OMEGA ZONE 8, ST HELENS

Omega St Helens Ltd / T. J. Morris Limited

Document Title
Water Framework Directive Assessment
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Omega St Helens / T. J. Morris Limited

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OPP DOC.9

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1 INTRODUCTION

1.1 INTRODUCTION

1.1.1. This Water Framework Directive (WFD) Assessment has been prepared on behalf of Omega St Helens / T. J. Morris Limited (referred to as 'the Applicant') in support of a hybrid planning application for the proposed westward expansion of the Omega Business Park into Zone 8 (referred to as the 'Proposed Development'), south of the M62, approximately 2km west of Junction 8 at its centre point. This WFD assessment is concerned specifically with the proposed diversion of the Whittle Brook, which forms part of the outline planning application site. Thus, the level of detail provided in this assessment is proportional to what is required for an outline planning application: additional detail pertaining to channel diversion works will be developed at the detailed design and planning phases following consultation with the Environment Agency and other regulatory bodies.

1.1.2. The Proposed Development is subject to a hybrid planning application for both detailed and outline planning permission and is described as follows:

'Hybrid Planning Application for the following development (major development);

(i) Full Planning Permission for the erection of a B8 logistics warehouse, with ancillary offices, associated car parking, infrastructure and landscaping; and

(ii) Outline Planning Permission for Manufacturing (B2) and Logistics (B8) development with ancillary offices and associated access infrastructure works (detailed matters of appearance, landscaping, layout and scale are reserved for subsequent approval).'

1.1.3. Subsequent to the submission of the planning application in December 2019 and the submission of this WFD assessment (OPP DOC.9) in January 2020, this report has been amended in light of post-submission changes to the Proposed Development. The changes to the Proposed Development are as follows:

OUTLINE ELEMENT

- Whittle Brook watercourse diversion route realigned – indicative route moved further east into the site and away from the perimeter of the application site.
- Whittle Brook watercourse diversion outline design amended to include 8m buffer zone to each side of realigned route.
- Outline area indicative masterplan (**Figure 1-1**) layout amended to accommodate realignment of the watercourse diversion – Unit 4 plot and building footprint reduced (revised floorspace remains unchanged due to the potential for the addition of mezzanine levels within any of the new buildings).

DETAILED ELEMENT

- East – west cycleway / footpath has been realigned to accommodate both the 8m offset for the watercourse and the corresponding batters.
- Unit 1 southern boundary and service yard has been moved northwards by varying degrees to accommodate the revised footpath alignment and associated changes in levels within the service yard.

- The level changes in the service yard have required the revision of the footprint of the Unit 1 western attenuation basins and the associated servicing and plant areas.
- 2m close boarded timber fence now shown along the extent of the northern boundary adjacent to the motorway in response to Highways England's consultation request.
- Increase in height of proposed timber board fence on the southern boundary from 3m to 3.5m to address changes in light spill on the realigned cycleway / footpath.
- Updated Unit 1 layout drawings also show an additional baler to the north elevation, along with some minor repositioning of the compactors and adjacent dock levellers in order to accommodate the baler. The associated canopy has also widened accordingly.

1.1.4. For the purposes of this WFD assessment, the most relevant changes to the Proposed Development are in relation to the Whittle Brook diversion and therefore appropriate amendments have been made to this report to reflect these changes.

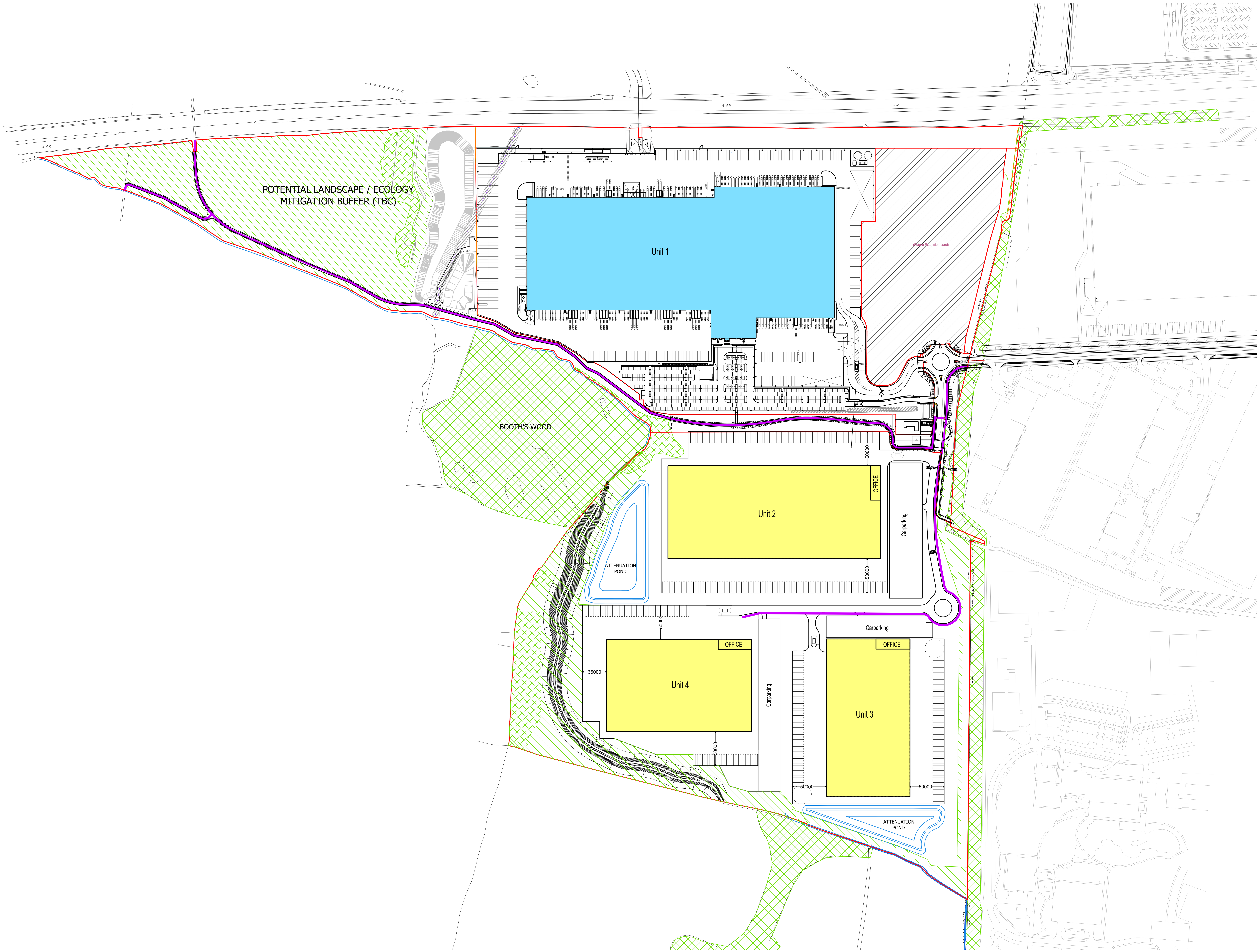
1.1.5. The outline planning application site requires the diversion of the Whittle Brook, which currently flows diagonally from north-west to south-east through the centre of the application site. The proposed diversion is shown on **Figure 1-1**. The proposed diversion of this watercourse triggers the need for a WFD assessment. The detailed planning application site would not impact upon local surface water bodies and therefore does not require a WFD compliance assessment. Therefore, all reference to the Proposed Development hereafter is specifically regarding the outline planning application site.

1.1.6. During the optioneering process, several routes for the diversion of the Whittle Brook were considered in consultation with fluvial geomorphologists. The preferred option being assessed was selected due to it both meeting the requirements of the Proposed Development and enabling sensitive channel design to accommodate both design flows and natural fluvial processes. The optioneering exercise and its outcome is presented in **Appendix A**. This WFD assessment considers the potential impacts of the Proposed Development on the preferred channel diversion option only.

1.1.7. The Proposed Development components that potentially impact upon the Whittle Brook comprise the following:

- Construction of up to 123,930 m^2 of manufacturing units and ancillary office space;
- Diversion of the Whittle Brook watercourse to accommodate the Proposed Development;
- Two attenuation ponds; and,
- Two drainage outfalls.

1.1.8. The design of the Proposed Development is shown in **Figure 1-1**.



Contractors must verify all dimensions on site before commencing any work or shop drawings. This drawing is not to be scaled. Use figured dimensions only.

Subject to statutory approvals and survey.

Building areas are liable to adjustment over the course of the design process due to the ongoing construction detailing developments.

Please note the information contained within this drawing is solely for the benefit of the employer and should not be relied upon by third parties.

The CDM hazard management procedures for the Chetwoods aspects of the design of this project are to be found on the "Chetwoods - Hazard Analysis and Design Risk Assessment" and/or drawings. The full project design teams comprehensive set of hazard management procedures are available from the Principle Designer appointed for the project.

North

Notes:

Please note Title Plans have been scaled using Ordnance Survey features which may have altered over time. Complete accuracy cannot be guaranteed without further on-site survey.

Any dimensions given are to be confirmed with site measure.

KEYS:

- PEDESTRIAN / CYCLE ROUTE
- Unit 1 TJM UNIT
- OUTLINE UNITS
- LANDSCAPE AREAS
- EXISTING WOODLAND
- TJM SUDS
- OUTLINE SUDS
- WATERCOURSE DIVERSION
- EXPANSION LAND

Rev	Revision Description	Date	Author/ Reviewer
	SK15Pedestrain/Cycle Route updated	06/08/20	RC/SF

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OMEGA WEST, WARRINGTON

Client
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Drawing Title
FIGURE 1-1 THE PROPOSED DEVELOPMENT AREA

Scale	Size	Drawn	Checked	Date
1:2500	A1	RC	SF	23/10/19

Project	Originator	Zone	Level	Type	Role	Number	Rev.
4150	CA	00	00	DR	A	05100	SK15

1.2 STUDY AREA

1.2.1. The study area is located within St. Helens borough on the outskirts of Warrington, Cheshire, and sits within Whittle Brook – a heavily modified, low energy gravel river – just south of the M62. The length of the Whittle Brook within the study area has been assessed for potential impacts of the Proposed Development on WFD status. This length of the watercourse is described as a 'Reach' and the Reach has been divided into three distinct morphological units (Reach 1; Reach 2 and Reach 3). The Whittle Brook survey Reaches are shown in **Figure 1-2**. The wider study area, which comprises the Whittle Brook catchment, is described in subsequent sections (see Sections 4.1, 4.2 and 4.3).

1.2.2. The Proposed Development could potentially impact Whittle Brook (Mersey Estuary) (GB112069060990), which lies within the Sankey Operational Catchment, the Mersey Lower Management Catchment and the North West River Basin District and sits within the study area.

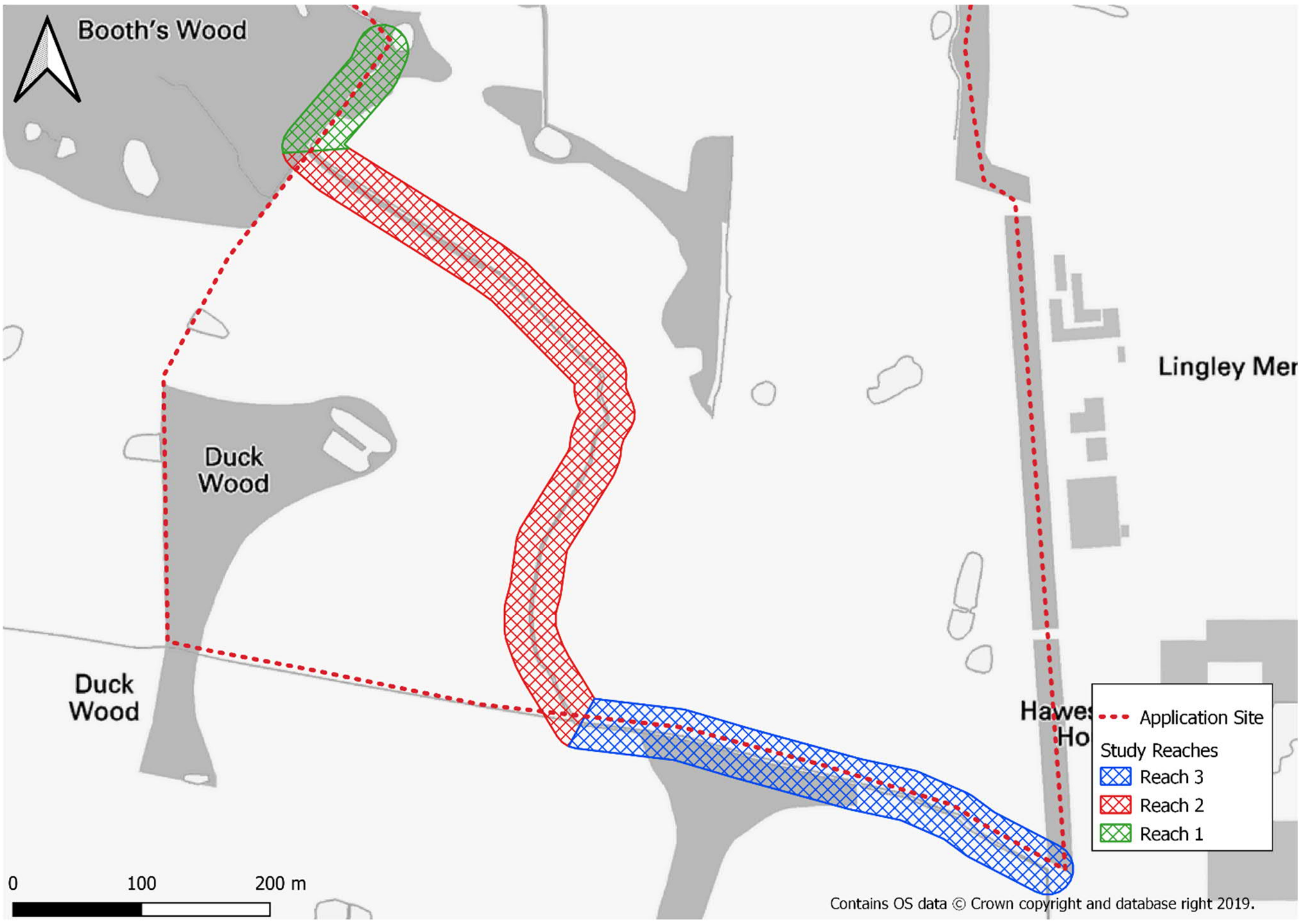

Figure 1-2 - Whittle Brook Survey Reaches

1.3 WFD ASSESSMENT

1.3.1. An impact assessment of any works/modifications to water bodies in the UK is required under the European Union's Water Framework Directive (2000/60/EC). The WFD is transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Compliance with the WFD legislation is required for permitting of the Proposed Development.

