

# Proposed Residential Development, Former Marchon Works, Whitehaven

## Flood Risk & Drainage Assessment

784-B030491

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Prepared on Behalf of Tetra Tech Limited.

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#### 1.0 INTRODUCTION

#### 1.1 PURPOSE OF THIS REPORT

Tetra Tech Ltd have been appointed by Persimmon Homes Lancashire and NPL Ltd to prepare a Flood Risk and Drainage Assessment (FRDA) in support of a hybrid planning application for circa 540 units, commercial space and public open space. Appendix A includes the proposed site layout.

#### 1.2 PROPOSED DEVELOPMENT

The proposed development comprises the construction circa 540 residential units. The proposed hybrid application seeks detailed consent for 140 dwellings, and outline consent for circa 400 units and commercial space.

## 1.3 REQUIREMENT FOR A FLOOD RISK AND DRAINAGE ASSESSMENT

The application site is located in Flood Zone 1, (i.e. land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability (AEP)) in any one year). However, since the site has an area in excess of 1 ha, then in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guide (Flood Risk & Coastal Change) (PPG), a Flood Risk Assessment is required to support the planning application.

The Parliamentary Written Statement<sup>1</sup> require applications for all major developments to be supported by a surface water strategy and where possible and reasonable, provide sustainable drainage systems (SuDS) in new developments, in order to protect people and property from flood risk and ensure that the flood risk to areas elsewhere is not increased.

#### 1.4 SCOPE OF THE REPORT

The FRDA will be undertaken in accordance with the NPPF, Planning Practice Guidance (PPG) (Flood Risk and Coastal Change), Environment Agency guidance and Local Standards and Guidance for Surface Water Drainage in Cumbria. The FRDA will consider all potential sources of flood risk including Main Rivers, Ordinary Watercourses, overland flow routes, groundwater, sewers, reservoirs and canals. The FRDA will identify a surface water drainage strategy for the site such that flood risk to the site and adjoining areas is not exacerbated, as required by the NPPF, and there will be a particular focus on the provision of SuDS on the site.

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<sup>&</sup>lt;sup>1</sup> Department for Communities and Local Government (December 2014), *Sustainable drainage systems: Written statement - HCWS161* 



The drainage assessment will also identify a foul drainage strategy. A review will be undertaken of the existing foul water drainage systems in the locality, to identify potential discharge points, and confirm the viability of any proposed connections to public sewerage infrastructure.

#### 1.5 LIMITATIONS OF THIS REPORT

This report has been prepared by Tetra Tech Ltd on behalf of Persimmon Homes Lancashire and NPL Ltd in connection with the scope of the report as described above and takes into account the particular instructions and requirements set out in our fee proposal and the acceptance. It is not intended for and should not be relied on by any third party and no responsibility is undertaken to any third party.

Tetra Tech Ltd accepts no duty or responsibility (including in negligence) to any party other than Persimmon Homes Lancashire and NPL Ltd and disclaims all liability of any nature whatsoever to any such party in respect of this report.

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#### 2.0 SITE DESCRIPTION

#### 2.1 EXISTING SITE

The site, as shown in Figure 1, is located to the west of Whitehaven, on land previously occupied by the Marchon chemical works site. The site's postcode is CA28 9PE and the site's grid reference is NX 96539 16487.



Figure 1 - Site Location<sup>2</sup>

The site covers an area of approximately 31 ha and comprises agricultural land to the north and some landscaping and abandoned roads associated with the former chemical works to the south. The northern area of the site is classified as greenfield land whilst the southern area of the site is classified as brownfield, as shown in Figure 1. The north and east of the site is surrounded by residential developments, by the former works site to the south, and by landscaping and agricultural land to the west.

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<sup>&</sup>lt;sup>2</sup> © Crown copyright and database rights [2021] Ordnance Survey 0100031673



A review of the topographical survey indicates that the site generally falls from east to west. The highest level is approximately 97.3 m AOD in the southeast of the site, and the lowest level is approximately 49.5 m AOD in the most western part of the site.

The topographical survey can be found in Appendix B.

#### 2.2 EXISTING DRAINAGE

#### 2.2.1 Watercourses

There are no existing rivers located near the site. The Irish Sea is located to the west of the site.

#### 2.2.2 Drains and Sewers

The United Utilities (UU) records show the presence of the following public sewers:

- A 225 mm diameter public surface water sewer is located along the northern boundary of the
  eastern area. The sewer extends from the adjacent residential neighborhood associated with
  Waters Edge Way. The sewer trends in a northerly direction from manhole 4402 before
  discharging into a 375 mm diameter public surface water sewer which flows in a westerly
  direction and discharges into the Irish Sea;
- A 2400 mm diameter public surface water sewer is shown adjacent to the northern boundary of the eastern area of the site and may indicate an existing surface water attenuation tank serving the Waters Edge Way neighborhood;
- A 225 mm diameter public foul sewer is shown to be within the eastern area of the site, trending
  in a northerly direction before appearing to discharge into a 450 mm diameter public combined
  sewer which continues to flow in a northerly direction;
- A 150 mm diameter public foul sewer is shown along the northern boundary of the eastern area
  of the site and appears to serve the Waters Edge Way neighborhood. The sewer is shown to
  flow in a westerly direction and appears to discharge into the aforementioned 225 mm diameter
  public foul sewer flowing through the site.

In addition to the UU sewers, there are two private surface water drains to the eastern part of the site, that discharges into the sea and served the former chemical works site. The existing drains and outfalls were built to serve the former factory. The northern pipe comprises a 600 mm diameter steel pipe, with the southern pipe being a 450 mm diameter pipe.

Previous surveys by others show that there is a 150 mm diameter plastic pipe flowing through the 600mm steel pipe, discharging leachate from the old mine. It is anticipated this discharge will cease once the site is remediated and developed, however this is to be confirmed by the specialist consultant.



#### **Existing Outfalls**

Tetra Tech visited the site in July 2021 to determine the existing condition of the existing outfalls. The northern outfall discharges into the sea via a submerged outfall. There is a shaft chamber in the rock that enables the pipe to drop to beach level. The second outfall is located at high level, with runoff presumably cascading down the cliff onto the beach.

The sewer records by UU are included in Appendix C. Appendix D includes the survey of the existing private drains by others. Appendix E includes relevant photographs from Tetra Tech's visit.

#### 2.3 GROUND CONDITIONS

#### 2.3.1 Published Geology

A review of the British Geological Survey (BGS) online geological mapping indicates the site is underlain by superficial deposits of Glacial Till. The northern area of the site is shown to be underlain by bedrock deposits from the Whitehaven Sandstone Formation. The southern area of the site is shown to be underlain by varying bedrock geology including the St Bees Evaporite Formation (described as comprising Dolomitic Limestone, Mudstone and Anyhdrite-Stone) and Brockram which is described as comprising Breccia.

#### 2.3.2 Site Investigation

An intrusive site investigation has been undertaken within the site by Betts Geo Environmental Limited on behalf of Persimmon Homes. The site investigation comprised a series of site visits to undertake trial pitting, window sampling and rotary boreholes with subsequent ground gas and groundwater monitoring visits.

The Ground Investigation Report (ref. 22PER008/GI) identifies that ground conditions consisted of various type of Made Ground generally overlying Clay/clayey Silt. Bedrock was encountered in the majority of holes with Sandstone being prominent in the northern area of the site and Limestone from the St Bees Evaporite across the remainder of the site. Siltstone was encountered in some of the trial pits along the south western site boundary. The Ground Investigation Report identifies various sources of visual and olfactory contamination were identified during the site investigation.

Groundwater was encountered at varying depths during the site investigation with the majority encountered within the Made Ground deposits which indicates this is likely to be perched. Groundwater monitoring was undertaken within window sample boreholes with groundwater depths of between 0.71



m below ground level (m bgl) – 2.95 m AOD. Groundwater monitoring was also undertaken with rotary borehole locations with depths ranging between 6.62 m bgl – 24.62 m bgl.

#### 2.3.3 Hydrogeology

The site is not situated within a groundwater Source Protection Zone (SPZ) or a drinking water safeguard zone (groundwater).

#### 3.0 FLOOD RISK

#### 3.1 FLUVIAL AND COASTAL FLOOD RISK

Fluvial flood risk is the risk arising from Main Rivers and Ordinary Watercourses. Coastal flood risk is the risk of flooding from the sea (tidal surges, waves, sea level raise). A floodplain is the area that would naturally be affected by flooding if a river rises above its banks. In England, floodplains of Main Rivers are divided into flood zones for planning purposes. These show the extent of the natural floodplain area at risk of inundation if there were no flood defenses or certain other manmade structures and channel improvements. They are divided as follows:

- Flood Zone 3 shows the land having a 1 in 100 or greater annual probability of river flooding; or a 1 in 200 or greater annual probability of flooding from the sea.
- Flood Zone 2 shows the additional extent of an extreme flood from rivers. It is land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding.
- Flood Zone 1 is the area of land where flooding from rivers and the sea is very unlikely.

