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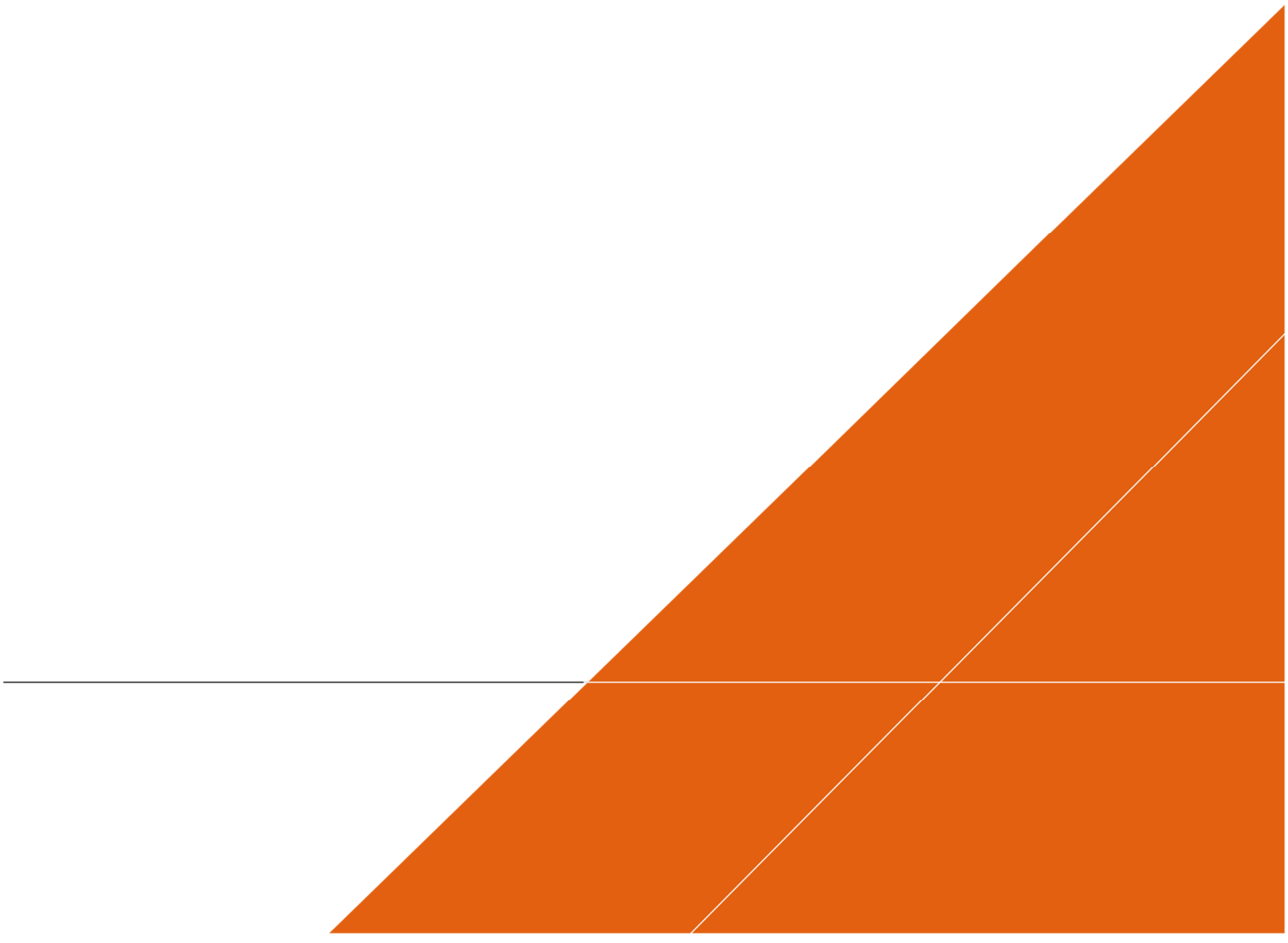
FIDDLERS FERRY, WARRINGTON - DEVELOPMENT FRAMEWORK, ALLOCATION SITE WIDE

Drainage Strategy

JANUARY 2024



Fiddlers Ferry, Warrington – Development Framework, Allocation Site Wide

Drainage Strategy

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P01	10/11/23	S Brown	First issue of new report updated from previously issued version 10057243-ARC-XX-XX-RP-CE-0005 – P06
P02	16/11/23	S Brown	Updated following Peel NRE comments
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Executive Summary

This drainage strategy has been prepared for the proposed development framework at the Fiddlers Ferry site to consider the proposed surface and foul water drainage.

The proposed surface water runoff utilises various Sustainable Drainage Systems (SuDS), to provide attenuation of surface water flows, preventing flooding within the site and downstream, and providing treatment of runoff. The foul drainage flows are connected to the existing pumping station within the current Fiddlers Ferry site.

The proposed surface water drainage system presented in this Drainage Strategy report considers separate solutions for the eastern residential & supporting community uses development phase and the western employment phases across the wider development area. The eastern strategy consists of plots discharging to multiple outfalls, with the western strategy of Phases 1, 2 and 3 discharging to a single outfall.

The eastern site will have a number of separate networks serving various proposed plots connecting to a watercourse through SuDS swale systems along the road corridors. The western site would utilise a single gravity drainage network accommodating connections from the proposed Phase 1, 2 and 3 developments.

Run-off from the majority of the eastern residential site will be directed along proposed swale corridors towards an existing ordinary watercourse running northwest to southeast though the development area. The existing watercourse that runs through the site links to the nearby River Mersey. The swale networks will require the construction of a new outfall into the ordinary watercourse. On-plot drainage will utilise SuDS techniques/systems to capture, store, treat and convey runoff to proposed swales or directly into the existing watercourse. Green space areas have been proposed throughout the site alongside the swales which will provide attenuation for the internal site road network and treatment of runoff, as well as wildlife & amenity benefits.

Run-off from the western employment site has been split into three phases, all of which will be directed to the Phase 1 drainage network and linked to the nearby River Mersey. This drainage network will include permeable paving in the car parking areas within development plots within Phase 1 to capture, provide filtration treatment, store and convey runoff. Attenuation for both Phase 2 & 3 connections to the network will also follow the same process of capture, store, treat and conveying of runoff before connecting to the Phase 1 network. In addition, a SuDS pond, swale and vortex separator chamber will be included within the Phase 1 works. These SuDS features will provide additional attenuation, improved treatment of runoff, wildlife & amenity benefits and ensure an exemplar SuDS arrangement is proposed for the site.

Overall, peak rates of surface water runoff from the site will be restricted, with flows from existing greenfield areas of the site limited to greenfield runoff rates, and runoff from existing brownfield areas of the site also limited to greenfield runoff rates, providing betterment to the surface water drainage regime for the whole development as each phase will be discharging to the receiving watercourse at a rate lower than it is currently.

Through the use of sustainable drainage systems, the increase in surface water runoff from the site will therefore be managed and attenuated onsite, for all storm events up to and including the 1 in 100-year rainfall events, including a 45% allowance for climate change. Pollution control measures are also included to minimise the risk of contamination or pollution entering the receiving water body from surface water runoff from the development. The proposed strategy therefore achieves the aims and objectives of both local and national planning policies.

The foul flows generated from the eastern residential development will be linked via gravity foul drainage networks which will connect to a new proposed pumping station located in the south-eastern corner of the site. Flows from the new pumping station will be directed to the existing pumping station located in the western employment development area near the retained substation building.

The western employment use development will link the proposed foul flows to the same existing pumping station via a new gravity foul drainage network. The proposed phase 1 employment site will convey flows to a proposed pumping station, which will then direct flows back to the existing (to be upgraded) pumping station located near the retained National Grid substation building. The existing foul pumping station that connects to the main sewer network located on the western boundary of the site would be upgraded and used the development.

1 Introduction

This report has been prepared by Arcadis Consulting (UK) Limited and commissioned by Peel NRE to set out a viable drainage strategy for the proposed foul and surface water drainage associated with the redevelopment of the former Fiddlers Ferry Power Station (FFPS) including agricultural land to the east (hereafter known as 'the site'). This report has been prepared in accordance with the requirements of Policies ENV2 (Flood Risk and Water Management) and MD3 (Fiddlers Ferry) of the adopted Warrington Local Plan 2002/23 to 2038/39 and supports the Development Framework relating to the redevelopment of the site.

2 Existing Site

2.1 Location

The site is comprised of land approximately 120 hectares in area and planned to be split into eastern residential and supporting community use development located on the agricultural land, and western employment use development located on the former power station.

As illustrated on Figure 1 below, the eastern area comprises the Residential Phase approximately 47 hectares in area, to be split into an estimated 13 plots based on the current masterplan (Pink Line). The western area comprises three phases of employment development: Phase 1 (Red line) being approximately 26 hectares; Phase 2 (Green Line) being approximately 22.5 hectares; and, Phase 3 being approximately 24.5 hectares (Blue Line) as shown in Figure 1 below.

The site consists of land of the former FFPS and adjacent farmland and woodland to its east. The site straddles the St Helens Canal at its southern end and the A562 Widnes Road to the north, with the surrounding area to the west mainly incorporating industrial premises and land to the east consisting of rural housing and private land and the Fiddlers Ferry Golf Club.

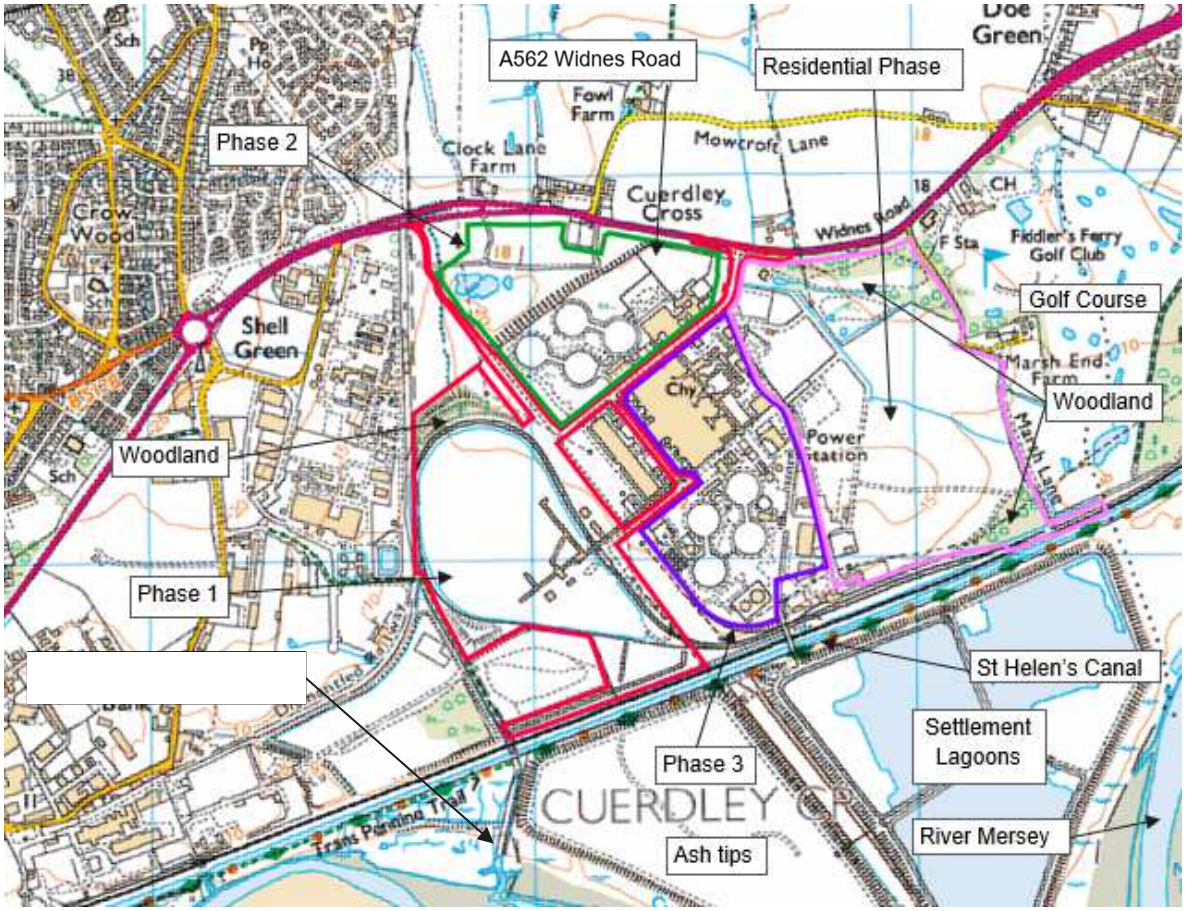


Figure 1 – Development Location Plan

2.2 Site Topography

A topographical survey for the existing Fiddler's Ferry site, located within the western development section, was undertaken by Amethyst Survey Limited in October 2022 and is contained in Appendix E for reference.