1.3.2. The primary aim of the WFD is to improve/maintain the Ecological Status/Potential of all water bodies and to prevent deterioration in status of the water bodies and their associated WFD quality elements. Ecological Status/Potential is determined by a suite of biological, physico-chemical and hydromorphological quality elements. This WFD assessment aims to establish the baseline conditions, evaluate potential impacts of the Proposed Development and assess compliance against WFD objectives.

1.3.3. The overarching objective of the WFD is for surface water bodies in Europe to attain overall 'Good Ecological Status' (GES) or 'Good Ecological Potential' (GEP). GES refers to situations where the ecological characteristics show only a slight deviation from natural/near natural conditions. In such a situation, the biological, chemical, physico-chemical and hydromorphological conditions are associated with limited or no human pressure. Artificial and heavily modified water bodies have a target to achieve GEP, which recognises their important uses, whilst ensuring the quality elements are protected as far as possible.

1.3.4. The WFD sets several objectives including:

- Prevent deterioration in status for water bodies;
- Aim to achieve good biological and good surface water chemical status in water bodies. For those water bodies that did not achieve GES by 2015, alternative objectives have been set by the Environment Agency where water bodies have been allocated a target date for compliance of either 2021 or 2027. The target date set for each water body takes into consideration measures that are practicably achievable for achieving GES or GEP;
- For water bodies that are designated as artificial or heavily modified, the objective is to achieve GEP. Those artificial/heavily modified water bodies that did not achieve GEP by 2015 need to achieve compliance by 2021 or 2027;
- Where is it considered either technically infeasible or disproportionately expensive to achieve GES or GEP by 2021 or 2027, alternative objectives have been set for the water body, such as a target to achieve Moderate status;
- Comply with objectives and standards for protected areas, where relevant; and,
- Reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.

1.3.5. Where a new modification, change in activity or change to a structure on a water body is proposed, a WFD assessment needs to consider whether the proposed alteration would cause deterioration in the Ecological Status or Potential of any water body. For heavily modified/artificial water bodies, proposed new modifications, or changes to activities or structures, may also result in WFD mitigation measures or actions, set to help a water body achieve GES/GEP, being ineffective. This could result in the water body failing to meet GES/GEP. Where a WFD assessment concludes that deterioration or failure to achieve GES/GEP may occur, an Article 4.7 assessment would be required, which makes provision for deterioration of status provided that certain stringent conditions are met.

1.3.6. The purpose of this WFD assessment is to evaluate the potential operational impacts arising due to the proposed diversion of the Whittle Brook (Mersey Estuary) (GB112069060990) water body. The potential construction impacts are also evaluated due to the potential effects they may have upon the status of WFD quality elements.

1.3.7. The assessment methodology used here is based on guidance provided by the Planning Inspectorate Advice Note 18: The Water Framework Directive (Ref. 11). This guidance outlines a three-stage process to WFD assessment: screening, scoping, and impact assessment.

STAGE 1: SCREENING

1.3.8. Screening is required to identify activities which have the potential to result in deterioration of a water body or fail to comply with the objectives of that water body. Screening also serves to identify those proposed activities (e.g. proposed construction methods) that are required to be taken through to scoping, and those activities that are unlikely to result in the deterioration of the water body.

STAGE 2: SCOPING

1.3.9. Scoping is required to identify risks to receptors from a projects' activities, based on the relevant water bodies and their water quality elements (including information on status, objectives, and the parameters for each water body). Potential risks to hydromorphology, biology (habitats and fish), water quality, WFD protected areas and invasive non-native species should be assessed. The scoping stage identifies which elements need to be carried forward to Stage 3.

STAGE 3: IMPACT ASSESSMENT

1.3.10. Where assessment has been considered necessary at scoping stage, an impact assessment is carried out for each receptor identified as being at risk in terms of potential deterioration or non-compliance with its specific objectives as set out in the River Basin Management Plan as a result of the project. Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided, the project would need to be assessed in the context of Article 4(7) of the WFD.

2 METHODOLOGY

2.1 DATA COLLECTION

DESK STUDY

2.1.1. A desk-based study was carried out to inform the WFD assessment, reviewing the existing information of the Proposed Development and application site to develop a baseline for the catchments, watercourses and surrounding areas. The following data sources were used for the desk study:

- Contemporary Ordnance Survey maps;
- Geology and soil maps;
- Current aerial photography;
- Environment Agency ecology data;
- Historic maps;
- Designated areas data (Ref. 6); and,
- WFD status and objectives from the 2015 North West River Basin Management Plan (Ref. 3) for cycle 2 data.

FIELD SURVEY

2.1.2. A walkover survey of the application site was undertaken to determine the baseline conditions of the watercourses potentially impacted by the Proposed Development and to evaluate potential impacts of both the construction (including enabling works) and operational phases. The following field surveys were undertaken.

Geomorphology/Hydromorphology Walkover Survey

2.1.3. A geomorphological walkover survey was conducted by an experienced geomorphologist on 16 September 2019 to gain an understanding of baseline conditions of the study Reach.

2.1.4. In addition to field notes, maps of the study area were annotated to capture the key geomorphological features and prevailing fluvial processes. Weather conditions up to and during the survey were fair and water levels were low to moderate. The survey covered approximately 1.1km of the Whittle Brook WFD water body. The survey methodology was adapted from Thorne (Ref. 10) and included data on:

- Valley Form
- Land use
- Floodplain and riparian zone
- Channel geometry
- Bank material and structure
- Bed material and forms
- Erosion features (sediment sources)
- Depositional forms (sediment sinks)
- Artificial features and modifications.

Aquatic Ecology Walkover Survey

2.1.5. An aquatic ecology walkover survey was conducted by an experienced aquatic ecologist on 16 September 2019 to gain an understanding of baseline conditions of the study Reach in terms of habitat quality and composition. The principle aim of the survey was to determine whether there was potential for the channel to support key invertebrate and fish (primarily brown trout) populations.

2.2 WFD ASSESSMENT PROCESS

2.2.1. Initial screening and scoping exercises were conducted to determine the need for a Stage 3 WFD impact assessment. The sequence of the Stage 3 WFD impact assessment is summarised below:

- **Step 1:** Identify potential generic operational impacts of the Proposed Development on WFD quality elements;
- **Step 2:** Site specific assessment of the Proposed Development against biological, physico-chemical and hydromorphological quality elements;
- **Step 3:** Review of mitigation measures to deliver WFD objectives;
- **Step 4:** Assessment of the Proposed Development against WFD objectives; and,
- **Step 5:** Assessment of the Proposed Development against other EU legislation.

2.2.2. Whilst the assessment of potential construction impacts is not required as part of a WFD assessment, these impacts may have detrimental impacts on the WFD quality elements and construction periods may sometimes be of long duration (i.e. several years). In addition, the construction impacts associated with a major diversion of a main river have the potential for significant effects on the water body. Thus, construction impacts have been considered, along with construction mitigation, to reduce or eliminate potential impacts on the water body and WFD quality elements.

2.3 LIMITATIONS AND ASSUMPTIONS

2.3.1. It was not possible to arrange a consultation meeting with the Environment Agency to confirm the methodology and design principles applied to this assessment prior to the submission of the planning application. The Scoping Opinion response from the Environment Agency does, however, confirm the need for a WFD assessment of the proposed watercourse diversion. However, a meeting was held with the Environment Agency on 5 May 2020.

2.3.2. In the absence of a meeting with the Environment Agency prior to the submission of the planning application, the WFD assessment was undertaken based upon a set of design principles and using professional judgement.

2.3.3. The Applicant has worked on the assumption that the proposed watercourse diversion will be acceptable to the Environment Agency and that it opens the opportunity to deliver improvements to the physical form and function of the watercourse, for which it is currently failing under WFD.

2.3.4. The WFD assessment has been undertaken based on indicative design principles only due to the watercourse diversion being subject to outline planning consent only at this stage. These design principles are stated in **Table 2-1**.

2.3.5. Detailed surveys, such as sediment sampling and analysis, fish and macroinvertebrate surveys, have not been undertaken for the outline planning application site. The need for detailed surveys is deferred to support the full planning application.

2.3.6. Observations recorded during the site visits represent a snap-shot of that moment in time; for example, the site visit was conducted during a period of low flow and fair-weather conditions, following a benign winter and summer, i.e. with no significant flood events. Thus, the channel has been characterised and assessed based on the prevailing conditions during a single site visit. The river may exhibit additional characteristics during, for example, extreme flow events or prolonged drought; however, these were not captured during the survey. Nevertheless, this is not considered to impede the ability to undertake this assessment.

2.3.7. Data recorded during the field survey reflects the weeks and months leading up to the survey: the channel may exhibit other morphological phenomena during particularly high flow events or following an extreme flow event. Thus, in the absence of time series data for the watercourse, inferences have been made based upon field data and a desk study exercise.

Table 2-1 – Design Principles for the Whittle Brook Channel Diversion

Design Principle	Description	Function
Riffle-pool sequence	Pools represent topographic low points of the channel, whilst riffles represent topographic high points. Riffles are typically spaced five to seven channels widths apart.	Riffles are shallow regions of the channel that are comprised of coarser material, whilst pools are deeper areas of the channel with generally finer substrate. Riffles are important spawning and incubation habitat for fish, whilst pools are important for areas of refuge and feeding. Incorporating riffle-pool sequences essentially mimics the natural arrangement of gravels and thus contributes to the hydromorphic functioning of the channel.
Inset berms	Small peninsular made from cohesive material.	Inset berms are placed in the channel in an alternating arrangement on left and right bank to create intermittent areas of concentrated flow. The primary functions of inset berms are to create flow variation and locally increase velocity. They also provide additional marginal habitat and, therefore, benefit a variety of aquatic and terrestrial species.
Two-stage channel	Multi-tiered channel that can accommodate both low and high flow whilst maintaining functionality.	Two-stage channels incorporate benches on either side of the main, low-flow channel, that function as low level floodplains during elevated flow. The benches of a two-stage channel can accommodate a wide range of flora and fauna and thus provide greatly enhanced riparian habitat in comparison to trapezoidal channels. In addition, the low-flow portion of the channel can be designed to maintain ecological connectivity during summer flows; whereas the upper, high-flow portion can be designed to become inundated at flows exceeding the 2-year flood, thereby contributing to flood attenuation whilst mimicking natural processes, albeit within the confines of a narrow corridor. This provides improved connectivity whilst still protecting the true floodplain, and thus the application site, from flood risk.
Lowered Berm	Areas of lowered land adjacent to the channel.	Lowered berms differ from inset berms in that they do not protrude into the channel. Instead they form small areas of the riparian zone that connect with the watercourse much more frequently than the wider riparian environment. In doing

Design Principle	Description	Function
		so, this creates parcels of wetland habitats that are of greater benefit for various aquatic and terrestrial species.
Marginal/ Riparian Planting	Planting of a wide variety of native plant species immediately adjacent to the channel.	The riparian planting would help stabilise the banks and retain fine material. In addition, it would provide valuable habitat to a plethora of species, as well as providing shade to the channel.

3 WFD SCREENING AND SCOPING

3.1 STAGE 1: WFD SCREENING

3.1.1. The purpose of the WFD screening stage is to identify the extent to which the Proposed Development may affect WFD water bodies that lie within the zone of influence of the Proposed Development.

SCREENING OF WATER BODIES

3.1.2. The Whittle Brook (Mersey Estuary) (GB112069060990) WFD water body, would be directly impacted by the Proposed Development due to the proposed diversion of this watercourse. Therefore, this WFD water body is screened in for further assessment.

3.1.3. The downstream water body is the River Mersey (GB531206908100) (a transitional water body). This is considered sufficiently far downstream from the Proposed Development to avoid any impacts and is therefore scoped out of further assessment.

3.1.4. The groundwater body that underlies the study area is the Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers (GB41201G101700). Activities relating to the construction and operation of the Proposed Development have been assessed in terms of their potential impact upon this groundwater water body. There are no anticipated impacts at the water body scale, therefore assessment of impacts to groundwater is scoped out.

SCREENING OF ACTIVITIES

3.1.5. The Proposed Development comprises the following key activities split into the detailed planning application site and the outline planning application site:

- Detailed planning application site:
  - Construction of a B8 warehouse (81,570 sq. m), with ancillary office space, parking access and landscaping proposals;
  - Three attenuation ponds;
  - One outfall into the Whittle Brook WFD water body discharging water from two attenuation ponds situated to the west of B8 warehouse; and,
  - One outfall into the Barrow Brook watercourse, discharging water from one attenuation pond to the north of the B8 warehouse.
- Outline planning application site:
  - Up to 123,930 sq.m of manufacturing (B2) and logistics (B8) development with ancillary offices and associated access infrastructure works;
  - Diversion of the Whittle Brook;
  - Two attenuation ponds; and,
  - Two outfalls into the Whittle Brook WFD water body discharging water from the north west and south east regions of the outline planning application site.