The Environment Agency's Flood Map for Planning indicates that the site is located entirely within Flood Zone 1 and therefore at very low risk of fluvial flooding from Main Rivers. This is shown in Figure 3 below. Whilst the site is near the sea, land within the site is raised to significant height above sea level with cliffs running along the shoreline, sea level rise would not impact on the site. There are no proposals to develop land adjacent to the cliffs where coastal erosion could occur.



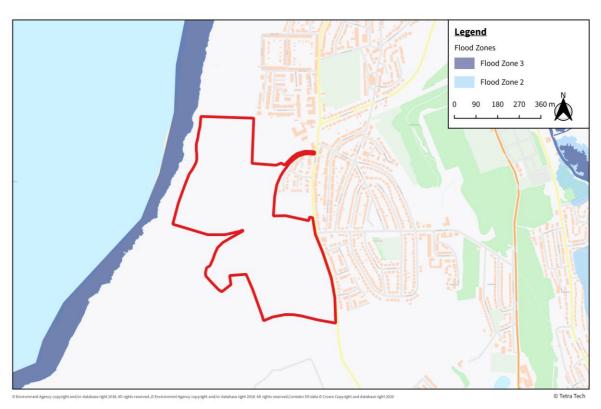


Figure 3 - Environment Agency Flood Map for Planning (November 2023)



#### 3.2 SURFACE WATER AND OVERLAND FLOWS

Surface water flooding occurs where high rainfall events exceed the drainage capacity in an area (i.e. sewer system and/or watercourse), leading to flooding.

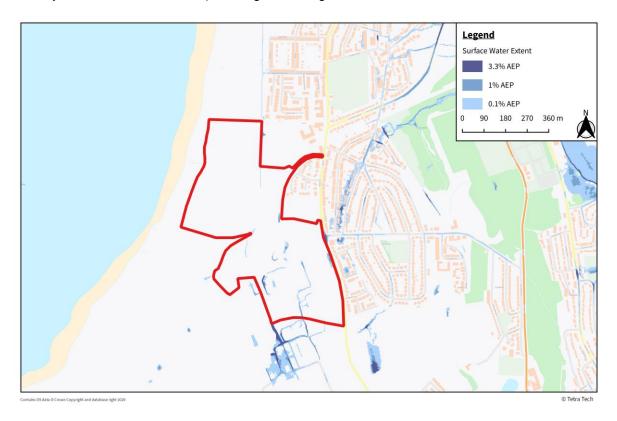


Figure 4 – Environment Agency Surface Water Flood Risk (November 2023)

The Environment Agency's Flood Risk from Surface Water Map shown as Figure 4 indicates that the site is at a very low risk of flooding from surface water. The map shows ponding within a few areas in the site; however, these are likely associated with low lying areas that will be removed when the site is developed. Notwithstanding, it is recommended that finished floor levels of proposed buildings are raised a minimum of 150 mm above surrounding ground levels.

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#### 3.3 GROUNDWATER FLOODING

Groundwater flooding occurs when water levels in the ground rise above the land surface. This type of flooding is most likely to occur in areas above an aquifer.

The Copeland Borough Council Strategic Flood Risk Assessment (SFRA) states that some areas in Whitehaven have experienced groundwater flooding, however these are not near the site.

Groundwater was encountered at varying depths during the previous site investigation with the majority encountered within the Made Ground deposits which indicates this is likely to be perched. Groundwater monitoring was undertaken within window sample boreholes with groundwater depths of between 0.71 m below ground level (m bgl) – 2.95 m AOD. Groundwater monitoring was also undertaken with rotary borehole locations with depths ranging between 6.62 m bgl – 24.62 m bgl. It should be noted that the ground investigation was undertaken over the winter period between November 2022 and January 2023 and groundwater levels are therefore likely to be representative of peak levels taking into account winter rainfall.

Based on the nature of the existing topography, the site will be subject to earthworks to create a suitable development platform.

Based on the above, the overall risk of groundwater flooding is considered to be low. However, it is recommended that finished floor levels of proposed buildings are raised a minimum of 150 mm above surrounding ground levels. It is further recommended that any property situated below proposed ground level is appropriately waterproofed to reduce the potential for the ingress of groundwater. Temporary dewatering of excavations may be required in the event of groundwater ingress during construction of the proposed development.

#### 3.4 SEWER FLOODING

Sewer flooding occurs when intense rainfall overloads the sewer system capacity and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

The location of existing sewers within the site are described in Section 2.2.2, in the event of surcharging of the existing public sewers, flooding may occur within the site, however, it is anticipated that flooding would be relatively shallow and of a short duration.



The proposed development will be served a network of new foul and surface water sewers that will be designed and installed in accordance with adoptable standards and subsequently offered to UU for adoption, subject to a formal Section 104 agreement.

Based on the above, the overall risk of sewer flooding is considered to be low. Notwithstanding, it is recommended that finished floor levels of proposed buildings are raised a minimum of 150 mm above surrounding ground levels.

There are a number of sewers within the site, however these are recent and have been designed in accordance with modern standards and are subject to regular maintenance by UU. Therefore, it is considered that the risk of flooding from sewers to the site is very low.

#### 3.5 RESERVOIR FLOODING

Although the probability of a catastrophic dam failure is considered to be extremely low, the consequence of such an event would be severe. The Environment Agency's Flood Risk from Reservoirs Map indicates that the site is not at risk of flooding as a result of reservoir failure.

#### 3.6 SUMMARY OF FLOOD RISK

Overall, the flood risk to the site from all sources is low.

It will be essential to ensure that no increase in flood risk occurs downstream of the site or on adjacent areas as a result of this development. The proposed mitigation measures are discussed in more detail within Section 5.



#### **4.0 DEVELOPMENT PROPOSALS**

#### **4.1 PROPOSED DEVELOPMENT**

A hybrid planning application has been submitted to Copeland BC for the development of circa 540 dwellings within the site. The detailed part of the hybrid application covers 140 dwellings, with the remaining 400 dwellings and commercial space seeking outline approval.

#### **4.2 SEQUENTIAL & EXCEPTION TESTS**

One of the aims of NPPF is to steer development away from zones of high flood risk towards Flood Zone 1. The proposed development components are classified as 'More Vulnerable' in accordance with Annex 3 of the NPPF. The site is located within Flood Zone 1 and has therefore been sequentially located within an area at low risk of flooding. Table 2 of the PPG (Flood Risk & Coastal Change) indicates that More Vulnerable development is considered acceptable within Flood Zone 1 without the requirement to apply the Exception Test.

#### 4.3 DEVELOPMENT AND FLOOD RISK

#### 4.3.1 Flood Risk to the Development

As assessed in Section 3, the site is in Flood Zone 1 for fluvial flood risk and a low risk of surface water flooding making the proposed development a low flood risk.

It is recommended that the finished floor levels of the proposed dwellings are raised a minimum of 150mm above the surrounding ground levels to mitigate the effects any future floods may have on these properties. It is further recommended that any property situated below ground level should be adequately waterproofed to reduce the potential for the ingress of groundwater. Temporary dewatering of excavations may be required in the event of groundwater ingress during construction.

#### 4.3.2 Flood Risk Arising from the Development

As an existing greenfield site, the proposed development will increase the impermeable area of the site. This will generate additional surface water runoff which, if uncontrolled, could increase the risk of surface water flooding elsewhere. It is therefore necessary to manage surface water runoff on site to avoid increasing the flood risk elsewhere. The proposed development will be subject to a surface water drainage strategy that will seek to ensure there is no increase in runoff as a result of the proposed development. Further details of the proposed surface water drainage strategy are provided in Chapter 5.

The drainage strategy in this report have been prepared by Ironside Farrar and show no increase in runoff is likely to be generated. Further details can be found in Chapter 5.



#### **5.0 SURFACE WATER MANAGEMENT**

#### **5.1 INTRODUCTION**

This chapter outlines the proposed surface water drainage strategy for the proposed development to demonstrate that there will be no increase in flood risk as a result of the proposed development. A surface water drainage strategy has been prepared by Ironside Farrar. The drainage strategy is summarised within this chapter with relevant drawings included as Appendix F and supporting calculations included as Appendix G.

#### **5.2 DRAINAGE HIERARCHY**

To ensure that surface water runoff from the site does not increase the risk of flooding, the management of runoff should be considered via a sequential approach, in line with Building Regulations<sup>3</sup>. The following options for the disposal of runoff have been considered, in order of preference:

#### Discharge to Ground

A review of BGS online mapping indicates the site is underlain by superficial deposits of Glacial Till.\_The northern area of the site is shown to be underlain by bedrock deposits from the Whitehaven Sandstone Formation. The southern area of the site is shown to be underlain by varying bedrock geology including the St Bees Evaporite Formation (described as comprising Dolomitic Limestone, Mudstone and Anyhdrite-Stone) and Brockram which is described as comprising Breccia. The presence of cohesive superficial strata is likely to preclude the use of infiltration.

The Ground Investigation Report (ref. 22PER008/GI) identifies that ground conditions consisted of various type of Made Ground generally overlying Clay/clayey Silt. Bedrock was encountered in the majority of holes with Sandstone being prominent in the northern area of the site and Limestone from the St Bees Evaporite across the remainder of the site. Siltstone was encountered in some of the trial pits along the south western site boundary. The Ground Investigation Report identifies various sources of visual and olfactory contamination were identified during the site investigation.