At this stage for the eastern portion of the development site, LiDAR data has been used to determine the existing site topography.

The existing topography within the confines of the western and eastern portions of development area are discussed further below.

2.2.1 Eastern Residential Development

Based on LiDAR and ordnance survey data, the eastern area, which comprises the residential phase of the site, typically falls towards the existing watercourse which runs northwest to southeast through the development area. The data indicates that an elevation of approximately 17m Ordnance Datum Newlyn (ODN) is present on the northern side with a second high point further south at roughly 16m ODN. Levels along the southern boundary of the residential phase are roughly 8 to 9m ODN and show that as the existing topography falls towards the St Helens Canal. This is shown in the Parameter Plan drawings in Appendix A.

A localised high point towards the southern end of the area disrupts the continuous fall across the residential phase with a watercourse located within a depression created by the level differences. Figure 2 below, taken from LiDAR data, highlights the elevations within the development area.

2.2.2 Western Employment Development

The western area, which comprises of Phases 1, 2 and 3 employment development plots, typically falls in a north to south direction towards the St Helens Canal and River Mersey. Ground levels are within the range of

20m (ODN) to the north near A562 Widnes Road and 8m ODN to the south of the site near the St Helens Canal, as shown in the Parameter Plan drawings in Appendix A.

Localised high and low points are seen throughout the western area of the site which disrupt the continuous falls across the area and are a result of previous site works and development. Figure 2 taken from LiDAR data highlights the elevations within the site area and confirms the levels across the site compared to topographical information received and as shown in the Parameter drawing in Appendix A and in Figure 2.

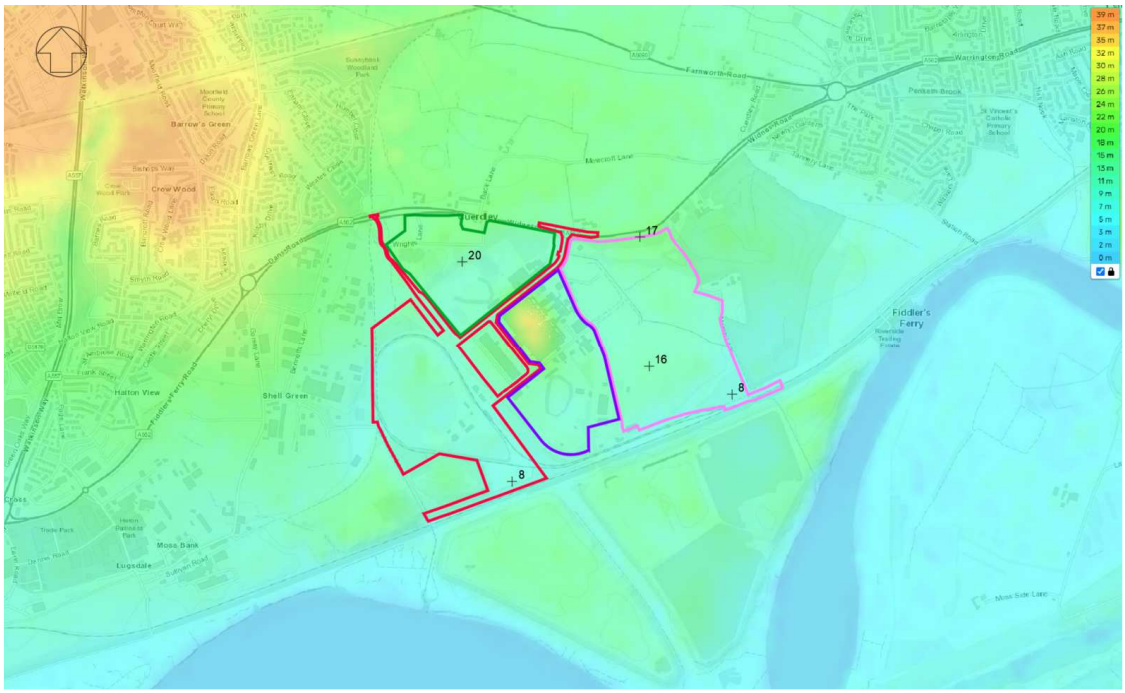


Figure 2 – Overall Site Elevation

2.3 Ground Conditions

British Geological Survey (BGS) mapping for the area indicates that the site is underlain by a combination of Chester Sandstone and Wilmslow Sandstone formations, overlain by Tidal Flat, Glaciofluvial and Till Deposits, likely associated with the adjacent watercourse. This mapping is shown in Figure 3 below.

A Ground Investigation Report prepared by Arcadis in December 2022, which describes ground conditions encountered during intrusive site investigation works concludes that the underlaying ground conditions on site were partly in line with the BGS mapping of Glaciofluvial/Till superficial deposits.

The underlying ground water levels vary across the site ranging from 1m to 4m below ground level (bgl), and the investigation noted that shallower perched water was found in the made ground deposits with deeper groundwater strikes within the natural geology.

From the information contained within this site investigation and the desk-based review, due to the soil types it is not anticipated that infiltration drainage will be feasible on this site. The shallower ground water in the western area coal pad would be managed through ground raising, ground works and reprofiling and the new surface water drainage system.

Galligu is also present within the underlaying strata, generally located within the southwestern area of the site. This material is noted to have been a waste by-product from historical industrial activities within the Widnes area and prior to the use of the site as a power station. Its presence on site is considered likely to be due its potential import and spread during the development of the former power station land. Galligu's physical state depends on its oxidation and water content, when dry it has a form of a silty sand texture but when wet its will rapidly soften and become thixotropic. Disturbing this material such as moving, disturbing or changes to its state of pressure will rapidly make it lose strength.

Remediation works in areas of the site where this material and other known contaminant is present will be undertaken before any proposed works commence. Land levels and any necessary land drainage will be dealt with at the detailed design stage.

2.3.1 Eastern Residential Development

Within the eastern residential phase of the development the Ground Investigation Report indicates that Glaciofluvial/Till superficial deposits were found at depths of up to 5m bgl and underlain with very dense sandstone deposits. Made ground Heterogeneous deposits comprising of silt, clay, sand and gravel forming grass or ploughed fields were found up to a depth of 1.2m bgl.

The report also notes that a western portion of the proposed residential phase is located within former industrial land associated with the former power station, although the sequence of superficial and underlying deposits are noted to be similar to above, the depths at which they were encountered were as follows; superficial deposits of Glaciofluvial/Till were found to depths of up to 10m bgl with underlaying weak sandstone encountered at depths from 8.65m bgl. Made ground deposits of the same heterogeneous deposits were found to a depth of 5m bgl.

2.3.2 Western Employment Development

Within the western employment phases of the development the Ground Investigation Report states that Glaciofluvial superficial deposits were found at depths up to 10m bgl and with sandstone deposits of depths up to 5.65m bgl. Made ground heterogeneous deposits comprising of silt, clay, sand and gravel were found up to a depth of 5.5m bgl.

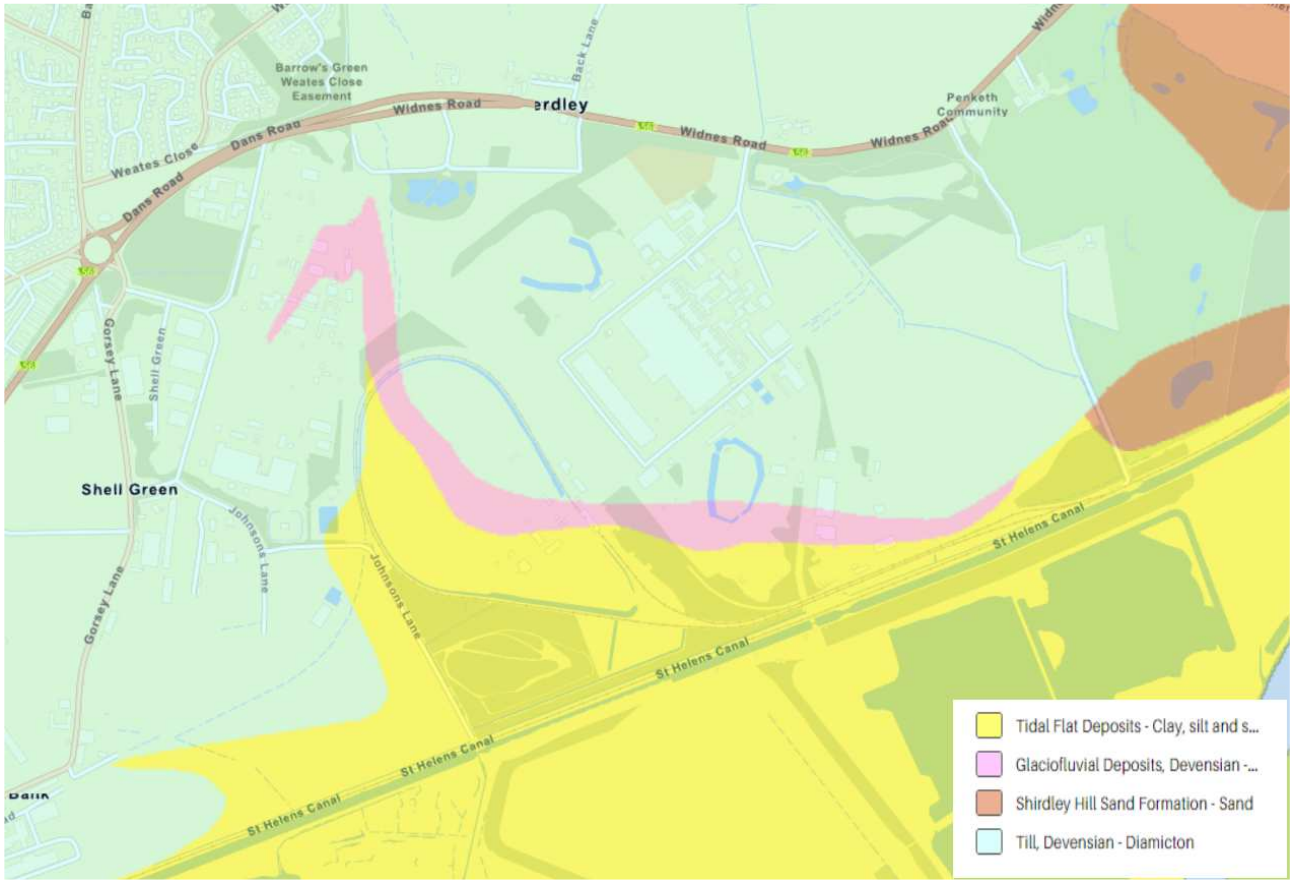


Figure 3 – BGS Mapping of Surface Geology

2.4 Existing Watercourses

2.4.1 Eastern Residential Development

An ordinary watercourse crosses though the proposed residential land running from the northwest to southeast, details and plans of this and the surrounding watercourses is contained within the Flood Risk Assessment within Fiddlers Ferry Power Station (FFPS) Redevelopment – Phase 1 Environmental Statement Volume 3 Appendix 11.1: Flood Risk Assessment. The catchment of the watercourse takes the flows from the proposed residential sites and is likely to include the area extending north of Widnes Road. The St Helens Canal is located immediately adjacent to the south boundary of the site as shown below in Figure 5.