3.1.6. The screening process is presented in **Table 3-1**.

Table 3-1 – WFD screening of activities

Activity	Screening Outcome	Justification
Detailed planning application site		
Construction of a B8 warehouse (81,570 sq. m), with ancillary office space, parking access and landscaping proposals	OUT	No anticipated direct impact upon the Whittle Brook WFD water body. Construction activities that may impact upon the watercourse due to proximity would be managed and mitigated through standard best practice and pollution prevention methods. Monitoring is recommended up- and downstream of works to assess mitigation. Such mitigation is considered in Section 5 of this report.
Three attenuation ponds	OUT	The proposed attenuation ponds are designed to accommodate a comparable volume of surface water as the existing site, which will be discharged back to the channel at rate comparable to greenfield Qbar.
Outfalls: Construction and operation of two outfalls: one into the Whittle Brook WFD water body and one into the Barrow Brook ordinary watercourse.	OUT	The outfalls are assumed to discharge into the watercourse at equivalent greenfield runoff rates. The flows within Whittle Brook are also being modelled to ensure no adverse impacts. The embedded design would ensure outfall design follows best practice and are angled in line with flow within the channel to mitigate the risk of localised bed scour. Water quality assessments would ensure that discharge meets required water quality standards. Therefore, with embedded mitigation in place, it is anticipated that there would be no impact upon the WFD water body because of the outfalls and associated discharge. Therefore, outfalls and their discharge have been screened out of further assessment.
Outline planning application site		
Construction of up to 123,930 sq.m of manufacturing (B2) and logistics (B8) development with ancillary offices and associated access infrastructure works	OUT	No anticipated direct impact upon the Whittle Brook WFD water body. Construction activities that may impact upon the watercourse due to proximity would be managed and mitigated through standard best practice and pollution prevention methods. Monitoring is recommended up- and downstream of works to support mitigation. Such mitigation is considered in Section 5 of this report.
Diversion of the Whittle Brook	IN	Diverting a watercourse has the potential for significant impacts upon the WFD water body and, therefore, requires further impact assessment. The scale of the assessment is scaled down due to it pertaining to the outline planning application site and the WFD assessment is based upon high-level design principles for the proposed watercourse diversion.
Two attenuation ponds	OUT	Two attenuation ponds would be designed to accommodate a comparable volume of surface water as the existing site, which would be discharged back to the channel at an appropriate rate (see justification for the following activity below).

Activity	Screening Outcome	Justification
Outfalls: Construction and operation of two outfalls into the Whittle Brook WFD water body	OUT	The outfalls would be designed to discharge into the watercourse at equivalent greenfield runoff rates. The flows within Whittle Brook would also be modelled to ensure no adverse impacts. The embedded design would ensure outfall design follows best practice and are angled in line with flow within the channel to mitigate the risk of localised bed scour. Water quality assessments would ensure that discharge meets required water quality standards. Therefore, with embedded mitigation in place, it is anticipated that there would be no impact upon the WFD water body because of the outfalls and associated discharge. Therefore, outfalls and their discharge have been screened out of further assessment.

3.1.7. Of these activities, the proposed diversion of the Whittle Brook is screened into further WFD assessment. This is due to 570m of the Whittle Brook being diverted, thus significantly altering its current course. Without appropriate assessment and mitigation, this proposed diversion could have a detrimental impact upon the status of the WFD water body.

3.1.8. The other activities listed in **Table 3-1** above are screened out of further WFD assessment as they will not impact directly upon the WFD waterbody.

3.2 STAGE 2: WFD SCOPING

3.2.1. The WFD scoping stage defines the level of detail required for further WFD assessment. This includes identifying risks to the WFD receptors from the Proposed Development's activities. Given that the planning application for the Proposed Development is a hybrid application, a higher level of WFD assessment is being undertaken than would normally be conducted for an outline planning application. On this basis, the WFD process has been used to both influence the route of the proposed watercourse diversion and to inform the route options selection (see **Appendix A**). The WFD assessment presented within this report is based upon an indicative design of the preferred watercourse diversion option only given that it is an outline planning application. Assumptions relating to the design elements that would be incorporated into the channel design at a later stage are listed and the assessment is based upon those assumptions. The scoping stage assessment is presented in **Table 3-2**.

Table 3-2 – WFD scoping of the Proposed Development's activities against WFD quality elements

WFD Quality Element	Risk to Receptor (Yes/No)	Scoping Outcome Reasoning
Biological Quality Elements		
Fish	Yes	Fish are not included in the WFD cycle 2 classification for this water body. Due to the significant impact of the channel diversion and sensitivity of this quality element, fish are scoped in for further assessment.
Invertebrates	Yes	Due to the significant impact of the channel diversion and sensitivity of this quality element, invertebrates are scoped in for further assessment.
Macrophytes and phytobenthos combined	Yes	Due to the significant impact of the channel diversion and sensitivity of this quality element, invertebrates are scoped in for further assessment.
Physico-chemical Quality Elements		
Thermal Conditions	No	Due to the small width of Whittle Brook, steep banks and the length of the proposed works, it is unlikely that the Proposed Development would affect thermal conditions. In addition, considerate planting would also limit any changes due to the Proposed Development. Therefore, this WFD quality element is scoped out of further assessment.
Oxygenation Conditions	Yes	The proposed works and diversion of Whittle Brook have the potential to mobilise soil within the Brook which may result in a reduction in dissolved oxygen. Monitoring is recommended up- and downstream of the Proposed Development.
Salinity	No	Salinity is not included in the WFD cycle 2 classification for this water body. It is unlikely the Proposed Development would affect salinity within this water body and likely that the proximity of the water body to the Mersey Estuary will have a greater effect. Therefore, salinity is scoped out of further assessment.
Acidification Status	No	It is unlikely the Proposed Development would affect acidification within this water body. Cement works would be away from the Brook and managed using best practice and appropriate mitigation. Therefore, acidification status is scoped out of further assessment.
Nutrient Conditions	Yes	The proposed works and diversion of Whittle Brook have the potential to mobilise soil within the Brook, which may

WFD Quality Element	Risk to Receptor (Yes/No)	Scoping Outcome Reasoning
		result in an increase in nutrients. Monitoring is recommended up- and downstream of the Proposed Development.
Hydromorphological Quality Elements		
Quantity and Dynamics of Water Flow	Yes	The existing Whittle Brook would be diverted; thus, consideration of quantity and dynamics of flow would be required in the design of the diverted channel.
Connection to Groundwater Bodies	No	The thick layer of drift geology (till and clay deposits) would ensure that the groundwater body is protected from activities associated with the Proposed Development.
River Continuity	Yes	The existing Whittle Brook would be diverted; thus, consideration of river continuity (lateral and longitudinal connectivity) would be required in the design of the diverted channel.
River Depth and Width Variation	Yes	The existing Whittle Brook would be diverted; thus, river depth and width variation would be considered in the design of the diverted channel.
Structure and Substrate of the River Bed	Yes	The existing Whittle Brook would be diverted; thus, the structure and substrate of the river bed would be considered in the design of the diverted channel.
Structure of the Riparian Zone	Yes	The existing Whittle Brook would be diverted; thus, the structure of the riparian zone would be considered in the design of the diverted channel.

4 WFD IMPACT ASSESSMENT

4.1 BASELINE CONDITIONS

WFD STATUS - SURFACE WATER

4.1.1. The surface water WFD water body potentially impacted by the Proposed Development is the Whittle Brook (Mersey Estuary) (GB112069060990). This water body lies within the Sankey Operational Catchment, the Mersey Lower Management Catchment and the North-West River Basin District. The WFD status for the Whittle Brook (Mersey Estuary) water body is provided in **Table 4-1**.

Table 4-1 – WFD Status of the (Whittle Brook (Mersey Estuary) potentially impacted by the Proposed Development (source Environment Agency, 2019)

Parameter	Current WFD Baseline Status
Water Body ID	GB112069060990
Water Body Name	Tributary of Whittle Brook (Mersey Estuary)
Water Body Type	River
Water Body area*	1459.43 ha (for Whittle Brook)
Hydromorphological Designation	Heavily Modified
Reason for Designation	The reasons cited include flood protection works and urbanisation.
Overall Ecological Status/Potential	Moderate
Current Overall Status/Potential	Moderate
Status Objective (overall)	Good by 2027 (disproportionate reasons)
Justification for not Achieving Good Status by 2015 (from 2009 Whittle Brook (Mersey Estuary) River Basin Management Plan	Physical modifications to the channel resulting from flood defence works and urbanisation as well as poor nutrient management, poor soils management and misconnections occurring within the catchment.
Protected Area Designation	The following nitrate vulnerable zones within the Whittle Brook water body are: NVZ12SW016390; NVZ12SW016370; and NVZ12SW016400.
Biological Quality Elements	
Overall Biological Quality Element Status Objective	Poor
Fish	Not assessed
Invertebrates	Poor
Macrophytes and phytobenthos combined	Not assessed

Parameter	Current WFD Baseline Status
Physico-chemical Quality Elements	
Overall Physico-Chemical Quality Element Status Objective	Moderate
Specific pollutants	Triclosan - High
Priority substances	Does not require assessment
Priority hazardous substances	Good
Dissolved inorganic Nitrogen	Moderate
Dissolved Oxygen	High
Overall Chemical Status	Good
Overall Chemical Quality Element Status Objective	Good by 2015
Hydromorphological Quality Elements	
Hydromorphology Supporting Elements Status	Supports Good
Hydrological regime	Supports Good
Mitigation Measures Assessment	
Current	Achieving Moderate or less 480104 – Flood protection; 480105 - Urbanisation

4.2 CATCHMENT CHARACTERISTICS

4.2.1. Whittle Brook is a highly engineered and managed watercourse draining a heavily urbanised and intensively farmed catchment. The Whittle Brook lies within an open lowland setting and flows between areas of housing and infrastructure within a predominantly arable farmland landscape.

4.2.2. The source of the Whittle Brook is located north of the M62, near Clock Face Village, at an elevation of 45m Above Ordnance Datum and flows in a north west to south east direction. The river continues through the densely populated area of Great Sankey before joining the River Mersey at National Grid Reference (NGR): SJ 57583 87039, approximately 4.5km downstream of the study Reach.

CATCHMENT GEOLOGY AND SOILS

4.2.3. The catchment bedrock geology of the Whittle Brook consists entirely of pebbly sandstone of the Chester Formation. These sedimentary rocks are fluvial in origin, detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river.

4.2.4. The superficial deposits present in the Whittle Brook catchment consists entirely of Devensian Till – Diamicton. These sedimentary deposits are glaciogenic in origin and detrital, created by the action of ice and meltwater.

4.2.5. The soil deposits present in the catchment of the Whittle Brook consist of deep loam to clayey loam soil, with a variable composition of clay, silt, sand and gravel. The soils are not prone to wind erosion but may be prone to displacement and particle entrainment during very wet years.

CATCHMENT HYDROLOGY

4.2.6. There are no gauging stations for the Whittle Brook, or the River Mersey Estuary. All hydrology data have been supplied via the Environment Agency's hydraulic model, which have been used in the Flood Risk Assessment (**OPP DOC. 1**).

HISTORICAL CHANNEL CHANGE

4.2.7. The historical mapping record reveals that Whittle Brook has not changed significantly since at least the mid-19th Century. The extensive channel modification that the watercourse has experienced through history predates formal mapping and surveying practices. As such, it can be assumed that the channel is morphologically stable. Similarly, there is little evidence in the available topographic data (specifically aerial LiDAR) that indicates the channel's former course. This is probably due to intensive farming with evidence of former channels having been ploughed out of the landscape. Moreover, the system probably, in its natural, unmodified state, originally exhibited a complex, anastomosing morphology with multiple channels draining a marshland or wet woodland environment. It is likely that land clearing for farming and settlement, and subsequent land drainage, ultimately led to the Whittle Brook network being confined to an over-deep, straightened and single-thread channel system.

4.3 BASELINE CHARACTERISTICS AGAINST WFD SURFACE WATER QUALITY ELEMENTS

BIOLOGICAL QUALITY ELEMENTS

Fish

4.3.1. Fish are not included as a biological receptor in the WFD cycle 2 classification for the Whittle Brook waterbody. Fish data were available for two Environment Agency monitoring locations on Whittle Brook (Upstream of the A57 (NGR: SJ57300388400) and downstream of the A57 (NGR: SJ35700387700)). Locations were close to the Whittle Brook confluence with the Mersey Estuary and a considerable distance downstream of the Proposed Development. Data were collected in 1994 and 2000. The fish community at both locations was limited with flounder, European eel and three-spined stickleback present in 2000. In 1994, European eel and three-spined stickleback were collected downstream of the A57 with European eel collected upstream of the A57. The tidal influence is evident at both locations with all three species able to colonise habitats with a saline influence.

Invertebrates

4.3.2. Macroinvertebrates are included as a biological receptor in the WFD cycle 2 classifications for Whittle Brook. The following biotic indices were provided by the Environment Agency: Whalley Hawkes Paisley Trigg - Number of Taxa (WHPT NTAXA) and Whalley Hawkes Paisley Trigg -

Average Score per Taxon (WHPT ASPT) (Ref. 7, 8 and 9); Lotic-invertebrate Index for Flow Evaluation (LIFE, Ref. 4); Proportion of Sediment-sensitive Invertebrates (Ref. 5). Environmental data required to calculate predicted biotic scores for this river type were not provided. Therefore, biotic indices were not assessed against a predicted WFD reference state.

4.3.3. Macroinvertebrate data were available from existing Environment Agency monitoring locations with surveys undertaken at two locations: PTC Union Bank Brook (NGR: SJ5543589568) and Barrow Hall Bridge (NGR: SJ5619989237). Locations were downstream of the Proposed Development within a section similar in habitat type and land use to the survey Reach adjacent to the Proposed Development. Data were collected in the spring and summer from 2000 to 2009 at PTC Union Bank Brook and in the spring and summer of 2000, 2013 and 2016 at Barrow Hall Bridge. The macroinvertebrate community assemblage was similar at both locations. Macroinvertebrate diversity was reduced (WHPT NTAXA range 8 to 16) and indicative of reduced water quality (WHPT ASPT below 5). The sensitivity of the macroinvertebrate community to reduced flows was moderate with LIFE scores below 7 across the data record. The macroinvertebrate community reflects river bed conditions that range from sedimented to moderately sedimented with PSI scores between 35 and 60.