Groundwater was encountered at varying depths during the site investigation with the majority encountered within the Made Ground deposits which indicates this is likely to be perched. Groundwater monitoring was undertaken within window sample boreholes with groundwater depths of between

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<sup>&</sup>lt;sup>3</sup> HM Government (2010), *The Building Regulations 2010, Approved Document H (Part H3)* 



0.71 m below ground level (m bgl) -2.95 m AOD. Groundwater monitoring was also undertaken with rotary borehole locations with depths ranging between 6.62 m bgl -24.62 m bgl.

Based on the above, the use of infiltration is not considered suitable for the disposal of surface water runoff generated by the proposed development.

#### Discharge to Watercourse

Based on the sites proximity to the Irish Sea, there is the potential to discharge surface water runoff at an unrestricted rate, however, further consultation will be required with the LLFA to agree an unrestricted discharge rate. In lieu of such agreement, it is proposed to discharge surface water runoff into the Irish Sea at a restricted rate, further details of which are provided below.

#### Discharge to Sewer

There is an existing surface water sewer within the site that served the former factory and now discharges to the sea. It is anticipated that a new connection to this drain will be feasible, subject to agreement with United Utilities, and it is proposed to discharge surface water runoff from this site using the existing outfall into the sea.

#### 5.3 REVIEW OF SUDS OPTIONS

In order to comply with the national guidelines and policies set by the NPPF and the Non-Statutory Technical Standards for Sustainable Drainage, as well as those of Cumbria County Council the design of the surface water drainage system should seek to maximise the use of SuDS techniques. This section reviews the suitability of the different SuDS features available for the proposed development site.

#### 5.4 THE SUDS MANAGEMENT TRAIN

The main purpose of SuDS is to manage the surface water runoff generated by a development within the development site, attenuating additional flows generated by the introduction of impermeable areas whilst providing water quality treatment to the runoff and amenity and landscape benefits to the community. SuDS features can be categorised as follows:

- Source Control: manage runoff at its source.
  - Water butts, green/brown roofs, permeable pavements, rainwater harvesting systems, bio-retention systems.
- Site Control: manage runoff generated by a wider area.
  - o Swales, ponds, infiltration devices, filter strip, French drains.
- Regional Control: manage runoff generated by several sites.



#### o Basins, ponds and wetlands

The following is an illustration of the SuDS principles and how they may be applied to a development via a SuDS Management Train.

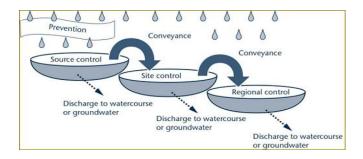


Figure 5 - SuDS Management Train

Table 1 below summarises the suitability of the different SuDS elements for the proposed development.

Table 1 – Review of SuDS elements for the proposed development

Type of SUDS	Description	Applicability to the Site
Source Control		
Water butts	Small storage tanks on each individual housing plot.	The installation of water butts would likely be considered by the individual future property owners. The attenuation benefits provided by water butts are considered to be limited, however, these may provide a source of water for non potable uses such as irrigation of garden areas.
Rainwater harvesting	Recycling of water from roofs and impermeable areas.	The attenuation benefits provided by rainwater harvesting are considered to be limited and would only be realised when the tanks were not full.



Type of SUDS	Description	Applicability to the Site
Green roofs	Vegetated roofs that reduce runoff and remove pollutants.	Based on the nature of the proposed development, which includes residential dwellings with pitched roofs, the use of green roofs is not considered to be feasible.
Pervious surfaces	Pavements that allow surface water to flow into underlying layers of the pavement and either infiltrate or drain to an on-site drainage network.	The proposed access roads will be offered for adoption therefore the use of permeable paving is not considered to be feasible.
Rain Gardens & Shallow depressions with free draining soil and planted with vegetation that withstands occasional flooding.		This could be incorporated into landscaped areas, however, the overall attenuation benefits are considered to be limited.
Site & Regional C	Control	
Filter Drains	Linear drains or trenches filled with granular material that allow infiltration to the surrounding ground.	Based on the nature of the underlying geology, the use of infiltration is considered to be unsuitable.
Swales	Vegetated channels to convey store and treat runoff.	Based on the nature of the site and associated topography, the use of swales is not considered to be feasible.
Detention basins & ponds	Shallow areas of open space that temporarily hold water and collect silt.	There is sufficient space for the provision of large open storage features in the western area of the site. The use of detention basins has been considered within the proposed drainage strategy.



Type of SUDS	Description	Applicability to the Site
Infiltration basins	Shallow depression that stores runoff before it infiltrates into the subsoil.	Based on the nature of the underlying geology, the use of
Infiltration devices	Generally granular trenches or soakaways that store water and allow infiltration to the surrounding ground.	infiltration is considered to be unsuitable.

#### 5.5 PROPOSED SURFACE WATER DRAINAGE

A surface water drainage strategy has been prepared by Ironside Farrar and is included as Appendix F. The surface water drainage strategy proposes to discharge surface water runoff generated by the proposed development to the Irish Sea via an existing headwall to the north west of the site.

Surface water runoff generated by the proposed development will be restricted to a rate of 86.1 l/s, which represents the existing greenfield QBAR runoff rate, during all events up to and including the 1 in 100 year plus 50% climate change scenario taking into account the latest guidance for peak rainfall intensity published in May 2022. Restricting runoff to the QBAR rate will seek to provide betterment during all events up and including the 1 in 100 year plus climate change scenario.

In order to achieve this restriction, surface water attenuation will be provided within a series of detention basins located in the western area of the site which will provide the following attenuation volumes:

Table 2 - Proposed storage volumes

Detention Basin	Storage Volume (m³)	
1	3122.3	
2	5807.0	
3	1818.4	
4	224.4	
5	203.3	
6	1946.5	



The proposed detention basins will include areas that will be over deepened to a maximum 300 mm depth to provide a permanent pool of water and will be planted within native species to contribute towards overall biodiversity requirements.

Surface water will ultimately discharge into detention basin 1 from which water will drain to the existing headwall via a hydrobrake or similar flow control device that will restrict runoff to a proposed rate of 86.1 l/s. Surface water will discharge into the Irish Sea via the existing headwall. It should be noted that further discussions are ongoing with the LLFA to potentially agree an unrestricted discharge rate.

#### 5.6 RESIDUAL FLOOD RISK AND EXCEEDANCE ROUTES

The primary residual risk would be associated with a failure of the surface water drainage system. The risk of flooding would also increase if the drainage system is not maintained on a regular, ongoing basis.

In addition, there remains a residual risk of a storm event that exceeds the capacity of the drainage system, as events beyond the 1 in 100 year storm event plus 50% allowance for climate change storm will not be catered for explicitly. In an event exceeding this magnitude, surface water runoff will flow in a westerly direction towards the Irish Sea. Finished floor levels of the proposed dwellings will be raised a minimum of 150 mm above surrounding ground levels thereby reducing the potential for the ingress of water during an exceedance event.

#### 5.7 WATER QUALITY

In accordance with Table 26.2 of The SuDS Manual CIRIA C753, the pollution hazard level is considered to be 'Low' for the proposed land use. Therefore, the requirements for discharge to surface waters state that the 'Simple index approach' should be used. Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use as set out in Table 3 below, which is an extract of Table 26.2. Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use. Table 26.2 of The SuDS Manual states the following:

Table 3 - Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro- carbons
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways, low traffic roads	Low	0.5	0.4	0.4
All roads except low traffic roads and motorways	Medium	0.7	0.6	0.7



Table 26.4 of The SuDS Manual states the various mitigation indices for different SuDS elements. These are shown below in Table 4.

Table 4 - SuDS Mitigation Indices (Discharge to Surface Water)

SuDS Feature	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6

Based on a comparison between the anticipated pollution indices and SuDS Mitigation indices, insufficient treatment is provided. However, the proposed drainage strategy includes the provision of six detention basins that will each provide a source of treatment. Where multiple SuDS features are used in combination, the total SuDS mitigation index for each pollutant is a combination of the mitigation indices of each element. The first SuDS feature water encounters will always be more effective than the subsequent features, given that the concentration of pollutants in the runoff entering these is lower. However, the overall treatment provided is likely to exceed the overall pollution hazard index. Moreover, the detention basins will be designed such that areas will be over deepened to a maximum of 300 mm to provide a permanent pool of water with associated native planting which will provide further treatment.

It should be noted that alternative SuDS options may also be considered during the detailed design stage which achieves or exceeds the water quality objective. Provided that the mitigation indices of the treatment techniques are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving system.

#### 5.8 DRAINAGE AND SUDS MAINTENANCE

SuDS require regular maintenance to ensure they remain operational over the lifetime of development. The proposed drainage network will be offered to United Utilities for adoption subject to Section 104 agreement. Maintenance of the proposed SuDS features will be undertaken by a delegated management company. Table 5 below summarises the anticipated maintenance requirements based on guidance contained within the CIRIA SuDS Manual C753.

