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<td>Date</td>
<td>16/02/2018</td>
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<tr>
<td>Made by</td>
<td>Nick Banks</td>
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<td>Checked by</td>
<td>Jonathan Plan</td>
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<td>Approved by</td>
<td>Steve Chewins</td>
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<td>Description</td>
<td>Drainage Strategy and Flood Risk Assessment</td>
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1. INTRODUCTION

1.1 Purpose and Objective

The purpose of this document is to outline the drainage strategy for the proposed Parkside Link Roads and to assess the level of Flood Risk.

The Parkside Link Road scheme includes the provision of two new sections of single carriageway as follows:

- Parkside Link Road West: Connecting A49 Winwick Road at a proposed new traffic signal controlled junction with A573 Parkside Road again at a new traffic signal controlled junction.
- Parkside Link Road East: Connecting A573 Parkside Road at a new offline roundabout with A579 Winwick Lane, again with a new offline roundabout.

A new dual two lane carriageway will be constructed to connect the M6 Junction 22 roundabout to the new roundabout at the junction of Parkside Link Road East with A579 Winwick Lane.

The route location is shown in Figure 1.1.

Section 2 of this report outlines the existing surface water regime for the areas along the link roads. Using this understanding, Section 3 of this report outlines a surface water strategy for the proposed Parkside Link Road - identifying catchments, attenuation, proposed outfalls and discharge limits.

Section 4 of this report assesses the Flood Risk on the development which considers the existing watercourses, level of flood risk and impact on the proposed link roads.
2. **EXISTING SURFACE WATER ASSESSMENT**

2.1 **Existing Hydrology**

From topographical information and the previous hydrological and drainage assessment, it is apparent that the hydrology of the development can be split into two main catchments, East and West of the M6. Existing watercourses and drainage catchments are detailed on drawing **PD-RAM-01-00-DR-C-0551** – **Drainage Strategy**.

2.2 **West of the M6**

The route of the Parkside Link Road West passes through the former Parkside Colliery site, running east to west between A49 Winwick Road and A573 Parkside Road. A small proportion of the road crosses hard standing areas within the former colliery site, however the majority of the proposed road is across permeable land.

Drainage records show there is a significant amount of existing drainage within the site which is indicated as draining to Oswald’s Brook to the south or Newton Brook to the east. The general lay of the land falls south to Oswald’s Brook which is classified as a Main River. Parts of the site drain to an Ordinary Watercourse that joins Oswald’s Brook.

Drainage surveys have not been undertaken to confirm the extent or outfalls of the existing drainage in this area. Drainage surveys will be undertaken as required for LLFA approval.

A search of public sewer records identifies a Untied Utility Surface Water Sewer within the A49, to the east of the site.

A site visit confirms a number of existing highway gullies on the A49 at the junction with the existing Parkside access. The outfall of these gullies is unknown.

2.3 **East of the M6**

The route of the Parkside Link Road East crosses two natural catchments and runs through predominantly open agricultural land. The northern catchment general falls to the North West but with no apparent outfall or watercourse in the area it is assumed the land drains via infiltration.

Environment Agency Records show that this area is within Groundwater Source Protection Zone 3.

A search of public sewer records has not identified any public sewers within this area. Existing highway drainage (gullies and manholes) are present although it is not known where these outfall to and no details are available.

The southern catchment consists mainly of agricultural land which falls to the south east towards the Main River Cockshot Brook. Site surveys have located a drainage outfall below Winwick Lane near the property Glendale. This pipe runs to an Ordinary Watercourse upstream of Cockshot Brook. This outfall is believed to collect highway and land drainage.