4.3.4. At the PTC Union Bank Brook location, data were collected annually for 10 years and provides evidence of changes in the macroinvertebrate community over this data period. Throughout this period both WHPT NTAXA and PSI indices varied considerably between years, whereas, WHPT ASPT and LIFE indices were relatively stable across the data period. This suggests that denuded habitat quality and sedimentation issues are stronger drivers of the macroinvertebrate community of Whittle Brook than organic pollution and flow.

Macrophytes

4.3.5. Macrophytes and phytobenthos (diatoms) are not included as a biological receptor in the WFD cycle 2 status of Whittle Brook. Macrophyte and diatom environmental data required to calculate predicted biotic scores for this river type was provided and therefore results are discussed against the predicted WFD reference state. Macrophyte and diatom data were available from existing Environment Agency monitoring locations with surveys undertaken at one location at Barrow Hall Bridge (NGR: SJ5619989237). Macrophyte data were collected in 2013 and 2016. Diatom data were collected in the spring and autumn of 2011 and 2016 with single season samples collected in 2010 (autumn) and 2013 (spring). The macrophyte community was similar in both 2013 and 2016 with diversity reduced (River macrophyte functional groups 4) and indicative of reduced water quality in 2013 with a high proportion of filamentous algae observed (17.5%). The high proportion of algae was responsible for the Moderate WFD status in 2013. In 2016, the proportion of filamentous algae reduced to less than 1% and the WFD status improved to Good. The diatom classification varied between seasons and years: ranging from Moderate in autumn 2010 to High in spring 2013. The number of motile diatoms was also high and suggests sedimentation is an issue on Whittle Brook.

4.3.6. No macrophyte assemblages were noted during the site visit. There are several potential reasons for this, which may work in combination to influence macrophyte growth; Reaches 1 and 3 are defined by straight, extremely over-deep channels that are situated within deciduous woodland. Shading cast by the dense tree cover, in addition to the deep, vertical banks will reduce light penetration and limit the macrophyte community's structure and composition. Conversely, Reach 2, whilst over-deep (to a lesser extent), has essentially no tree cover. This, in combination with the narrow channel and very close proximity of intensively cultivated fields, means that bank-side vegetation growth is extensive. In addition, Himalayan balsam accounts for much of the species present which dominates the riparian zone and will also limit light penetration within the channel and outcompete native species.

PHYSICO-CHEMICAL QUALITY ELEMENTS

4.3.7. No data were available for Whittle Brook within the application site. Historical data was available for one location downstream of the Proposed Development: Great Sankey (A57 Road Bridge NGR: SJ5726788261). The A57 Road Bridge location is influenced by the Mersey Estuary and is considered unsuitable. Data were available for one location on Union Bank Brook, a tributary adjacent to Whittle Brook and is considered unsuitable. In the absence of suitable data, the assessment of the Proposed Development on physico-chemical quality elements is undertaken using the published physico-chemical WFD status listed on Catchment Data Explorer (Ref. 1).

Oxygenation Conditions

4.3.8. Whittle Brook is currently not failing for the physico-chemical element dissolved oxygen with the current WFD 2016 cycle 2 status High. This is supported in part by the prevailing channel morphology, particularly the riffle-pool, whose intermittent broken water surface promotes water oxygenation and other gaseous exchanges.

4.3.9. The WFD status of dissolved oxygen has been at Good/High status since 2009 with the Moderate status of the physico-chemical element since 2012 driven by nutrient issues in the catchment. Therefore, it is unlikely that the Proposed Development would result in a deterioration of dissolved oxygen and subsequent impacts on the ecological community of Whittle Brook.

Nutrients

4.3.10. Whittle Brook is failing for the physico-chemical element phosphate with the current WFD cycle 2 status Moderate. Reasons for not achieving good status for phosphate are given for the following: pollution from rural areas from the sector ‘agriculture and rural land management’ and pollution from towns, cities and transport from the sectors ‘Domestic general public’ and ‘urban and transport’.

HYDROMORPHOLOGY QUALITY ELEMENTS

Quantity and Dynamics of Flow

4.3.11. The general morphology of Whittle Brook is that of a low gradient, low energy, pool-riffle system. The channel has, at some point in history, been significantly modified by human activity into a single thread channel that follows an often completely straight planform. Nevertheless, frequent riffles interspersed with pools are seen throughout the study Reach. Whilst Reaches 1 and 3 exhibit quite strong pool-riffle morphologies, Reach 2 was noted to be overgrown with vegetation and suffering from silt accumulation (see **Plate 4-1**). Thus, the flow structure therein was noted to be a little more homogenous, comprising predominantly of a glide flow character and weaker pool-riffle sequencing.

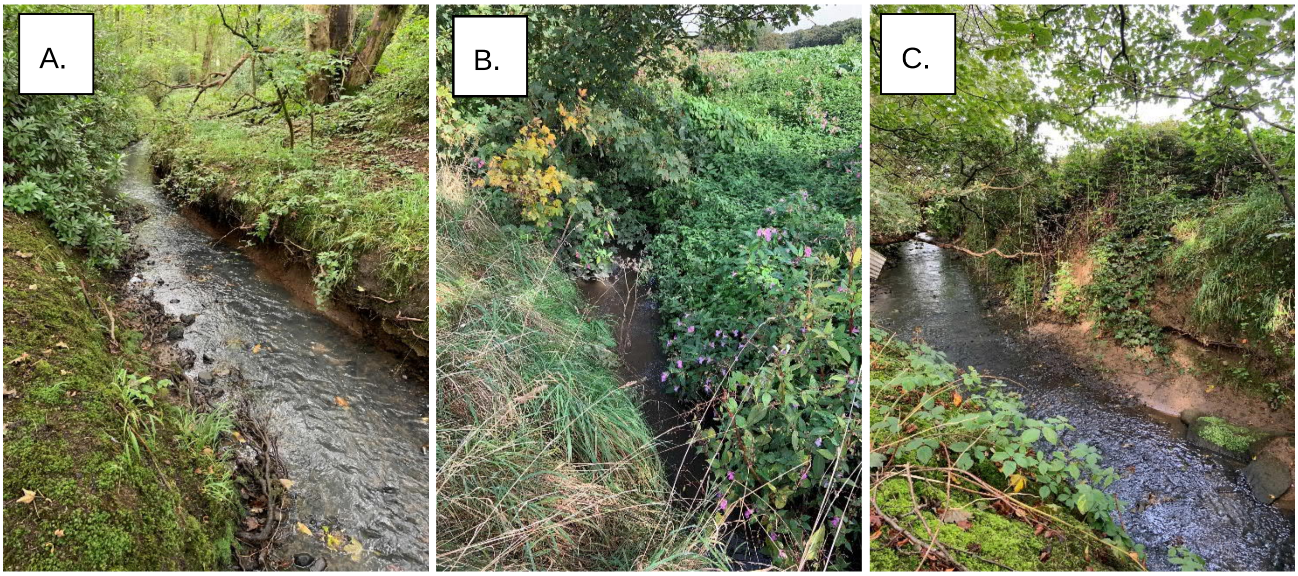

Plate 4-1 – Quantity and Dynamics of Flow throughout the study Reach. A: Reach 1; B: Reach 2 and C: Reach 3

River Continuity

4.3.12. Whittle Brook through the study Reach is, for the most part, disconnected from its floodplain; however, this is particularly severe through Reach 3 where, in places, the channel is occasionally almost as deep as it is wide for considerable distances, and exhibits a homogenous, rectangular cross-sectional form. This grossly over-deep character is a symptom of channel straightening, modification, and probably historical dredging activity that has left the Brook isolated from its floodplain during all but the most extreme flow events. However, Reaches 1 and 2 are less impacted by this phenomenon, though the width: depth ratio is still skewed towards the over-deep classification (**Plate 4-2**).

4.3.13. Longitudinal connectivity throughout the study Reach, however, is essentially unimpeded. No major in-channel structures were noted during the walkover survey; thus, there is no significant disruption to sediment transport processes and hydrological connectivity (and therefore ecological connectivity) in terms of physical barriers.

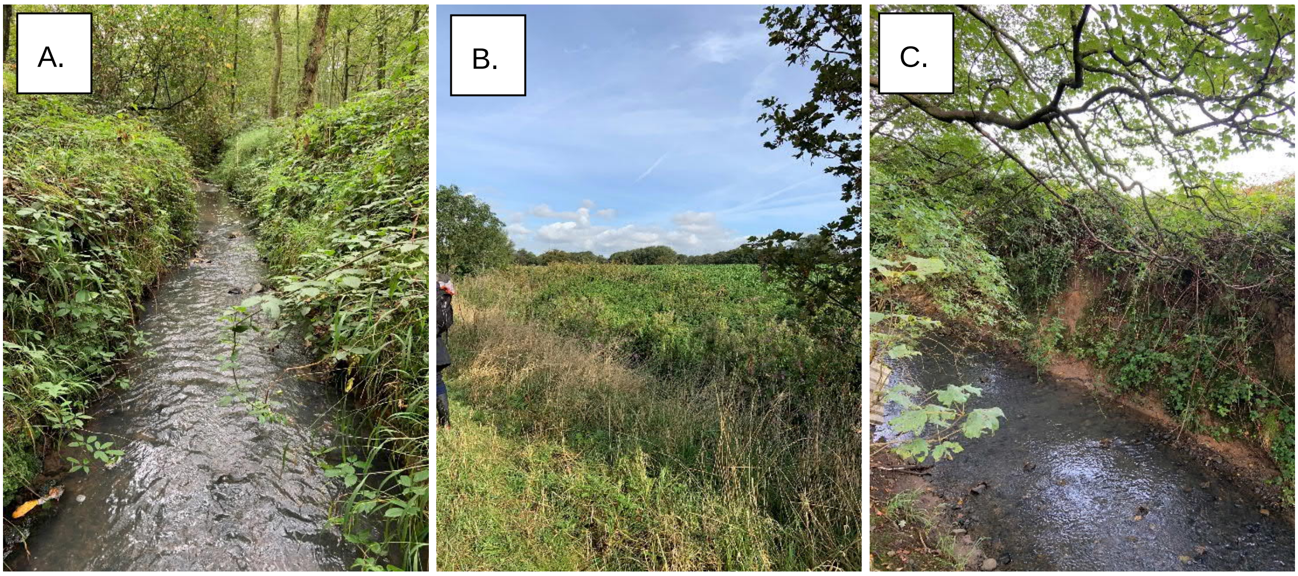

Plate 4-2 - River Continuity within Reaches 1 (A), 2 (B) and 3 (C)

River Width and Depth Variation

4.3.14. River width and depth characteristics through Reach 1 are generally consistent with a pool-riffle morphology; however, the modified nature of the channel means that channel width remains largely uniform (wetted width is ~1.5m – 2m) (**Plate 4-3**). The uniform width continues into Reach 2; however, here, there appears to be little variation in terms of depth. This is probably due to considerable silt accumulation, which, in combination with a lack of riparian trees, and thus an absence of a buffer between the intensively farmed adjacent fields, has led to the channel becoming essentially choked with vegetation.

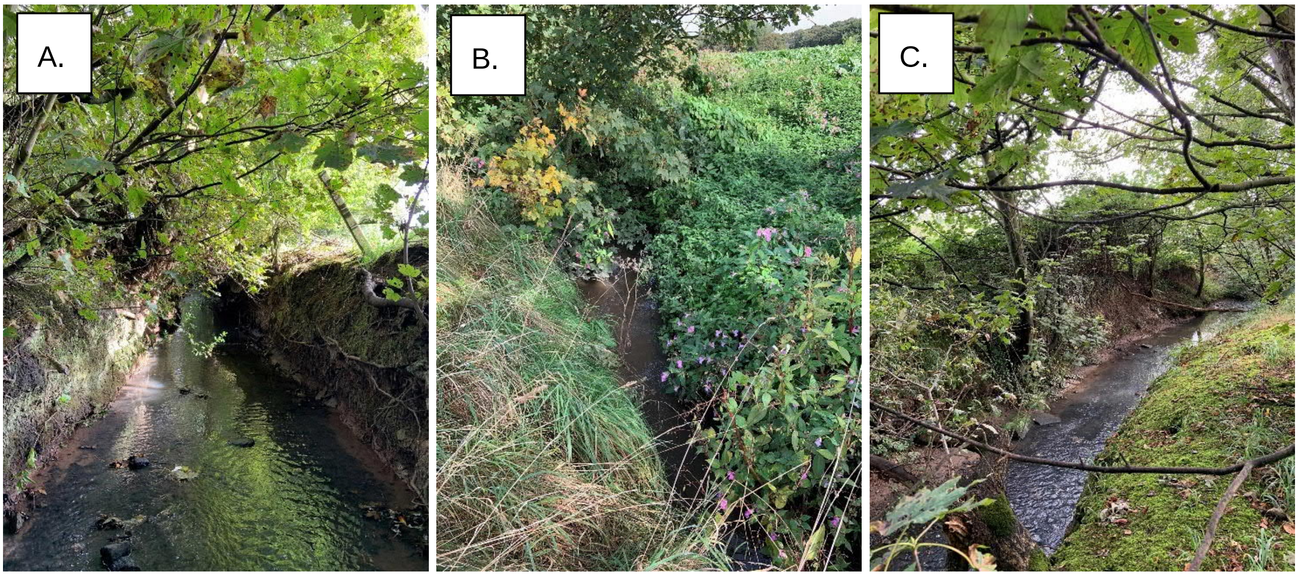

Plate 4-3 - River Width and Depth Variation

Structure and Substrate of the River Bed

4.3.15. The natural substrate of Whittle Brook through the study Reach is mostly dominated by small to medium gravels, with smaller proportions of sand and cobble (**Plate 4-4**). Coarser sediments are generally arranged into riffles, whilst pools are comprised of finer material. However, as previously discussed, the channel is suffering from considerable fine silt input from the surrounding agricultural land and probably diffuse sources elsewhere in the catchment.

