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Millom Iron Line

Drainage Strategy Report

Curtins Ref: 081617-CUR-ZZ-ZZ-T-C-92002

Revision: P03

Issue Date: 07 April 2025

Client Name: Cumberland Council via Story Contracting

Client Address: Parkhouse Building, Kingmoor Business Park, Carlisle, Cumbria CA6 4SJ

Site Address: Hodbarrow Nature Reserve, Millom, Cumbria

Control Sheet

Rev	Description	Checked	Issued	Date
P01	First Issue	CLN	PT	18 May 2023
P02	Update to clarify existing pumping situation	GW	GW	29 November 2023
P03	Document ref. no. change, rework of boundaries and Visitors Centre proposals	GW/PT	GW	07 April 2025

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Author	Signature	Date
Glen Watson BSc (Hons) Principal Civil Engineer		07/04/2025

Reviewed	Signature	Date
Glen Watson BSc (Hons) Principal Civil Engineer		07/04/2025

Authorised	Signature	Date
Peter Thomas MEng (Hons) CEng MICE Design Director		07/04/2025

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1.0 Executive Summary

Full planning permission sought for the erection of a new Visitors Centre, access road, car parking and associated landscaping at Millom Iron Line, Millom, Cumbria, nearest site postcode is LA18 4LB.

The General Arrangement Site Masterplan, drawing 289-LYR-XX-ZZ-DWG-L-1000 by Layer Studio is provided in Appendix A.

The overall proposed development comprises:

Erection of visitors centre with café/shop, group room, staff/volunteer, toilet facilities and car park; consolidation, repair and installation of interpretive sculpture to Towsey Hole Windmill; refurbishment of existing Tern Island hide; new bird hides, pathways, gateway features and street furniture; enhancement of wildlife habitats; associated landscaping and drainage infrastructure; and maintenance of byway with restricted vehicular access.

The drainage strategy follows English national standards. SuDS (Sustainable Drainage Systems) will be used to treat surface water runoff. The proposal includes:

- Pervious paving which filter flows through the pavement surface and attenuate below ground.
- Filter and fin drains which collect runoff.
- Proprietary vortex separators which spin out suspended solids (e.g. silt), metals and oils, such as ACO Quadrceptor and/or Hydro International Downstream Defender.

Alternative SuDS elements are proposed in the ‘Water Quality Assessment’ document, noting that certain SuDS elements are restricted/prohibited by land ownership boundaries.

The lifespan of the development is assumed to be 60 years, ending in 2085. The EA guidance states that for a ‘development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).’

Therefore, the climate change allowances should be 35% for the 1:30 year and 1:100 year event.

SuDs hierarchy feasibility for surface water (SW) and foul water (FW) disposal:

- Infiltration – SW & FW Not viable
- Watercourse/Waterbody – SW - Lagoon outfall discounted as land locked/no route available. Redhills Quarry pond viable restricted to existing greenfield rates. FW too ecologically sensitive & contractually difficult.
- Existing Private surface water drainage system – Not viable
- Surface Water Sewer – SW & FW Not viable
- Combined Water Sewer – SW not viable, FW main drainage option (pumped solution required)

2.0 Introduction

2.1 Project Background

Curtins were instructed by Cumberland Council via Story Contracting to develop a Drainage Strategy (DS) for the proposed development of a new Visitors Centre and associated access/car parking at Millom Iron Line, Millom, Cumbria. The purpose of the DS is to support the planning application. The nearest site postcode is LA18 4LB and the site is centred on National Grid Reference (NGR) 317429mE 478489mN. What3Words reference: rebounder.named.graphic.

There are also a number of discrete remote elements of work across the Iron Line site, including Hodbarrow Beacon and the former Windmill as well as isolated areas of landscaping. At the time of preparation of this report it is not envisaged that positive drainage will be provided to any of these elements, rather the existing hydraulic situation will be replicated by the use of porous materials wherever possible. As such, the following drainage strategy report focusses on the Visitors Centre and associated hard landscaping only (where contributing areas dictate a positive outfall).

The report provides information with regards to the proposed drainage elements relating to the proposed development and is based on currently available information at the time of writing.

2.2 Proposed Development

Full planning permission for the erection of a new Visitors Centre, access road, car parking and associated landscaping.

The General Arrangement Site Masterplan, drawing 289-LYR-XX-ZZ-DWG-L-1000 by Layer Studio is provided in Appendix A.

The overall proposed development comprises:

Erection of visitors centre with café/shop, group room, staff/volunteer, toilet facilities and car park; consolidation, repair and installation of interpretive sculpture to Towsey Hole Windmill; refurbishment of existing Tern Island hide; new bird hides, pathways, gateway features and street furniture; enhancement of wildlife habitats; associated landscaping and drainage infrastructure; and maintenance of byway with restricted vehicular access.

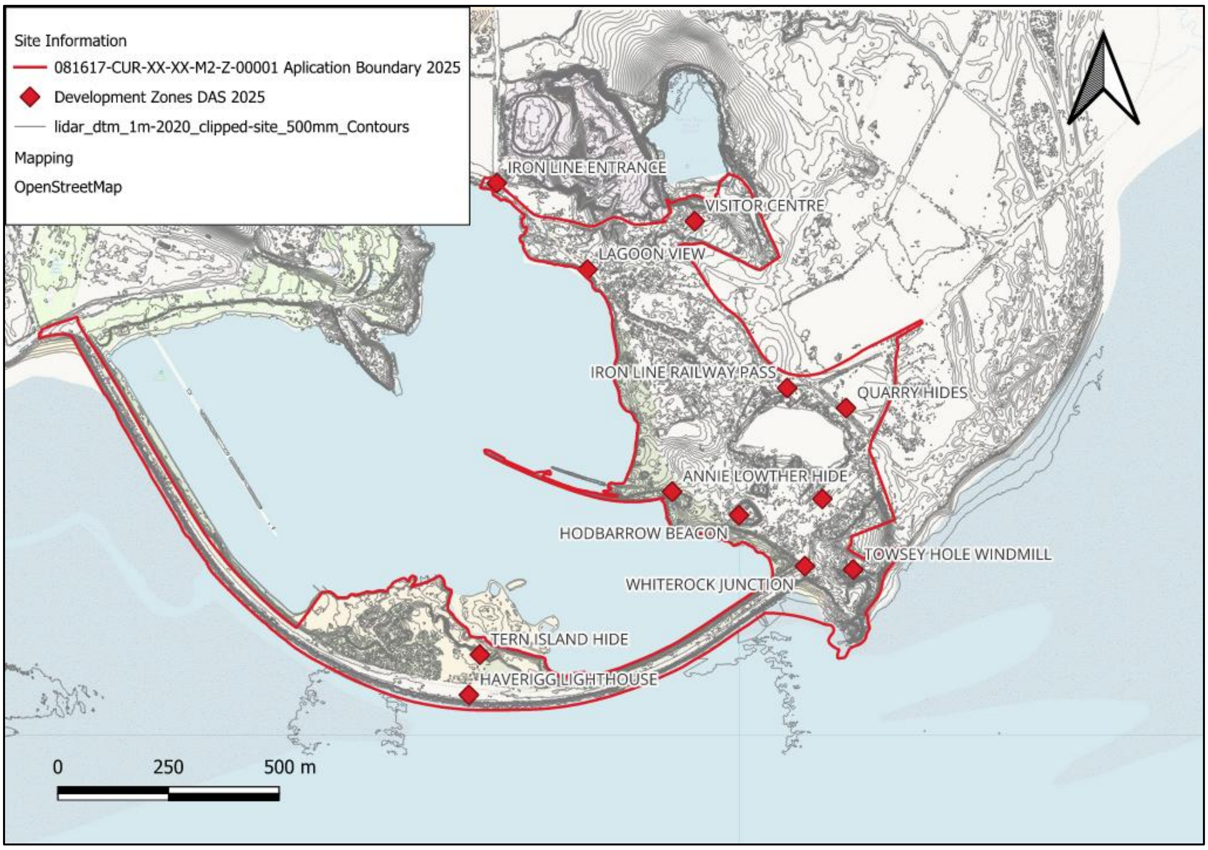


Figure 2-1: Location of landmarks and key spaces

In respect to the Visitors Centre, the approximate building footprint has been measured from the Architect's Plan as 380m^2. The Finished Floor Level (FFL) is proposed at **14.50mAOD,** allowing for a shallow ramped access from existing ground levels in the northeast quadrant. Car parking to the west and northwest quadrants is to be tiered in concentric arc, rising away from the building, rising from 14.50mAOD to 16.60AOD.

In respect to the other elements of the development, no significant changes to existing ground levels are envisaged by the proposals.

2.3 Future Developments

The development is proposed to be built out in a single phase, with no further proposals or plans to extend the Visitors Centre once it is constructed. Remote small upgrades may be possible but will have little impact on existing drainage philosophies.

If in the future it did expand, then the drainage network and attenuation features would need to be assessed at the time for capacity to meet the current guidelines at such time.

3.0 SuDS Guidance and Standards

3.1 Introduction

In July 2018, the Government made changes to the National Planning Policy Framework which made Sustainable Urban Drainage Systems [1] (SuDS) a requirement for the determination of planning applications for 'major' developments. The requirements of a sustainable drainage system are set out in the government's Non-statutory technical standards for sustainable drainage systems.

A Drainage Strategy will therefore be required as part of the Planning Application for the development, as the site is considered to be 'major' development by the Town and Country Planning Order 2015 as total floor space will exceed 1,000m2.