Warrington Council have identified historical drainage problems on the A562 near the existing site entrance. Site investigations of the existing drainage system are currently ongoing. From the information gathered at present the likely source of the historical flooding issues is due to blockages in the existing drainage system causing the watercourse flowing into the site from the north, to back up in heavy flow conditions. Additional investigation has established that, this watercourse discharges eastwards at present into the existing culverted arrangement that takes it under the railway and St Helens Canal, then passes to the east of the lagoons into a discharge point into the River Mersey, as shown in Figure 4 below.

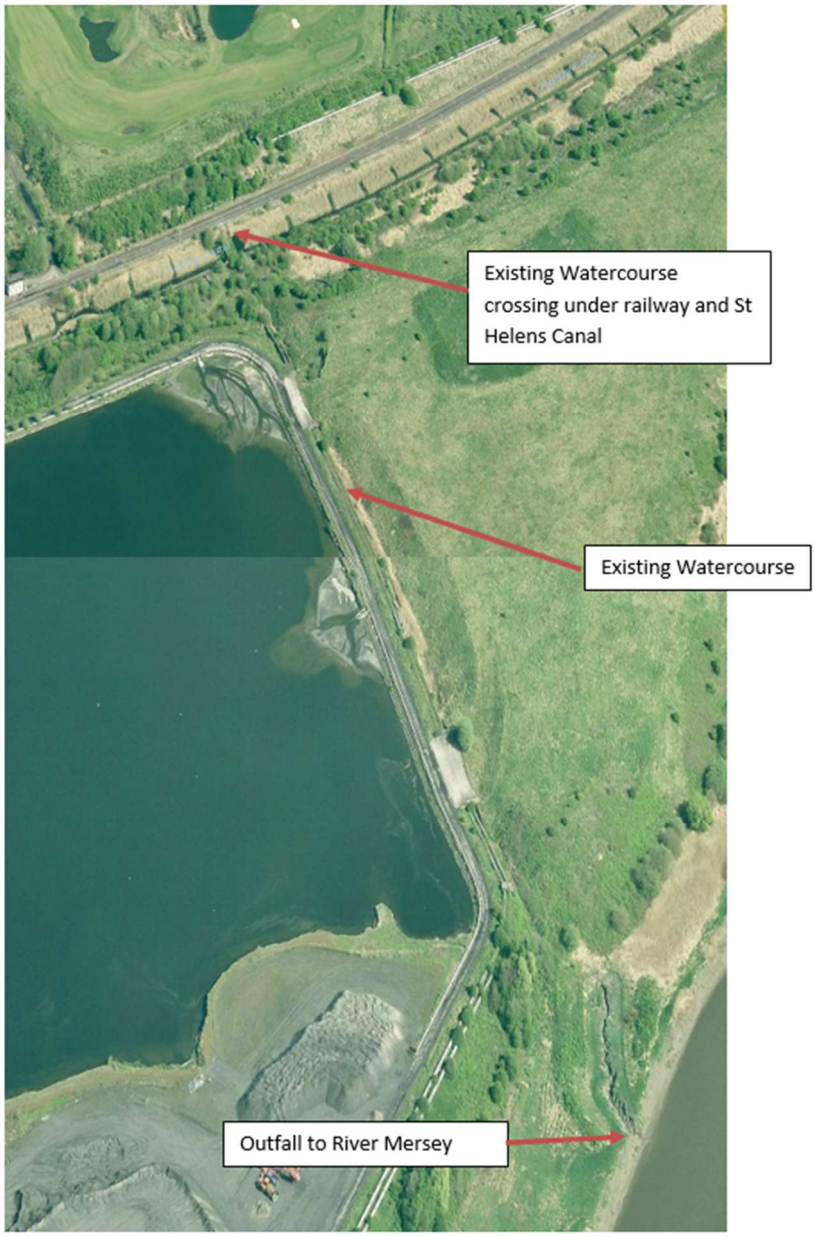


Figure 4 – Existing Eastern outfall

2.4.2 Western Employment Development

The nearest watercourse to the western phases of the site is the River Mersey, just south of the Phase 1 development and south of the immediately adjacent St Helens Canal to the southern boundary as shown in Figure 5.

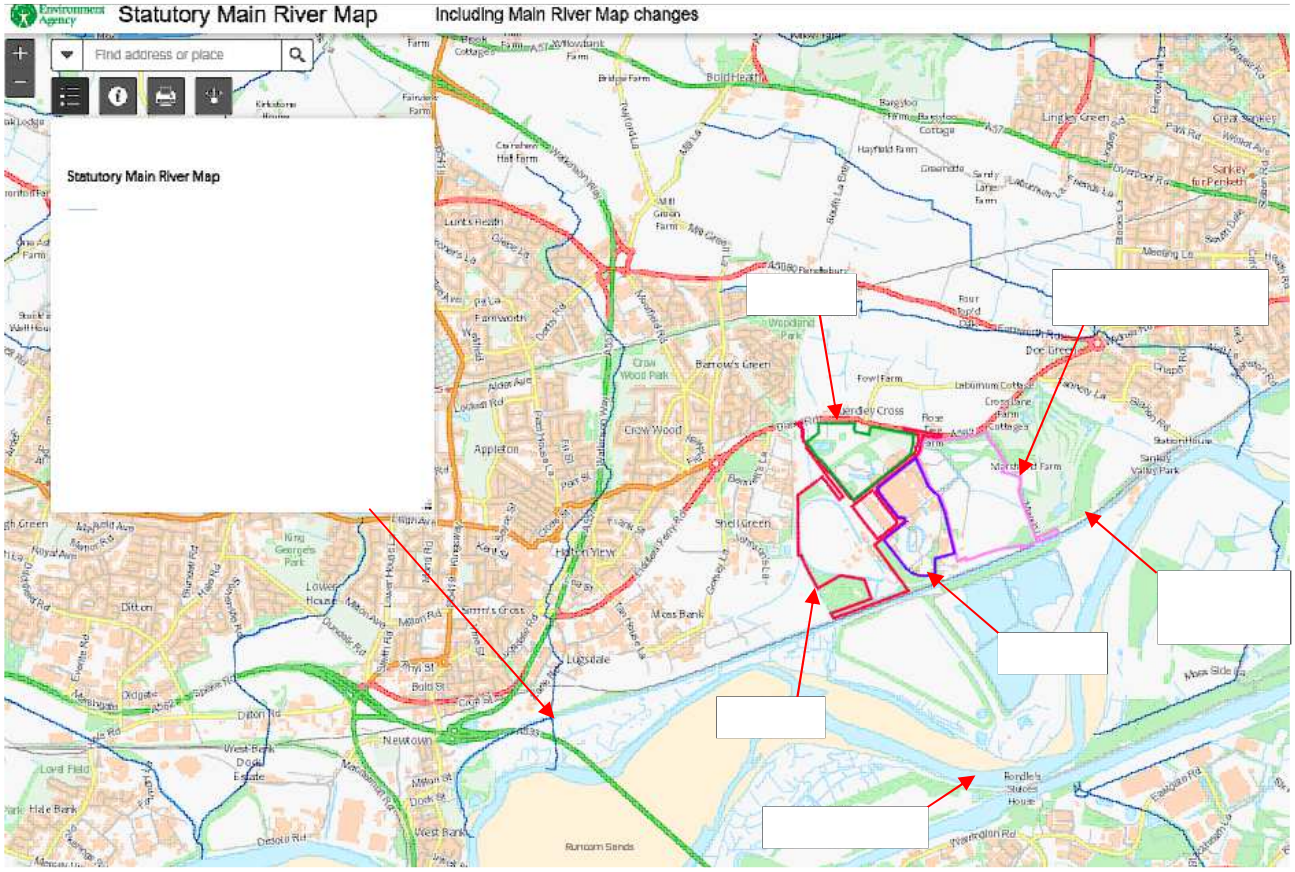


Figure 5 – Environment Agency Main River Map

2.5 Existing Drainage Infrastructure

2.5.1 Foul & Combined Sewer Network

United Utilities Sewer Asset records, contained within Appendix C, show that existing surface water, foul water and combined networks are present within the former power station land on the site. These networks are a combination of private and public sewers and include a foul pumping station and rising main within the sewer network.

The sewer records indicate the presence of a 300mm diameter combined sewer network passing from employment Phase 2 to the north of the site and draining via gravity along the existing road network. Details of this sewer are shown in Appendix C drawing 10057243-ARC-XX-ZZ-SK-CE-5500. Smaller private foul water pipes of unknown diameter are recorded outfalling into the combined sewer intermittently throughout the run.

The combined sewer is then pumped, via a 150mm diameter rising main, to an existing 150mm diameter sewer located on Johnsons Lane, to the west of the site. The sewer asset records show the rising main traversing the outer northern perimeter of the former coal pad in Phase 1 before connecting into the existing sewer.

The sewer asset records indicate that the depths of the manholes vary to a maximum depth of approximately 2.5m. It is proposed to divert the rising main during construction of the employment Phase 1 works, to enable development of the Phase 1 and future employment Phase 2, Phase 3 and Residential Phase works. Further details are discussed in Section 7.

United Utilities have been contacted with regards to the capacity within the existing network, which should accommodate employment Phase 1 and any improvements to accommodate future employment Phase 2, Phase 3 and Residential Phase to be confirmed. United Utilities Sewer Asset records, contained within Appendix C, show that existing surface water, foul water and combined networks are present along the western

boundary of the site. These networks are a combination of private and public sewers within the site boundary with a foul pumping station and rising main within the adjacent western development area.

2.5.2 Surface Water Sewer Network

The eastern Residential Phase development area is primarily agricultural land with an existing watercourse crossing the site. The catchment for the eastern residential area extends to the north of Widnes Road and connectivity will be maintained in the drainage strategy for the site. It is anticipated that the existing surface water networks in the western site area covering the former power station land will be removed or grouted to decommission when the power station is demolished, and the site cleared for construction with a new surface water network constructed. Further survey will be undertaken for both the western and eastern areas in the detailed design stage for each to confirm the direct catchment, capacity and condition of any existing drainage networks retained.

2.6 Existing Runoff Rates

2.6.1 Eastern Residential Development

The eastern Residential Phase has a total area of 47ha, and approximately 28ha of this total is proposed to be developed. Of this 28ha, 13ha is brownfield and the rest is greenfield. The area slopes primarily towards the existing unnamed watercourse that crosses though the development area, with runoff from a section along the southern boundary flowing overland toward a separate watercourse. Discharge rates for each plot of the development have been described in Section 5.4.1.1. As the Residential Phase development area is a mix of brownfield and greenfield, the calculation of existing site run off is based on 25% of the existing site being urbanised, and summarised in Table 1 below and contained in Appendix G.

Return Period (years)	Existing Site Runoff Rate (l/s/ha)
1	301.8
QBAR (Rural)	240.0
QBAR (Urban)	346.9
30	552.3
100	639.5

Table 1 – Eastern Development Existing Site Runoff Rates

The proposed surface water strategy for the eastern Residential Phase will provide a betterment on the calculated discharge values for the brownfield area of the site by limiting the discharge to the calculated Mean Annual Floor (QBAR) greenfield runoff rate.

2.6.2 Western Employment Development

The western area of the site and planned Employment Phases is brownfield and larger than 50 hectares which has been considered in the calculation of the pre-development surface water run-off. The current site is free discharging into the concrete channel that runs parallel to the St Helens canal along the southern boundary and discharges into the River Mersey. Therefore, a brownfield runoff rate has been calculated using IH 124 methodology to determine a QBAR flow for an urban area of 73 hectares. Results from this calculation are shown in Table 2 below and in Appendix G.