Plate 4-4 – Structure and substrate of the river bed (the notebook is 15x10 cm)

Structure of Riparian Zone

4.3.16. The riparian zone through the study Reach is mixed: Reaches 1 and 3 are located on the fringes of native deciduous woodland and are therefore well-shaded with a reasonably complex arrangement of shrubs plants and tree root wads providing a mosaic of riparian habitats (**Plate 4-5**). Conversely, Reach 2 sits within intensively farmed agricultural land and thus has a very poor riparian zone with little buffer between the channel and cultivated fields (which are presumably bare in winter). Further impacts upon the riparian zone include extensive stands of Himalayan balsam, which were noted throughout the study Reach. In addition, the grossly over-deep nature of the channel and its highly modified banks, mean that the riparian zone is largely disconnected from the channel and thus probably does not perform optimally in terms of providing habitat.

Plate 4-5 - Structure of Riparian Zone in the upstream (A) and downstream (B) Reaches of Whittle Brook

4.4 IMPACT ASSESSMENT

STEP 1: POTENTIAL GENERIC OPERATIONAL IMPACTS OF THE PROPOSED DEVELOPMENT ON WFD QUALITY ELEMENTS

4.4.1. Potential pressures and impacts of the Proposed Development have been identified along with embedded mitigation measures that would be assumed when the Proposed Development progresses from the current outline planning application to a full planning application and subsequent detailed design (**Table 4-2**). The proposed mitigation thus forms the basis of this assessment, using the indicative design and design principles stated (see **Table 2-1**).

Table 4-2 - Pressures, potential impacts and associated mitigation for works to the Whittle Brook (Mersey Estuary) water body (Ref. 12)

Pressure	Sub-pressure	Potential Impacts	Mitigation Measures
Operations and Maintenance	Channel Diversion	Loss of aquatic habitats.	The diverted channel to be reinstated with in-channel habitats that would support a wide range of fish and invertebrate species.
		Loss of channel shading and marginal habitat.	Planting of native, deciduous trees and location-appropriate plant species would provide shading and good quality riparian habitat.
		Transfer of invasive non-native species.	Use of appropriate techniques to prevent transfer of invasive non-native species.
		Potential loss of aquatic and morphological (physical) habitat. Loss of channel-floodplain connectivity.	A two-stage channel design would provide enhanced lateral connectivity. However, topographic constraints and Flood Risk Assessment requirements would mean that that the channel would have to fully accommodate floods up to the 100-year (plus climate change) flood.
		Reduction in geomorphic functionality	The realigned channel would be designed to function geomorphologically. Pool-riffle sequences, channel berms and gravel bars would be installed to kickstart and maintain geomorphic processes.

4.4.2. The mitigation measures set out in subsequent sections below are based on the design principles described in **Table 2-1**. Successful implementation of these principles within the design of the channel diversion are considered sufficient to mitigate the anticipated potential impacts of the Proposed Development and proposed watercourse diversion and prevent deterioration of the current WFD water body status. The design principles may also offer an opportunity to deliver a positive contribution towards the water body's WFD mitigation measures and WFD status.

STEP 2: SITE SPECIFIC ASSESSMENT OF THE PROPOSED DEVELOPMENT AGAINST BIOLOGICAL, PHYSICO-CHEMICAL AND HYDROMORPHOLOGICAL QUALITY ELEMENTS

4.4.3. The site-specific impacts of the Proposed Development on the biological, physico-chemical and hydromorphological quality elements of the water bodies are provided in **Table 4-3**. The proposed mitigation options are based on established principles and are sympathetic to the baseline condition of the channel. The specific dimensions of the mitigation features would need to be determined and refined at the detailed design phase. The assessment assumes that the proposed mitigation features would function as intended.

Table 4-3 – Operational impacts on the WFD quality elements on the Whittle Brook (Mersey Estuary) (GB112069060990) water body

Quality Element	Potential Impact	Mitigation
Water body ID	GB112069060990	
Water body name	Whittle Brook (Mersey Estuary)	
Biological Quality Elements		
Composition and Abundance of Aquatic Flora	**Channel Diversion** Baseline conditions in Whittle Brook currently support a low number of macrophyte functional groups, probably due to channel shading and high turbidity (see paragraph 4.3.5). Additional light penetration due to the diversion of the watercourse into a newly created open channel may encourage macrophyte growth in the channel. However, nutrients in Whittle Brook could result in excessive macrophyte growth and the dominance of species that thrive in high nutrient conditions.	**Channel Diversion** Appropriate tree and riparian planting would manage excessive macrophyte growth due to excess nutrients in Whittle Brook. An increase in habitat types would improve the diversity of the macrophyte community of Whittle Brook. Riparian planting is proposed to mitigate potential impacts of the Proposed Development on WFD status. With mitigation in place, there would be no deterioration at the water body scale.
Composition and Abundance of Benthic Invertebrate Fauna	**Channel Diversion** Loss of morphological diversity and habitat. Changes to the flow regime as a result of the proposed channel diversion could result in a change in the composition of the invertebrate communities present in Whittle Brook.	**Channel Diversion** Incorporating design principles to the channel diversion to improve the diversity of habitats would serve to mitigate the impacts of the Proposed Development. A temporary loss of invertebrate communities would occur as a direct result of the works; however, recolonization of the new channel would be expected. Thus, the proposed mitigation would offset expected impacts to the composition and abundance of macroinvertebrates and, as a minimum, prevent a decline in the status of this quality element.
Composition, Abundance and Age Structure of Fish Fauna	**Channel Diversion** Loss of morphological diversity and habitat. Changes to the flow regime as a result of the proposed	**Channel Diversion** Incorporating the design principles to the channel diversion to improve the diversity of habitats would serve

Quality Element	Potential Impact	Mitigation
	channel diversion could result in the loss of substrates and sediments that are important for juvenile fish.	to mitigate the impacts of the Proposed Development on the fish community within the study Reach through the creation of appropriate functioning habitat. Thus, the proposed mitigation would offset expected impacts to the composition, abundance and age structure of fish fauna.
Physico-Chemical Quality Elements		
Oxygenation Conditions	**Channel Diversion** The channel diversion could result in a loss of functioning flow structure that promote oxygenation (e.g. riffles). Increased suspended sediments (particularly organics and particulate matter) can increase biochemical oxygen demand within a small watercourse. Combined with increased turbidity levels limiting photosynthesis potential, temporary effects on dissolved oxygen could be observed. An increased release/mobilisation of nutrients (e.g. phosphorus) could contribute to (short term or longer term) eutrophication and indirectly dissolved oxygen.	**Channel Diversion** Movement of agricultural soils would be managed and mitigated through standard best practice and pollution prevention methods. Monitoring is recommended up- and downstream of works to assess management practices. Incorporating suitable design principles to the channel diversion would serve to mitigate the impacts of the Proposed Development. Riffle-pool sequences would promote oxygenation and prevent silt accumulation and associated risks to water quality. Thus, the proposed mitigation would offset potential impacts to oxygenation conditions.
Nutrient Conditions	**Channel Diversion** The diverting of the channel could result in the mobilisation of nutrients from agricultural soils.	**Channel Diversion** Construction activities that may impact upon the watercourse due to proximity would be managed and mitigated through standard best practice and pollution prevention methods. Additionally, incorporating suitable design principles to the channel diversion would serve to mitigate the impacts of the Proposed Development. Riffle-pool sequences would prevent silt accumulation in faster flowing sections and allow deposition of sediment in slow flowing sections. Incorporation of suitably sized gravels and removal of fine material during realignment of the channel would enhance this section. Thus, the proposed

Quality Element	Potential Impact	Mitigation
		mitigation would offset potential impacts to nutrient conditions.
Hydromorphological Quality Elements		
Quantity and Dynamics of Water Flow	**Channel Diversion** The Proposed Development would realign approximately 570m of the Whittle Brook and divert the watercourse to the periphery of the application site, thus removing the existing channel within the application site. The over-deep character of the existing channel means that floodplain interactions are infrequent, with localised regions connecting under extreme flow events exceeding a 100-year flood event, and thus flow is predominantly contained entirely within the channel. The channel diversion could retain this character and therefore impede the water body from meeting its objectives.	**Channel Diversion** The proposed channel would be designed to perform optimally in terms of quantity and dynamics of flow. Hydraulic heterogeneity would be introduced through the incorporation of in-channel topographic variability – i.e. pool-riffle sequences and gravel features. In addition, the cross-sectional form of the diverted channel would provide enhanced lateral connectivity through a two-stage channel design. A two-stage channel design would allow for a degree of lateral connectivity onto the adjacent, slightly elevated benches of the channel. These would act as a pseudo-low-level floodplain at flows exceeding a two-year event. In addition, the incorporation of lowered and inset berms would promote localised connectivity at elevated flows approaching a Q10 flow (i.e. the 10th percentile flow – that which is exceeded 10% of the time).
River Continuity	**Channel Diversion** The diverted channel could disrupt longitudinal and lateral continuity. The over-deep character of the existing channel means that floodplain interactions are infrequent, with localised regions connecting under extreme flow events exceeding a 100-year flood event. The channel diversion could retain this character and therefore impede the water body from meeting its objectives.	**Channel Diversion** Longitudinal connectivity would be maintained, as no channel structures, such as weirs or culverts, are proposed. Lateral connectivity would be enhanced in the form of an appropriately scaled two-stage channel. The proposed two-stage channel design would allow for a degree of lateral connectivity onto the adjacent, low-level berms. These would act as a pseudo-low-level floodplain at flows exceeding a two-year event. In addition, the incorporation of lowered and inset berms would promote localised connectivity at elevated flows approaching a Q10 flow.

Quality Element	Potential Impact	Mitigation
River Depth and Width Variation	**Channel Diversion** The diverted channel could lack width and depth variation.	**Channel Diversion** The length of diverted channel would include sufficient width and depth variation to function hydromorphologically. Appropriately spaced pool-riffle sequences would encourage topographic variability (and therefore depth variability), whilst the riffles alone would provide slightly wider areas. Strategically placed gravel features (point bars and side bars) and inset berms would provide occasional narrow and wide points respectively, thereby generating additional flow heterogeneity.
Structure and Substrate of the River Bed	**Channel Diversion** The diverted channel could have an inappropriate substrate or a substrate composition that is not conducive to hydromorphic or ecological functioning.	**Channel Diversion** Natural gravel would be retained from the existing channel for re-use in the proposed channel diversion. However, the substrate of the channel diversion would be sized appropriately to maintain natural geomorphic processes. Undesirable material, i.e. fine silt, would be disposed of accordingly.
Structure of the Riparian Zone	**Channel Diversion** The current condition of the riparian zone along the study Reach of Whittle Brook is poor. Sparse patches of small trees provide limited benefits to the watercourse (shading, cover, habitat etc.); however, generally, the riparian zone specifically in relation to the length of channel that would be lost as a result of the Proposed Development is practically non-existent.	**Channel Diversion** The channel diversion would include riparian planting, providing a structured riparian zone with suitably selected species including grasses, wild flower mixes, shrubs and trees. The inset berm features would be planted with wetland plant species to provide additional riparian variety. The channel would be lined with native trees to provide a buffer against diffuse pollution and additional habitat for terrestrial species. Removal of trees along the Whittle Brook would be required for enabling works. Tree removal would be minimised as far as practicable. Tree planting is proposed as part of the mitigation principles (outlined in **Table 2.1.**) along the Whittle Brook diversion. Trees removed for construction purposes would be replaced with a native species mix as far as practicable.

Operational Monitoring

4.4.4. There is likely to be a direct, temporary, medium-term residual effect on the Whittle Brook (Mersey Estuary) WFD water body following the implementation of mitigation measures. However, once the watercourse diversion is functioning, as designed, habitat improvements within the watercourse have the potential to improve the current WFD status of this section of Whittle Brook. Operational monitoring is recommended at suitable locations prior the start of works to create a baseline dataset to supplement data already collected by the Environment Agency. Once the channel diversion is completed, monitoring for a period of 5 years is recommended to ensure that the channel diversion has met its design objectives, and the ecological community has recovered/improved to the status recorded prior to the channel diversion. Monitoring should include aquatic ecology surveys, such as macroinvertebrates and fish, if fish were present pre-construction, and river habitat surveys to record the diversity of natural features present in the diverted watercourse. Surveys should occur soon after construction, following any high magnitude flow event and after 5 years. This monitoring should be arranged by the appointed Contractor.

4.4.5. The continuance (magnitude and duration) of groundwater level rebound within the Primary Sherwood Sandstone underlying the application site is unknown. Therefore, it recommended that groundwater level monitoring is continued for at least 5 years of operation to better gauge the significance of this phenomena. Currently, it is not thought to be significant, but the matter does currently entail some element of uncertainty.

STEP 3: REVIEW OF MITIGATION MEASURES TO DELIVER WFD OBJECTIVES

4.4.6. For Heavily Modified Water Bodies, a suite of WFD mitigation measures are set during the river basin planning process. These WFD mitigation measures are designed to assist the water body in achieving its WFD objectives. An assessment of the Proposed Development's compliance with the relevant mitigation measures set out for Whittle Brook (Mersey Estuary) (GB112069060990) is presented below. Each relevant WFD mitigation measure set for the water body is evaluated in terms of embedded mitigation, which aims to mitigate the impacts of the Proposed Development and ensure no further deterioration, and any enhancements proposed, which may contribute towards the achievement of the WFD mitigation measure set for the water body within the River Basin Management Plan and net gain. At present, none of the WFD mitigation measures set for the water body within this River Basin Management Plan are 'in place'.

4.4.7. Currently, the WFD mitigation measures set for the water body are achieving 'Moderate'. Urbanisation, and associated transport, and agricultural and rural land management are key pressures on the water body and it is the physical modifications associated with the water industry (reservoirs) that have altered the morphology of the water body and its potential to achieve GEP.

WFD Mitigation Measures

Remove or soften hard bank: timber revetment

4.4.8. No timber revetments were noted on the day of survey. Furthermore, the diverted channel would be designed in such a way that revetments would not be required.

Remove or soften hard bank: reinforcement

4.4.9. Only a small section of hard bank revetment was noted on the day of survey, located at approximately NGR: SJ 54865 90346. This is the point at which the proposed channel would diverge from the existing route and thus would mean that the existing revetment would be removed to give way to a more naturally functioning channel. Therefore, the proposed diversion would make a small contribution towards this WFD mitigation measure.