3.2 National Planning Policy and Guidance

3.2.1 National Planning Policy Guidance[2] (NPPF) states that:

3.2.2 Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- take account of advice from the lead local flood authority
- have appropriate proposed minimum operational standards
- have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- where possible, provide multifunctional benefits.

3.2.3 Guidance on the design criteria for different site situations in the Non-Statutory Technical Standards for Sustainable Drainage state:

Peak Flow Control

- Greenfield developments - peak runoff rate from the development for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.
- Brownfield developments - peak runoff rate from the development for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the Greenfield runoff rate from the development for the same rainfall event.

[1] https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

Volume Control

- Greenfield developments - Where reasonably practicable, the runoff volume from the development in the 1 in 100 year, 6 hour rainfall event should never exceed the Greenfield runoff volume for the same event.
- Brownfield developments - Where reasonably practicable, the runoff volume from the development in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.
- Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with points above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Flood Risk Within the Development

- The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.
- The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event.
- The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

Sustainable Drainage Hierarchy

Paragraph 056 of the NPPF Planning Practice Guidance (PPG Ref: 7-056-20220825) on Flood risk and coastal Change[3] states:

The types of sustainable drainage system which it may be appropriate to consider, will depend on the proposed development and its location, as well as any planning policies and guidance that apply locally. Where possible, preference should be given to multi-functional sustainable drainage systems, and to solutions that allow surface water to be discharged according to the following hierarchy of drainage options:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

[3] https://www.gov.uk/guidance/flood-risk-and-coastal-change

3.3 Climate Change

On 10th May 2022 the Environment Agency published revised climate change allowances[4] for peak rainfall intensities which should be applied to new developments, based on the River Management Catchment the development lies in, and development design life.

South West Lakes Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	40%
2070s	35%	45%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	30%	45%
2070s	35%	50%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

This map contains information generated by Met Office Hadley Centre (2019): UKCP Local Projections on a 5km grid over the UK for 1980-2080. Centre for Environmental Data Analysis, 2022

Figure 3-1: South West Lakes Management Catchment peak rainfall allowances

The lifespan of the development is assumed to be 60 years, ending in 2085. The EA guidance states that for a 'development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).'

Therefore, the climate change allowances should be 35% for the 1:30 year and 1:100 year event.

3.4 Stakeholder Engagement

Dialog with United Utilities is ongoing surrounding foul water, available connection points and capacity. Noting that the nearest public foul sewer is located a considerable distance (Mainsgate Road, Millom) from the development and would require pumping.

Extensive discussions have been held with the LLFA/LPA to discuss the development proposals, in particular the drainage strategy options.

Meetings with the ecologist to understand the ecological constraints.

Further details of the planning submission are set out in the accompanying Planning Statement.

[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-rainfall-intensity-allowance

3.5 Approach to Determining Appropriate Strategy

The following sections of this strategy follow the above guidance in

- Setting strategic surface water management objectives,
- Assessing the existing site characterisations,
- Setting the SuDS design criteria,
- Identifying suitable points of discharge,
- assessing Opportunities and Constraints and
- producing a drainage strategy appropriate for planning purposes

4.0 Strategic Surface Water Management (SWM) Objectives

Following CIRIA C753 The SuDS Manual (C753) Section 7.4, the below objectives are considered by Curtins to be suitable for the surface water drainage design, based the output of Section 3.0.

Topic	Strategic objective
Flood risk	Flood risk to the development to be managed and the development is not to increase flood risk for surrounding areas. A separate Flood Risk Assessment is available which reviews all existing and potential sources of flooding.
Water quality	Surface water outfalls to the former Redhills Quarry (now naturally filled pond/lagoon) to the north are potentially viable. Appropriate treatment of discharge will be required. Foul water – treated effluent cannot be viably treated and discharge to ground and/or waterbodies.
Urban heating & air pollution	The development is in a low-density suburban environment so urban cooling is not a key driver. However, strategic objectives for flood risk, habitat and biodiversity will contribute to climate resilience.
Replenishing groundwater	Infiltration should be used where feasible. Existing infiltration rates are unknown. Site is contaminated and mostly made ground – infiltration techniques unlikely viable.
Biodiversity	Preserve and enhance existing habitat. Incorporating green SuDs should create habitat where possible. Areas to the west of the development are ideal for SuDS (noting limiting land boundaries) with biodiversity benefits such as ponds/swales, but the level of disruption and mitigation is still important. It is advisable to keep habitat areas clustered and fenced off to reduce the risk of wildlife and visitors getting too close.
Water resource	There will be a requirement for potable water at the Visitors Centre. It is thought that this will be supplied from a reliable water source. Use rainwater to irrigate soft landscaping areas where possible passively.
Low carbon construction	Selecting paving and drainage systems and materials which have a low embodied carbon, limiting excavation, using systems which provide dual purpose such as permeable sub-base for pavement sub-structure and attenuation, and minimising the use of steel, cement and certain plastics, will all be considered.
Amenity	The main opportunity for providing appropriate amenity value in the SuDS design is the proposed swales/ponds within the habitat on the west side of the site (noting limiting land boundaries). With appropriate primary treatment, any SuDs ponds should not have a heavy pollution load, meaning its potential for amenity and biodiversity value are high. The main beneficiary will be building users who may wish to walk through the amenity areas.
Climate Change	The surface water proposals should include allowances for appropriate anticipated climate change based on recognised EA/LLFA guidance. The climate change allowances should be 35% for the 1:30 year and 1:100 year event.
Approval and adoption	The local planning authority will be the approving body for the surface water management system. Noting separate Environment Agency permit potential. The site drainage will be entirely owned and operated by Cumberland Council so operation and maintenance design need only consider the needs of the client.

Table 1: Strategic Surface Water Management (SWM) Objectives Table

5.0 Conceptual design

Following the guidance set out in C753 Section 7.5.1, the characterisations set out in the below relating to surface water management were established for the site.

5.1 Site characterisation outcomes

Site topography	Much of the site is sloped down towards the east. There is a sweeping embankment from the east and around to the north of the site. To the west the levels also fall away towards the lagoon. The site levels vary from 16m down to 3m AOD. Immediately North of the Visitors Centre, a vertical rock face remains from the former Redhills quarry, c. 10m in height.
Existing flow routes and discharge points	Currently any overland flow will follow the sloping topography down to the east and west. There will be some infiltration and some absorption from the adjacent vegetation which will also slow any overland flows. An existing lagoon is located approximately 250m southwest that being a potential surface water outfall. It is understood that the lagoon has a pumped control to ensure water levels are consistent for the adjacent caravan/holiday development immediately on its north shore. The lagoon is ecologically sensitive being the centre of the RSPB reserve. Former Redhills quarry now naturally filled pond/pool to the north is located approximately 70m from the site, that also being a potential surface water outfall. It is understood that the lagoon has a pumped control and methane stripping treatment plant. Water levels are anticipated to remain fairly consistent. For context and note; from discussions with the Lead Local Flood Authority (LLFA), Environment Agency (EA), Local Planning Authority (LPA) and Cumberland Council (CC) as client, the former quarry pond has a pumped outfall to a methane treatment plant before outfalling via the downstream end of the Millom Wastewater Treatment Works (WwTW) effluent discharge pipe further north, out to the estuary. There are restrictions on discharge quality, rates and volumes with the Environment Agency and the LLFA. According to the trade effluent permit in place and the outfall agreement with Cumberland Council (formerly Cumbria County Council) (as owner/operator of the Waste Recycling Centre and quarry pond), and United Utilities (as owner of the receiving WwTW outfall/discharge pipework) and with the EA (as receiving watercourse/outfall) permit/agreement for discharge is in place already. These are both back-to-back meaning the same flows from one end are expected at the other end. Note that there are significant restrictions on volumes and flow rates that Redhills Quarry needs to be maintained, as such restricting all new impermeable areas to greenfield rate will be required.
Potential for infiltration	Reviewing British Geological Survey and Soilscapes mapping information for the surrounding land the site appears to be based on Devensian Till (loamey and clayey) and further away Raised Marine Deposits (sand and gravel) classified as *'Naturally wet'* with *'impeded infiltration potential'* suggesting that infiltration techniques may not be possible. Invasive Phase 2 Ground Investigations suggest Made Ground was encountered onsite. Infiltrations techniques are deemed unfeasible due to depth of said Made Ground and contamination risk.
Potential for surface water discharge	Runoff from the existing Visitors Centre catchment is mainly drained to the east where the lower lying ground levels are. From here it would drain to the north as the ground levels drop away slightly. This is where the former Redhills quarry pool/pond is located, and that being the natural flow path. Runoff from the highest part of the site would also drain to the south and west towards the lagoon following the sloping topography. Access to the west is though restricted by land ownership boundaries and as such no formal drainage routes can pass. Therefore, the change to a point discharge is not considered to adversely impact the waterbodies. There is also an ordinary watercourse, Crook Pool, further to the east/ south east approximately 500m from the site and the Duddon estuary (sea) to the south.