A search of public sewer records has not identified any sewers within this area.
2.4 Greenfield Runoff Rates

The existing Greenfield Runoff Rates (GFR) for the two main catchments have been assessed using the online HR Wallingford Greenfield Runoff Estimation Tool, these are shown in Table 2.1

<table>
<thead>
<tr>
<th>Qbar</th>
<th>West of M6 (l/s/ha)</th>
<th>East of M6 (l/s/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.13</td>
<td>6.13</td>
<td>6.13</td>
</tr>
</tbody>
</table>

3. PROPOSED LINK ROAD DRAINAGE STRATEGY

3.1 Drainage Strategy

The proposed Parkside Link Road will be drained by new dedicated highway drainage systems. The proposed highway drainage systems will follow Sustainable Urban Drainage techniques to improve quality and reduce peak flow. Discharge rates from proposed drainage networks that outfall to watercourses will be limited to the equivalent (GFR) of the catchment or the practical minimum flow restriction to avoid blockages of 5L/S, whichever the greater.

The proposed drainage strategy is detailed on drawing PD-RAM-01-00-DR-C-0551 – Parkside Link Road Drainage Strategy. Descriptions of the proposed highway drainage networks are discussed in the remainder of this section.

Land to the north and south of Parkside Link Road (ch 0 and ch750) will be developed in the future. Initial discussions regarding the future development drainage has identified potential discharge of surface water to Oswald’s Brook. It has been agreed that a cross drain shall be included within the Parkside Link Road West to accommodate this future need.

3.2 Proposed Parkside Link Road West Highway Drainage Networks

Parkside Link Road West can be separated into four highway drainage networks.

Highway Network 1 - A49 Junction to Ch. 18 - 200 – (A-1) Will be drained via a series of gullies to a swale. The restricted run-off will be attenuated via a swale prior to discharge into the existing United Utilities (UU) surface water sewer in the A49. Flow will pass through a catchpit prior to connection to the Public Sewer to provide silt protection.

The proposed connection to the UU sewer has not been agreed and is to be confirmed. If the proposed connection to the UU sewer in not granted then two alternative outfalls are available. The first alternative is to discharge to Oswald’s Brook via a new standalone outfall. The second alternative is to connect into existing highway drainage network, however details of the network would need assessed to confirm if this is a viable option.

Highway Network 2 Ch. 200 – 992 – (A-2) Will be drained via a series of gullies to a new swale adjacent to the link road. The restricted run-off will be attenuated by swales and a pond prior to out-falling to Oswald’s Brook via a new outfall. The catchment includes the majority of the highway cutting runoff which will be collected by a filter drain and swale.

Highway Network 3 Ch. 992 – 1075 (A-3) - Will be drained via a series of gullies to a new swale adjacent to the link road. The restricted run-off will be attenuated by swales prior to out-falling to discharge to the Ordinary Watercourse upstream of Oswald’s Brook. The catchment includes the part of the highway cutting runoff which will be collected by a filter drain and swale.
**Highway Network 4** Ch. 1075 – 1440 (A-4) - Will be drained via a series of gullies to a new swale adjacent to the link road. The restricted run-off will be attenuated by a swale prior to out-falling to the Ordinary Watercourse upstream of Oswald’s Brook.

### 3.3 Proposed Parkside Link Road East Highway Drainage Networks

Parkside Link Road East can be separated into two highway networks, 5 and 6.

**Highway Network 5** – this consists of the proposed Winwick Lane dual carriageway, roundabout, tie-in to old Winwick Lane and approximately 400m of new link road (A-5) - this will be drained via a series of gullies into new swales adjacent to the road. The discharge from the highway drainage network will be limited to 5 l/s – refer Section 3.4. The discharge from the proposed highway drainage network will flow to the Ordinary Watercourse upstream of Cockshot Brook.

Construction of the road will affect existing land drainage. The road design includes toe of embankment drainage and culverts to intercept overland flow and convey it to the Ordinary Watercourse upstream of Cockshot Brook. So as not to increase pass forward flow to the Ordinary Watercourse the proposed Winwick Lane culvert (below the proposed road) has been design to have the same full bore capacity as the existing outfall pipe.