Invasive species techniques

4.4.10. An invasive species removal and management plan would be implemented as part of the mitigation measures required to mitigate the potential impacts of the Proposed Development. Himalayan balsam was noted to be particularly prevalent throughout the Reach. It is reasonable to surmise that the invasive plant is established upstream of the application site; thus, to have a tangible impact, the proposed management technique should adopt a 'top down' approach to manage Himalayan balsam as far as practicable. Removal of Himalayan balsam and considerate planting of native species mixes would also reduce bank erosion and sedimentation in Whittle Brook.

Align and attenuate flow

4.4.11. The proposed river diversion design would create flood storage, albeit within the confines of the two-stage channel. The intention would be for the inset floodplain area of the channel (i.e. the low-level berms) to become inundated at flows exceeding a two-year flood event. In addition, the proposed inset berms features would promote this lateral interaction at elevated flows. This would be in addition to attenuation ponds located within the application site, which would be designed to offset the loss of permeable ground as a result of the Proposed Development.

Educate landowners

4.4.12. The Proposed Development does not offer a realistic opportunity to educate land owners.

STEP 4: ASSESSMENT OF THE PROPOSED DEVELOPMENT AGAINST WFD OBJECTIVES

4.4.13. The WFD compliance assessment for the Proposed Development is summarised in **Table 4-4**. Potential impacts of the Proposed Development have been assessed in terms of the WFD water body and mitigation proposed to mitigate these potential impacts, as presented above. Therefore, with mitigation in place, the Proposed Development is considered to be WFD compliant.

Table 4-4 – Compliance assessment of the Proposed Development against WFD Status

Water body ID	GB112069060990
Water body name	Whittle Brook (Mersey Estuary)
Deterioration in the status/potential of the water body	**Biological:** It is not envisaged that the Proposed Development would cause a deterioration in the status/potential of the water body for biological elements. **Physico-chemical:** It is not envisaged that the Proposed Development would cause deterioration in the status/potential of the water body for the physico-chemical quality elements. **Hydromorphological:** It is not envisaged that the Proposed Development would cause deterioration in the status/potential of the water body for the hydromorphological quality elements.
Ability of the water body to achieve Good	The Proposed Development and mitigation would not prevent the implementation of WFD mitigation measures towards GEP.

Water body ID	GB112069060990
Ecological Potential/Status	
Impact on the WFD objectives of other water bodies within the same RBD	No downstream or upstream impacts associated with the preferred watercourse diversion option and the mitigation measures proposed are anticipated. This includes potential impacts to the Mersey Estuary Special Protection Area (SPA), which sits within the Mersey (GB531206908100) WFD water body. The SPA is situated approximately 14km downstream of the application site and is therefore considered sufficiently disconnected to avoid any potential impacts. The proportional size difference between the application site and the SPA means that any risks associated with the Proposed Development construction and operation activities would be negligible. A robust Construction Environmental Management Plan would ensure that any potential risks would not be propagated downstream during the construction phase. Similarly, the proposed WFD mitigation measures and Sustainable Drainage Systems, would ensure that risks associated with the expected operational activities of the Proposed Development would not be transmitted downstream.
Ability to contribute to the delivery of the WFD objectives	Yes

STEP 5: ASSESSMENT OF THE PROPOSED DEVELOPMENT AGAINST OTHER EU LEGISLATION

4.4.14. Article 4.9 of the WFD requires that *"Member States shall ensure that the application of the new provisions guarantees at least the same level of protection as the existing Community legislation"*.

4.4.15. The Nitrates Directive is relevant to the assessment of new modifications. No additional sources of nitrates would be introduced to the water body as part of the Proposed Development. Therefore, no separate assessment is required for nitrates.

4.4.16. The Freshwater Fish Directive was originally adopted in 1978 and was consolidated in 2006, then repealed in 2013. Therefore, no separate assessment is required for fish. The proposed watercourse diversion and mitigation is designed to provide habitat suitable for fish to future-proof the Proposed Development design.

5 CONSTRUCTION IMPACTS

5.1 POTENTIAL CONSTRUCTION IMPACTS

5.1.1. The WFD assessment does not require assessment of potential construction impacts on a water body. This is because the impacts are temporary and do not permanently affect the water body. However, construction impacts are considered in this section due to the potential impacts of the construction activities of the Proposed Development on the Whittle Brook water body.

5.1.2. For the assessment of construction impacts, fluvial geomorphology has been separated into three elements: the sediment regime; channel morphology; and fluvial processes. An ecology element is also included to outline potential impacts on habitats and species. **Table 5-1** outlines the potential impacts on these elements during the construction of the Proposed Development.

5.1.3. The construction impacts have the potential to have a significant impact due to the proposed diversion of the Whittle Brook. In addition, weather conditions would also influence the severity of impacts. Many of these impacts would worsen with intense or prolonged rainfall events during the construction phase.

5.1.4. It is assumed that construction of the channel diversion would be undertaken 'offline', with flow being diverted upon completion.

Table 5-1 – Potential Construction Impacts on the Whittle Brook (Mersey Estuary) WFD Water Body

Source of Impact	Potential Impacts and Mitigation
Suspended Solids Increased fine sediment supply to watercourses is likely to occur during construction works. This could result from: ▪ runoff from vegetation-free surfaces ▪ plant and vehicle washing ▪ earthworks ▪ vegetation clearance	**Sediment regime** Construction impacts could include fine sediment release, which may cause detrimental impact. The risk of this occurring should be minimal if best practice and pollution prevention guidelines are followed. Potential impacts include changes to the water quality due to sediment release and smothering of ecological habitats. For the watercourse diversion, the channel would be created offline prior to the commencement of the main body of work and the water diverted into the new channel before wider construction commences. Banks should be planted/seeded prior to diverting the water into the new channel. This would manage the risk of sediment release when flow is re-directed into the new channel. Water should be diverted during the spring/summer months when then risk of an extreme rainfall event is lower. **Channel morphology** Construction impacts would principally involve removal of the existing channel, to be realigned. Thus, reinstatement of morphological features would form a part of the construction mitigation. **Natural fluvial processes** No significant impact. Similarly, construction of the new channel would remove the exiting fluvial processes. This would be managed through sensitive channel design that would enable natural fluvial processes to operate relative to the channel type. Appropriately sized and spaced pool-riffle sequencing, for example, would result in a self-sustaining bedform; while appropriate channel dimensions would maintain the natural hydraulics of the system. **Ecology** Construction impacts could include sediment release (and release of other pollutants), which may have a detrimental impact on aquatic ecology. The risk of this occurring should be minimised if best practice and pollution prevention

Source of Impact	Potential Impacts and Mitigation
	guidelines are followed. Additionally, mitigation measures for specific ecological risks, such as fish species, should be adhered to and would be detailed in a Construction Environmental Management Plan, which would be produced by the appointed Contractor. Potential impacts include changes to the water quality due the sediment release, choking and smothering of ecological habitats such as gravels used for spawning, as well as changes in flow regime disturbing organic matter that provide food and habitat for macroinvertebrates. Construction activities should be planned to avoid the sensitive lifecycle stages of the fish present. Construction phase activities with the potential to effect localised dissolved oxygen concentrations include: disturbance/mobilisation of soils and particulate matter from disturbed ground or stockpiled materials; and, increased leaching and mobilisation of solutes from disturbed ground, stripped land or stockpiled materials, such as the release/mobilisation of nutrients (e.g. nitrate, phosphate, ammonia), dissolved organic carbon, and pesticides/herbicides from current/historic agricultural land. During construction, agricultural soils and associated nutrients would be mobilised; on the assumption that application site soils have a high phosphate adsorption and solute content, construction activities that disturb soils (as set out above cf Dissolved Oxygen discussions) have the potential to increase phosphate concentrations. Measures to control phosphate inputs should focus on good soil control, with movement of agricultural soils being managed and mitigated through standard best practice and pollution prevention methods. Monitoring is recommended up- and downstream of the Proposed Development to assess management practices and the works do not result in a deterioration in water quality.
Vegetation clearance Vegetation clearance during construction could reduce the stability of the river channels, increasing the potential for erosion and associated sediment release. Sediment release is likely to be greatest where vegetation clearance is required on slopes and would be particularly significant where woodland clearance is required.	**Sediment regime** Potential impacts include changes to water quality due to sediment release and smothering of ecological habitats. Potential impacts on the sediment regime due to fine sediment release during vegetation clearance should be minimised by following best practice and pollution prevention guidance for working in water bodies. **Channel morphology** Vegetation removal would be required for the construction of the Proposed Development. Thus, construction impacts may cause destabilisation of existing morphological features such as riffles and gravel bars due to fine sediment ingress which could have the potential to smother natural sediment and alter the prevailing bedform. The proposed watercourse diversion and enhancements would reinstate such features with high-quality substrate and clean gravels. **Natural fluvial processes** No significant impact. **Ecology** Fine sediment release could choke sediments utilised by aquatic organisms (invertebrates, fish etc.). Increased suspended sediment load could adversely impact trout (if present) by reducing visibility, therefore adversely impacting upon feeding habits. In addition, suspended sediment can irritate the gills of adult fish, and lead to mortality in younger fish. Potential impacts would be minimised by following best practice and pollution prevention guidance for working in water bodies.
Site compound areas	**Sediment regime**

Source of Impact	Potential Impacts and Mitigation
	Construction impacts could include sediment release, which may cause detrimental impact to the watercourse. Potential impacts include changes to the water quality due to sediment release and smothering of ecological habitats. The risk of this occurring should be minimal if best practice and pollution prevention guidelines are followed. **Channel morphology** No significant impact. **Natural fluvial processes** No significant impact. **Ecology** Construction impacts could include substance releases, which may cause a detrimental impact on aquatic ecology. Potential impacts include changes to the water quality due the substance release and smothering of ecological habitats and macrophytes. The risk of this occurring should be minimal if best practice and pollution prevention guidelines are followed. Additionally, mitigation measures for specific ecological risks, such as fish species, should be adhered to and would be detailed in a Construction Environmental Management Plan. **Water quality** Construction impacts could include contaminant release from substances such as fuel or concrete during the construction of the Proposed Development and activities in and around the site compound area. This could detrimentally impact the water quality and ecology downstream. Cement pollution could increase the pH and alkalinity in the water body, affecting aquatic life. The risk of this occurring should be minimal if best practice and pollution prevention guidelines are followed.

5.2 CONSTRUCTION MITIGATION

5.2.1. Potential environmental risks during construction include:

- Fuel/ oil spillage resulting in contamination of Whittle Brook;
- Contamination of Whittle Brook with cement material;
- Contamination of Whittle Brook with chemicals; and.
- Contamination of Whittle Brook with sediments.

5.2.2. The release of potentially toxic compounds such as fuel, oils and chemicals could have a significant impact in the vicinity and downstream of the construction site. Measures need to be in place to prevent the accidental release of pollutants into the watercourse.

PREVENTION AND MITIGATION MEASURES

- All operatives would be made aware of the need to protect the Whittle Brook watercourse from contamination, including Environment Agency guidance and legal obligations.
- To prevent fine sediment entering the Whittle Brook watercourse, construction activities should occur away from the watercourses where possible.
- When construction activities, including stock piling and plant and vehicle washing, occur near the Whittle Brook watercourse, they should be separated from the watercourse with barriers (e.g. sediment fences) to prevent surface runoff from these sites entering the watercourse.
- Geotextile-material silt fences should be installed to filter suspended solids from runoff.

- Timing of works must be carefully considered. If possible, construction should be carried out during periods of low flow and rainfall (typically during summer months) to reduce the risk of scour and erosion around structures and reduce runoff from the construction area.
- The extent of vegetation clearance should be limited as far as practicable within 8m of a watercourse to reduce the amount of sediment released during clearance and the potential release of sediment from bare ground following clearance.
- The works should be carried out in accordance with established best practice, which would be outline in the Construction Environmental Management Plan.
- Pollution spill kits should be kept on site; in the event of an incident these will be used.
- Any contaminated soils will be removed immediately to a suitable landfill site.
- Bins should be provided on site for debris.
- Where possible, avoid excavating into the watercourse to limit the extent of disturbance.
- Cleaning of tools and shuttering will be carried out in water not draining directly to the watercourse.
- In any event of expected heavy rain, pouring concrete and other activities, which increases the risk of contaminating runoff, should not be undertaken

5.3 CONSTRUCTION MONITORING

5.3.1. No monitoring is required for groundwater during the construction period. Water quality monitoring should be carried out by the appointed Contractor during construction as part of best practice.

6 CONCLUSION

6.1.1. The Proposed Development forms a hybrid planning application; however, this WFD assessment is in relation to the outline planning application site only. The principle activity associated with the outline planning application site that specifically relates to WFD is the diversion of a 570m Reach of the Whittle Brook.

6.1.2. The Proposed Development has the potential to impact upon the Whittle Brook (Mersey Estuary - GB112069060990) WFD water body, which is designated as a heavily modified water body. The Proposed Development has the potential to impact upon several WFD quality elements; however, the mitigation measures that have been proposed in this assessment would serve to mitigate those potential impacts.

6.1.3. Whittle Brook is a small WFD designated heavily modified waterbody currently classified as Moderate with an objective of GEP by 2027. Current issues preventing Whittle Brook from achieving its 2027 WFD objective include pollution from rural and urban sources and physical modification. The proposed initial construction works would incorporate Sustainable Drainage Systems for the treatment of water before discharging to the Brook. Suitable best practice and mitigation methods would be implemented during the construction phase to minimise any changes in water quality, the current WFD designation and the 2027 WFD objective.

6.1.4. The Proposed Development requires the diversion of a 570m section of the Whittle Brook, which would incorporate morphological habitat features suitable for this watercourse type. These features would contribute towards mitigating the anticipated impacts of the Proposed Development and potentially provide improvements to the physical form and function of the watercourse.

6.1.5. Biological and physico-chemical data for Whittle Brook were temporally and spatially limited for all WFD receptors. The data available, while limited, allowed the ecological community and associated pressures to be assessed. Sedimentation and poor habitat were important drivers of the ecological community.