	However due to the nature and importance of the habitat routes careful consideration, discussions and design are required to achieve a suitable outfall.
Site flood risks	See the site-specific Flood Risk Assessment. The bulk of the flood risk is associated to the drainage for the redevelopment with very few other risk anticipated.
Existing site land use	The site was previously used as an Iron Mine. The Visitors Centre site is coincident with a former reservoir which has since been back filled. The scope of demolition/site clearance following closure of the mine and quarry is not clear, however the majority of structures shown on historic maps are no longer present above ground.
Existing site infrastructure	The Visitors Centre site is not believed to have any existing infrastructure. Some field type drains are evident feeding into the lagoon at much lower elevations. Lower portion of the HWRC access appear to have limited drainage direct for the former Redhills quarry. The nearest combined sewer and potential outfall is United Utilities chamber '4300' which lies on Mainsgate Road, Millom. This is a considerable distance away. Alternative 'non main drainage' means of foul water disposal have been explored but discounted.
Existing soils	British Geological Survey and Soilscapes mapping information for the surrounding land the site appears to be based on Devensian Till (loamey and clayey) and further away Raised Marine Deposits (sand and gravel) classified as *'Naturally wet'*.
Local habitats and biodiversity	The whole site is considered to be of significant ecological importance. The vegetation and RSPB Reserve provides an important habitat for wildlife. Overlooking the Duddon Estuary SSSI and the Morecambe Bay and Duddon Estuary SPA, Hodbarrow reserve comprises a freshwater lagoon within the seawall with rich flower and insect communities living on the limestone slag. Grasssland and scrub stretches inland to provide a haven for insects and breeding songbirds. This coastal lagoon and grasslands, located on the site of a former iron mine, support breeding terns, ringed plovers, redshanks and oystercatchers. Great crested grebes nesting on the island too. See the site-specific Ecological assessment/reports. These facts limit the available space for drainage components, potentially reducing the possible open top features and their use./placement.

Table 2: Site Characterisation outcomes table

5.2 Development characterisation outcomes

Proposed topography, land use and landscape characteristics	The site is to be plateaued where the Visitors Centre is located with an FFL at around 14.5m AOD. Levels will largely remain as existing, except the Visitors Centre first floor/roof which will reach higher than the local surroundings to provide better vista. There will be a tiered car park, terraced up the hill radially out from the Visitors Centre. The car park access will be via the existing access to the existing Redhills Quarry Household Waste Centre. Some widening of the access roads will be necessary to facilitate the safe passing fo vehicles/vehicle management onsite.
Proposed flood risk management strategy	Rates of surface water discharge will be controlled and restricted for event up to and including the 1:100 year rainfall (plus climate change allowances) to the existing 1:1 year equivalent Greenfield runoff rate. As outlined in section 5.0.
Proposed site infrastructure	The proposed drainage system should be possible to install with minimal disruption to the previously developed part of the Hodbarrow reserve and former Iron Line, which has since revegetated. Existing features including a mine shaft and derelict building located to the west of the new Visitors Centre are to remain without interference. Minor footway rerouting may be necessary.

	The whole Visitors Centre site will be routed towards the north/Redhills quarry pond, from a proposed drainage catchment perspective.
Proposed building style and form	Passivhaus circular building split over two floors with a balcony to the upper floor. Wall will appear stone faced filled gabions with exposed steelwork structure. Floors will be cast in-situ concrete to the ground floor. Gabion basket retaining walls, tarmac access roads, permeable parking areas are anticipated.
Proposed adoption and maintenance of surface water management system	The SW network(s) are to remain in private ownership.

Table 3: Development characterisation outcomes table

5.3 SuDS Design Criteria

	Preferred Delivery of SuDs Design Criteria
Water quantity	All surface water discharge shall be restricted to the 1:1 year greenfield rate from each catchment i.e existing greenfield rate. Runoff from the 1:30 year event should be attenuated below ground (i.e. not cause flooding) and the 1:100 year should be attenuated on site without posing a risk to people or property. The site lies in the Southwest Lakes Management Catchment, for the EA guidance[5] on peak rainfall allowances. Therefore, attenuation will be provided for the 1:30 year +35% climate change and the 1:100 year +35% events, based on a 60 year design life.
Water quality	Surface Water runoff areas at risk from contamination should receive water quality treatment. The development land uses can be categorised as follows. The simple index approach has been used from C753. The pollution hazard indices from Table 26.2 are (Total suspended solids (TSS), Metals and Hydrocarbons (HC): • Commercial Building roofs = Low hazard, TSS: 0.3, metals: 0.2, HCs: 0.05 • Non-residential Car parking and site roads = Medium hazard, TSS: 0.7, metals: 0.6, HCs: 0.7 • Site with heavy pollution, eg highly frequented lorry approaches to waste sites, site where chemicals and fuels are delivered, handled, stored or used = High TSS: 0.8, metals: 0.8, HCs: 0.9
Amenity	Provide open SuDS, where possible, which provide pleasant areas for visitors to look over from the centre and feel like they are in nature.
Biodiversity	Design to minimise the adverse impact on existing biodiversity and ecology, and any open top SuDS features should maximise the biodiversity improvement, providing a net gain. Ponds/swales could provide habitats for Natterjack Toads. They should have gently sloping sides to ensure safe passage out of the pools for toadlets and hold water down to a maximum water depth of 50 - 70cm that will dry out in late summer in an average year. The use simple pipe sluices could be installed so that the pools can be drained down in late summer. Vegetation within and surroundings should be kept low-cut Fenced off from visitors Nearby sandy banks, stone walls, piles of stones that could act as hibernacula.

Table 4: Preferred Delivery of SuDs Design Criteria table

[5] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

5.4 Feasible points of discharge

Surface Water Disposal Method	Potential	Description
Infiltration	✗	British Geological Survey and Soilscapes mapping information for the surrounding land the site appears to be based on Devensian Till (loamey and clayey) and further away Raised Marine Deposits (sand and gravel) classified as *'Naturally wet'* with *'impeded infiltration potential'* suggest that infiltration techniques may not be possible. Invasive Phase 2 Ground Investigations suggest Made Ground was encountered onsite. Infiltrations techniques are deemed unfeasible due to depth of said Made Ground and contamination risk.
Watercourse/ Waterbody	✓	A lagoon is approximately 250m to the southwest – although restricted by land ownership boundaries and as such no formal drainage routes can pass – outfall discounted. The former Redhills quarry now naturally filled pond/pool is located approximately 70m to the north. Runoff from the existing catchment is mainly drained to the east where the lower lying ground levels are. From here it would drain to the north as the ground levels drop away slightly. This is where the former Redhills quarry pool/pond is located, and that being the natural flow path. The proposed discharge point for the Visitor Centre site will be towards to the north east and restricted up to the 1:100 year rainfall (plus climate change allowances) to the existing 1:1 year equivalent Greenfield runoff rate. It is anticipated a new headwall/reuse of an existing headwall onto the Redhills Quarry will be necessary. Therefore, the change to a point discharge is not considered to adversely impact the waterbodies.
Existing Private surface water drainage system	✗	There is no formal positive surface water drainage on site. Some field type drains are evident feeding into the lagoon and the former Redhill Quarry at much lower elevations. There is potential to reuse some of the outfall pipework/spill way to suit the drainage system (subject to further investigations).
Surface Water Sewer	✗	There are no surface water sewers within range of the site.
Combined Water Sewer	✗	Not viable as a surface water disposal method. FW – viable The nearest combined sewer and potential outfall is United Utilities chamber '4300' which lies on Mainsgate Road, Millom. This is a considerable distance away. Alternative 'non main drainage' means of foul water disposal have been explored but discounted. Dialogue with UU must be held to confirm capacity within the combined sewer to accommodate unrestricted foul water flows.

Table 5: Feasible points of discharge table

5.5 Surface water sub-catchments and flow routes

Existing drainage areas will be retained, except for the western most upper level part of the Visitors Centre parking/access with it now forming part of the eastern catchment. Essentially all discharge to the Redhill quarry will be restricted to existing greenfield equivalent rates with appropriate flood control and attenuation provided upstream.

Wider periphery areas of redevelopment will remain as per existing catchments.

Catchment Name	Colour	Treatment
Welcome Centre and top car park (Lagoon Catchment)	Magenta	SuDS scheme required.
Visitors Centre, car park and immediate access road/parking (Redhills Quarry Catchment)	Cyan	SuDS scheme required.

Table 6: Sub Catchments

The development catchment is as follows and are shown in detail on the Proposed Drainage Plan drawings 081617-CUR-01-ZZ-DR-C-92001 and 92002. An extract is shown below.