Table 5 – Maintenance tasks and frequency required

SuDS Feature	Maintenance Task	Recommended Frequency	
Detention Basin	Remove litter and debris	Monthly	
	Cut grass in and around basin	<ul> <li>Monthly (as required)</li> </ul>	
	Inspect inlets and outlets	<ul> <li>Monthly</li> </ul>	
	Remove sediment from inlets and outlets	Annually (as required)	
	Repair erosion or other damage	As required	



#### **6.0 FOUL DRAINAGE**

#### **6.1 EXISTING FOUL DRAINAGE**

There is an existing 225mm diameter foul sewer flowing north through the central part of the site.

#### **6.2 PROPOSED FOUL DRAINAGE**

The development proposals include up to 540 units. In accordance with the Sewerage Sector Guidance, the expected peak foul flow from this number of units is 27 l/s. United Utilities is reviewing the existing capacity in the sewer to confirm if any upgrades would be required.

A foul drainage strategy has been designed by Ironside Farrar and is shown in the drawings included at Appendix F. Based on the site topography, the western half of the dwellings proposed in the northern part of the site would not be able to drain by gravity to the existing sewer. Therefore, a pumping station will be required to convey the flows to the UU foul sewer. A final review of levels in the southern part of the site, which used to house Marchon chemical works, will be required to determine whether a gravity discharge to the existing sewer would be practical.

The provision of a pump for foul drainage purposes presents a potential source of flood risk in the event of pump failure. Proposed foul drainage will be offered to United Utilities for adoption subject to Section 104 agreement and will therefore be installed in accordance with UU adoptable standards. Emergency storage will be included within the pumping station in accordance with UU requirements. Telemetry will be installed to raise the alarm to allow for appropriate maintenance to be undertaken in the event of pump failure.



#### 7.0 CONCLUSIONS AND RECOMMENDATIONS

#### 7.1 CONCLUSIONS

- 1. This FRDA has been produced in support of an accepted hybrid planning application for the development of circa 540 dwellings in the former Marchon site in Whitehaven.
- The FRDA has been undertaken in accordance with the NPPF (Chapter 14), PPG (Flood Risk and Coastal Change), Environment Agency guidance and Guidance for Surface Water Drainage in Cumbria.
- 3. This assessment has identified that the proposed development can be implemented in accordance with the relevant flood risk and drainage national and local planning policies.
- 4. The application site area covers approximately 31 ha and falls within Flood Zone 1.
- 5. The site is at low risk of flooding from all sources.
- 6. Surface water runoff from the site is to be drained to the sea via an existing outfall to the north, which previously served the former factory's drainage system.
- 7. Surface water runoff will be restricted to a rate of 86.1 l/s during all events up to and including the 1 in 100 year plus 50% climate change scenario with attenuation provided in the series of detention basins. Further consultation with the LLFA is ongoing to discuss the potential for free discharge into the Irish Sea.
- 8. The proposed drainage system will be offered to UU for adoption, including the existing outfalls.
- 9. It is proposed to drain foul flows to the existing UU public foul sewer. Part of the proposed foul drainage network will be pumped. The proposed pumping station will include suitable mitigation to reduce the risk of flooding in the event of pump failure.

#### 7.2 RECOMMENDATIONS

- 1. Further liaison with UU is required to confirm the future maintenance of the existing outfalls.
- Additional surveys of the existing drains are required to confirm the condition and any required improvements.
- 3. Final levels on southern section of the site could be designed to enable a gravity connection to the existing foul public sewer.
- 4. All proposed dwellings should be raised a minimum of 150 mm above surrounding ground levels.

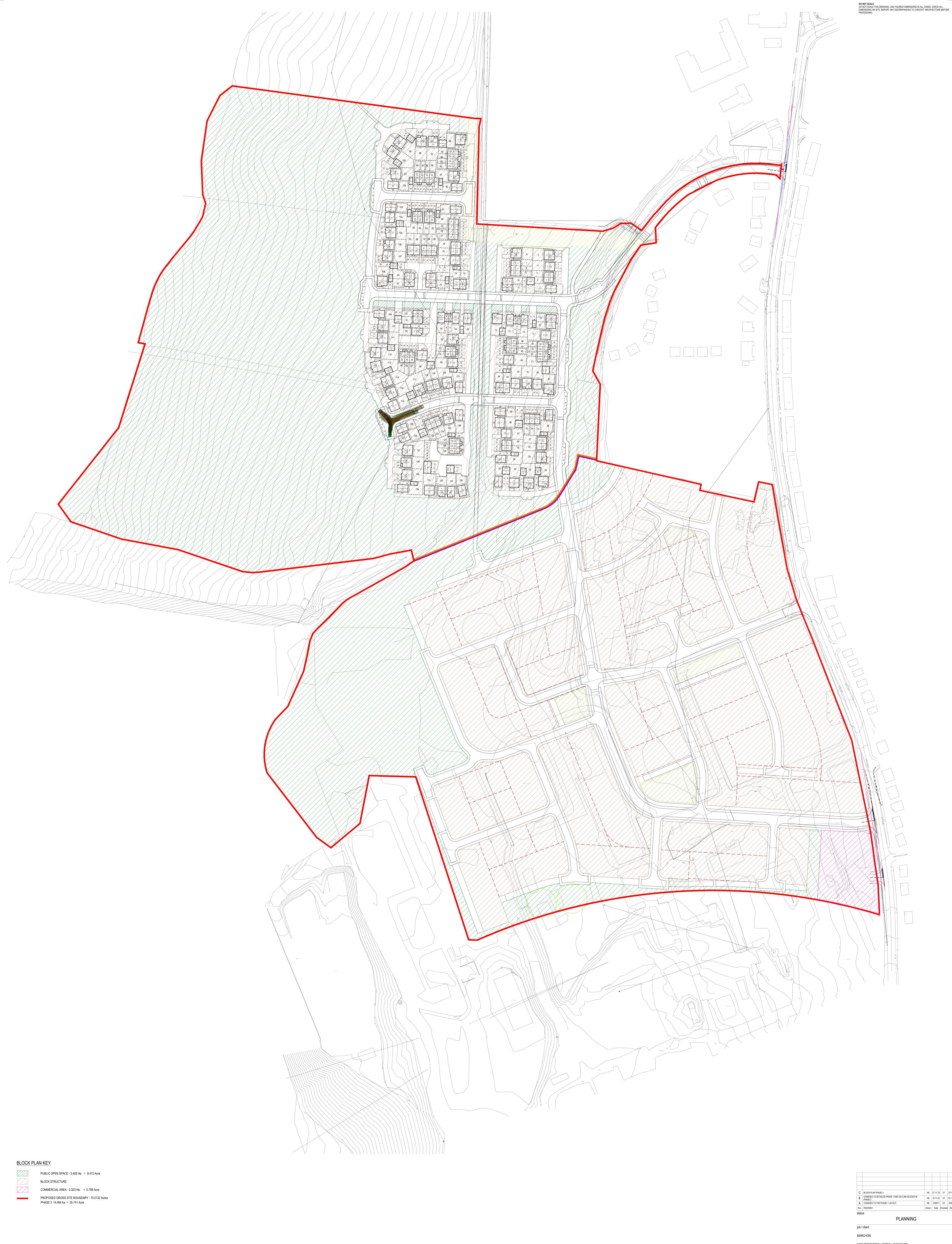


- 5. Any property situated below ground level should be adequately waterproofed to reduce the potential for the ingress of water.
- 6. Temporary dewatering of excavations may be required in the event of groundwater ingress during construction.
- 7. All SUDS should be designed in accordance with The SUDS Manual (Ciria C753) and Defra's Non-technical standards for sustainable drainage systems.
- 8. A comprehensive inspection and maintenance schedule shall be provided and implemented to ensure that the drainage system is maintained in a good operational manner.



#### **APPENDICES**

## APPENDIX A – PROPOSED SITE LAYOUT



KB 27.11.23 ST 2711.23 KB 16.11.23 ST 19.11.23 KB 230911 ST 230911 Drawn Date Checked Date FOR PERSIMMON HOMES LANCASHIRE drawing title PROPOSED MASTERPLAN PLAN BLOCK PLAN PHASE 2 drawing no. MP\_01 08.03.21 drawn by sheet size 1/1000 KB 320J Mayoral Way Team Valley Trading Estate Gateshead NE11 0RT 0191 - 4661611 info@cpt-group.co.uk



## **APPENDIX B – TOPOGRAPHICAL SURVEY**





## APPENDIX C – PUBLIC SEWER RECORDS



Francisco Aguilar

3 Sovereign Square Sovereign Street, West Yorkshire Leeds, LS1 4ER

FAO:

How to contact us:

United Utilities Water Limited Property Searches Haweswater House Lingley Mere Business Park Great Sankey Warrington WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: B030491

Our Ref: UUPS-ORD-302870

Date: 01/07/2021

**Dear Sirs** 

#### Location: 1 WATERS EDGE CLOSE, WHITEHAVEN, CA28 9PE

I acknowledge with thanks your request dated 30/06/2021 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <a href="http://www.unitedutilities.com/work-near-asset.aspx">http://www.unitedutilities.com/work-near-asset.aspx</a>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please contact us.