6.1.6. Prior to the full planning application stage, it is recommended that water quality and biological (fish, macroinvertebrate, macrophytes and phytobenthos) data is collected at suitable locations up- and downstream of the proposed works. A river habitat survey should also be conducted along the Reach to be diverted, and upstream and downstream, to be used as a baseline for comparing and assessing the performance of the proposed channel diversion. Data should also be collected pre- and post-implementation of construction activities, by the appointed Contractor, to provide a suitable baseline assessment and to adequately assess any possible impact/benefits of the Proposed Development.

6.1.7. With all mitigation measures outlined in this assessment taken into account, the Proposed Development would be compliant under the WFD.

7 REFERENCES

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Appendix A

CHANNEL DIVERSION OPTIONEERING

Public

APPENDIX A: CHANNEL DIVERSION OPTIONEERING

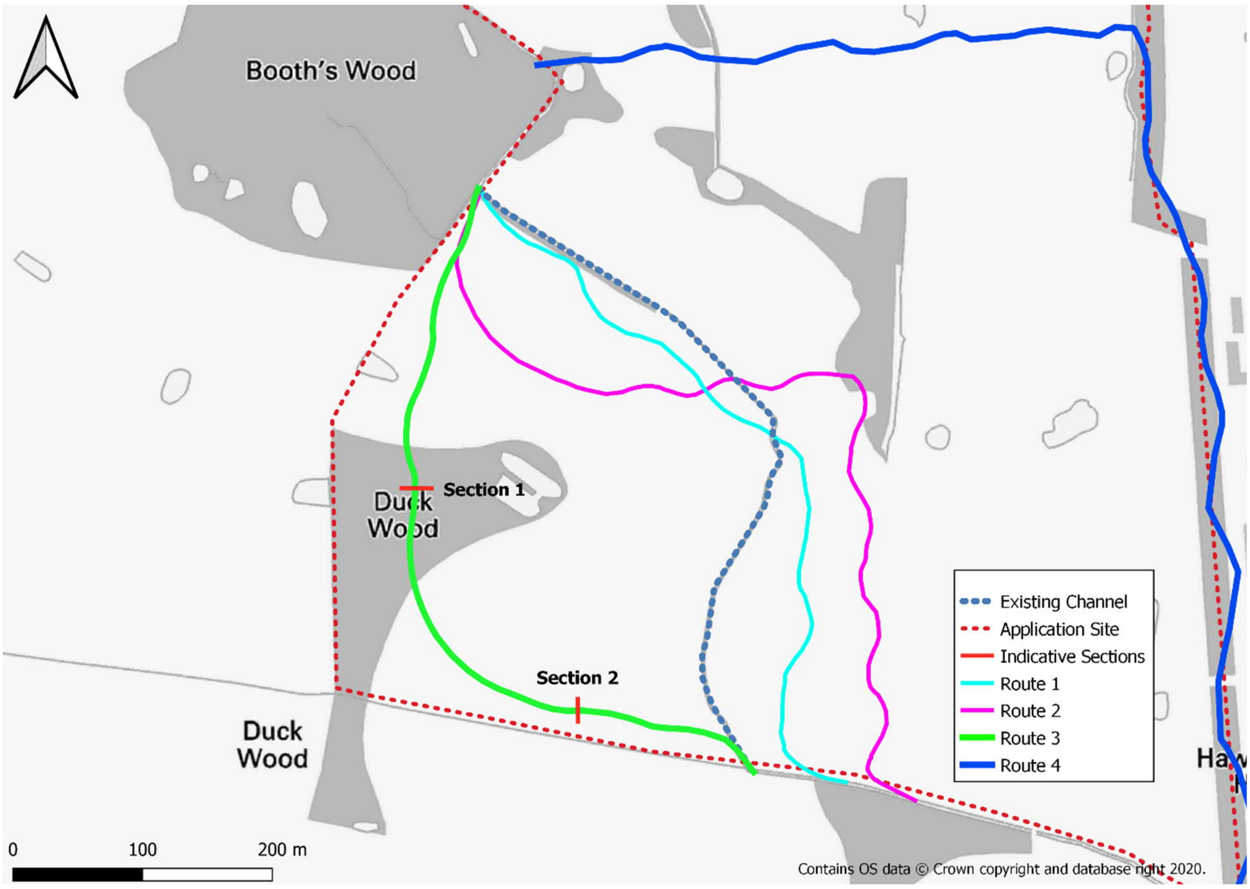
INTRODUCTION

Construction of the Proposed Development would require an approximately 570m length of the Whittle Brook watercourse to be diverted. The existing length of river is between SJ 54867 90344 and SJ 55063 89905. An optioneering exercise was undertaken to reveal four potential channel route options, taking into consideration both the Applicant’s requirements (i.e. maximising the amount of space available for development) and environmental constraints, including WFD compliance, and opportunities. These route options represent an indicative route corridor and show the intention to create a moderately sinuous channel planform for the watercourse diversion.

THE OPTIONEERING PROCESS

The primary goal of the optioneering process was to achieve a balance between environmental constraints, the Applicant’s objective of maximising the area of usable space for development, and the technical feasibility of creating a functional channel in terms of hydromorphic and ecological processes. The ‘buildability’ of potential channel diversion routes was also considered, in addition to potential construction risks associated with the Proposed Development. Four potential channel route options were identified, each of which was assessed on their expected ability to either satisfy the Applicant’s requirements or provide and ecologically/hydromorphological functioning system. The route options are provided in **Figure A-1**. These route options are indicative only and the detail of the watercourse diversion design would be developed during detailed design. This would take a multi-disciplinary approach combining hydraulic modelling, fluvial geomorphology, aquatic ecology, groundwater, landscape and terrestrial ecology inputs, in addition to working collaboratively with river engineers. For this WFD assessment, a route options corridor was thus assessed encompassing a broad corridor either side of the proposed indicative centreline of the proposed channel diversion.

Figure A-1 - Potential indicative channel diversion route options



OPTIONEERING OUTCOME

The optioneering process revealed that the most optimal route is Route 3. This would divert the watercourse away from the Proposed Development, thus reducing the risks associated with construction: the channel could be diverted prior to the main construction phase and begin to re-establish natural processes, unhindered, throughout the construction process. The channel, thereafter, would be sufficiently far removed from the Proposed Development to avoid risks associated with operational activities.

Following submission of the planning application, further discussions have been undertaken relating to the Route 3 corridor and an alteration to the proposed indicative diversion has arisen through design iteration. This is still an indicative design, based upon a broad corridor around the indicative Route 3 option allowing for future design iteration and variation to the proposed planform, showing an intention for the route of the watercourse diversion and that it would be a moderately sinuous channel. This refinement to the indicative design provides beneficial change to the previously proposed indicative Route 3 option in that the length of the diversion is now shorter than the previous Route 3 option, thus minimising the overall increase in channel length compared with the baseline and reducing the resulting impact upon channel slope to negligible. This alteration, however, does not impact the outcomes of the assessment or the required mitigation measures presented within this report (**OPP DOC.9**). This is due to quantities of mitigation having not been specified for the outline planning application, such as the number of low-level berms, number of riffles and pools required, the number of riparian tree species to be planted *etc*. To inform the outline planning application, no design has been undertaken for the Route 3 option as this would require detailed surveys and modelling, which goes over and above the requirements for outline planning. However, it has always been the intention that detailed design would refine and improve upon the indicative route corridor to reduce negative impacts. However, the **OPP DWG. 12 5969-Z8-SK-015 Rev D - PARAMETERS PLAN 4** allows sufficient space to accommodate further design iterations at the detailed design phase. In addition, **OPP DWG. 13 5969-Z8-SK-009 Rev D - INDICATIVE WATERCOURSE DIVERSION ROUTE AND SECTIONS** are provided at the end of this report.

Table A-1 - Channel diversion route optioneering

Route Option	Description	WFD Compliance	Complies with Applicant's Requirements
1	Route option 1 would improve upon the existing channel in terms of hydromorphological and ecological functioning; however, this option would dissect too much of the Applicant's land and would considerably hinder development. The channel would be amidst the Proposed Development; therefore, there would likely be risks to the watercourse posed during the construction phase.	Likely	No
2	Route option 2 would probably not function properly in terms of hydromorphology and ecology. The essentially right-angle bends would create flow conveyance issues and, due to an increase in channel length, may readily become silted at lower flow. Moreover, the channel would be situated amongst the Proposed Development and therefore would only have a narrow riparian corridor and there would likely be further risks to the watercourse posed during the	Unlikely	Yes

Route Option	Description	WFD Compliance	Complies with Applicant's Requirements
	construction phase. The channel would also likely be of trapezoidal design.		
3	Route option 3 would likely function in terms of hydromorphology and ecology. There is enough space to create functioning riparian environment, and a two-stage, sinuous channel, which would permit lateral connectivity to a greater extent than the current channel.	Likely	Yes
4	Route option 4 is similar to Route option 3 in that it would allow the Applicant to develop the site as desired. However, the route would add significant length to the channel, which may have implications for flow conveyance and sediment transport processes. Due to the increased length of the watercourse, introducing sinuosity into the planform would be restricted, thus impacting negatively on channel design and fluvial processes. Therefore, there is a risk that this option would not be WFD compliant.	Unlikely	Yes

In order to demonstrate the viability of Route 3, an indicative long section and two cross sections have been prepared (see **Figures A-2** (**OPP DWG. 14 INDICATIVE WATERCOURSE DIVERSION LONG SECTIONS**) and **A-3**). In addition, the proposed Route 3 length and gradient is compared with the baseline in **Table A-2**. Whilst these are, at present, conceptual, the elevation fall between the proposed offtake and reconnection with the existing channel and the resulting channel gradient would support the design concepts discussed in the main body of this report (see **Table 2-1**).

Figure A-2 – Indicative Watercourse Diversion Long sections

DO NOT SCALE

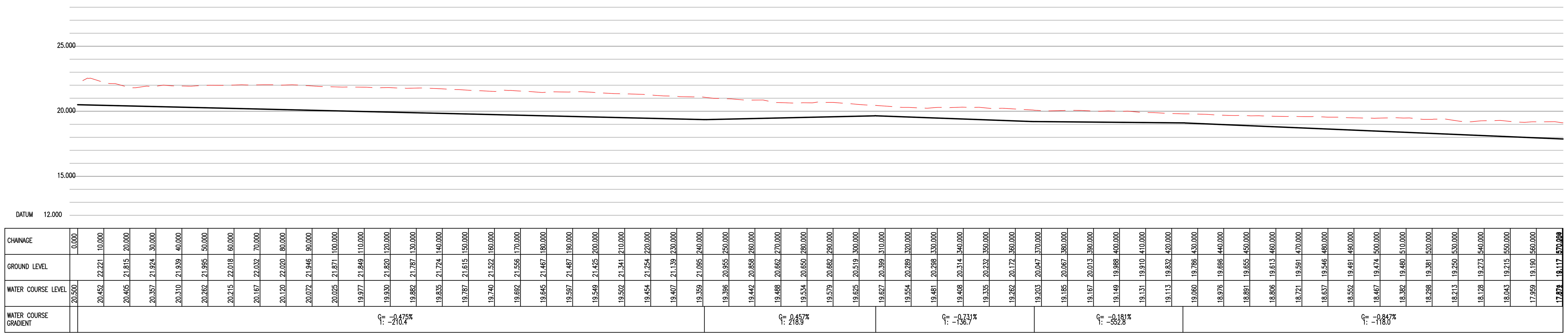
NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.

KEY

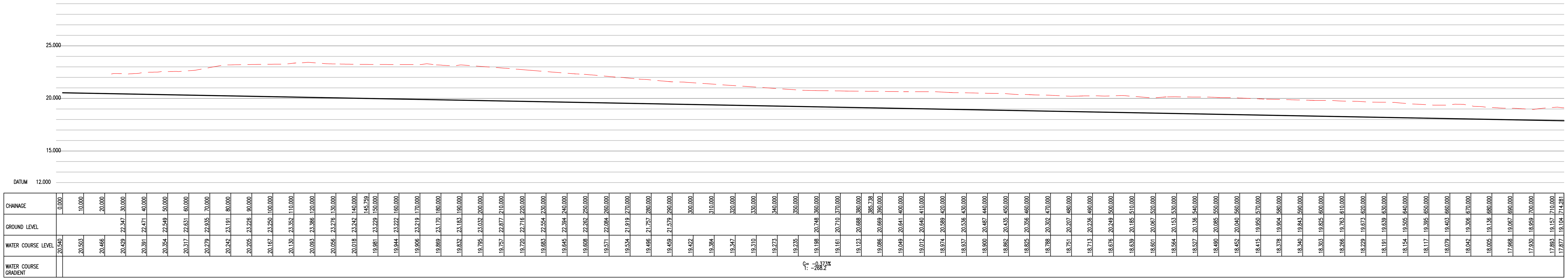
EXISTING GROUND LEVEL

WATERCOURSE INVERT LEVEL



EXISTING WATERCOURSE

SCALE – 1:1000(H) 1:200(V)



PROPOSED WATERCOURSE

SCALE – 1:1000(H) 1:200(V)

PLAN

SCALE – 1:1250

REV	DATE	BY	DESCRIPTION	CHK	APP
A	06/08/2020	TS	FIRST ISSUE	SG	SG

DRAWING STATUS: PLANNING

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CLIENT: OMEGA ST HELENS LTD / T.J. MORRIS LIMITED

ARCHITECT: N / A

SITE/PROJECT: OMEGA ZONE 8 ST HELENS

TITLE: FIGURE A-2 INDICATIVE WATERCOURSE DIVERSION LONG SECTIONS OPP DWG. 14

SCALE @ A1: AS SHOWN	CHECKED: SG	APPROVED: SG
PROJECT NO: 70065969	DESIGNED: TS / DRAWN: TS	DATE: August 20

DRAWING No: 5969-Z8-SK-016 REV: A

Figure A-3 – Indicative cross sections showing the general design principle for the channel diversion. Note, these are for demonstration purposes only and specific dimensions and water levels will be elucidated at detailed design