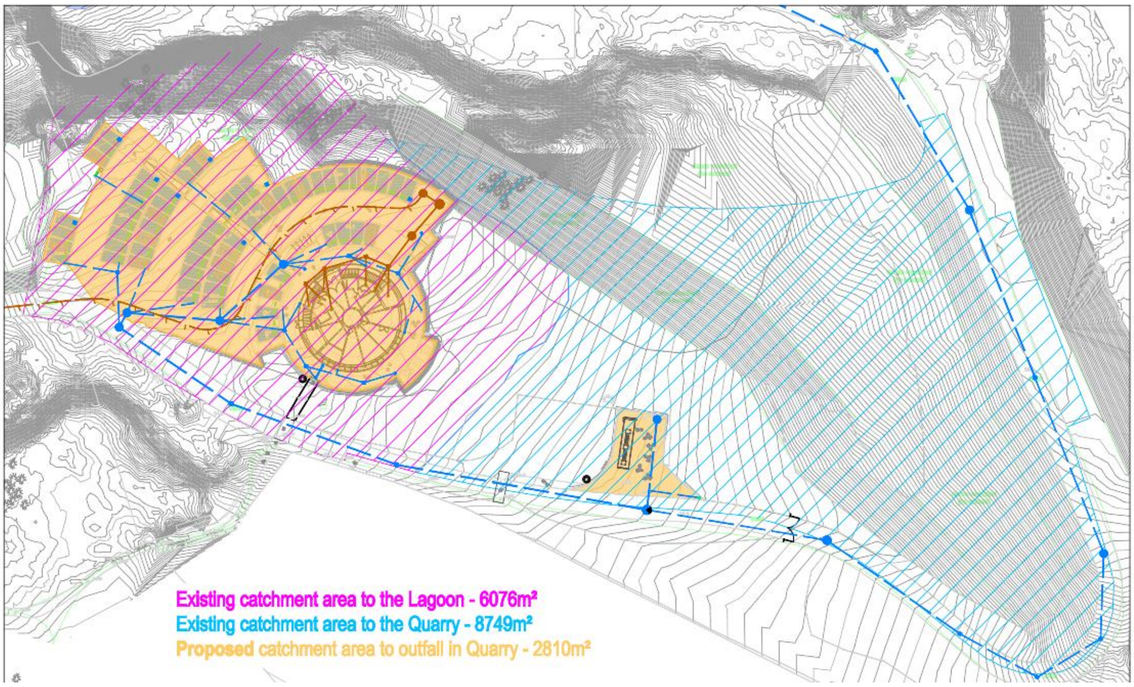


Figure 5-1: Existing/Proposed Catchment Area extract

The Visitors Centre surface water catchment from the access roads, parking area and roof shall drain via a formalised route to the former Redhillls Quarry pool/pond directly. An assessment of catchment and existing flows/rates has been undertaken to prove that the flows directed towards the quarry are no worse than the existing situation.

5.6 Selection of SuDS components for the management train

Water quantity	Runoff collection mechanism	Standard roof downpipes from roofs. External areas drain to permeable paving. Where this is not possible, gullies and channel drains shall be used.
	Interception mechanism	No interception currently proposed. Rainwater harvesting is to be explored at detailed design stage. Infiltration not feasible, as noted previously.
	Storage	The majority of attenuation will be provided by below ground storage attenuation tanks, with some provided by permeable construction.
	Conveyance	Piped conveyance to downstream components.
	Exceedance	See section 5.3.
Water quality	Discharges to surface waters and Surface water protection measures	Suitable protection measures for this development are identified in 081617-CUR-ZZ-XX-T-C-92701 - Water Quality Assessment in **Error! Reference source not found.**D. Most areas will be treated by pervious pavements. Vortex separator(s, for example ACO Quadrceptor) will be provided to treat runoff from all other areas.
Amenity	Trees and planters provide cooling and shade. If a bioretention system can be provided if may be educational benefit.	
Biodiversity	Trees and planters provide biodiversity.	

Table 7: SuDS components for the management train

6.0 Outline SW Design

6.1 Design Proposals

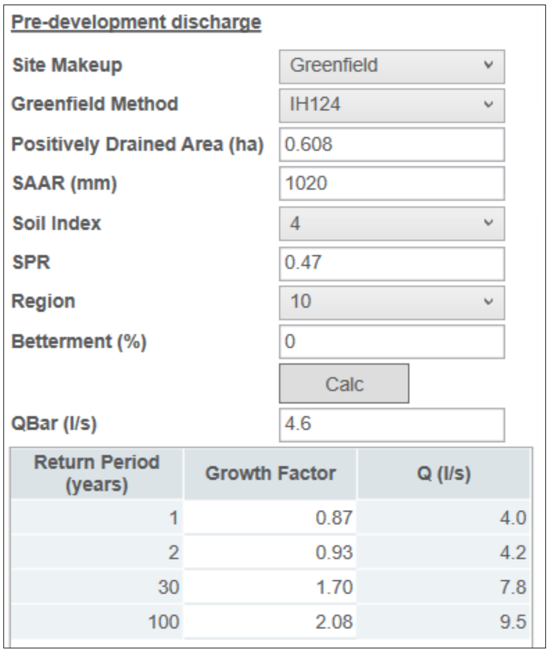
Refer to the following plans/calculations:

- 081617-CUR-01-ZZ-DR-C-92001-P02 - Drainage Strategy Sheet 1,
- 081617-CUR-01-ZZ-DR-C-92002-P02 - Drainage Strategy Sheet 2 and
- 081617-CUR-01-ZZ-DR-C-92003-P01 - Drainage Strategy Sheet 3.
- 081617-CUR-XX-XX-D-C-92200-P02 - Drainage Details Sheet 1
- 081617-CUR-XX-XX-D-C-92201-P02 - Drainage Details Sheet 2
- 081617-CUR-XX-XX-T-C-00001-P01 - Surface water drainage calculations
- 081617-CUR-ZZ-XX-T-C-92701-P01 - Water Quality Assessment.

6.2 Assessment of Pre- and Post-development Site Runoff

Pre-development Site Runoff

The site should be considered to have a greenfield discharge in terms of its runoff response. The existing Visitor Centre site catchment is split into two following the existing topography: Lagoon Catchment and Redhills Quarry Catchment. The highest/western side falling towards the lagoon in the south west, while the lower/eastern side falling towards the north east and Redhills Quarry.

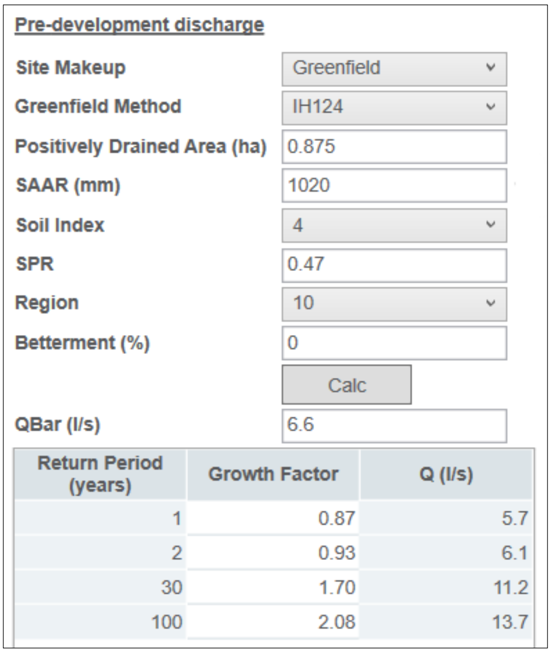


Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.608
SAAR (mm)	1020
Soil Index	4
SPR	0.47
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	4.6

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	4.0
2	0.93	4.2
30	1.70	7.8
100	2.08	9.5

Figure 6-1: Pre-dev. Lagoon Catchment Analysis



Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.875
SAAR (mm)	1020
Soil Index	4
SPR	0.47
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	6.6

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	5.7
2	0.93	6.1
30	1.70	11.2
100	2.08	13.7

Figure 6-2: Pre-dev. Redhill Quarry Catchment Analysis

Post-development Site Runoff - Visitors Centre

Based on an assessment of catchment areas and constraints associated with the outfalls, namely the rates and volumes to the quarry pool, the catchments have been split and existing/proposed flows/rates have been calculated.

Lagoon Catchment – outfall to the Lagoon to the west

Due to being land locked by third party ownership boundaries, a route through to the lagoon is no longer viable. Consequently, flows have been combined with the Redhill Quarry catchment but restricted back to existing greenfield discharge rates.

Redhills Quarry Catchment – outfall to the Quarry Pond to the north

The post-development discharge rate will be restricted to 1:1 year Greenfield rate, calculated by the IH124 method below. The site will be divided into catchments to suit site constraints so that the total surface water discharge for the catchment does not exceed 5.70 l/s (litres/second) for all storms up to and including the 1:100 year plus climate change event.

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
Rainfall Events	Singular	Additional Storage (m^3/ha)	0.0
FSR Region	England and Wales	Starting Level (m)	
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	5.7
Summer CV	0.750	30 year (l/s)	5.7
Winter CV	0.840	100 year (l/s)	5.7
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +35% 360 minute (m^3)	123

Figure 6-3: Post Development Catchment Design/Simulation Criteria

For context and note; from discussions with the Lead Local Flood Authority (LLFA), Environment Agency (EA), Local Planning Authority (LPA) and Cumberland Council (CC) as client, the former quarry pond has a pumped outfall to a methane treatment plant before outfalling via the downstream end of the Millom Wastewater Treatment Works (WwTW) effluent discharge pipe further north, out to the estuary. There are restrictions on discharge quality, rates and volumes with the Environment Agency and the LLFA. According to the trade effluent permit in place and the outfall agreement with Cumberland Council (formerly Cumbria County Council) (as owner/operator of the Waste Recycling Centre and quarry pond), and United Utilities (as owner of the receiving WwTW outfall/discharge pipework) and with the EA (as receiving watercourse/outfall) permit/agreement for discharge is in place already. These are both back-to-back meaning the same flows from one end are expected at the other end.

Note that there are significant restrictions on volumes and flow rates that Redhills Quarry needs to be maintained, hence restricting all new impermeable areas to greenfield rate.

6.3 Water Quantity

Catchment Name	Area (ha)	Flow (l/s)	Attenuation (m^3)
Proposed Visitor Centre impermeable area	0.2870	5.7 (wider Redhills catchment)	114-183 (160m3 provided through refined model/ design)

Table 8: Proposed catchment area, restriction/flow and attenuation/storage

Note that the above catchment areas are subject to change through design development, which will affect the flow control and attenuation volumes. The above attenuation volumes were calculated using an outline hydraulic model and are subject to further refinement through a detailed hydraulic model which will account for available volumes in the wider surface water drainage system. The principles set out in sections 6.1 i.e. the 1:1 year greenfield rate for the existing catchment at 5.70 l/s for design storms up to the 1:100 year and 35% climate change allowances.