Return Period (years)	Brown Field Runoff Rate (l/s/ha)
1	795.6
QBAR	914.4
30	1324.2
100	1438.5

Table 2 – Western Development Existing Site Runoff Rates

The proposed surface water strategy for the western development of the site will provide a significant betterment on the calculated discharge values by limiting the discharge to the calculated Mean Annual Flood (QBAR) greenfield runoff rate. This will discharge the runoff from the site into the receiving watercourse at a lower rate than the current arrangement.

2.7 Existing Flood Risk

2.7.1 Fluvial/Coastal Flood Risk

The Flood Map for Planning (Rivers and Sea) shows that the vast majority of the site is contained within Flood Zone 1, equivalent to an annual change of flooding from the St Helens Canal and River Mersey less than 1 in 1,000 (0.1%), stated as a 'low' probability of flooding in planning terms according to the National Planning Policy Framework (NPPF). A small section of the site bounding the perimeter of St Helens Canal is shown to be within Flood Zone 3, equivalent to an annual chance of flooding of 1 in 100 (1%) or greater. This is indicated to be contained within the extents of the St Helens canal with no impact on the proposed development areas. The proposed development would not impact on baseline flood risk from these sources. Figure 6 below shows the fluvial and coastal flood risk to the development.

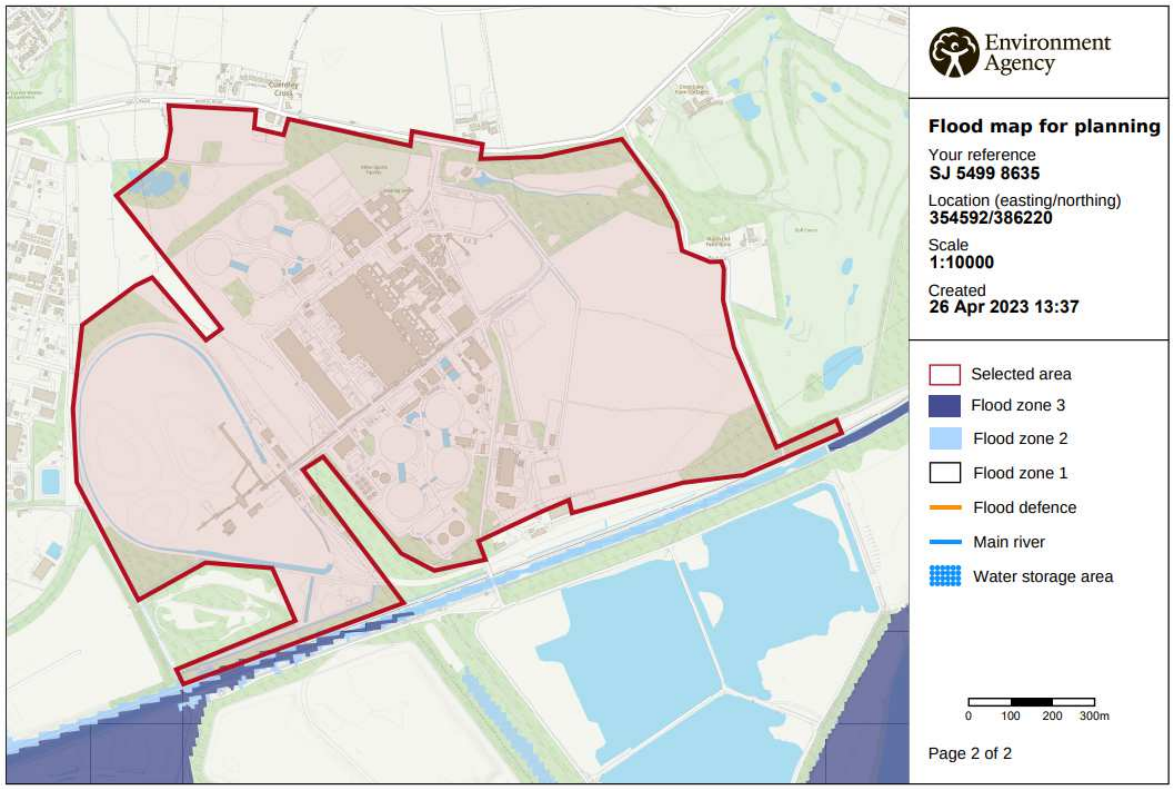


Figure 6 – Fluvial & Coastal Flooding Risk

2.7.2 Surface Water Flood Risk

The Environment Agency (EA) Risk of Flooding from Surface Water Mapping is reproduced in Figure 7 and shows there are areas of the current site that are prone to a varying risk of surface water flooding. The risk of flooding from surface water map assesses flooding resulting from severe rainfall events based on the following three scenarios:

- 1 in 30 (3.3%) annual probability rainfall event ('High' Risk);
- 1 in 100 (1%) annual probability rainfall event ('Medium' Risk); and,
- 1 in 1000 (0.1%) annual probability rainfall event ('Low' Risk).

Land with less than a 1 in 1000 (0.1%) annual probability of surface water flooding is considered to be at a 'Very Low' risk. The higher risk areas are mainly present along the existing road network, the existing coal pad in the employment Phase 1 area and the existing watercourse ditch through the middle of the eastern Residential Phase development area.

The proposals in this report will ensure that the site drainage addresses the surface water flood risk to the local areas and provides mitigation and management for dealing with surface water runoff from the site.

The existing lagoons to the south of the railway line would not present a fluvial flood risk to development site. The lagoons would be subject to works including reduction of water levels but would not be affected by the development.

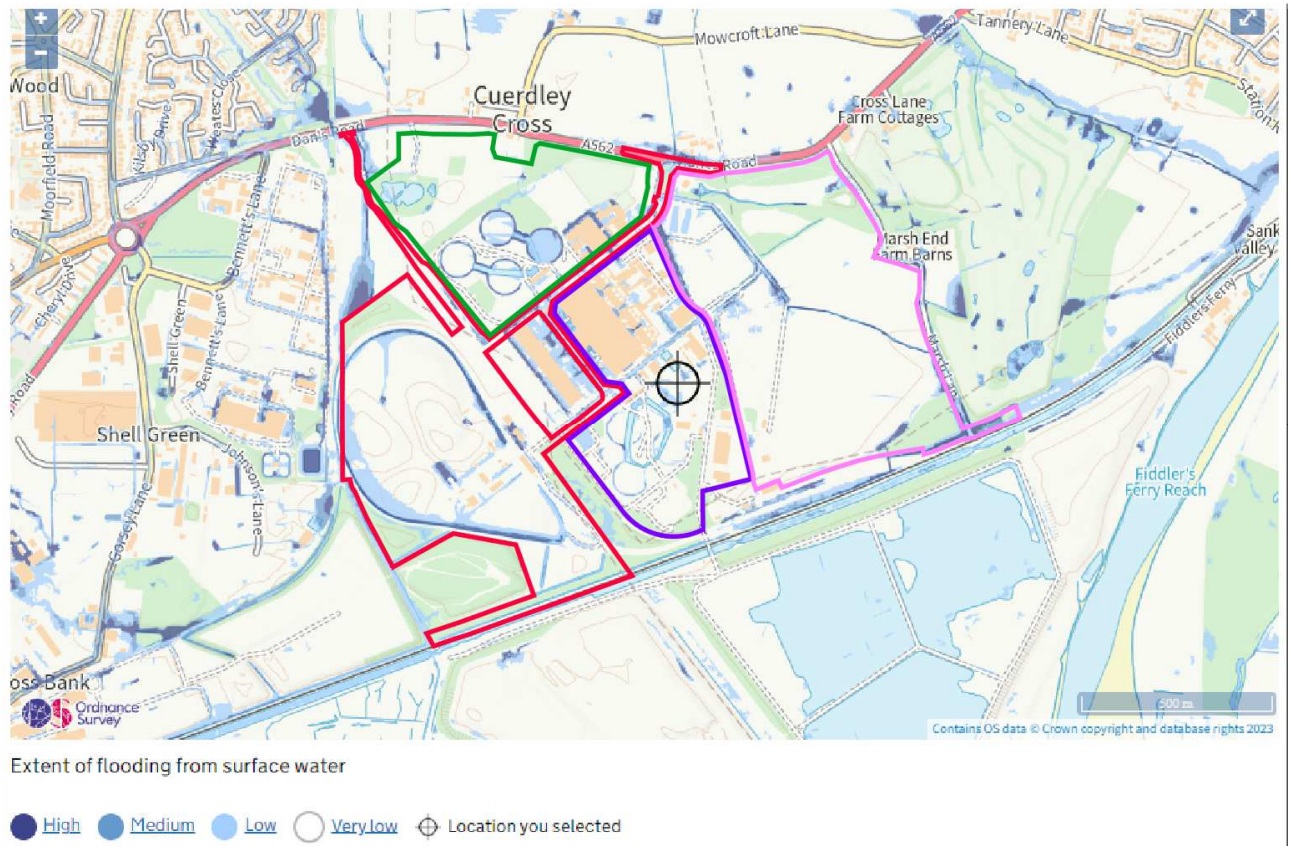


Figure 7 – Surface Water Flood Risk

3 PROPOSED DEVELOPMENT

3.1.1 Eastern Residential Development

The proposed eastern Residential Phase development has been split up into a number of plots based on the current framework masterplan as a basis for this assessment, with interconnecting access roads and green space areas shown in Figure 8 below and on the Drainage Strategy drawing in Appendix A

The existing woodland areas to the south and to the north of the site are to remain as part of the development proposals with the existing designated ordinary watercourse forming a green corridor through the central section of the site with adequate access and easement requirements to council standards. The current masterplan has a total of 11 residential plots with two further plots located to the southwest for a proposed primary school and local centre located in the existing brownfield site area.

The existing watercourse section to the north of the site is to be diverted to allow for development of the plot parcels in that area and will utilise culverts at crossings of the proposed access roads. All the plots will connect into the ordinary watercourse and consents would be sought from the Lead Local Flood Authorities (LLFA) to allow construction of the surface water drainage outfalls. The existing outfall to the south of the site connects to the Mersey River via a connected piped network crossing the St Helens Canal and railway line, as detailed in section 2.4.1.

All plots on the Residential Phase development are to capture, store, treat and convey runoff using Sustainable Drainage Systems (SuDS) before discharging into proposed swales located adjacent to the access road corridors. These swales will also provide drainage capture and conveyance of runoff flows from the access roads before outfalling into the ordinary watercourse.

Plot 2c is located toward the northwest of the site as shown in Appendix A Parameter Plan and Figure 8 below, and site levels are required to be raised to allow for overland flow drainage towards the proposed swale corridor.

The final plot connections and culvert for road crossings will be finalised as part of future planning applications and to the appropriate standards at that time.

Where it is proposed to connect to existing drainage systems or watercourses, they would be checked for suitability with the condition, connectivity, capacity and functionality to be verified. All existing watercourses would have the exact location shown on plan and capacities to accept discharged flows verified. Any systems in poor condition or blocked would be repaired as part of proposed drainage works.