Yours Faithfully,

Karen McCormack Property Searches Manager

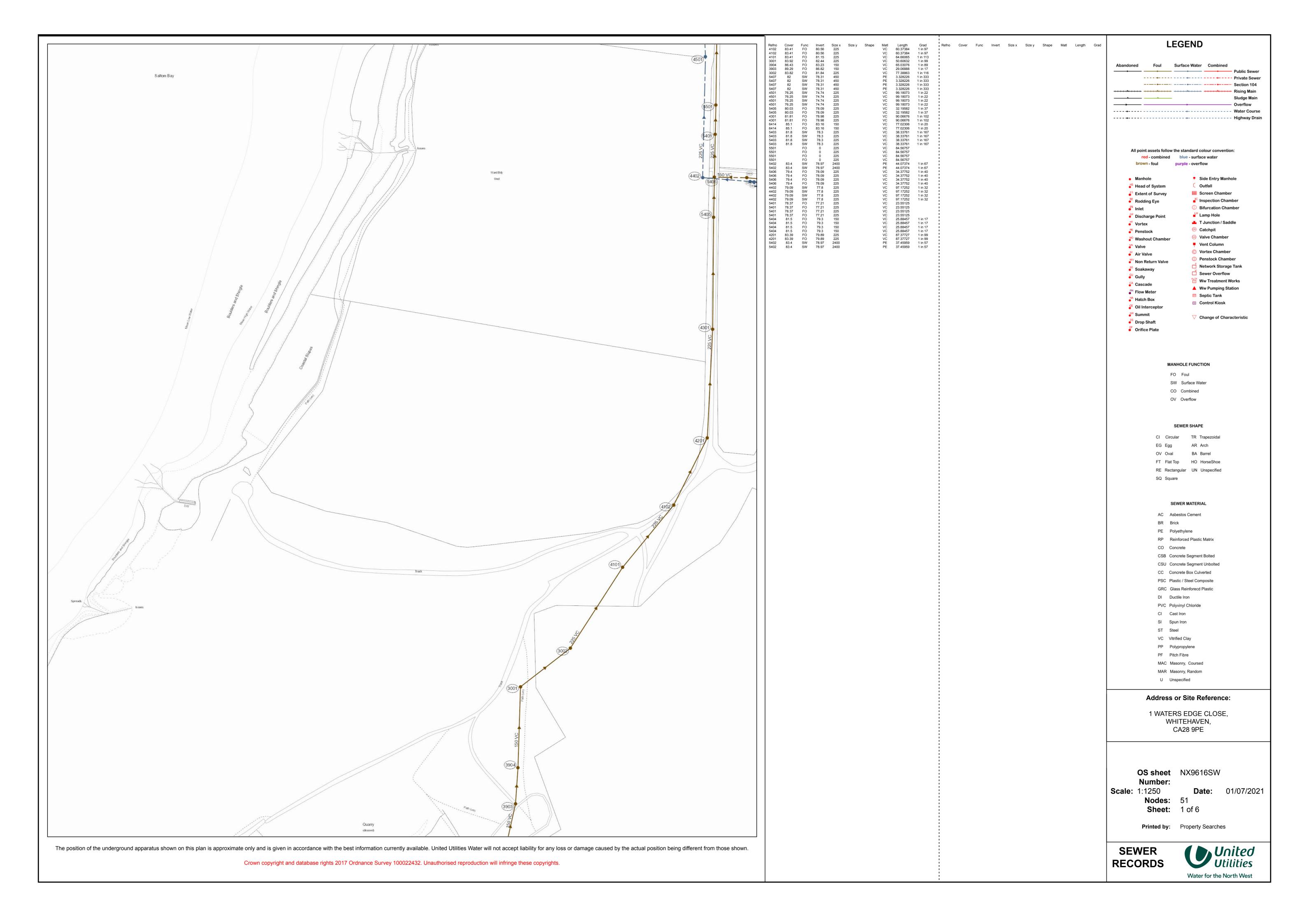


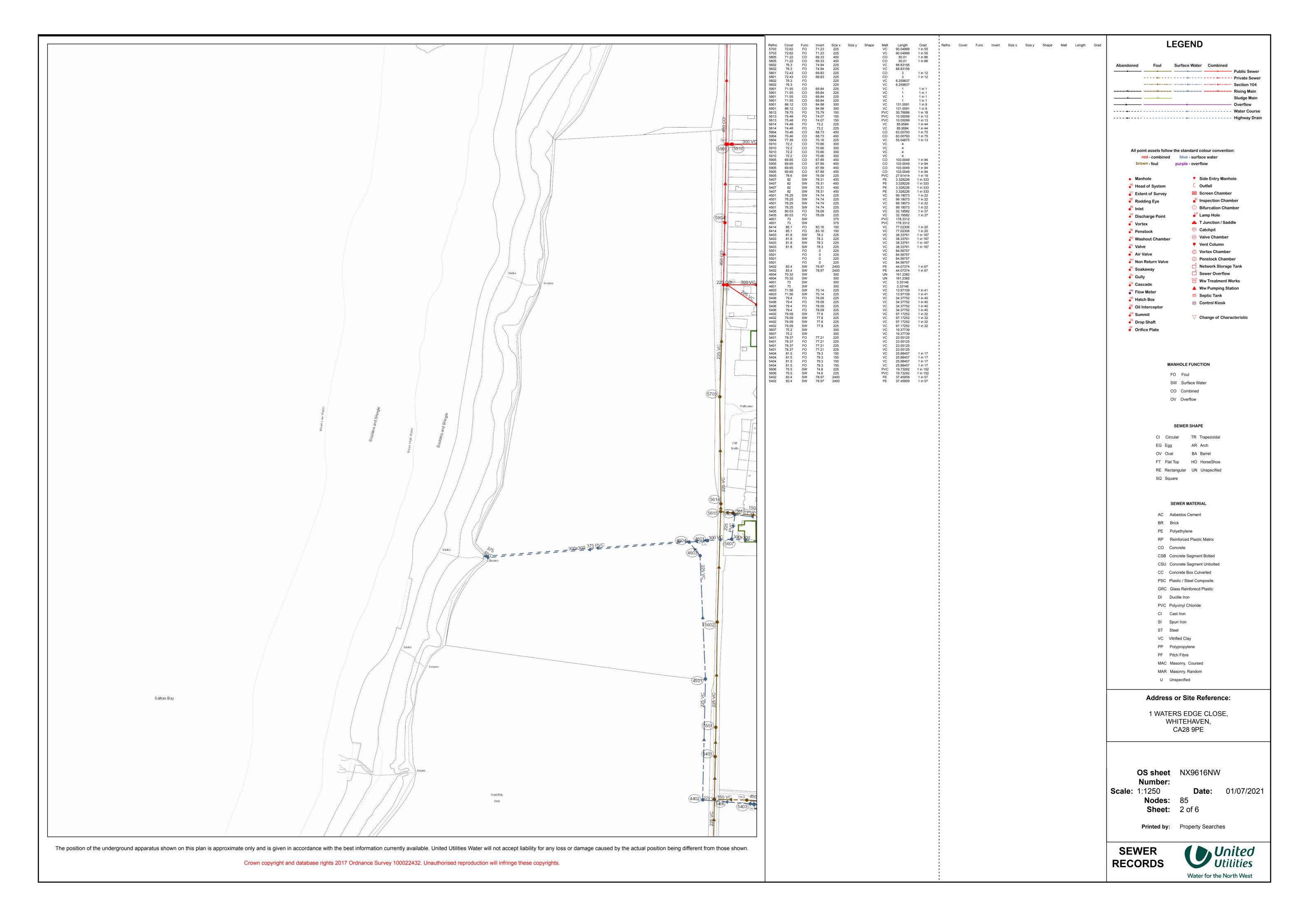
#### TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