The bulk of the attenuation will be provided in a combination of permeable paving, below ground attenuation tanks and/or large diameter pipes.

The final calculations should include for a permanent surcharge to the quarry pool/pond as a worst-case scenario that the drain is full to the crest level at the time of the design rainfall events. The water levels will need to be confirmed prior to detailed design stage and levels of the outfall amended as necessary to suit actual water levels in the former quarry pool/pond.

6.4 Designing for Local Drainage System Failure

In accordance with general principles discussed in CIRIA Report C635, Designing for Exceedance in Urban Drainage the proposed surface water drainage, where practical, should be designed to ensure no increased risk of flooding to buildings on the site or elsewhere because of extreme rainfall, lack of maintenance, blockages or other causes.

Blockage

The site levels design will grade external surfaces away from buildings and into other hardstanding areas. There will be a degree of redundancy where water that cannot be drained by one blocked linear drain or gully will flow overground to the next available linear drain or gully. If blockages are so extensive that this is not possible, the levels will be designed to overland flows drain to the outfall Redhills Quarry (as per the existing condition).

Exceedance

The site drainage has been designed to attenuate the 100-yr rainfall event, including an allowance for climate change. No flooding has been calculated in the worst case event.

Exceedance flows will be retained on site within the drainage system as far as practical however for rainfall events of a greater return period it may be necessary to pass forward more flow or to spill flow from the system. The site levels design will allow overland flows to discharge to the lower part of the site towards the existing vegetation. Additional temporary storage could be provided within the terraced car parking extents with the use of full height kerbs.

Parking areas could be designed to offer additional storage volume should the drainage system be exceeded. Where appropriate, kerb lines should be raised by half batter kerbs (0.1m) to help retain flood water and allow drainage back into the system through the permeable surface.

Drainage Contingency

The proposed surface water drainage system has been designed to provide adequate storage volume against flooding, including an allowance for climate change in accordance with current best practice.

Building Layout and Detail

To meet accessibility requirements, new buildings tend to have level access and therefore, external levels will be set wherever possible to fall away from the buildings ensuring any flood water runs away from, rather than towards the building. Anywhere this is not possible thresholds will include drains.

6.5 Water Quality Treatment

The design should incorporate the following components where possible:

Type of SuDs component	Pollution Mitigation Indices			Viability
	TSS	Metals	Hydrocarbons	
Filter strips	0.4	0.4	0.5	Potentially viable
Filter drain	0.4	0.4	0.4	Potentially viable - incorporated
Swale	0.5	0.6	0.6	Unviable due to land take/space
Bioretention system	0.8	0.8	0.8	Potentially viable but significantly limited in available footprint
Permeable pavements	0.7	0.6	0.7	Viable - incorporated
Detention basin	0.5	0.5	0.6	Unviable due to land take/space
Pond	0.7	0.7	0.5	Unviable due to land take/space
Wetland	0.8	0.8	0.8	Potentially viable if land can be redesignated
Proprietary treatment systems (see below)	These must demonstrate they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			Necessary and viable – incorporated (see below)

Table 9: C753, Table 26.3 Indicative SuDs mitigation indices for discharges to surface waters

Unfortunately, may SuDs features/components are not viable due to their land take/footprints given the site ecological constraints and third party land boundaries. Consequently, proprietary treatment systems must be used to achieve to necessary water quality treatment.

The below proprietary treatment systems have also been considered, with the supplier quoted pollution mitigation indices, as of March 2025. While some products have a lower mitigation, they are still appropriate for use when backed up with secondary treatment, such as the ‘ACO Quadrceptor, which would be appropriate when used with upstream sediment traps/permeable paving etc.

Proprietary System	Pollution Mitigation Indices		
	TSS	Metals	Hydrocarbons
Hydro-International Downstream Defender Advanced Vortex	0.5	0.4	0.5
Klargester – AquaTreat	0.85	0.64	0.99
Marsh Hydroil Full retention separator	0.8435	0.6326	0.975
ACO QuadraCeptor	0.8	0.8	0.8

Table 10: C753, Table 26.3 Proprietary treatment pollution mitigation Indices examples

The below table summarises the total pollution mitigation indices for each land use category. These are based on the simple index approach from C753. The pollution mitigation indices are from Table 26.3, with the above Klargester – Aqua Treat proprietary system. Where two stages of treatment are required, the mitigation indices for the second stage of treatment have been factored by 0.5 to account for reduced performance due to lower inflows.

Land Use	Hazard Indices	Mitigation Indices
Building/ commercial roofs	Low hazard, TSS: 0.3, metals: 0.2, HCs: 0.05	Sediment trap TSS: 0.4, metals: 0.4, HCs: 0.4 ✓
Car parking/ aisles access road	Medium hazard, TSS: 0.7, metals: 0.6, HCs: 0.7	Pervious paving, sediment trap and downstream defender (min)/ ACO Quadrceptor <TSS: 1.15, metals: 1.0, HCs: 1.15 ✓
Site wide industrial roads (HWRC/tip access if drained)	High hazard, TSS: 0.8, metals: 0.8, HCs: 0.9	Filter drains, sediments traps and proprietary treatment TSS: 1.0, metals: 1.0, HCs: 1.0 ✓

Table 11: Pollution hazard indices and mitigation indices/measures

The Water Quality Assessment calculations can be seen in Appendix D.

Surface water treatment from the catchment is provided by stone filled filter trenches, permeable construction and propriety treatment units where possible. The permeable construction provides some the attenuation for this catchment but a dedicated attenuation tank and flow control (Hydrobrake) beneath the proposed coach parking/drop off allows a restriction back to the 1:1 year greenfield runoff rate for all storms up to and including the 1:100 year + 35% climate change event. Connection to the quarry pond will be via a newly formed drain or open channel/swale adjacent to the access road.

Flows from the Visitor Centre access road/aisles have a medium pollution hazard so require two stages of treatment. The first stage being SuDs components, sediment traps, filter drains where possible followed by a proprietary treatment system. Other methods of initial treatment include the use of Trapped Gullies and Catchpit chambers, which may be used to filter out high volumes of sediment and aid maintenance.

Permeable paving/ filter drain, and an Aco Quadrceptor are proposed as a final stage of treatment for the contributing catchment.

Runoff from roofs can be effectively treated by frequent sediment traps.

The type(s) of mitigation proposed may be further considered as the site design is finalised i.e. paving surfaces etc. The proposals for pollution protection should be agreed with the lead local flood authority (LLFA).

7.0 Proposed Foul Water Drainage Strategy

7.1 Design Proposals

Refer to the following plans/calculations:

- 081617-CUR-01-ZZ-DR-C-92001-P02 - Drainage Strategy Sheet 1,
- 081617-CUR-01-ZZ-DR-C-92002-P02 - Drainage Strategy Sheet 2 and
- 081617-CUR-01-ZZ-DR-C-92003-P01 - Drainage Strategy Sheet 3.
- 081617-CUR-XX-XX-D-C-92200-P02 - Drainage Details Sheet 1
- 081617-CUR-XX-XX-D-C-92201-P02 - Drainage Details Sheet 2
- 081617-CUR-ZZ-XX-T-C-92702-P01 - BW Foul Flows and Loads 4

7.2 Design Detail

A separate foul water drainage system is proposed for the Visitor Centre site. This is to drain via an immediate gravity system to a convenient location within the service yard directly north of the building. From here it shall be pumped along the access road, and up Mainsgate Road. The outfall being the nearest combined sewer and potential outfall is United Utilities chamber '4300' which lies on Mainsgate Road, Millom. This is a considerable distance away. Alternative 'non main drainage' means of foul water disposal have been explored but discounted.

Based on the following person use rates/notes:

Description	No.
Canteen (provides hot drinks, pre-prepared sandwiches, cakes, confectionary etc) (Assumed Calc value of Restaurants - Snack Bars & bar meals)	58
Staff workers - (Office / Factory without canteen)	10
Visitor toilets (Toilet (WC) (per use)	150

Table 12 British Water Foul Flows and Loads Code of Practice

We therefore expect the development runoff to be circa 0.1 l/s (British Water Foul Flows and Loads – Code of Practice – Appendix C). The flow rate from the foul has been factored into the overall allowable 1:1 year greenfield discharge rate and the surface water rate reduced to accommodate the foul flow.

We have held meetings and had discussions with the LLFA/UU during the pre-app advice period and agreed the drainage philosophy in principle.