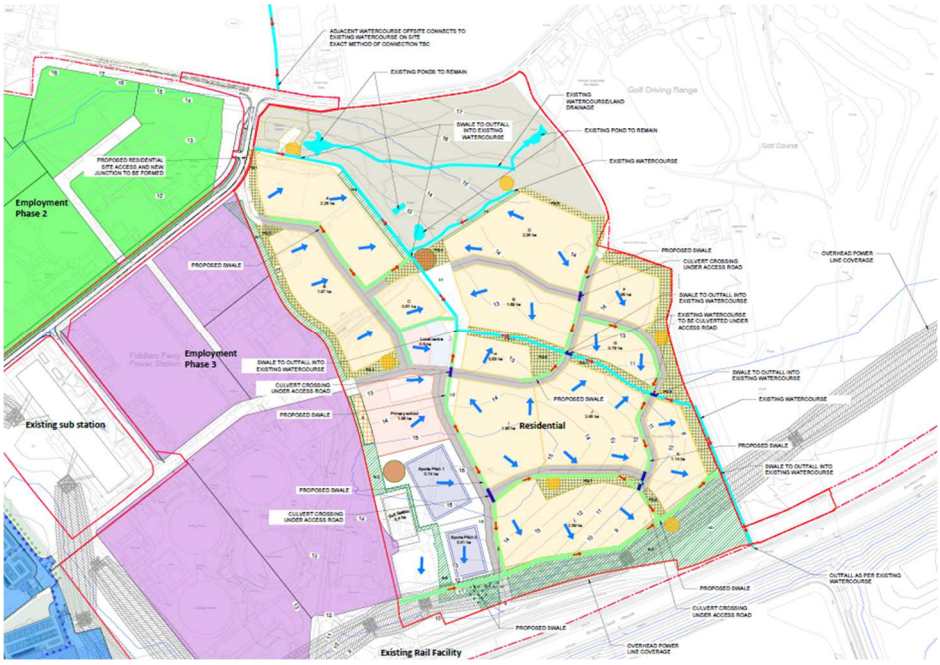


Figure 8 – Eastern Residential Development Plan

3.1.2 Western Employment Development

The western area of site is to be split into three Employment Phases as shown in Figure 9 below, with Phase 1 located to the south-west (Blue), Phase 2 located to the north (Green) and Phase 3 located to the East (Purple). The existing sub-station building between the Phases is to remain. The existing and improved access road splits the Phase 2 & 3 Employment Phases and connects to Phase 1.

Figure 9 – Western Phased Employment Development Plan

The proposed Phase 1 development comprises of four industrial units with service and circulation yards, car parking and associated access road connections and landscaping and amenity open spaces, including a large SuDS attenuation pond as illustrated in 9 above.

The development will be arranged around a road running parallel to the aqueduct. Car parking areas within each unit are to be constructed with permeable paving for surface water storage and treatment. These units will connect into the Phase 1 road drainage system passing through the attenuation SuDS pond before discharge.

Swales will be located adjacent to the access road to provide drainage capture and conveyance of runoff flows from the access roads before outfalling into the ordinary watercourse via the SuDS pond and vortex separator chamber, to ensure that an exemplar SuDS arrangement is proposed for the site. The outfall location for the proposed drainage system is on the southwest side of Unit 4, where the existing drainage channel running parallel to St Helens Canal is being reinstated with a vegetated SuDS swale to provide additional treatment of the site runoff before discharge to the ordinary watercourse. Existing drainage systems or watercourses will be checked for suitability with the condition, connectivity, capacity and functionality to be verified by future planned surveys. Any systems in poor condition, or blocked etc will be repaired/ replaced as part of proposed drainage works.

4 Planning Policy Requirements

4.1 Planning Policy Requirements

The Technical Guidance to the National Planning Policy Framework (NPPF) (December 2023, Department for Communities and Local Government) specifies that developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems. The drainage proposals within this strategy have been prepared to meet these planning policy requirements.

4.2 NPPF PLANNING PRACTICE GUIDANCE

The Flood Risk and Coastal Change category of the Planning Practice Guidance which accompanies the NPPF and Policy ENV2 (Flood Risk and Water Management) of the adopted Warrington Local Plan 2022/23 to 2038/39 both state that the aim should be to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration).
2. To a surface water body.
3. To a surface water sewer, highway drain, or another drainage system.
4. To a combined sewer.

4.3 Lead Local Flood Authority Requirements

Warrington Borough Council has produced a set of guidance notes on planning and development, set out in a Sustainable Drainage Systems (SuDS) Design and Technical guidance document.

The guidance notes state that:

'The design of the drainage system must take into account the impact of rainfall falling on any part of the site and also any estimated surface runoff flowing onto the site from adjacent areas.

Drainage systems must be design so that, unless an area is designed for flood management in the Local Flood Risk Management Strategy, flooding from the drainage system does not occur:

A. On any part of the site for a 1 in 30 year rainfall event; and

B. During a 1 in 100 year + Climate Change rainfall event in any part of:

- *A building (including a basement), or;*
- *Utility plant susceptible to water (e.g. pumping station or electricity substations), or;*
- *On neighbouring sites during a 1 in 100 year Climate Change rainfall event.'*

The guidance notes also states:

'Where a contaminated land site is proposed for redevelopment, SuDS may still be used for drainage of surface water. However, the design of the drainage system will be site-specific and dependent upon the contaminants at the site. The remediation strategy and the risks posed by any residual contamination, in addition to normal design considerations.'

The guidance note also states for the SuDS Management Train that:

'Individual SuDS, located both in public and private area, should be accounted for in the context of a Management Train that reinforced and, where possible, follows the natural pattern of drainage. the Management Train incorporates a hierarchy of technique:

1. *Prevention – the use of good site drainage and housekeeping measures on individual sites to prevent runoff and pollution;*
2. *Source Control – control of runoff at, or very near, its source;*
3. *Site control – management of water from several sub-catchments;*
4. *Regional control – management of runoff from serval sites.'*

4.4 Strategic Flood Risk Assessment (SFRA)

Warrington Borough Council SFRA states that for both Flood Zone 1 & 2 sites:

'Developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage techniques.'

4.5 Policy ENV2 – Flood Risk and Water Management

Policy ENV2 (Flood Risk and Water Management) of the adopted Warrington Local Plan 2022/23 to 2038/39 sets out the following general principles:

1. *Development should be focused towards areas at the lowest risk of flooding from all sources*
2. *Sustainable water management measures must be integrated into developments to reduce flood risk across the Borough and to avoid adverse impacts on water quality and quantity.*
3. *New development should not result in increased flood risk from any source, or cause other drainage problems, either on the development site or elsewhere.*
4. *No development should take place within 8m of the top of the bank of a watercourse either culverted or open, or within 8 metres of a raised flood defence, such as a flood wall or a flood embankment, unless this approach is supported by the Environment Agency and Warrington Borough Council as the Lead Local Flood Authority.*

Policy ENV2 confirms that the Council will only support development proposals where the risk of flooding has been fully assessed, understood and justified, with the implementation of appropriate mitigation measures where necessary. The policy also provides further guidance on the scope of flood risk assessments, as well as the design of drainage schemes for new development, including surface water management and sustainable drainage systems, and the maintenance and management of such systems.

4.6 Policy MD3 – Fiddlers Ferry

Policy MD3 (Fiddlers Ferry) of the adopted Warrington Local Plan 2022/23 to 2038/39 allocates the former Fiddlers Ferry Power Station site, including the agricultural land to the east, for mixed-use development, comprising approximately 101ha of employment land and a minimum of 860 new homes in the Plan period. In accordance with Policy MD3, Peel NRE have prepared a Development Framework, which will guide the redevelopment of the site. The Development Framework is required to include a site-wide foul and surface water drainage strategy, incorporating exemplary sustainable drainage systems (SuDS) and flood alleviation measures. This Drainage Strategy satisfies that requirement and provides an allocation site wide approach

to foul and surface water drainage. This Drainage Strategy will guide the preparation of detailed drainage strategies for each phase of development, which will be provided as part of the relevant planning application.

5 General Drainage Design Principles

In line with Building Regulations Part H, and the principles set out within the CIRIA SuDS Manual, the order of preference for discharge of surface water runoff is:

- Ground infiltration within the site.
- Attenuation and discharge at a restricted rate to a watercourse;
- Attenuation and connection at a restricted rate to an existing surface water piped network.
- Attenuation and connection at a restricted rate to an existing combined water piped network.

Ground infiltration is normally the preferred method of discharging surface water runoff from a proposed development and should be used wherever feasible to mimic the existing diffuse discharge to ground. However, as previously stated in Section 2.3 ground infiltration is not feasible and has been discounted as a method of surface water discharge from this development due to soil type and presence of contamination in the southwestern section of the Phase 1 employment site. In keeping with the hierarchy as described, discharge from the site will incorporate SuDS features with discharge to the existing watercourse.

It is proposed to provide the following drainage infrastructure as part of the development:

- Separate surface and foul water systems within the site boundary.
- Surface water systems to incorporate SuDS features as far as is reasonably practicable to ensure an exemplar SuDS arrangement is proposed for the site.
- Surface water discharge at a controlled rate to the adjacent watercourse or drainage feature.
- Foul water drainage discharged to the existing combined sewer on the western periphery of the site.

5.1 Design guidance

The following design guidance will be adhered to for the proposed foul and surface water drainage systems serving the proposed site.

- Building Regulations Part H.
- National Planning Policy Framework (NPPF & accompanying Planning Practice Guidance.
- Sewers for Adoption (for future option to be adopted).
- Construction Industry Research & Information Association (CIRIA) Guidance for design of SuDS features.
- BS EN 752:2008 Drainage & Sewer Systems Outside Buildings.
- BS EN 12056:200 Gravity Drainage Inside Buildings.
- SuDS Manual, CIRIA C753.
- Design Manual for Roads and Bridges (DMRB)
- The Manual of Contract Documents for Highway Works (MCHW)
- Warrington Borough Council highway design requirements

5.2 Key Design Principles

5.2.1 Eastern Residential Development

Specific design criteria for the surface water drainage system include:

- Surface water drainage will convey runoff to the existing watercourse at a controlled rate with SuDS features and flow controls.

- Surface water system designed to prevent flooding in any part of the site for the critical duration, 1:100-year return storm event, including an allowance of 45% climate change.
- Surface water runoff will be designed to greenfield runoff rates to provide betterment for the brownfield area of the Residential Phase.
- Each plot to manage runoff via on plot attenuation/site specific SuDS features such as permeable paving in non-adopted paved areas and roadways, storage crates (in non-adoptable areas) and, swales where feasible. Suitable for the development and discharge at the rates specified in Section 5.4.1.1.
- Multiple plots to discharge directly into existing watercourse at controlled greenfield runoff rate.
- Multiple plots to discharge into swale corridors before out falling into exiting watercourse at controlled greenfield runoff rate. The outfall is not envisaged to be subject to tide locking but measures to accommodate flows and non-return would be incorporated into the system.

5.2.2 Western Employment Development

Specific design criteria for the surface water drainage system include:

- Surface water drainage will convey runoff to the adjacent channel watercourse at a controlled rate via flow control.
- Surface water system designed to prevent flooding in any part of the site for the critical duration, 1:100-year return storm event, including an allowance of 45% climate change.
- Surface water runoff will be designed to greenfield runoff rates to provided betterment for the proposed site as referred to in Section 5.4.2.1.
- Each Phase to manage runoff via on plot attenuation/site/treatment specific SuDS features such as permeable paving and storage crates in non-adoptable areas and swales where feasible. Suitable for the development and discharge at the rates specified in Section 5.4.2.1.
- Phases 2 & 3 to discharge into Phase 1 main spine surface water sewer at controlled rate as specified in Section 5.4.2.1.
- Surface Water Drainage conveyed through a swale to an attenuation pond, stored and discharged at Green Field Runoff Rate into a swale.
- Outfall into the proposed vegetated swale via a vortex separator chamber, on the southern end of the site which connects to the River Mersey. The outfall is not envisaged to be subject to tide locking but measures to accommodate flows and non-return would be incorporated into the system.

5.3 Sustainable Drainage Systems

The proposed Surface Water Drainage Strategy layout utilising SuDS techniques is included in Appendix A. The drainage system has been designed to mimic a greenfield situation as closely as practicably possible, following best practice and provides a betterment of current land use. The principles employed in this drainage strategy are to attenuate surface water to within the allowable rates, whilst providing measures to improve the quality of this runoff with the use of suitable SuDS features.

SuDS are water sensitive drainage systems which mimic natural catchment processes to manage urban runoff. A ‘treatment train’ of various SuDS is required to capture, detain, convey and discharge water from an urban environment. The treatment train concept is fundamental to designing a successful SuDS strategy.

The treatment train philosophy uses drainage techniques to systematically control the three elements of runoff: pollution, flow rates and volumes. This is achieved in three main steps: Source Control, Conveyance Control and Discharge Control (Figure 10). Source control is preferred to those further down the train as they lead to the retention of pollutants and control of water before it enters the proposed or existing drainage network or watercourse. All of the methods suggested are recommended controls considered for SuDS and will be utilised where practical.