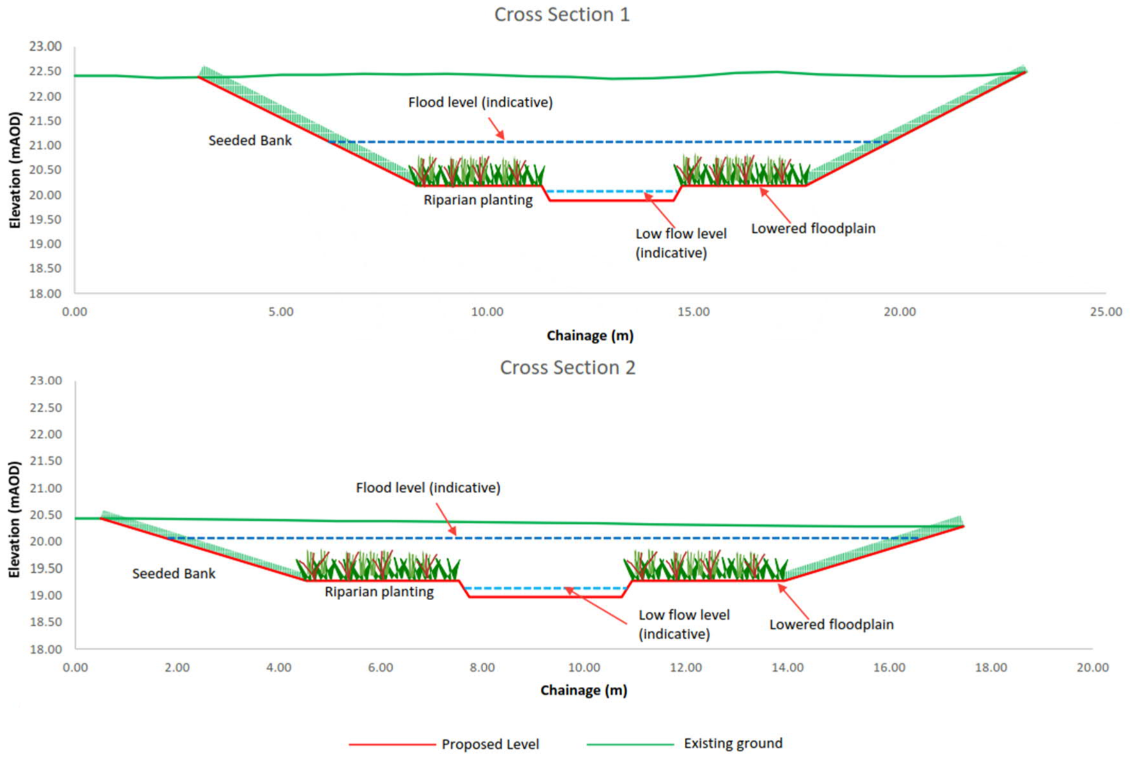

Table A-2 – Comparison of length and gradient between existing and proposed channels

	Channel Length	Channel Gradient
Existing	570m	0.0037
Proposed	639	0.0034
Difference	**+69m**	**-0.0003**

DO NOT SCALE

KEY

HYBRID PLANNING APPLICATION BOUNDARY

WATERCOURSE DIVERSION CORRIDOR

REV	DATE	BY	DESCRIPTION	CHK	APP
D	06/08/2020	TS	MASTERPLAN ADDED	SG	SG
C	04/08/2020	TS	UPDATED FOLLOWING COMMENTS	SG	SG
B	31/07/2020	TS	SHADED AREA UPDATED	SG	SG
A	19/07/2020	TS	FIRST ISSUE	SG	SG

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ARCHITECT: N / A

SITE/PROJECT: OMEGA ZONE 8 ST HELENS

TITLE: PARAMETERS PLAN 4 WATERCOURSE DIVERSION OPP DWG. 12

SCALE @ A1:	CHECKED:		APPROVED:
1:1000	SG		SG
PROJECT NO: 70065969	DESIGNED: TS	DRAWN: TS	DATE: July 20

DRAWING No: 5969-Z8-SK-015 REV: D

File name D:\ONEDRIVE\WSP\OMEGA ZONE 8\DRAWINGS\5969-Z8-SK-015.DWG, printed on 06 August 2020 11:56:30, by Toby Smith

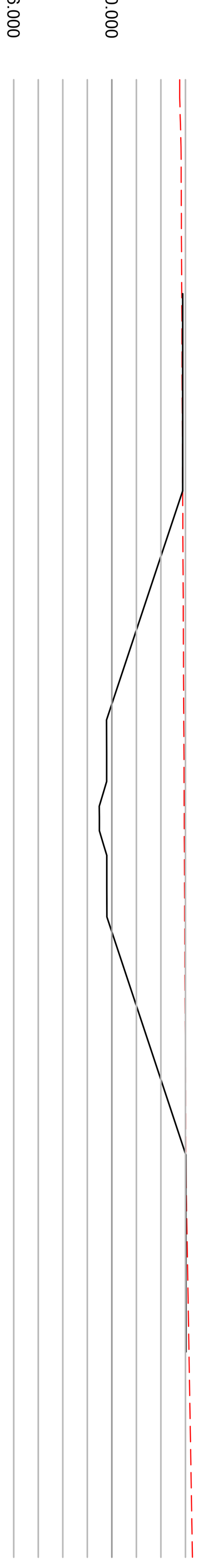
DO NOT SCALE

KEY

- HYBRID PLANNING APPLICATION BOUNDARY
- EXISTING GROUND PROFILE
- PROPOSED GROUND PROFILE

NOTES

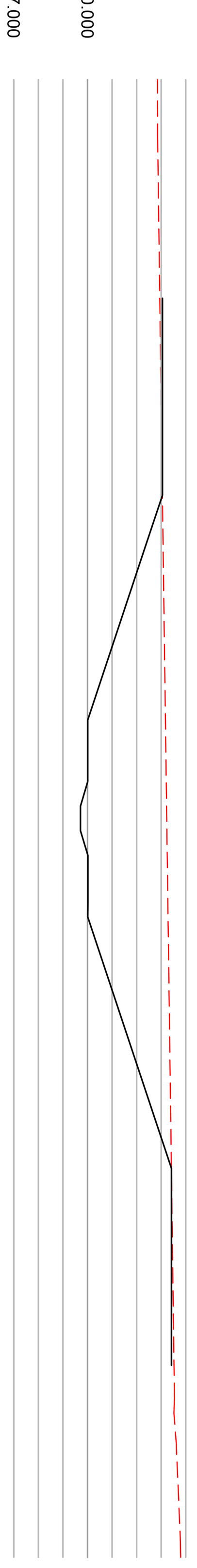
1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.



200.000 DATUM 16.000

20.000

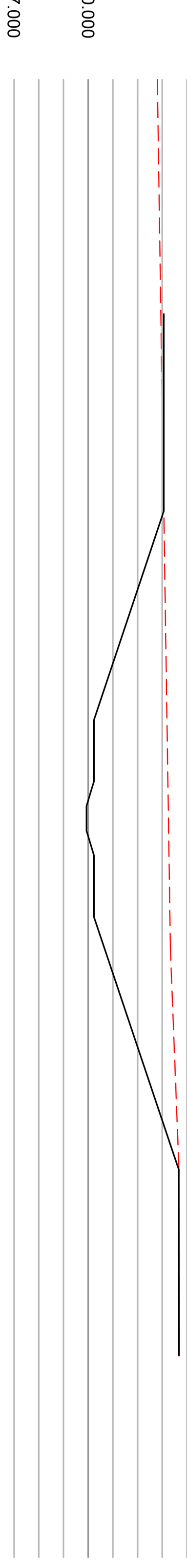
OFFSET	EXISTING LEVEL	PROPOSED LEVEL
30.0	22.765	
29.0	22.771	
28.0	22.799	
27.0	22.821	
26.0	22.826	
25.0	22.830	
24.0	22.835	
23.0	22.840	
22.0	22.845	
21.0	22.850	22.890 22.890
20.0	22.854	22.889
19.0	22.859	22.888
18.0	22.864	22.888
17.0	22.869	22.887
16.0	22.873	22.887
15.0	22.878	22.887
14.0	22.883	22.886
13.0	22.888	22.784
12.0	22.892	22.451
11.0	22.897	22.118
10.0	22.902	21.784
9.0	22.907	21.451
8.0	22.912	21.118
7.0	22.916	20.784
6.0	22.921	20.451
5.0	22.926	20.118
4.0	22.931	19.784
3.0	22.935	19.785
2.0	22.940	19.786
1.0	22.945	19.637
0.0	22.950	19.489
1.0	22.954	19.641
2.0	22.959	19.792
3.0	22.964	19.794
4.0	22.969	19.796
5.0	22.974	20.129
6.0	22.978	20.462
7.0	22.983	20.795
8.0	22.988	21.129
9.0	22.993	21.462
10.0	22.997	21.795
11.0	23.002	22.129
12.0	23.007	22.462
13.0	23.012	22.795
14.0	23.016	23.015
15.0	23.029	23.016
16.0	23.046	23.016
17.0	23.063	23.017
18.0	23.080	23.017
19.0	23.096	23.018
20.0	23.113	23.019
21.0	23.130	23.019
22.0	23.147	23.020
23.0	23.164	
24.0	23.181	
25.0	23.198	
26.0	23.215	
27.0	23.232	
28.0	23.249	
29.0	23.266	
30.0	23.283	



150.000 DATUM 17.000

20.000

OFFSET	EXISTING LEVEL	PROPOSED LEVEL
30.0	22.853	
29.0	22.854	
28.0	22.856	
27.0	22.865	
26.0	22.878	
25.0	22.892	
24.0	22.905	
23.0	22.918	
22.0	22.932	
21.0	22.945	23.050 23.050
20.0	22.958	23.050
19.0	22.972	23.050
18.0	22.985	23.050
17.0	22.998	23.050
16.0	23.012	23.050
15.0	23.025	23.050
14.0	23.039	23.050
13.0	23.052	23.009
12.0	23.065	22.675
11.0	23.079	22.342
10.0	23.092	22.009
9.0	23.105	21.675
8.0	23.119	21.342
7.0	23.132	21.009
6.0	23.145	20.676
5.0	23.159	20.342
4.0	23.172	20.009
3.0	23.186	20.010
2.0	23.199	20.011
1.0	23.212	19.862
0.0	23.226	19.714
1.0	23.239	19.866
2.0	23.252	20.015
3.0	23.266	20.014
4.0	23.279	20.012
5.0	23.292	20.345
6.0	23.306	20.679
7.0	23.319	21.012
8.0	23.332	21.345
9.0	23.346	21.679
10.0	23.359	22.012
11.0	23.373	22.345
12.0	23.386	22.679
13.0	23.399	23.012
14.0	23.413	23.345
15.0	23.426	23.415
16.0	23.439	23.415
17.0	23.453	23.415
18.0	23.466	23.415
19.0	23.479	23.415
20.0	23.493	23.415
21.0	23.506	23.415
22.0	23.520	23.415 23.415
23.0	23.533	
24.0	23.524	
25.0	23.584	
26.0	23.639	
27.0	23.682	
28.0	23.725	
29.0	23.768	
30.0	23.792	



100.000 DATUM 17.000

20.000

OFFSET	EXISTING LEVEL	PROPOSED LEVEL
30.0	22.800	
29.0	22.815	
28.0	22.830	
27.0	22.845	
26.0	22.860	
25.0	22.875	
24.0	22.890	
23.0	22.905	
22.0	22.920	
21.0	22.935	
20.0	22.950	23.063 23.063
19.0	22.965	23.063
18.0	22.980	23.063
17.0	22.995	23.063
16.0	23.010	23.063
15.0	23.025	23.062
14.0	23.040	23.062
13.0	23.055	23.062
12.0	23.070	22.901
11.0	23.085	22.568
10.0	23.100	22.235
9.0	23.115	21.901
8.0	23.130	21.568
7.0	23.145	21.234
6.0	23.160	20.901
5.0	23.175	20.567
4.0	23.190	20.234
3.0	23.205	20.234
2.0	23.220	20.234
1.0	23.235	20.084
0.0	23.250	19.933
1.0	23.265	20.083
2.0	23.280	20.233
3.0	23.295	20.233
4.0	23.310	20.233
5.0	23.325	20.568
6.0	23.357	20.903
7.0	23.395	21.238
8.0	23.434	21.573
9.0	23.473	21.908
10.0	23.511	22.243
11.0	23.550	22.578
12.0	23.588	22.912
13.0	23.627	23.247
14.0	23.665	23.581
15.0	23.668	23.668
16.0	23.670	23.670
17.0	23.671	23.671
18.0	23.672	23.672
19.0	23.673	23.673
20.0	23.674	23.674
21.0	23.675	23.675
22.0	23.676	23.676
23.0		
24.0		
25.0		
26.0		
27.0		
28.0		
29.0		
30.0		

REV	DATE	BY	DESCRIPTION	CHK	APP
D	05/08/2020	TS	POWER LINES REMOVED, KEY AMENDED	SG	SG
C	31/07/2020	TS	DRAWING RETITLED	SG	SG
B	29/07/2020	TS	BASIN ALIGNMENT AMENDED	SG	SG
A	01/07/2020	TS	FIRST ISSUE	SG	SG

DRAWING STATUS: PLANNING

wsp

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CLIENT: OMEGA ST HELENS LTD / T.J. MORRIS LIMITED

ARCHITECT: N / A

SITE/PROJECT: OMEGA ZONE 8 ST HELENS

TITLE: INDICATIVE WATERCOURSE DIVERSION ROUTE AND SECTIONS OPP DWG. 13

SCALE @ A1:	CHECKED:	APPROVED:
1:1000 (PLAN) 1:250 (SECTS)	SG	SG

PROJECT No:	DESIGNED:	DRAWN:	DATE:
70065969	TS	TS	July 20

DRAWING No: 5969-Z8-SK-009 REV: D

File name D:\ONEDRIVE\WSP\OMEGA ZONE 8\DRAWINGS\5969-Z8-SK-009.DWG, printed on 05 August 2020 08:19:46, by Toby Smith

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