8.0 Appendices

Appendix A Proposed site plan

Appendix B Proposed Drainage Drawings

Appendix C Drainage Calculations

Appendix D Water Quality Assessment

Appendix A Proposed Site Plan

FURNITURE / BOUNDARIES

F1.0 - PICNIC TABLE
Location: Site wide
Material: Corten Steel / Timber / Concrete

F2.0 - BENCH
Location: Site wide
Material: Corten Steel / Timber / Concrete

F2.1 - BENCH (EXISTING)
Location: Site wide
Material: Timber

F3.0 - WAYFINDING - SITE NAVIGATION
Location: Site wide
Material: Corten Steel w/ laser cuttings

F4.0 - WAYFINDING - ARRIVAL
Location: Site wide
Material: Corten Steel w/ laser cuttings

F5.0 - INFO BOARD: ECOLOGY
Location: Site wide
Material: Corten Steel w/ laser cuttings

F5.1 - INFO BOARD: MAP LOCATION
Location: Site wide
Material: Corten Steel w/ laser cuttings

F5.2 - INFO BOARD: HERITAGE
Location: Site wide
Material: Corten Steel w/ laser cuttings

F6.0 - VIEWING SCREEN
Location: To Hidden Lagoon
Material: Timber

F7.0 - DOUBLE LEAF GATE
Location: Road to Welcome Building / HWRC
Material: Subject to future detail

F7.1 - SINGLE LEAF GATE
Location: To Tern Island fence
Material: Subject to future detail

F8.0 - FEATURE FENCE
Location: Site wide
Material: Timber

F8.1 - EXISTING FENCE
Location: Site wide
Material: Timber

F9.0 - FEATURE ARTWORK
Location: Site wide
Refer to Design & Access Statement Chapter 7

F10.0 - CAR PARK PAY MACHINE
Location: To Visitor Centre car park
Material: -

F11.0 - FEATURE CONC BENCH w/ TIMBER TOP
Location: Site wide
Material: Concrete / Timber

F12.0 - CYCLE PARKING
Location: Site wide
Material: Steel

F13.0 - TIMBER LOGS
Location: To car parking spaces
Material: Timber

F14.0 - EV CHARGING LOCATIONS
Location: To welcome building car park
Material: -

F15.0 - THRESHOLD DETAIL
Location: To key thresholds
Material: Corten

F16.0 - BIRD HIDE
Location: To Hidden Lagoon / Lagoon
Material: Timber

F17.0 - PV CANOPY
Location: To welcome building car park
Material: Subject to future detail

F18.0 - WASTE BIN
Location: Site wide
Material: Corten

F19.0 - HAND RAIL
Location: To entrance steps
Material: Steel

F20.0 - BOLLARD
Location: To Byway Entrances
Material: Timber

NOTES:

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KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

HARDWORKS

S1.0 — **S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P)**
Location: To primary pedestrian routes
Dims: 1.5m wide

S2.0 — **S2.0 - STONE TO DUST SURFACE (V)**
Assumed: Existing surface planed - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing

S3.0 — **S3.0 - TIMBER BOARDWALK (P)**
Location: To sand dune raised walkway
Dims: 1.8m wide w/ low upstand

S4.0 — **S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 1.5m wide trench cover w/ passing places

S5.0 — **S5.0 - VEHICULAR ROUTE (MACADAM) (V)**
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 4.8m wide

S6.0 — **S6.0 - NATURAL STONE PAVING (P)**
Location: To Towsey Hole Windmill

S7.0 — **S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)**
Location: To in ground railway details / Visitor Centre / Hodbarrow Lighthouse

S7.1 — **S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
Location: To Visitor Centre / Whiterock Junction

S8.0 — **S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide

S9.0 — **S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre

SE — **SE - SURFACE EXISTING**
Location: As noted

STORY

Cumberland Council

ORIGINATOR

Layer.studio

W layer.studio
T 01625 523 157
E manchester or newcastle@layer.studio

MANCHESTER
8b Grove Street
Wilmslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client
Cumberland Council

Project
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Millom, Cumbria

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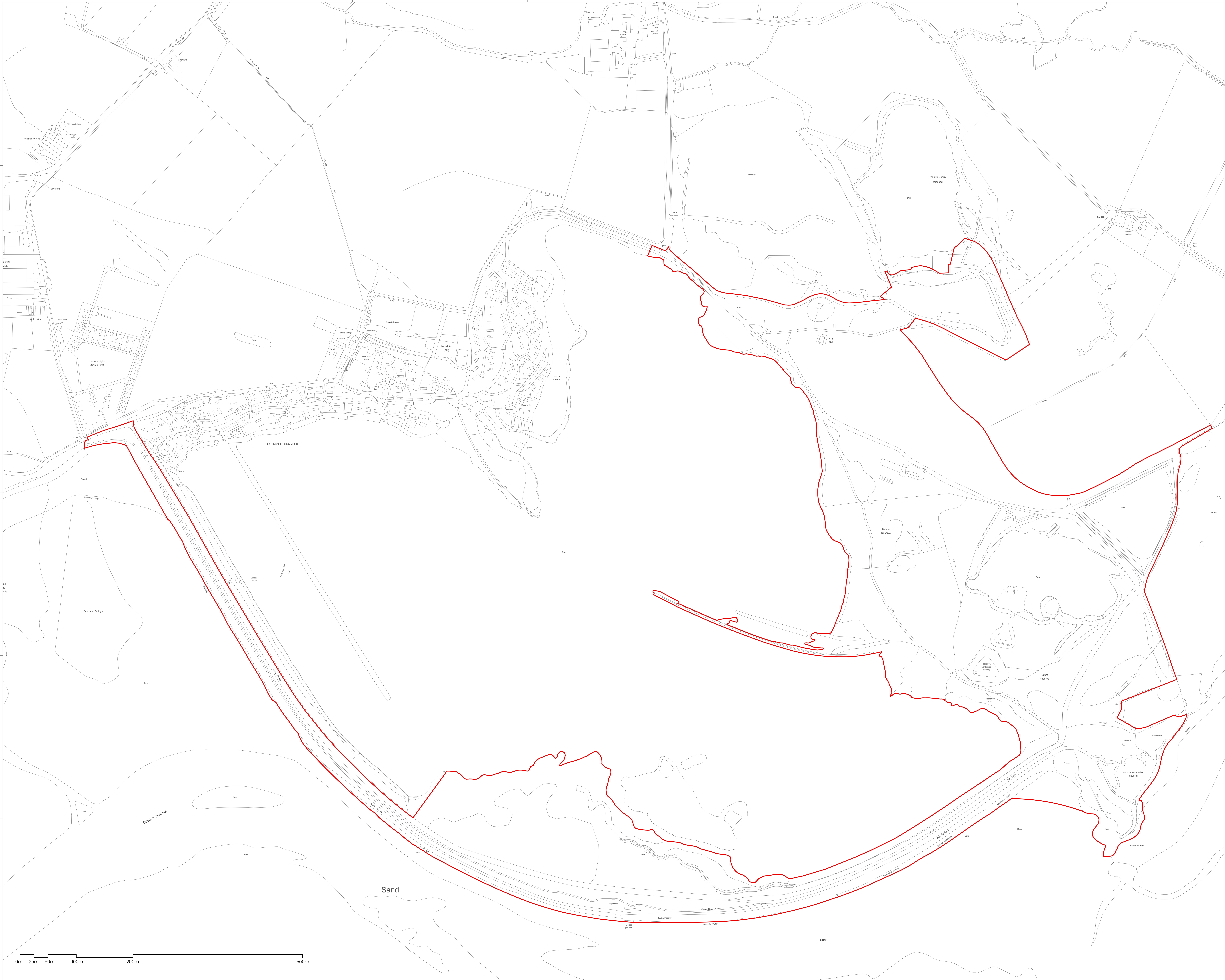

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Layer.studio

W layer.studio
T 01625 523 157
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NEWCASTLE
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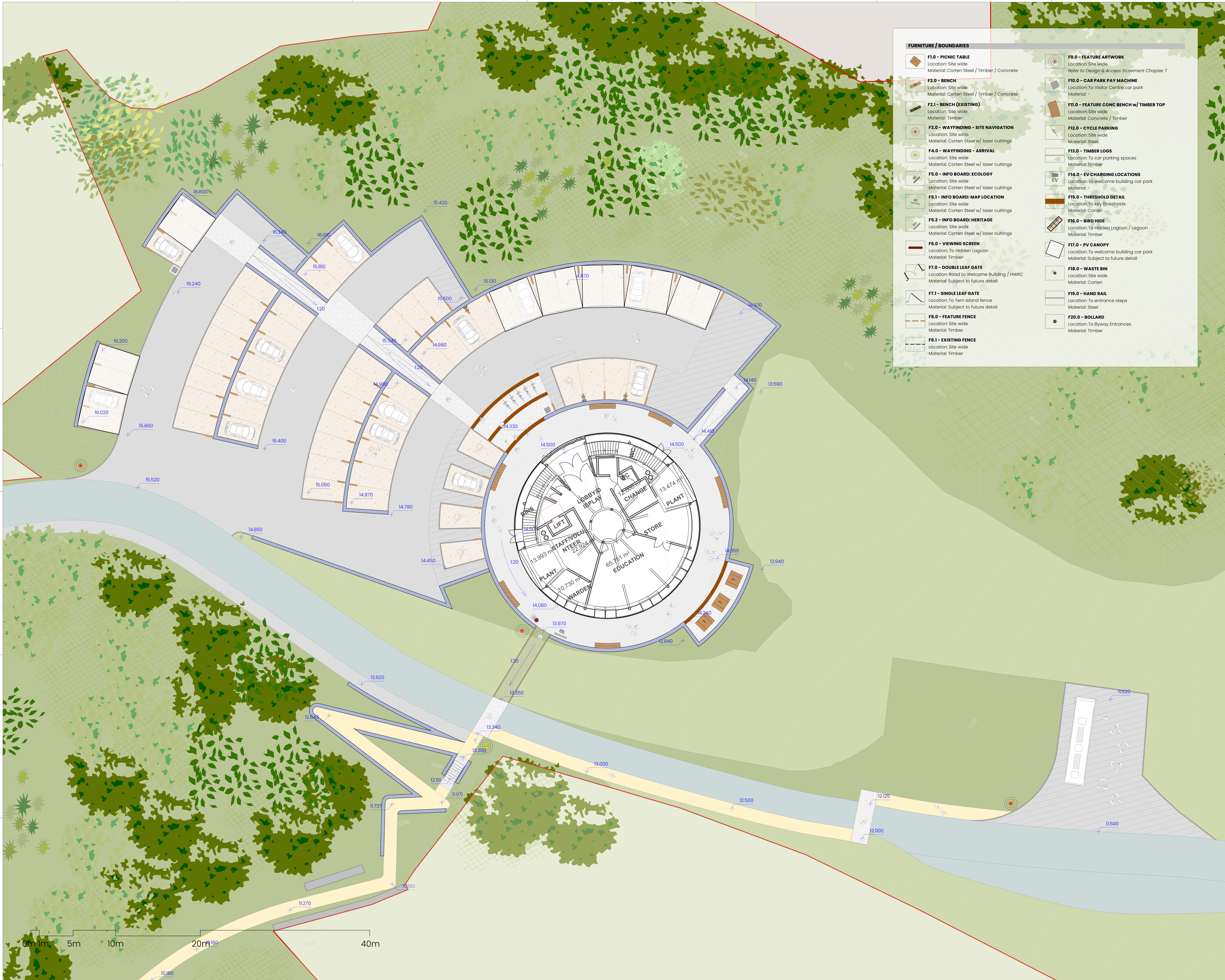

