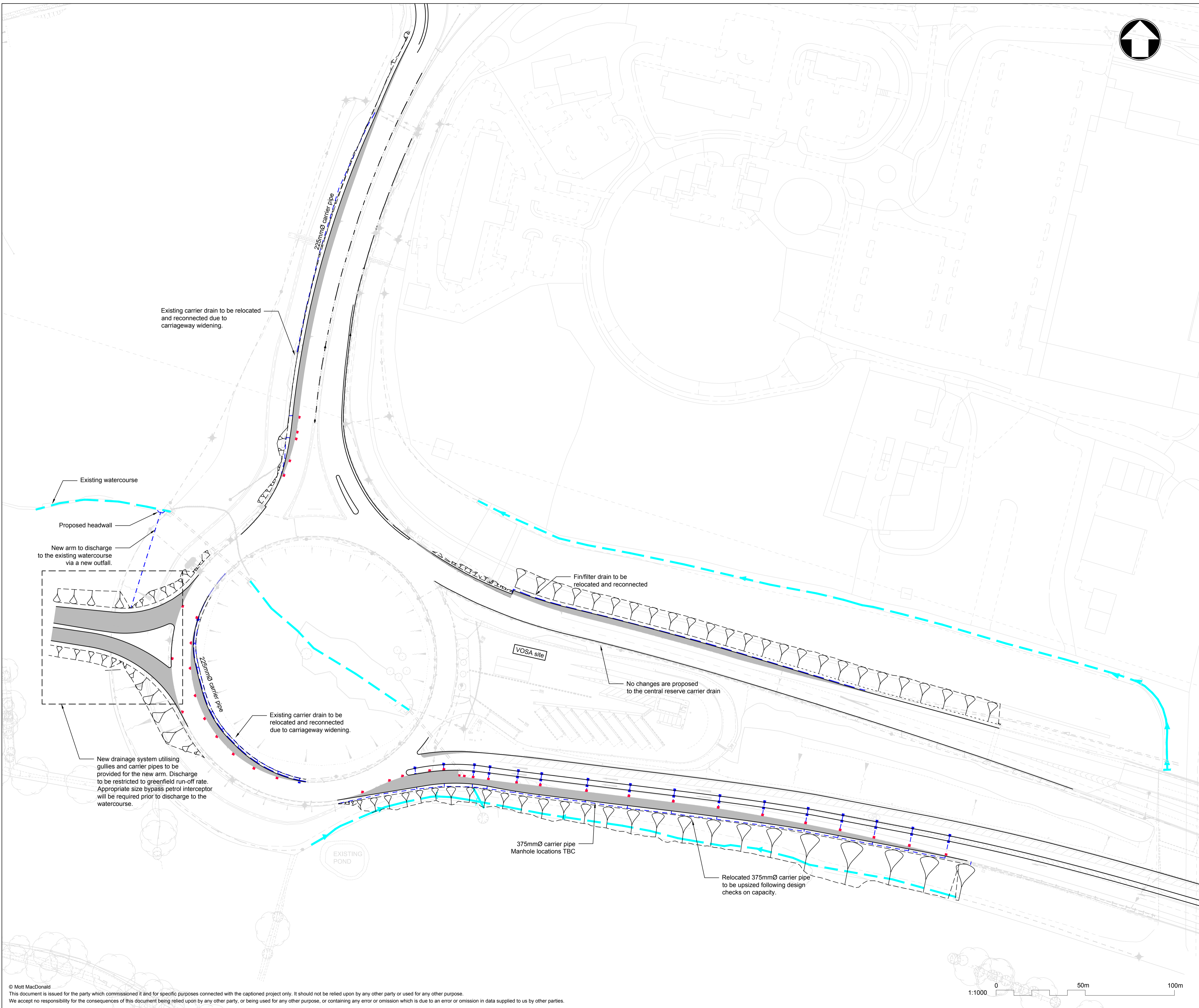
Designed	P Whittaker	PW	Eng check	K Radband	KR
Drawn	T Bowman	TB	Coordination	K Radband	KR
Dwg check	K Radband	KR	Approved	S Alexander	SA
Scale at A1	1:1250	Status	PRE	Rev	P2
		Security			STD

Drawing Number  
**MMD-357876-C-DDR-00-0007**





## **B. Appendix B Drainage Strategy Plan**



- Notes**
- All units are in metres unless specified.
  - All earthworks slopes shown at 1 in 3. Earthworks profile may be reduced subject to ground conditions.
  - Drawing based on topographic survey by Premier Surveys Ltd, September 2014.
  - Indicative road markings are shown. Lane allocation and road marking layout to be developed in conjunction with signing strategy.
  - Drawing shows the proposed drainage network which is subject to change upon detailed design.

**Key to symbols**

	Carriageway widening
	Top of embankment
	Base of embankment
	Existing ditch
	Existing fin drain
	Proposed fin drain
	Existing carrier drain
	Proposed carrier drain
	Existing combined kerb drainage
	Existing headwall
	Proposed headwall
	Existing gully to be retained
	Existing gully to be abandoned
	Proposed gully
	Existing catch pits
	Existing manholes
	Existing interceptor

**Reference drawings**

MMD-375876-C-DDR-00-0007 - General Arrangement Overview

P1	28.02.17	PA	First Issue	RQ	MB
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Cuerden  
 Drainage Strategy  
 General Overview

Designed	G Bolton	GAB	Eng check	R Quadery	RQ
Drawn	P Allotey	PA	Coordination	K Radband	KR
Dwg check	R Quadery	RQ	Approved	S Alexander	SA
Scale at A1	Status	Rev	Security		
1:1000	PRE	P1	STD		
Drawing Number	MMD-375876-C-DDR-00-0002				

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