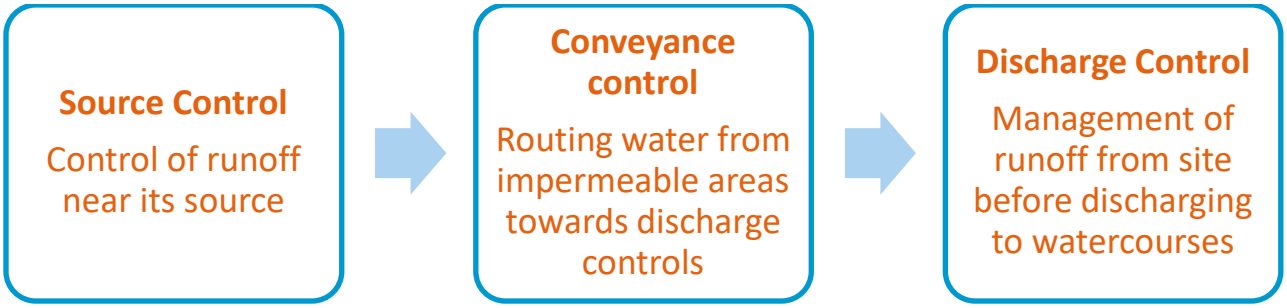


Figure 10 - SuDS Treatment Train

Individual SuDS components are not treated in isolation but work together as a suite of drainage features. The SuDS components integrated into the proposed drainage system will reflect the desirability to have a mix of SuDS components across the site, as different components have different capacities for treatment of individual pollutants.

5.4 Surface Water Management Strategy

5.4.1 Eastern Residential Development

The design of a surface water drainage system to serve the eastern Residential Phase development considers both water treatment and on-site attenuation and conveyance, in accordance with the SuDS Manual (CIRIA C753).

The proposed SuDS components aim to emulate the natural drainage of the site through attenuation of flows and controlled discharge to the adjacent watercourse, with runoff from a small area of the site's access road discharging to surface water swale corridors.

The proposed SuDS components will also provide treatment of runoff, alleviating potential water quality issues in the receiving watercourse.

5.4.1.1 Proposed Surface Water Drainage

As discussed in Section 2.6.1, a quarter of the existing Residential Phase area is classified as brownfield conditions with the rest being greenfield farmland. The partial brownfield runoff rates combined with the greenfield area of the Residential Phase have been calculated using Micro Drainage software, using the ICP SuDS methodology and can be found in Table 1 with runoff rates summarised as per hectare.

To provide betterment of the existing brownfield area and maintain the existing greenfield areas of the Residential Phase the proposed development will utilise greenfield (QBAR) runoff rates as shown in Table 3 and Appendix G. The total permissible runoff rate for the whole Residential Phase will be limited to 240.0 l/s, providing betterment compared to the current calculated brownfield/greenfield runoff rate of 346.9 l/s.

Return Period (years)	Greenfield Runoff Rate (l/s)	Greenfield Runoff Rate (l/s/ha)
1	208.8	4.5
QBAR	240.0	5.1
30	406.9	8.7
100	499.2	10.7

Table 3 – Greenfield Runoff Rates

5.4.1.2 Residential Development Plot Discharge Rates

For the basis of this assessment and the current framework masterplan, the permissible discharge rates from each residential plot are contained in Table 4 based on calculated total plot development area and to permissible greenfield runoff rates.

All of the plots would have attenuation within the plot area before discharging at the flow rate as summarised in Table 4, and the estimated plot attenuation has been calculated and shown in Section 5.4.1.3 below.

Plot	Area (m²)	Area (ha)	Required Discharge Rate (l/s)
Plot A	22800	2.280	11.6
Plot B	19700	1.970	10.0
Plot C	6100	0.610	3.1
Plot D	22600	2.260	11.5
Plot E	16900	1.690	8.6
Plot F	9500	0.950	4.8
Plot G	7900	0.790	4.0
Plot H	6300	0.630	3.2
Plot I	19000	1.900	12.5
Plot J	24500	2.450	12.5
Plot K	11400	1.140	5.8
Plot L	25900	2.590	13.2
Proposed Sports Pitch	22408	2.241	11.4
Proposed Primary School	13600	1.360	6.9
Proposed Local Centre	5000	0.500	2.6
Substation	4000	0.400	2.0
Proposed Road Network	37877	3.798	19.4

Table 4 - Site Plot Discharge Rates

5.4.1.3 Plot Attenuation

As previously mentioned in Section 5.4.1.2 and Table 4, all plots on the Residential Phase development will be restricted to greenfield run off rates discharging into the existing watercourse. Methods of attenuation on plot are to be determined by the plot developer using SuDS surface systems for example ponds or swales and permeable paving with cellular storage crates.

Estimated storage requirements for each plot are shown in Table 5 below based on Micro Drainage Quick Storage Estimate calculator.

The calculation has been run using the 100 Year Storm + 45% Climate change and with a safety factor of 2.0. Each plot area has been estimated to be 60% impermeable area as stated in Table 5, and the proposed road network has been calculated using 100% impermeability.

Plot	Area (m^2)	Area (ha)	Impermeable Area (ha)	Estimated Attenuation (m^3)
Plot A	22800	2.280	1.368	1196
Plot B	19700	1.970	1.182	1034
Plot C	6100	0.610	0.366	320
Plot D	22600	2.260	1.356	1186
Plot E	16900	1.690	1.014	887
Plot F	9500	0.950	0.570	500
Plot G	7900	0.790	0.474	415
Plot H	6300	0.630	0.378	331
Plot I	19000	1.900	1.140	996
Plot J	24500	2.450	1.470	1284
Plot K	11400	1.140	0.684	598
Plot L	25900	2.590	1.554	1346
Proposed Sports Pitch	22408	2.241	0.816	1175
Proposed Primary School	13600	1.360	0.300	714
Proposed Local Centre	5000	0.500	0.240	260
Substation	4000	0.400	1.344	211
Proposed Road Network	37977	3.798	3.798	3198

Table 5 – Site Plot Estimated Required Attenuation

The total surface water attenuation storage volume for the whole development is estimated to be 15,650m^3.

5.4.1.4 Outfall to Watercourse

The individual residential plot developments would outfall attenuated and treated surface water flows to the proposed swales incorporating suitable flow controls (e.g. hydrobrake) at the rates started in Table 4.

All plots on the Residential Phase would outfall into the existing watercourse running northwest to southeast through the site at their equivalent greenfield runoff rate. A total of eight separate outfalls into the vegetated swale are currently proposed from the plots before discharge to the existing watercourse as shown in the Drainage Strategy drawing in Appendix A. The existing watercourse will also take the flows from the residential sites. Additional investigation has established that, this watercourse discharges eastwards at present into the existing culverted arrangement that takes it under the railway and St Helens Canal, then

passes to the east of the lagoons into a discharge point into the River Mersey. Given that it presents no drainage or flooding issues at present and the residential proposals will restrict the runoff with climate change to at the existing greenfield rate or better, this is in principle a viable option for the discharge of the surface water for these eastern residential sites and the detailed design will be provided at the planning application stage. At the detailed design stage for the eastern development a CCTV and conditional survey of this existing connection will be undertaken to ensure suitability of retaining the existing outfall route.

Having established that the watercourse currently discharges eastward and this being the preferred route for the eastern residential site, there is still the alternative proposition to allow the surface water to drain westwards if this existing connection can't be utilised. This adds flexibility that would be reviewed in more detail at the detailed design stage and would require works to alter the channel levels and a new connection made into the existing outfall infrastructure on the applicant's land discharging to the River Mersey. The future management and maintenance for either option would of course be dealt with by way of a management plan appropriate to which solution was utilised.

5.4.1.5 Results

The total combined residential plots outfall at 140.5 l/s, as shown in Table 4, and is included within the required greenfield runoff rate of 240l/s for the entire Residential Phase based on the values in Table 3 and calculations in Appendix G. This new greenfield figure will provide roughly 41% betterment to the existing section of brownfield areas on site.

Attenuation volumes for the residential plots on site shown above in Table 5 have been estimated to achieve greenfield runoff rates.

Final swale sizes on the Drainage Strategy drawing found in Appendix A will be subject to detail design at application stage to confirm sufficient capacity to convey the flows and volumes of water discharged from the proposed plot connections to 100-year storm +45% Climate change. The swale design will also have sufficient capacity to capture, store, treat and convey runoff from the new roadways.

5.4.2 Western Employment Development

The design of a surface water drainage system to serve the proposed development includes both water treatment and on-site attenuation, in accordance with the SuDS Manual (CIRIA C753).

The proposed SuDS components aim to emulate the natural drainage of the site through attenuation of flows and controlled discharge to the adjacent watercourse, with runoff from a small area of the site's access road discharging to surface water sewers.

Due to the size of the plot developments and effect on the longitudinal fall on roadways, linear kerb drainage may be required in some areas of the site, although conventional gully and SuDS methods would be used where possible.

The proposed SuDS components will also provide treatment of runoff, alleviating potential water quality issues in the receiving watercourse. As an employment use development, measures to isolate flows and contain pollution incidents would be incorporated into the system such as penstocks or other flow controls.

5.4.2.1 Proposed Surface Water Drainage

As discussed in Section 2.6.2, approximately 75% of the existing Employment Phase area has brownfield conditions and is understood to have free discharge into the existing concrete lined channel running south of the former coal pad and parallel to St Helens Canal. The brownfield runoff rates for the Employment Phase area have been calculated in Micro Drainage software, using the IH 124 Methodology and can be found in Table 2 with runoff rates summarised as per hectare.

To provide betterment for the proposed development the Employment Phase area will utilise greenfield (QBAR) runoff rates as shown in Table 6 and Appendix G. Therefore, the total permissible runoff rate for the

development will be limited to 357.2 l/s, providing a betterment compared to the calculated Brownfield runoff rate of 914.4 l/s. This provides a 61% reduction in the discharge rate to the receiving watercourse for the Employment Phase area compared to the current flows discharging from the same area.

Return Period (years)	Greenfield Runoff Rate (l/s)	Greenfield Runoff Rate (l/s/ha)
1	310.7	4.29
QBAR	357.2	4.93
30	605.6	8.36
100	742.9	10.26

Table 6 – Greenfield Runoff Rates

5.4.2.2 Development Phase discharge rates

The permissible discharge rates from each Employment Phase are shown in Table 7 and Table 8 below. For employment Phases 2 and 3, these have been calculated based on the total phase development area and the permissible greenfield runoff rate.

Employment Phase 2 and 3 of the proposed development are to have attenuation and treatment on site before discharging at a flow rate of 115 l/s from Phase 2 and 124.6 l/s from Phase 3. An additional allocation for the existing sub-station building to be retained of 188 l/s (as provided by National Grid worst case storm probability of 3.3%) has been included in the Phase 1 network calculations.

Each of the four units within Phase 1 have set specified discharge rates from their site and are shown below in Table 7. The strategy is to discharge at a specific rate, and extra storage is provided within the attenuation pond to ensure the permissible calculated runoff rate from the full development site maintains a maximum greenfield rate of 357.2 l/s.

5.4.2.3 Phase 1

Each unit has a stated discharge rate to be incorporated and attenuated within the main Phase 1 drainage network as shown in Table 7.

The Phase 1 area is proposed to drain via gravity towards the attenuation pond upstream of the proposed reinstated swale running parallel to the St Helens Canal.

Each unit is to manage, attenuate and treat surface water runoff within their plot via the use of SuDS, such as cellular attenuation crates underneath permeable car parking bays. Roof drainage is to discharge into storage, such a modular cellular units.