Note: any future development of land adjacent to the proposed link road that requires discharge of surface water will need to consider the effect on total pass forward flow to the Ordinary Watercourse upstream of Cockshot Brook. Any such arrangement will need to be developed with SHC – however the proposed design includes surface water routes (swales and culverts) to make such a connection possible.

**Highway Network 6** - The new Parkside Road, roundabout and approximately 420m of new link road south east of the new roundabout (A-6) - will be drained via a series of gullies to new swales adjacent to the road. Discharge of this run-off will be via infiltration within the swales and an infiltration basin located in the vicinity of the new Parkside Road roundabout.
3.4 Assessment of Catchments and discharge rates

The greenfield run-off rate (GFR) for each highway catchment has been calculated using Qbar (6.13 l/s) – see Tables 3.1 to 3.6. The proposed discharge rates from the highway drainage are detailed below:

**Highway Network 1**
It is proposed to outfall highway drainage network 1 to a United Utilities sewer within the A49 Winwick Road. The total contribution area to this outfall is given in Table 3.1 below.

With a GFR of 2.5 l/s a maximum discharge rate of **5 l/s* is proposed to meet the practical minimum flow restriction, however agreement to make this connection has not yet been received from United Utilities.

| Table 3.1 – Highway Network 1 Catchment |
|-----------------|--------|------|
| Ref  | Area (ha) | GFR (l/s) |
| A-1  | 0.41       | 2.5   |
| **Total** | **0.41**       | **2.5**   |

*Proposed maximum discharge rate requires written approval with United Utilities

**Highway Network 2**
It is proposed to outfall highway drainage network 2 to Oswald’s Brook. The total contribution area to this outfall is given in Table 3.2 below.

A maximum discharge rate of **15.3 l/s** is proposed based upon the greenfield runoff rate, initial discussions with the Environment Agency have indicated this is acceptable however formal agreement has not yet been sought.

| Table 3.2 – Highway Network 2 Catchment |
|-----------------|--------|------|
| Ref  | Area (ha) | GFR (l/s) |
| A-2  | 2.5       | 15.3  |
| **Total** | **2.5**       | **15.3**   |

**Highway Network 3**
It is proposed to outfall highway drainage network 3 to the Ordinary Watercourse upstream of Oswald’s Brook. The total contribution area to this outfall is given in Table 3.3 below.

With a GFR of 1.2 l/s a maximum discharge rate of **5 l/s** is proposed to meet the practical minimum flow restriction, initial discussions with St Helens Council have indicated this is acceptable, however formal agreement has not yet been sought.

| Table 3.3 – Highway Network 3 Catchment |
|-----------------|--------|------|
| Ref  | Area (ha) | GFR (l/s) |
| A-3  | 0.2       | 1.2   |
| **Total** | **0.2**       | **1.2**   |

**Highway Network 4**
It is proposed to outfall the highway drainage from network 4 to the Ordinary Watercourse upstream of Oswald’s Brook. The total contribution area to this outfall is given in Table 3.4 below.

With a GFR of 3.1 l/s a maximum discharge rate of **5 l/s** is proposed to meet the practical minimum flow restriction, initial discussions with St Helens Council have indicated this is acceptable, however formal agreement has not yet been sought.
### Table 3.4 – Highway Network 4 Catchment

<table>
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<tr>
<th>Ref</th>
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<tr>
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**Highway Network 5**

It is proposed to outfall highway drainage network 5 to the Ordinary Watercourse upstream of Cockshot Brook. The total contribution area to the highway network is given in Table 3.5 below.

It is estimated that the existing outfall pipe flowing to the Ordinary Watercourse has a capacity of 95 l/s. To maximise discharge potential for future development, the discharge from the proposed link road will be limited to 5 l/s**, thus providing approximately 90 l/s of available capacity within the existing outfall pipe for drainage of the remaining catchment and flow from future development.