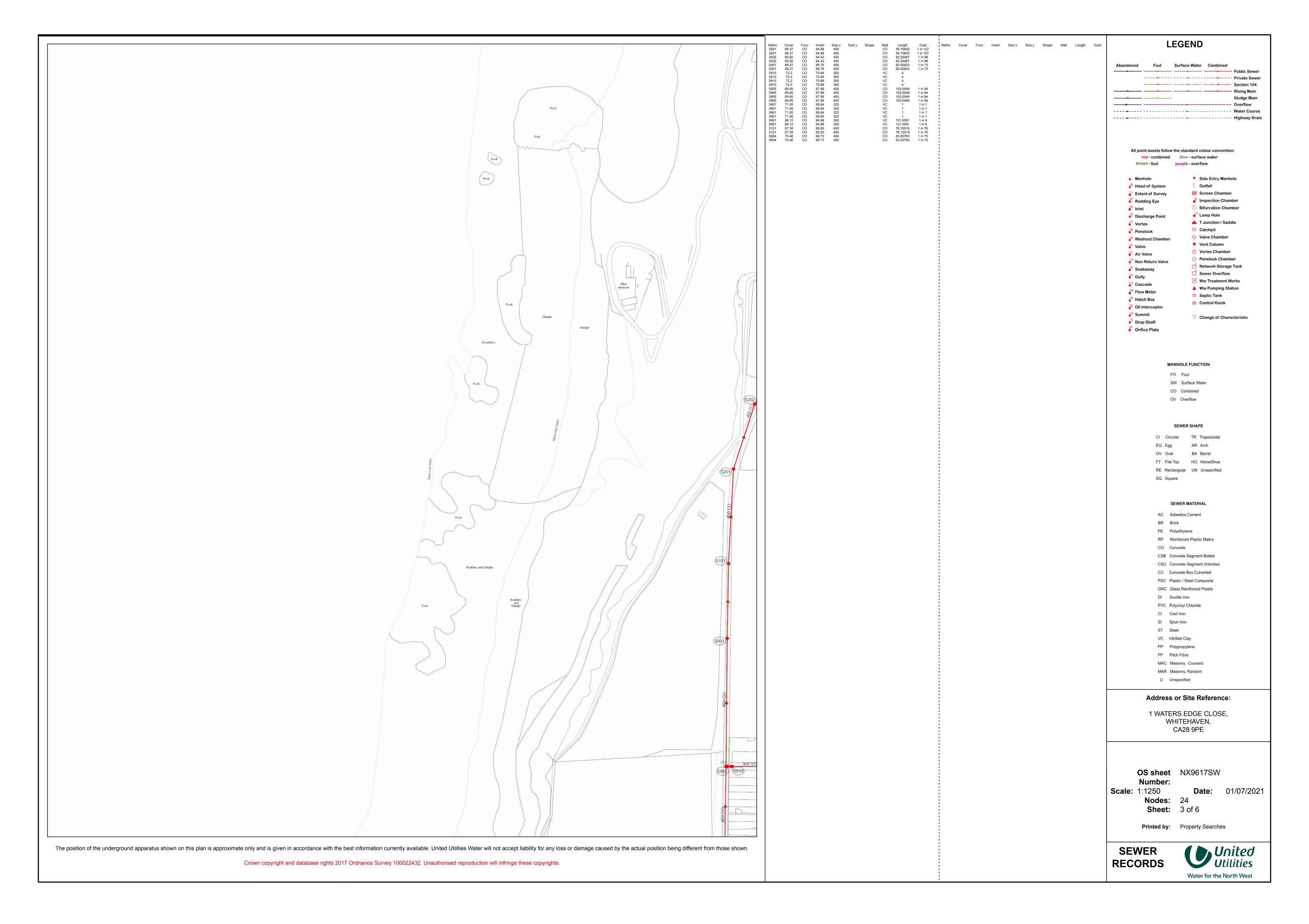
These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