Unit	Area (m^2)	Area (ha)	Required Discharge Rate (l/s)
1	1850	1.850	10
2	5800	5.8	27.3
3	12656	12.656	140
4	4425	4.425	25.2

Table 7 – Phase 1 Unit Discharge Rates

5.4.2.4 Phase 2 and 3

Phases 2 and 3 would generally follow the strategy proposed for the Phase 1 Employment development, with surface water flows managed by attenuation and use of solutions such as cellular attenuation crates underneath permeable car parking bays. The further phases should also provide suitable space for open water SuDS features such as ponds or swales where possible. Runoff from the proposed development on Phase 2 and 3 are to discharge into main surface water network in Phase 1 at the maximum specified control rate as shown in Table 8.

Phase	Allowable Discharge Rate (l/s)	Area (m^2)
Phase 2	115	22.402
Phase 3	124.6	24.430

Table 8 – Phase Discharge Rates

5.4.2.5 Pond to Outfall

The proposed SuDS pond as illustrated in Figure 11, will provide enhanced biodiversity and amenity to the Phase 1 area and overall site. For amenity use, access to the pond would be DDA compliant incorporating adequate maintenance access and working space.

The proposed SuDS pond will have a storage volume of approx. 7,000m^3 to cater for surface water runoff flows from Phases 1, 2 and 3 and discharges via a flow control device, such as a hydrobrake, to the proposed outlet pipe or swale which connects via a vortex separator to the improved existing channel. The existing channel which is being reinstated to a vegetated swale as part of the proposed works, outfalls to the River Mersey. The pond connections would include safety and trash screens.

Figure 11 – Typical Pond Landscape Design

The SuDS attenuation pond will been designed to ensure the surface water system does not flood for rainfall events up to the 1 in 100-year return period storm, which includes an allowance of 45% for climate change and maintains a minimum freeboard of 0.3m in this event.

A 0.6m freeboard as in accordance with Warrington Borough Council Sustainable Drainage Systems (SuDS) Design and Technical Guidance is not able to be achieved for the SuDS pond in Phase 1. This is due to the constraints with the topography of the site and the levels of the proposed spine road within Phase 1 and the outfall to the reinstated swale, meaning that the proposed drainage system from the spine road to the outfall are at the minimum grades that achieve self-cleansing velocities and therefore, the depth of the pond is not able to be increased. The site constraints of the red line boundary to the south of the pond and the boundaries of Plots 3 and 4 mean that the plan area or the pond is also restricted and can't be increased. As shown in Figure 11 a footpath, planting and other amenities also need to be provided between these boundary constraints and the SuDS pond. With these constraints a minimum 0.3m freeboard has been provided which is in line with CIRIA C753. The SuDS Manual Section 23.4.5. This reduced 0.3m minimum

freeboard has been agreed with the Warrington Borough Council LLFA as part of the pre-application discussions.

6 Site-Specific Use of SuDS Components

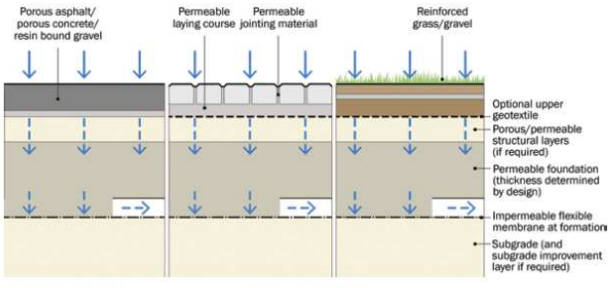
6.1.1 Water Quality Improvement

Water quality improvement measures will also be included to minimise the risk of contamination or pollution entering the receiving water body from surface water runoff from the development. This drainage strategy report describes how the following features could be incorporated as part of the proposed development. These could potentially be complemented by additional small scale and/or on-plot features, such as on plot rain gardens, that could help to further attenuate run-off. The need for, and/or feasibility of, such additional features would be subject to site-specific design and assessment at planning application stage.

The surface water drainage system will be designed to comply with the requirements of the SuDS treatment train as set out in CIRIA 753. Trapped highway gullies will be incorporated into the surface water drainage system to help mitigate diffuse pollution arising from the development proposals and all surface water will be routed through the proposed SuDS features, namely:

- Permeable paving in parking areas,
- Cellular Storage located under/at the parking areas,
- SuDS Attenuation Pond,
- Vortex Separator Chamber,
- Swales.

A review has been undertaken of the suitability of various SuDS treatments taking into account the site conditions/ constraints and is shown in Table 9 below. The following devices will be incorporated where possible as part of the proposed development. A summary of the performance of each treatment device is contained within Appendix D. Treatment train calculations are contained in Appendix E.

ITEM	DESCRIPTION
PERMEABLE PAVING  Figure 20.14 Pervious pavement system types: Type C – no infiltration Image Ref: CIRIA Report C753 – The SuDS Manual v6	Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface, before use, infiltration to the ground or controlled discharge downstream. Permeable paving is one of two types of pervious pavement, where the surface is formed of a material that itself is impervious to water. The materials are laid to provide void space through the surface to the sub-base. Location and use on site: Unadopted paved areas/ car parking within the eastern site at Phases 2 and 3. Car parking areas serving Phase 1 units within the western employment development.
SuDS ATTENUATION PONDS	SuDS attenuation ponds are landscaped depressions that are intended to have a constant small volume of water present through all rainfall and dry events. As an online component as is proposed here, surface runoff from regular storm events are routed through the pond for treatment and during more extreme events when

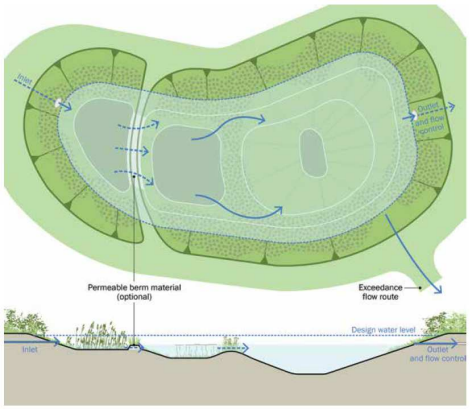
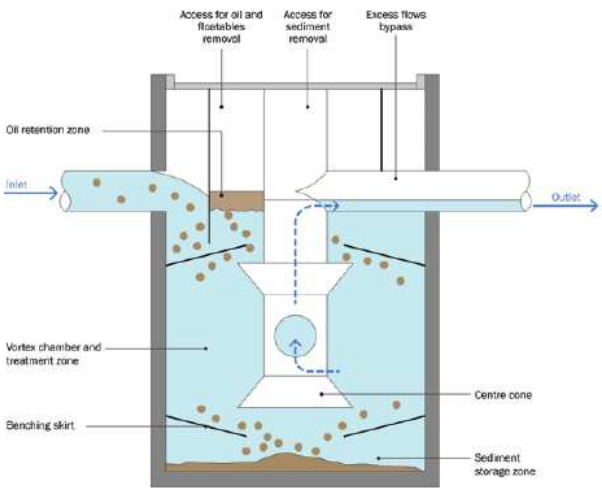
 Image Ref: CIRIA Report C753 – The SuDS Manual v6	flows rise, because the outlet is restricted the pond fills and provides attenuation. Location and use on site: A SuDS attenuation pond is a possible solution for capture and attenuation for on plot drainage before discharge. A SuDS attenuation pond is also proposed at the southern point of the western employment site before discharge to the watercourse.
SWALES  Image Ref: CIRIA Report C753 – The SuDS Manual v6	Swales are flat bottomed, vegetated open channels, designed to convey, treat, and often attenuate surface water runoff. When incorporated into site design, they can often enhance the natural landscape and provide aesthetic and biodiversity benefits. Swales can have a variety of profiles and can incorporate a range of different planting strategies. Location and use on site: multiple swales are proposed within the eastern residential development within the road network corridor to convey discharged flows from plots and provide drainage capture for the proposed road before discharging into the existing watercourse. A swale is proposed on the east side of the access road between the roads leading to Phase 2 and 3 and downstream of the proposed SuDS attenuation pond before discharge to the watercourse on the western Employment Phase.
VORTEX SEPARTORS  Image Ref: CIRIA Report C753 – The SuDS Manual v6	Vortex separators or hydrodynamic separators are structures that use gravity and centrifugal force to separate out and collect medium-sized sediments and other litter or debris from the runoff flows. Location and use on site: A vortex separator is proposed after the SuDS attenuation pond before the runoff discharges into the reinstated to a vegetated swale and outfall to the ordinary watercourse.

Table 9 – SuDS Components Incorporated into Proposed Design

Within the eastern Residential Phase development, multiple swales are proposed within the proposed road corridors, with the plots utilising plot specific SuDS features to capture, store, treat and convey surface water

flows into the swale network, to convey the flows of surface water drainage to the outfall into the existing watercourse.

Green spaces throughout the Eastern Residential Phase development have the potential capacity to provide attenuation ponds if required. The inclusion of these ponds within the design will help to increase the storage capacity of the catchment areas as well as provide opportunities to improve amenity and biodiversity of the site.

Within the western Employment Phase development, a SuDS attenuation pond is proposed to capture and store the main flow of runoff from Phases 1, 2 and 3. The attenuation pond is located outside of the design flood extent and within an area easily accessible to site users. The pond will provide amenity, biodiversity, water quality and water quantity measures for the SuDS scheme. The construction of the SuDS attenuation pond and possibly the proposed swale adjacent to the access road will also require the installation of an impermeable liner to ensure there are no contamination issues with the groundwater of the site. To install these liners a certain level of over dig to provide adequate backfill weight to counter the uplift force of the sites water table will be required. These calculations will be undertaken as part of the detailed design for each phase.

6.2 Pond Uplift

Uplift pressure or Hydrostatic uplift is an upward pressure applied to a structure/pond that has the potential to raise it relative to its surroundings. If the weight of the structure is not greater than the force of the uplift pressure problems can occur. The downward load should be at least 25% greater than the uplift pressure.

6.2.1 Eastern Residential Development

Any pond/attenuation proposed on plots will require a pond uplift check to determine how much if any over dig may be required, checks to determine if the proposed swales will also need to be conducted at detailed design stage for this area.

6.2.2 Western Employment Development

The proposed attenuation pond in the western development is located to the south of the site. Due to the size and location of the pond relative to the water table, pond uplift will have an influence and an uplift calculation will be required to be undertaken to determine the depth of backfill required above the liner. Uplift assessments of all the drainage items within the areas of high-water table will be undertaken to ensure that there are no flotation risks.

6.3 Overland Flow Paths

Individual drainage features would be designed to accommodate a variety of specific maximum rainfall events depending on the requirements of legislation, the adopting party, and constraints local to the feature, typically the 10-year, 30-year or 100-year rainfall events together with an allowance for climate change. Therefore, where not feasible, practical, or permitted to deliberately accommodate 100-year events, surface water exceeding the design event could result in overland flows.

The overland flow paths will follow the existing topography and drain in the direction of the general fall across the development. See Parameter Plan Drawing in Appendix A. As part of the detailed design for each area of the development, an assessment of these overland flows for the proposed area and highway designs will be carried out and a drawing showing these flows paths in more detail will be produced.

6.4 Design Rainfall

Rainfall within the catchment has been simulated using the Flood Estimation Handbook (FEH) methodology. The FEH method provides a more recent dataset and uses a larger rainfall record for generating the methodology. The FEH method uses grid references to determine the unique characteristics of the development catchment.

6.5 Adoption

6.5.1 Eastern Residential Development

Any conventional piped drainage on plots serving more than two curtilages will be design in accordance with Ofwat's Design and Construction Guidance and will be offered for adoption by United Utilities or a NAV (New Appointments & Variations) organisation. The Highway Drainage on the access roads within the residential areas will be designed to adoptable standards (Design Manual for Roads and Bridges - DMRB) and are planned to be put forward for adoption by Warrington Borough Council.

Private drainage within each plot of residential parcels will be design in accordance with Building Regulations Part H and will be responsibility of the individual property owner(s). The owner(s)/ lease holder(s) will be made aware of this maintenance responsibility by outlining this within any land sale or lease agreement to bind them to undertake these responsibilities.

It is envisaged that the proposed swales within the road corridor will be the same as the other highway drainage systems, where these will be designed to adoptable standards and will be put forward for adoption by Warrington Borough Council.