### Table 3.5 – Highway 5 Network Catchment

<table>
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<th>Ref</th>
<th>Area (ha)</th>
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</thead>
<tbody>
<tr>
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<td>11.22</td>
</tr>
<tr>
<td>Total</td>
<td>1.83</td>
<td>11.22</td>
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</table>

**Proposed maximum discharge rate set at 5 l/s to maximise free capacity within existing outfall pipe – rate to be agreed with Warrington Borough Council.

**Highway Network 6**

It is proposed to outfall highway drainage network 6 via an infiltration system. The total contribution area to this outfall is given in Table 3.6 below.

The infiltration system will consist of an infiltration basin to provide both an infiltration area but also a storage volume. Preliminary infiltration tests have indicated infiltration rates of 1 x10-6 m/s should be used for design.

### Table 3.6 – Highway Network 6 Catchment

<table>
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<th>Ref</th>
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<th>GFR (l/s)</th>
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<tr>
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### 3.5 Proposed Surface Water Attenuation

With the catchments and discharge rates defined, outline drainage networks have been modelled using Microdrainage software to estimate the required attenuation volume for 100 year Storm Return Periods with 40% climate change allowance. The results are given below:

**Highway Network 1**

This arrangement requires a surface water storage volume of approximately **175m3** assuming a maximum discharge rate of 5 l/s is permitted to the Public Sewer.
Highway Network 2

This arrangement requires surface water storage of volume of approximately \(1400\text{m}^3\) within the proposed pond assuming a maximum discharge rate of \(15.3\ \text{l/s}\) is permitted into Oswald’s Brook.

Highway Network 3

This arrangement requires a surface water storage volume of approximately \(15\text{m}^3\) assuming a maximum discharge rate of \(5\ \text{l/s}\) is permitted from the Highway into the Ordinary Watercourse upstream of Oswald’s Brook.

Highway Network 4

This arrangement requires a surface water storage volume of approximately \(225\text{m}^3\) assuming a maximum discharge rate of \(5\ \text{l/s}\) is permitted from the Highway into the Ordinary Watercourse upstream of Oswald’s Brook.

Highway Network 5

This arrangement requires a surface water storage volume of approximately \(1800\text{m}^3\) assuming a maximum discharge rate of \(5\ \text{l/s}\) is permitted.

Highway Network 6

Modelling has determined that this arrangement requires a surface water storage volume of approximately \(2000\text{m}^3\) assuming an infiltration rate within the basin of \(1\times10^{-6}\ \text{m/s}\). No outfall from the infiltration basin is proposed.
3.6 **Pollution control measures**

An initial assessment of the pollution risk to receiving water has been undertaken following HD45 – Road Drainage and the Water Environment.

The spill risk assessment of the proposed link roads, junctions and roundabouts has identified the risk of a spill incident as low.

Discharge of highway runoff to surface watercourses has been assessed using Highways Agency Water Risk Assessment Tool (HAWRAT). The assessment indicates that the impact on water quality from the proposed highway drainage network is at an acceptable level for receiving watercourses.

The proposed drainage systems include trapped gullies, grassed swales, catch pits and vegetated attenuation / infiltration ponds. These will provide passive water quality improvements to prior discharge to watercourses.

A discharge of highway runoff to groundwater assessment (not including any mitigation measures) has been undertaken and returned medium risk score.

Environment Agency records show the infiltration basin is within Groundwater Source Protection Zone (SPZ) 3 – see Figure 3.1.

Guidance within HD45 indicates that an infiltration system with a medium risk score located within SPZ 3 has potential for creating moderately adverse effects and may require mitigating measures to protect groundwater.

Further consultation with the Environment Agency is required to further assess the level of risk to groundwater from the proposed infiltration system and determine any mitigating measures required.

![Figure 3.1 – EA Ground Water Protection Zone Map extract](image-url)
4. ASSESSMENT OF FLOOD RISK

4.1 Flood Map For Planning

A review of The Environment Agency Flood Map For Planning identifies that both Parkside Link Road West and Parkside Link Road East are entirely within Flood Zone 1 – See Figure 4.1 & 4.1a below.