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ORIGINATOR
Layer.studio
W layer.studio
T 01625 523 157
E manchester or newcastle@layer.studio

MANCHESTER
8b Grove Street
Wilmslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client
Cumberland Council

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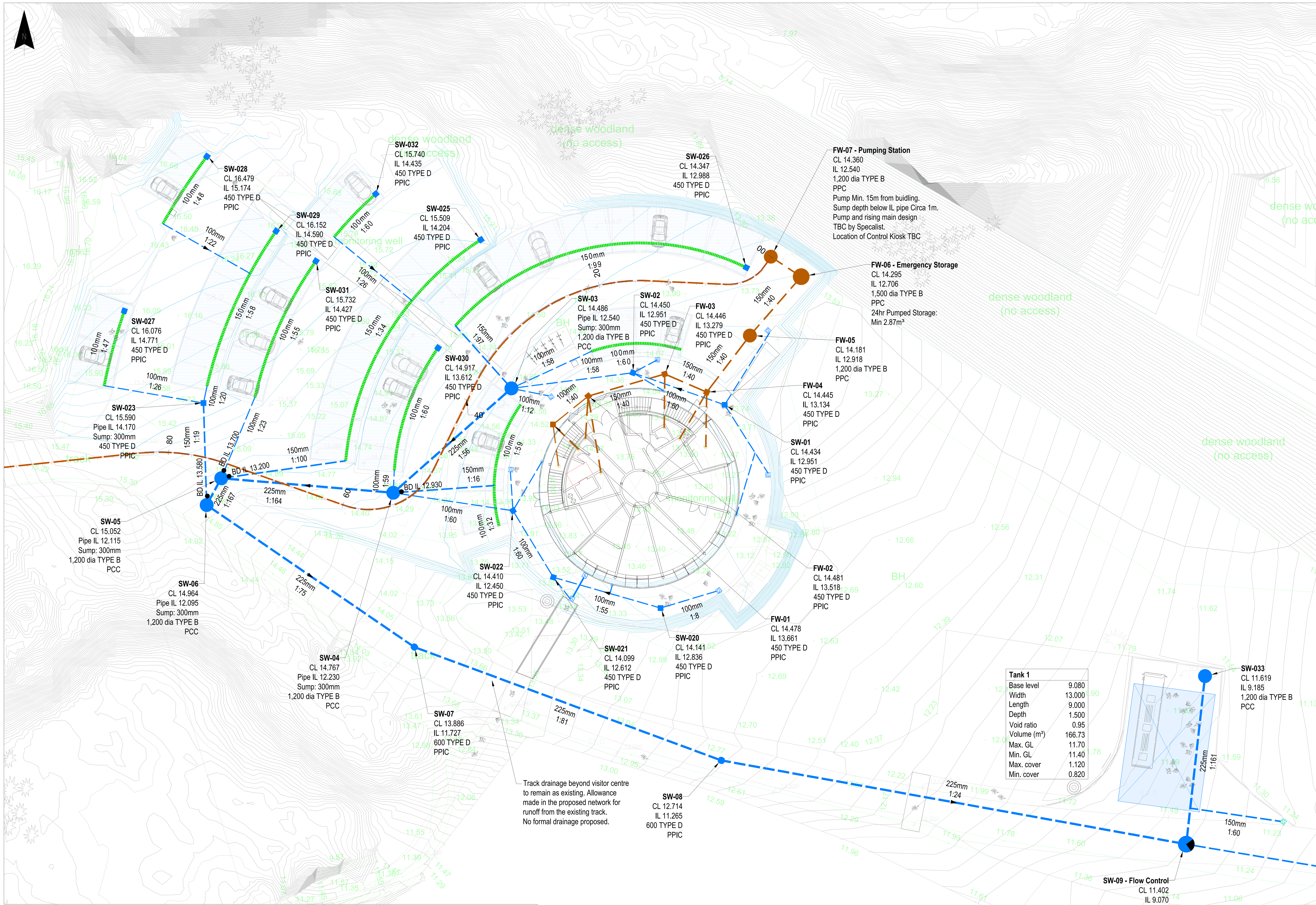
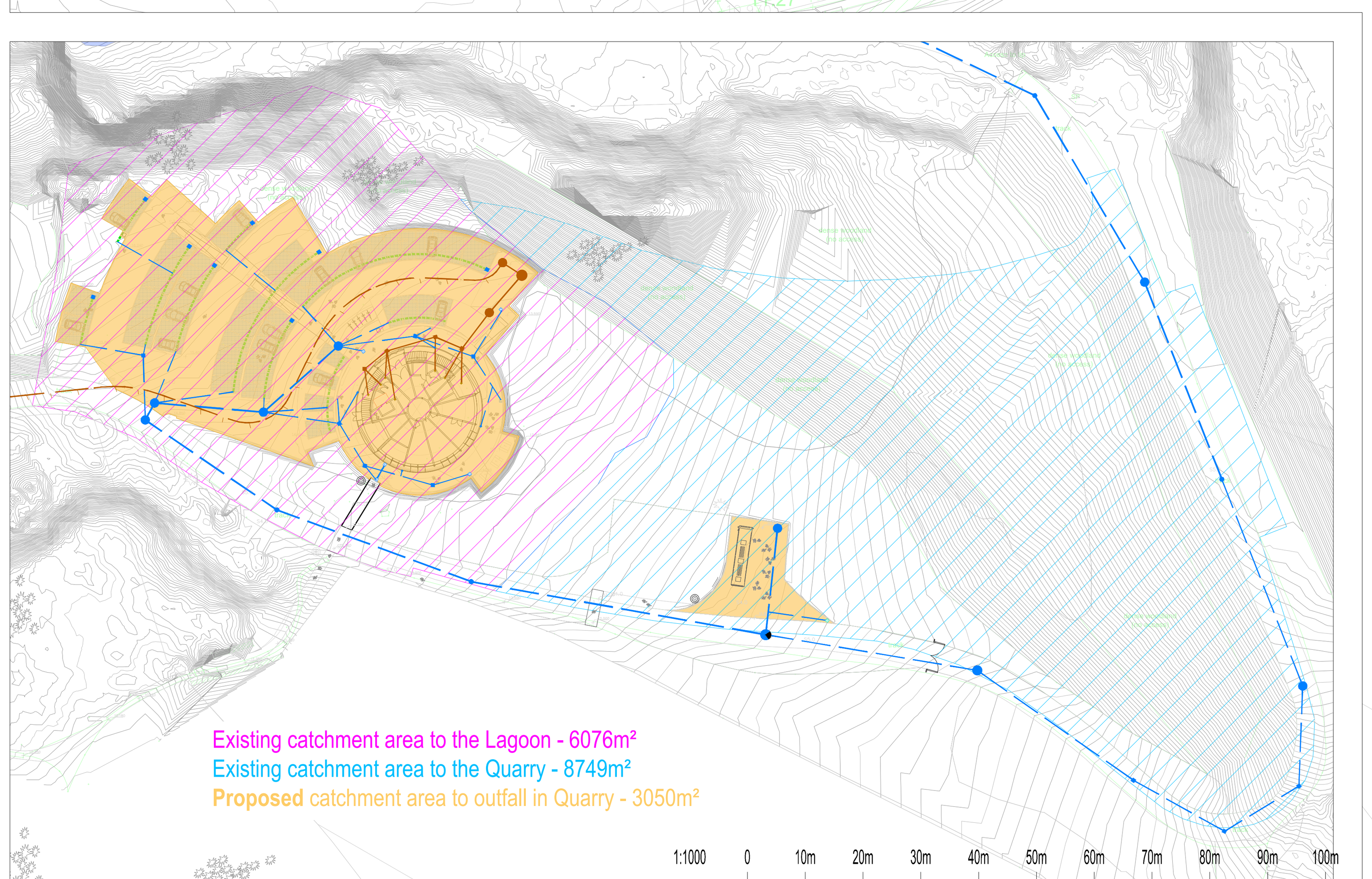
Stage 3	Planning	P02

Appendix B Proposed Drainage Drawings



Tank 1	
Base level	9.080
Width	13.000
Length	9.000
Depth	1.500
Void ratio	0.95
Volume (m³)	166.73
Max. GL	11.70
Min. GL	11.40
Max. cover	1.120
Min. cover	0.820

DRAINAGE PLAN (Scale 1:250)



CATCHMENT AREA PLAN (Scale 1:1000)

Surface Water Drainage Philosophy - Outfall to Quarry (North)

1. Surface water drainage drain via permeable paving and surface water gullies. Catchment of the proposed site to drain down the hill following existing road centerline.
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5. Proposed Impermeable area: 0.305ha
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7. Rate of runoff equates to a 58% betterment over the 1:100 greenfield runoff rate).
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9. A combination of permeable paving, gravel filled filter trenches, silt trap/catchpit chambers, and ACO Quadraceptor provides water quality improvement.