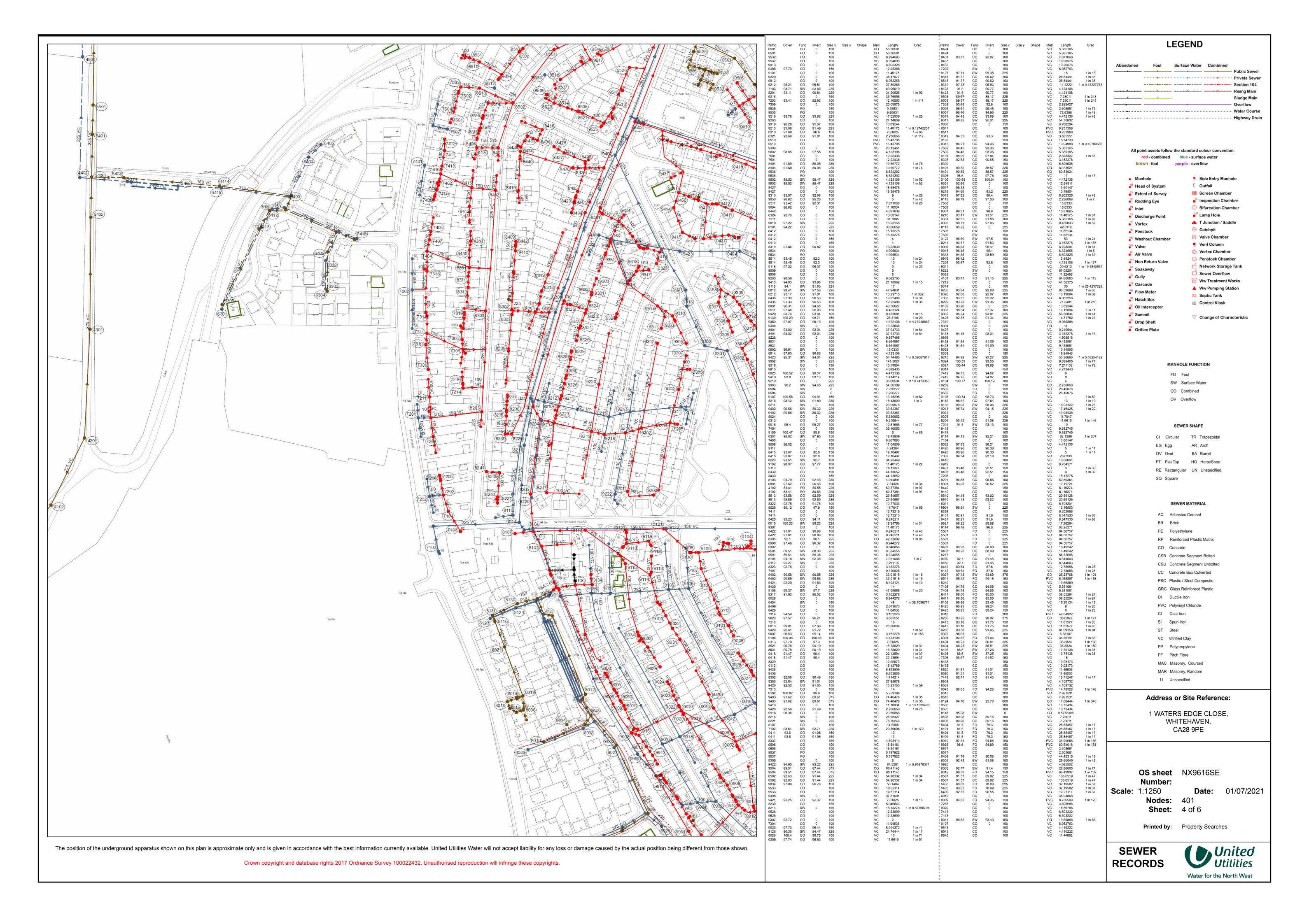
#### **TERMS AND CONDITIONS:**

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

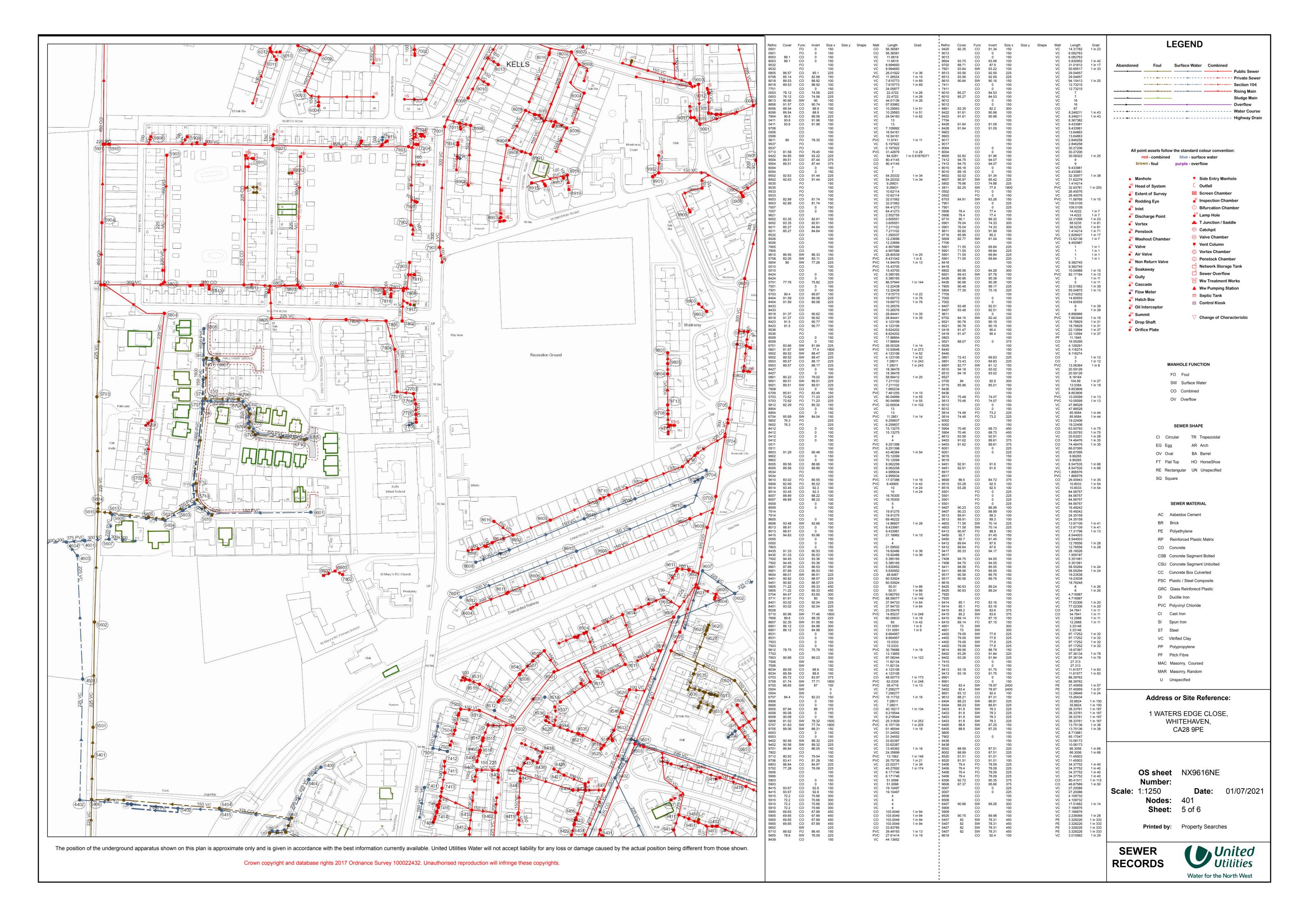








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Refno Cover Func Invert Size x Size y Shape Matt Length Grad Refno Cover 8128 93.6 FO 93.6 150 PVC 13.54145 1 in 16 6301 91.55 SW 90.3 300 VC 72.59887 1 in 70 8129 94.93 FO 92.75 150 PVC 14.68596 1 in 163	Func Invert Size x Size y Shape Matl Length Grad
8129 94.93 FO 92.75 150 PVC 14.68596 1 in 163 8019 FO 100 PVC 5.2676879 FO 100 VC 3.016679 FO 100 FO S.2676879 FO 100 FO S.2676879 FO FO S.2676879 FO	Abandoned Foul Surface Water Combined  → → → → → Public Sewe
5402 83.4 SW 78.97 2400 PE 44.07374 1 in 67 5402 83.4 SW 78.97 2400 PE 44.07374 1 in 67 9431 92 CO 90.71 150 VC 3.605551 9431 92 CO 90.71 150 VC 3.605551 8515 93.28 CO 92.5 100 VC 10.8033 1 in 54	
8515       93.28       CO       92.5       100       VC       10.8033       1 in 54         9513       89.91       CO       89.3       100       VC       24.35159         9513       89.91       CO       89.3       100       VC       24.35159	Rising Main  Sludge Main  Overflow
9202 CO 100 VC 2.236068 6413 90.97 FO 88.9 150 VC 17.31798 1 in 13 9417 95.33 CO 94.17 100 VC 28.16026 8003 97.54 SW 94.23 150 VC 47.30701 1 in 99 9517 90.56 CO 89.76 150 VC 19.23538	→
9517 90.56 CO 89.76 150 VC 19.23538 9517 90.56 CO 89.76 150 VC 19.23538 9206 CO 0 100 VC 23.34524 8231 CO 100 VC 7.526254 6414 85.1 FO 83.16 150 VC 77.02306 1 in 20	
6414 85.1 FO 83.16 150 VC 77.02306 1 in 20 6415 85.2 SW 83.6 375 CO 34.7841 1 in 11 6415 85.2 SW 83.6 375 CO 34.7841 1 in 11 6410 89.14 FO 87.15 150 VC 12.2988 1 in 11	All point assets follow the standard colour convention:
89.14 FO 87.15 150 VC 12.2988 1 in 11  8004 96.2 SW 93.13 450 PE 4.915501 1 in 15  8326 92.78 CO 91.13 150 VC 6.082763  4402 79.09 SW 77.8 225 VC 97.17252 1 in 32	red - combined blue - surface water brown - foul purple - overflow
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9907 97.05 SW 94.29 375 CO 21.43478 1 in 268 8402 93.26 CO 91.84 225 VC 97.36134 1 in 78 8402 93.26 CO 91.84 225 VC 97.36134 1 in 78 8133 94.94 CO 93.1 225 VC 97.36134 1 in 78 8133 94.94 CO 93.1 225 VC 2.633412 1 in 8 9134 96.28 CO 93.78 150 VC 13.59582 1 in 41	● Head of System Outfall  ■ Screen Chamber  ■ Screen Chamber
7410 CO 0 150 VC 27.313 7410 CO 0 150 VC 27.313 829 CO 225 VC 34.36416	■ Rodding Eye ■ Inspection Chamber ■ Inlet ■ Bifurcation Chamber ■ Discharge Point ■ Lamp Hole
8105     95.3     SW     92.94     225     VC     58.65811     1 in 101       5402     83.4     SW     78.97     2400     PE     37.45959     1 in 57       5402     83.4     SW     78.97     2400     PE     37.45959     1 in 57       8125     94.94     SW     92.73     600     CO     11.64635     1 in 233       8235     CO     100     VC     14.40156	W Vortex
9033 97.86 CO 96.86 100 VC 3.162278 1 in 45 9326 CO 100 VC 25.67566 8821 FO 150 PVC 25.67566	₩ Washout Chamber  Valve Chamber  Valve Chamber
5403 81.8 SW 78.3 225 VC 38.33761 1 in 167 5403 81.8 SW 78.3 225 VC 38.33761 1 in 167 5403 81.8 SW 78.3 225 VC 38.33761 1 in 167 5403 81.8 SW 78.3 225 VC 38.33761 1 in 167 5403 81.8 SW 78.3 225 VC 38.33761 1 in 167 6305 91.58 FO 89.92 150 VC 67.5574 1 in 66	Air Valve  ○ Vortex Chamber  ○ Penstock Chamber
9104 95.81 CO 93.95 150 VC 8.014688 1 in 47 I	Soakaway  Soakaway  Gully  Network Storage Tank  Sewer Overflow
1940   79.4   FO   78.09   225   VC   34.37752   111 40	CA Cascade  Ww Pumping Station  Flow Meter  Septic Tank
S406	☐ Hatch Box ☐ Control Kiosk ☐ Oil Interceptor
8126 94.8 SW 0 CO 0.6266254	Summit  □ Change of Characteristic □ Drop Shaft □ Change of Characteristic
4301     81.81     FO     78.98     225     VC     90.06676     1 in 102       4301     81.81     FO     78.98     225     VC     90.06676     1 in 102       6403     88.58     SW     85.81     375     CO     54.91792     1 in 25       6403     88.58     SW     85.81     375     CO     54.91792     1 in 25	● Orifice Plate
9411 CO 0 225 VC 51.05464  9411 CO 0 225 VC 51.05464  9418 CO 0 225 VC 51.05464	
4501       76.25       SW       74.74       225       VC       99.18073       1 in 22         4501       76.25       SW       74.74       225       VC       99.18073       1 in 22         4501       76.25       SW       74.74       225       VC       99.18073       1 in 22	MANHOLE FUNCTION  FO Foul
8241 CO 100 VC 10.46606 1 8534 CO 100 VC 8.598037 1	SW Surface Water CO Combined
9414 93.5 CO 92.5 100 VC 12.64911 9414 93.5 CO 92.5 100 VC 12.64911 8505 91.46 CO 90.95 150 VC 19.64911 7409 CO 0 100 VC 6.202866	OV Overflow
7409 CO 0 100 VC 6.202866 0419 90.82 CO 100 VC 15.85093 0419 90.82 CO 100 VC 15.85093 9115 CO 0 100 VC 8.062258 4201 83.39 FO 79.89 225 VC 87.37727 1 in 99	SEWER SHAPE
4201 83.39 FO 79.89 225 VC 87.37727 1 in 99 8238 CO 100 VC 4.506634 7414 CO 100 VC 4.135752 7414 CO 100 VC 4.135752	CI Circular TR Trapezoidal  EG Egg AR Arch
8405 93.24 CO 100 VC 2.044366 4 8405 93.24 CO 100 VC 2.044366 4 8405 93.24 CO 100 VC 2.044366 4 8430 94.79 FO 92.88 150 PVC 16.64019 1 in 128	OV Oval BA Barrel  FT Flat Top HO HorseShoe
7214 93.34 CO 92.18 100 VC 16.03122 9042 97.08 FO 94.49 150 PVC 31.4377 1 in 150 8108 94.94 CO 92.41 150 VC 10.88623 1 in 156 8110 FO 150 PVC 5.076295 8331 93.37 CO 92 150 VC 17.02939 9440 CO 89.77 100 VC 8.190701	RE Rectangular UN Unspecified  SQ Square
9440 CO 89.77 100 VC 8.190701 I 6401 91.87 SW 90.43 225 VC 47.5904 1 in 17 I 9909 96.61 SW 94.17 375 CO 58.24958 1 in 121 I	SQ Squale
5401 /8.3/ FO //.21 225 VC 23.55125	SEWER MATERIAL
8132       94.92       CO       92.66       150       PVC       2.833179       1 in 11         9312       CO       0       100       VC       69.2315         8127       93.63       FO       93.63       150       PVC       6.983881       1 in 233         9901       CO       0       225       VC       51.10773       00         6406       89.49       SW       87.97       300       VC       9.91241       1 in 22         6406       89.49       SW       87.97       300       VC       9.91241       1 in 22	AC Asbestos Cement BR Brick
SAUT   78.37   FU   77.21   225   VC   23.55125     8132   94.92   CO   92.66   150   PVC   28.33179   1 in 11     9312   CO   0   100   VC   69.2315     8127   93.63   FO   93.63   150   PVC   6.983881   1 in 233     9901   CO   0   225   VC   51.10773     6406   89.49   SW   87.97   300   VC   9.91241   1 in 22     6406   89.49   SW   87.97   300   VC   9.91241   1 in 22     6406   89.49   SW   87.97   300   VC   9.91241   1 in 22     9514   90.21   CO   89.56   100   VC   14.42235   1 in 55     9514   90.21   CO   89.56   100   VC   22.83179   1 in 317     8535   CO   100   VC   4.298528	PE Polyethylene  RP Reinforced Plastic Matrix
8535 CO 100 VC 4.298528 8535 CO 100 VC 4.298528 7211 CO 0 100 VC 17.02943 8002 96.89 SW 93.75 150 VC 10.44419 1 in 33	CO Concrete  CSB Concrete Segment Bolted
	CSU Concrete Segment Unbolted  CC Concrete Box Culverted
	PSC Plastic / Steel Composite  GRC Glass Reinforecd Plastic
	DI Ductile Iron PVC Polyvinyl Chloride
	CI Cast Iron SI Spun Iron
	ST Steel  VC Vitrified Clay
	PP Polypropylene PF Pitch Fibre
	MAC Masonry, Coursed  MAR Masonry, Random
	U Unspecified
	Address or Site Reference:  1 WATERS EDGE CLOSE,
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	SEWER RECORDS Utilities  Water for the North West