![Flood Map For Planning](image)

**Figure 4.1 – EA Flood Map For Planning extract (Parkside Link Road West)**

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The proposed Parkside Link Road West sits within Flood Zone 1. The nearest area of land that has a higher Flood Risk Level is approximately 420m south-west of the link Road.

The area of higher risk near Gallows Croft is designated as Flood Zone 3. The zone appears to cross the A49 approximately 520m south of the proposed junction with Parkside Link Road West.

The distance of Flood Zone 3 from the Parkside Link Road West indicates that road is not at risk of fluvial flooding.
The proposed Parkside Link Road East sits within Flood Zone 1. The nearest area of land that has a higher Flood Risk Level is approximately 500m west of the link road.

The area of higher risk is designated as Flood Zone 3 and is adjacent to Cockshot Brook.

The distance of Flood Zone 3 from the Parkside Link Road East indicates that road is not at risk of fluvial flooding.

An existing electricity substation is located 25m north of the proposed Parkside Link Road West around ch550. The proposed road levels adjacent to the substation vary between 27.35 and 27.60m AOD. The proposed road is partly constructed on a low embankment up to 300mm above existing levels. The existing ground level at the sub-station boundary is typically 27.70m AOD.

Although the proposed road adjacent to the substation higher than the existing levels, the finished road levels in this area are up to 250mm below the level of the substation boundary. As a result the proposed road will not increase the flood risk to the existing substation.
4.2 Flood Risk From Surface Water

A review of The Environment Agency Flooding Risk From Surface Water identifies that Parkside Link Road West passes close to areas prone to pluvial flooding although the road does not pass directly through the zones of flooding – See Figure 4.2 below.

Figure 4.2 – EA Flooding From Surface Water Map extract for Parkside Link Road West © Environment Agency copyright and database rights 2017. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100024198
A review of The Environment Agency *Flood Risk From Surface Water* identifies that Parkside Link Road East also passes near to areas prone to High, Medium and Low risk of pluvial flooding – See Figure 4.3 below.

![Figure 4.3 - EA Flooding from Surface Water Map extract for Parkside Link Road East](image-url)

*Figure 4.3 – EA Flooding from Surface Water Map extract for Parkside Link Road East*

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The proposed roundabout on Parkside Road is located adjacent to areas that have sporadic pluvial flood risk indicated by the blue shading. Figure 4.4 is an extract of the depth analysis of the surface water flooding in the area adjacent to the proposed Parkside Road roundabout.

The flood depths given in Figure 4.4 appear to be in the; below 300mm, and 300 to 900mm ranges, although the extent of this flooding is relatively small compared and some distance away from the road.

A review of the topographical survey in this area identifies that the ground is relatively flat, with levels varying between 32.30m and 32.80m AOD. This suggests that the maximum depth that surface water would accumulate to in this area is 500mm.

The proposed roundabout and roads in this area will be built on embankment with finished road levels a minimum of 500mm above existing ground level, therefore the existing level of pluvial flooding will not adversely affect the operation of the proposed road.

Figure 4.4 – EA Depth of Flooding From Surface Water extract at Parkside Road Roundabout
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The proposed roundabout on Winwick Lane is located in an area that has pluvial flood risk indicated by the blue shading. Figure 4.5 is an extract of the depth analysis of the surface water flooding in the areas adjacent to the proposed Winwick Lane roundabout.

The flood depths given in Figure 4.5 appear to be in the below 300mm, and 300 to 900mm ranges, and confined to north west of the proposed roundabout.

A review of the topographical survey in this area identifies a depression in the land to the west of Winwick Lane; the levels in this depression are approx. 28.50m, with Winwick Lane in the order of 29.30m AOD.