The extent of permeable paving will be determined by the plot developer but is envisaged to be limited to curtilage of individual dwellings on plots, therefore the maintenance of these feature will be the responsibility of the individual property owner(s)/ lease holder(s). A detailed description of the adoption of the drainage items is contained within the site wide maintenance and management report within Appendix F.

6.5.2 Western Employment Development

The proposed surface water drainage network for Phase 1 will include elements that are to remain private. The permeable paving and underground storage devices within the plots/units are to remain private, including drainage connecting to each unit. Private drainage within each plot/unit will be design in accordance with Building Regulations Part H and will be the responsibility of the individual property owner(s). The owner(s)/ lease holder(s) will be made aware of this maintenance responsibility by outlining this within any land sale or lease agreement to bind them to undertake these responsibilities. Drainage within the existing access road will be designed to adoptable standards but are not planned to be put forward for adoption at this time, therefore this will remain the maintenance responsibility of the landowner for the lifetime of the development, unless otherwise agreed or adopted in future. The SuDS attenuation pond and connection to the outfall will also remain private under the responsibility of Peel. Any roads within Phases 2 & 3 will be developed and designed to adoptable standards but are not planned to be put forward for adoption at this time, therefore this will remain the maintenance responsibility of the landowner for the lifetime of the development, unless otherwise agreed or adopted in future. A detailed description of the adoption of the drainage items is contained within the site wide maintenance and management report within Appendix F.

6.6 Maintenance

A site wide maintenance and management plan has been prepared in Appendix F to set out the respective responsibilities between adoptable and private systems. It is envisaged that a management company or other appropriate vehicle would be established to oversee the maintenance of the western and eastern development areas under overall control of Peel.

Adequate maintenance provision will be provided, with easements based on the planned maintenance activities, typically 3-4m wide access routes and up to 8m easements for maintenance of existing

watercourses. Plan drawings will be produced for all phases and sections within the eastern and western areas at the detailed design stages for each area.

Access chambers in the piped drainage system will be located within the footpaths rather than the carriageway so that this doesn't cause long term surface maintenance issues and that the drainage can be easily and safely accessed for maintenance without the need to close the full road and reduce the traffic management on roadways needed during maintenance.

The Sustainable Drainage Systems within the proposed drainage network will require maintenance to ensure they function as intended. In accordance with the SuDS Manual (Ciria, 2015) the maintenance schedules are detailed in the maintenance and management report within Appendix F

6.7 SuDS Construction

The construction of SuDS usually only requires the use of standard civil engineering construction and landscaping operations, such as excavation, filling, grading, top soiling, seeding, planting etc. These operations are specified in various standard construction documents, such as the Civil Engineering Specification for the Water Industry (CESWI).

Construction of permeable paving is regulated by the Building Regulations Part H (Drainage and Waste Disposal) which sets out the requirements for drainage of rainwater from the roofs of buildings.

Water contaminated with silt must not be allowed to enter drains as it may cause pollution. All parts of the drainage system will be protected from construction runoff to prevent silt clogging the system and causing pollution downstream. Measures to prevent this include soil stabilisation, early construction of sediment management basins, channelling runoff away from surface water drains, and erosion prevention measures.

After the end of the construction period and prior to handover to the site owner/operator:

- Subsoil that has been compacted during construction activities should be broken up prior to the re-application of topsoil to public open space to reinstate the natural infiltration performance of the ground.
- Checks must be made for blockages or partial blockages of orifices or pipe systems.
- Any silt deposited during the construction must be completely removed.
- Soils must be stabilised and protected from erosion whilst planting becomes established.

Detailed guidance on the construction related issues for SuDS is available in the SuDS Manual (CIRIA C753 2015).

7 Foul Water Drainage

7.1 Design Criteria

The foul water drainage design has been based on criteria stated within Sewers for Adoption, 8th Edition.

7.2 Flow rates

7.2.1 Eastern Residential Development

Design peak foul flows have been calculated using the Sewers for Adoption 8th Edition standards for residential and commercial buildings for each of the plots on the development, including an estimated number of 860 houses, a primary school, substation and local centre.

The flow rates from the primary school, local centre and substation have been calculated using the design flow standards from the Sewers from Adoption 8th Edition, though the combination of domestic design flows (0.6 litres per second per hectare) and trade effluent design flows (0.5 litres per second per hectare for normal industry) the overall discharge can be calculated as shown in Table 10 below.

Using the Sewers for Adoption 8th Edition standard of 4000 litres per dwelling per day) 0.05 litres per second per dwelling) the design peak flow rate for the below calculations. The total number of houses has been split between 11 plots and have been pro-rated per area of plot and is shown in Table 10 below for peak flow discharge rates:

Plot	Estimates houses per Plot	Peak Discharge Rate (l/s)
Plot A	91	4.3
Plot B	79	3.7
Plot C	24	1.2
Plot D	90	4.2
Plot E	68	3.2
Plot F	38	1.8
Plot G	32	1.5
Plot H	25	1.2
Plot I	76	3.6
Plot J	98	4.6
Plot K	46	2.2
Plot L	104	4.8
Sports Pitch	NA	NA
Primary School	NA	1.50
Local Centre	NA	0.6
Substation	NA	0.4

Table 10 – Eastern Area - Plot Foul Water Drainage Discharge Rates

Therefore, the design peak foul flow rate for the whole development has been calculated to be 38.8 l/s.

7.2.2 Western Employment Development

Design peak foul flows have been provided by the plot designers for each unit of the Phase 1 development and are shown in Table 11 below:

Unit	Discharge Rate (l/s)
1	1.2
2	3.2
3	7.9
4	2.6

Table 11 - Phase 1 Unit Foul Water Drainage Discharge Rates

Therefore, the for the Phase 1 development has been calculated to be 14.9 l/s.

The deign peak foul flow rate for Phases 2 and 3 has been estimated to be 28.5 l/s based on a pro rata of the Phase 1 development flow rate.

The flow rates from the exiting site connected to the existing adopted pump station have also yet to be determined.

7.3 Adoption

For the eastern Residential Phase development area, any conventional piped drainage on plots serving more than two curtilages will be designed and constructed in accordance with Sewers for Adoption and will be offered for adoption to United Utilities or NAV or other management company.

Private foul drainage within residential parcels will be designed in accordance with Building Regulations Part H and will be responsibility of the individual property owner(s).

The proposed foul water drainage network within the proposed residential access roads through the eastern Residential Phase development area will be designed to sewers for adoption standard as shown in Foul Water drainage Strategy drawing in Appendix A.

For the western Employment Phase development area, the proposed foul water drainage network will include elements that are to remain private and elements that have the option to be offered for adoption at a later date.

7.4 Foul Water Drainage Strategy

7.4.1 Eastern Residential Development

The foul water drainage strategy is based on following the current site topography to determine direction of gravity fed sewer systems for the whole site. Due to the relative level of the site compared to the existing pumping station and drainage lengths, a pumping station will be required to connect foul flows to the existing pumping station located near the power station building in the adjacent western site area. The location of the pumping station will be to the south-eastern corner of the site near Plots 9 and 10 as shown on the Foul Water Drainage Strategy drawing in Appendix A.

A total flow rate of 38.8 l/s will be communicated along gravity fed sewer routes to the proposed pumping station.

Up to six gravity fed foul sewer drainage networks will be required to collect discharge from the plots on the site at rates started in Table 10. The proposed rising main network exiting the pumping station will travel west along the access road leading to the proposed primary school, before heading north to the local centre where the rising main will exit the site at western development road connection. A gravity fed network will then connect to the existing pumping station off site.

7.4.2 Western Employment Development

The foul water strategy is based on use of the existing utilities already on site, with a flow of up to 14.9 l/s to be communicated from Phase 1 and up to 28.5l/s to be communicated from Phases 2 and 3 to the existing foul water pumping station located near the retained substation building.

Foul drainage for Phase 1 is to have a piped gravity system that will run down the proposed spine road to a proposed pumping station. Due to the level differences across the development area this pumping station in Phase 1 is required. This pumping station will pump the foul water flows to the existing pumping station on site where it will join a combined drainage network.

It is envisioned that these flows from Phases 2 and 3 will utilise the diverted public combined sewer along the redeveloped access roads to discharge into the same existing pumping station as Phase 1. Proposed combined sewer diversion route shown in Appendix C drawing 10057243-ARC-XX-ZZ-SK-CE-5500.

The rising main from the existing pump station itself will also have a diversion to run past Unit 2 and 3 of the Phase 1 development area, this diversion will terminate with it connecting to the existing system within Johnsons Lane to the west of Phase 1.

8 Conclusions

The drainage strategy proposed for the eastern residential and western employment development sites provides a viable framework for the development of surface water and foul systems. The strategy and outline design have been carefully considered to ensure that they are adequate for the site.

The proposed development site falls primarily within Flood Zone 1. However, the provision of a surface water network discharging at the permissible greenfield QBAR rate will have a beneficial impact on flood risk in the area as the discharge will be considerably lower than the current rate. In addition to this, the quality of the surface water discharged will also be improved by implementing a Sustainable Drainage System (SuDS) treatment train to ensure that an exemplar SuDS arrangement is proposed for the site, which will include source control measures in the form of a swales adject to the access roads and permeable paving within the on-plot developments.

The proposed drainage strategy also provides a viable solution for the draining of foul flows generated from the development. This will be achieved through the implementation of a new gravity foul drainage network that will connect to the existing foul water drainage pumping system off-site near the retained substation building.

This Drainage Strategy provides a comprehensive strategy for foul and surface water drainage across the entire Fiddlers Ferry Allocation Site, in accordance with the requirements of Policies ENV2 (Flood Risk and Water Management) and MD3 (Fiddlers Ferry) of the adopted Warrington Local Plan 2022/23 to 2038/39, as well as the NPPF and all other relevant policies and guidance (summarised in Section 4). This Allocation Site Wide Drainage Strategy will guide the preparation of detailed drainage strategies for each phase of development, which will be provided as part of the relevant planning application.

APPENDIX A
Drawings

APPENDIX B
Calculations

APPENDIX C
United Utilities Sewer Asset Records

APPENDIX D
SuDS Components Performance

The effectiveness of SuDS components in improving development surface water runoff quality is summarised in Figure 12 below. Combinations of treatments can be used to reduce potential pollutants from reaching the receiving watercourse.

	Inter-ception	Peak flow contr ol: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydro-carbons/ PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Pervious Pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Var
Filter Strips	Y	N	N	N	N	Y	N	Y	Y	Var
Swales	Y	Y	S	Y(*)	N	Y	Y(+)	Y	Y	Y(-)
Trenches	Y	Y	S	Y(*)	N	N	N	Y	Y	Y(-)
Detention Basins	Y	Y	Y	N	Y	Y	Y(+)	Y	Y	Var
Ponds	N	Y	Y	N	Y	N(~)	Y	Limited	Y	Var
Wetlands	N	Y	S	N	Y	N(~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bioretention Systems	Y	Y	S	Y(*)	N	N(~)	Y	Y	Y	Y
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y (!)	Y (!)	Y (!)
Subsurface Storage	N	Y	Y	N	Y	N(~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N(~)	N	N	N	N

Figure 12 – Effectiveness of SuDS Components

Notes:

- S Not normally with standard designs, but possible where space is available, and designs mitigate impact of high flow rates.
- Y (*) Where infiltration is facilitated by the design.
- N (~) Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
- Y (+) Where designs minimise the risk of fine sediment mobilisation during larger events.
- Y (!) Where designs specifically promote the trapping and breakdown of oils and PAH based constituents.
- Y (‘’) Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
- Var. The nutrient removal performance is variable and can be negative in some situations.

- Y (-) Good nutrient removal performance where subsurface bio-filtration systems with a permanently saturated zone included within the design.

APPENDIX E
Topographical Survey

APPENDIX F
Treatment Train Calculations

APPENDIX G
Maintenance and Management Plan

APPENDIX H
Greenfield Runoff Calculations

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