Refno Cover Func Invert Size x Size y Shape Matl Length Grad 8516 CO 100 VC 7.991531	efno Cover Func Invert Size x Size y Shape Matl Length Grad	LEGEND
8516         CO         100         VC         7.991531         I           8516         CO         100         VC         7.991531         I           6403         88.58         SW         85.81         375         CO         54.91792         1 in 25         I           6403         88.58         SW         85.81         375         CO         54.91792         1 in 25         I           0505         CO         100         VC         10.72434         I		Abandoned Foul Surface Water Combined
0505         CO         100         VC         10.72434         I           9411         CO         0         225         VC         51.05464         I           9411         CO         0         225         VC         51.05464         I           4604         70.32         SW         300         UN         161.2382         I           4604         70.32         SW         300         UN         161.2382         I		Public Sewer
9408 89.98 CO 89.15 100 VC 7.28011 1 9408 89.98 CO 89.15 100 VC 7.28011 1 5607 75.2 SW 300 VC 19.37739 1 5607 75.2 SW 300 VC 19.37739		Rising Main Sludge Main
5404     81.5     FO     79.3     150     VC     25.88457     1 in 17       5404     81.5     FO     79.3     150     VC     25.88457     1 in 17       5404     81.5     FO     79.3     150     VC     25.88457     1 in 17       5404     81.5     FO     79.3     150     VC     25.88457     1 in 17		→- Overflow→ Water Course
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4501 76.25 SW 74.74 225 VC 99.18073 1 in 22 1 4501 76.25 SW 74.74 225 VC 99.18073 1 in 22 1 7820 CO 100 VC 5.078386		All point assets follow the standard colour convention:
8517 CO 100 VC 2.305661 6408 91.79 FO 90.08 150 VC 44.42315 1 in 15 8534 CO 100 VC 8.598037 18534 CO 100 VC 8.598037 1		red - combined blue - surface water brown - foul purple - overflow
9603 88.94 CO 87.55 225 VC 31.63758 1 in 20 9414 93.5 CO 92.5 100 VC 12.64911 9414 93.5 CO 92.5 100 VC 12.64911 8505 91.46 CO 90.95 150 VC 19.41649		Manhole     Side Entry Manhole     Outfall
9001 81.98 CO 0 150 VC 29.41088 7409 CO 0 100 VC 6.202866 7409 CO 0 100 VC 6.202866		Estent of Survey  Rodding Eye  Inspection Chamber  Bifurcation Chamber
0419         90.82         CO         100         VC         15.85093         I           8501         91.57         CO         89.82         225         VC         105.6519         1 in 47         I           8501         91.57         CO         89.82         225         VC         105.6519         1 in 47         I           5405         80.03         FO         78.09         225         VC         32.19582         1 in 37         I		□ Discharge Point □ Lamp Hole □ Vortex □ T Junction / Saddle
7414 CO 100 VC 4.135752 7414 CO 100 VC 4.135752 8405 93.24 CO 100 VC 2.044366 8405 93.24 CO 100 VC 2.044366		Penstock
9511 89.29 CO 88.6 150 VC 17.88854 8016 88.98 CO 88.06 150 VC 5.09902 8016 88.98 CO 88.06 150 VC 5.09902 7413 CO 100 VC 6.503232 7413 CO 100 VC 6.503232		Valve  Vent Column  Vent Column  Vent Column  Vent Column  Vent Column  Penstock Chamber  Penstock Chamber
9543 CO 100 VC 4.410222 I 9543 CO 100 VC 4.410222 I 7001 90 CO 88.43 300 VC 89.05907 1 in 44 I 7001 90 CO 88.43 300 VC 89.05907 1 in 44		Soakaway  Gully  Wall Was Treatment Works
9804 CO 100 VC 8.193428 1 9440 CO 89.77 100 VC 8.190701 1 9440 CO 89.77 100 VC 8.190701 1 7011 90.22 CO 88.95 150 VC 10.44031		Cascade  Ww Pumping Station  Flow Meter  Septic Tank
8540 CO 100 VC 11.44662 I 8540 CO 100 VC 11.44662 I		● Hatch Box ■ Control Kiosk ■ Oil Interceptor
8507 CO 0 100 VC 12.04159 1 5401 78.37 FO 77.21 225 VC 23.55125 1 5401 78.37 FO 77.21 225 VC 23.55125		Sufficient   Change of Characteristic  Prop Shaft  Orifice Plate
5401         78.37         FO         77.21         225         VC         23.55125         1           5401         78.37         FO         77.21         225         VC         23.55125         9713         VC         24.97556         9004         80.96         CO         100         VC         24.97556         9004         80.96         CO         80.16         225         VC         91.30354         1 in 16         9004         8916         CO         100         PVC         4.587301         9004         8916         CO         100         PVC         4.587301         9004         9004         80.96         CO         0         100         VC         3.016679         9004         9004         80.96         CO         0         100         VC         3.016679         100         9004         80.96         CO         0         100         9004         80.96         CO         100         9004         80.96         CO         100         9004         4.587301         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004         9004		
8916     CO     100     PVC     4.587301       8916     CO     100     PVC     4.587301       7409     CO     0     100     VC     3.016679       7409     CO     0     100     VC     3.016679       8019     89.55     CO     0     100     VC     6.403124       8019     89.55     CO     0     100     VC     6.403124       8019     89.55     CO     0     100     VC     6.403124		MANHOLE FUNCTION
6406 89.49 SW 87.97 300 VC 9.91241 1 in 22 6406 89.49 SW 87.97 300 VC 9.91241 1 in 22 9431 92 CO 90.71 150 VC 3.605551 9431 92 CO 90.71 150 VC 3.605551		FO Foul  SW Surface Water
9514     90.21     CO     89.56     100     VC     14.42235     1 in 55     1 psi4       9514     90.21     CO     89.56     100     VC     14.42235     1 in 55     1 psi4       9606     86.81     CO     85.91     150     VC     20.61553     1 psi4       9516     88.84     CO     87.42     150     VC     2     1 psi4       9027     CO     100     VC     17.55291     1 psi4		CO Combined OV Overflow
8535         CO         100         VC         4.298528         8535         CO         100         VC         4.298528         8918         CO         100         PVC         29.38382         9918         PVC         29.38382         9918         PVC         29.38382         9918         9918         CO         100         PVC         29.38382         9918         9918         PVC         29.38382         9918		
0804 CO 100 PF 7.357718		SEWER SHAPE  CI Circular TR Trapezoidal
		EG Egg AR Arch OV Oval BA Barrel
		FT Flat Top HO HorseShoe  RE Rectangular UN Unspecified  SQ Square
		ow oquane
		SEWER MATERIAL  AC Asbestos Cement
		BR Brick PE Polyethylene
		RP Reinforced Plastic Matrix CO Concrete
		CSB Concrete Segment Bolted CSU Concrete Segment Unbolted
		CC Concrete Box Culverted  PSC Plastic / Steel Composite
		GRC Glass Reinforecd Plastic  DI Ductile Iron
		PVC Polyvinyl Chloride CI Cast Iron SI Spun Iron
		ST Steel  VC Vitrified Clay
		PP Polypropylene PF Pitch Fibre
		MAC Masonry, Coursed  MAR Masonry, Random
		U Unspecified  Address or Site Reference:
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		WHITEHAVEN, CA28 9PE
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