The topography suggests that the overland flow from the north-west would “pond” up to 800mm deep within this depression until it drains via existing land drainage or spills into the road, this correlates with the extents of flooding shown in Figure 4.5.

At present if the pluvial flood water spilt on to Winwick Lane it would likely drain away via the existing highway drainage or potentially run overland to the existing watercourse through the property Glendale.

The proposed road intercepts the identified pluvial flooding. To prevent pluvial flooding encroaching on to the highway the proposed design incorporates toe of embankment drainage and culverts. These ditches and culverts intercept and direct land run-off below the road to the existing outfall pipe below Winwick Lane. However, so as not to pass forward flows that will exceed the capacity of the existing Winnick Lane outfall pipe and increase flooding downstream, the ditch and culvert system has been design to have the same capacity as the existing outfall pipe.

Figure 4.5 – EA Depth of Flooding From Surface Water extract at Winwick Road Roundabout

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5. EFFECT OF PROPOSALS ON FLOOD RISK

5.1 Parkside Link Road West

The proposed drainage strategy for Parkside Link Road West will not increase the level of surface water run-off that enters the watercourses as a result of the flow control and attenuation measures provided with the design. As such the road will not adversely affect the existing flooding issues of Oswald’s / Newton Brook.

The proposed route of Parkside Link Road West is within Flood Zone 1 and so it neither affects nor is affected by the current extents of flooding in the area.

5.2 Parkside Link Road East

The proposed drainage strategy for Parkside Link Road East will not increase the level of surface water run-off that enters the watercourses as a result of the flow control and attenuation measures provided. As such it will not adversely affect the existing fluvial flooding identified on Cockshot Brook.

The proposed route of Parkside Link Road East is within Flood Zone 1 and so it neither affects nor is affected by the current levels of flooding in the area.

Based upon the Environment Agency’s Surface Water Flood Depth Mapping the proposed roundabouts at both ends of Parkside Link Road East may potentially affect the extents and routing of surface water flooding.

A review of the existing ground levels adjacent to the proposed Parkside Road Roundabout suggest the accumulation of surface water shown on the EA’s mapping is due to small local depressions within a flat area of land, although the exact reason has not been investigated. However the extents of this surface water flooding is small and intermittent any change that may result from the proposed road construction will be negligible.

A review of the existing ground levels adjacent to the proposed Winwick Lane Roundabout suggest the accumulation of surface water shown on the EA’s mapping is due to a local depressions adjacent to the Winwick Lane some 800mm higher. It is evident that surface water accumulates here as the runoff cannot drain via the existing land drainage quick enough.

The proposed highway design includes ditches and culverts to intercept and convey overland flow to the existing outfall pipe below Winwick Lane at a controlled rate so not the exceed the capacity of the existing outfall pipe downstream. The provision of this land drainage will prevent any overland flow affecting the proposed road.
6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The outline drainage design for Parkside Link Road will provide sustainable drainage systems that will not adversely affect the volume or quality of water entering the receiving waters. The proposed infiltration system is within SPZ 3 and requires consultation with the Environment Agency to establish mitigation measures.

Although the proposed highway drainage networks solely drain the proposed roads, the design includes provision for existing over land flow by way of toe of embankment drainage and culverts to maintain the existing land drainage regime.

The proposed link roads are within Flood Zone 1 and so are not adversely affected by fluvial flooding and do not impinge on any flood plain.

The existing electricity substation adjacent to Parkside Road West is 250mm higher than proposed road levels and so will not increase a flood risk of the substation.

The localised pluvial flooding identified adjacent to the Parkside Road and Winwick Lane roundabouts will not adversely affect the operation of the road due to the proposed road being above the indicated surface water flood depths and the provision of land drainage within the design.

6.2 Recommendations

Develop the outline highway drainage design following the principles identified in this strategy.

Undertake relevant consultations relating to surface water discharge in order to finalise the design and obtain the appropriate consents.
APPENDIX A

OUTLINE DRAINAGE STRATEGY DRAWING