Proposed Foul Drainage Philosophy

10. Foul to drain to pumping station on north east side of site.
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12. **Foul Loading - TBC**

British Water Foul Flows and Loads - Code of Practice

Canteen 58 covers	- 10 l/p/a
Staff 10 works	- 50 l/p/a
Visitor Toilets - 150 visitors	- 10 l/p/a
Total flow	- 2,870 l/d

Over 9h opening time
=2,870/(9 x 3,600) ≈ 0.01 l/s

Design Notes:

13. Below ground pipes Ø to be 100mm for Surface water, and 150mm for foul UNO.
14. Invert levels are for chamber outfall pipes, UNO.
15. Placement of lids/covers/frames to suit paving patterns where possible and to be wholly within one surface pavement type where possible - to landscape architects specification.
16. Final placement of internal foul pop-ups to be confirmed.
17. 24hr Emergency pump storage based on foul loading total flow.

Information require from others to develop design:

18. Pumping station, pressure break/air admittance/flush out chambers and rising main to be designed by specialist.
19. Quarry outfall bank levels and water level range to be confirmed.

GENERAL NOTES:

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2. Do not scale this drawing. any ambiguities, omissions and errors on drawings shall be brought to the engineers attention immediately. All dimensions must be checked / verified on site.
3. All dimensions are in metres unless noted otherwise.
4. For general notes refer to drawing.

KEY:

- Surface water private drain
- Surface water flow control
- BD IL ## — Incoming backdrop IL
- Rainwater pipe
- Surface water private gully
- Surface water highway gully
- Filter drain (perforated pipe)
- Channel drain (with Access, and Sump box)
- Pervious pavement
- Below ground surface water storage tank
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- Foul water rising pump main
- Foul water pop-up
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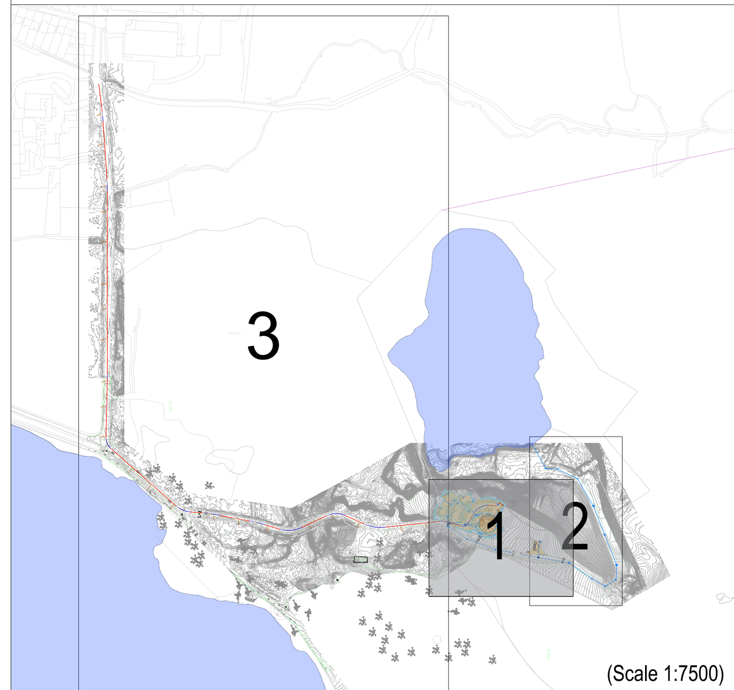
SHEET LAYOUT



(Scale 1:7500)

Rev:	Description:	Date:	By:	Chkd:
P02	REVISED SCHEME FOR PLANNING	07/04/25	CC	GW
P01	INITIAL ISSUE	15/05/23	CLN	GW

Curtins
Units 24-25 Riverside Place K Village Lound Road Kendal LA9 7FH
01539 724 823
kendal@curtins.com
www.curtins.com

Status: SUITABLE FOR INFORMATION **S2**

Client: STORY — Cumberland Council

Project: MILLOM IRON LINE

Drg Title: DRAINAGE STRATEGY SHEET 1

Drawn By	Designed By	Checked By
CC	CC	GW
	Date: 04/04/25	Scales @ A1: 1:250

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
081617 - CUR - 01 - ZZ - D - C - 92001	P02

\\ke-fs-1\Projects\B081617 Millom Iron Line\Q4-Production\4A-Models-Drawings\C\Model\

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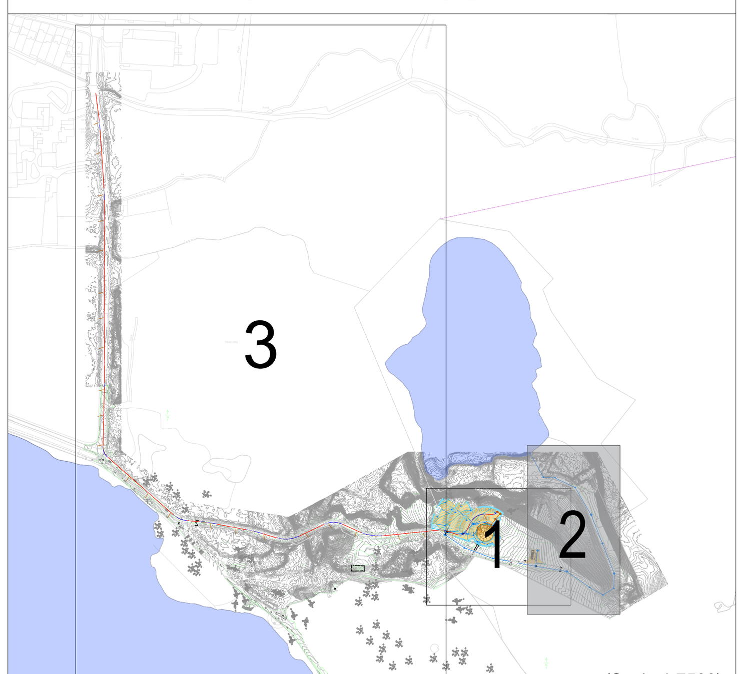

(Scale 1:7500)

Rev:	Description:	Date:	By:	Chkd:
P02	REVISED SCHEME FOR PLANNING	08/04/25	CC	GW
P01	INITIAL ISSUE	15/05/23	CLN	GW

Curtins
Units 24-25 Riverside Place K Village Lound Road Kendal LA9 7FH
01539 724 823
kendal@curtins.com
www.curtins.com

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Status: SUITABLE FOR INFORMATION S2

Client: STORY; Cumberland Council

Project: MILLOM IRON LINE

Drg Title: DRAINAGE STRATEGY SHEET 2

Drawn By	Designed By	Checked By
CC	CC	GW
	Date 07/04/25	Scales @ A1 1:250

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
081617 - CUR - 01 - ZZ - D - C - 92002	P02

\\ke-fs-1\Projects\B081617 Millom Iron Line\Q4-Production\4A-Models-Drawings\C\Model\

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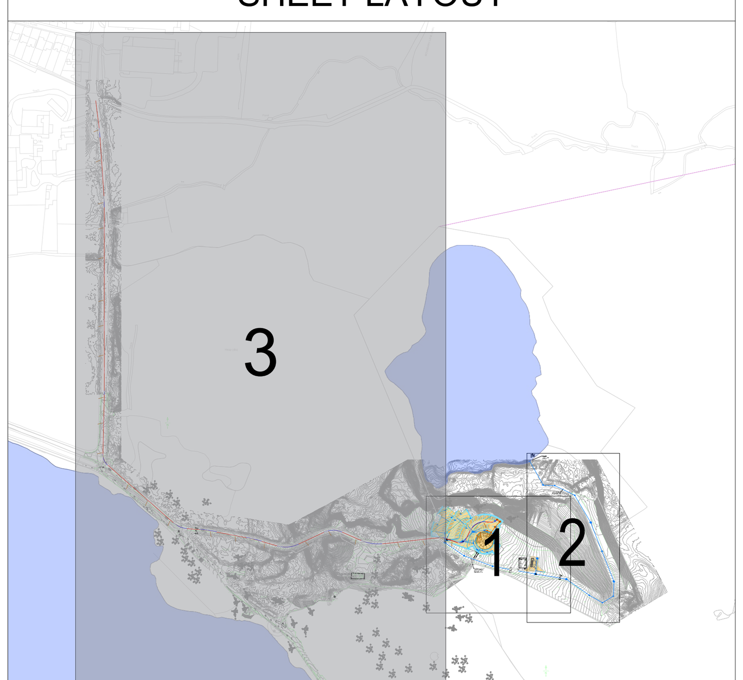

(Scale 1:7500)

Rev:	Description:	Date:	By:	Chkd:
P01	INITIAL ISSUE FOR PLANNING	08/04/25	CC	GW

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Status: SUITABLE FOR INFORMATION S2

Client: STORY / Cumberland Council

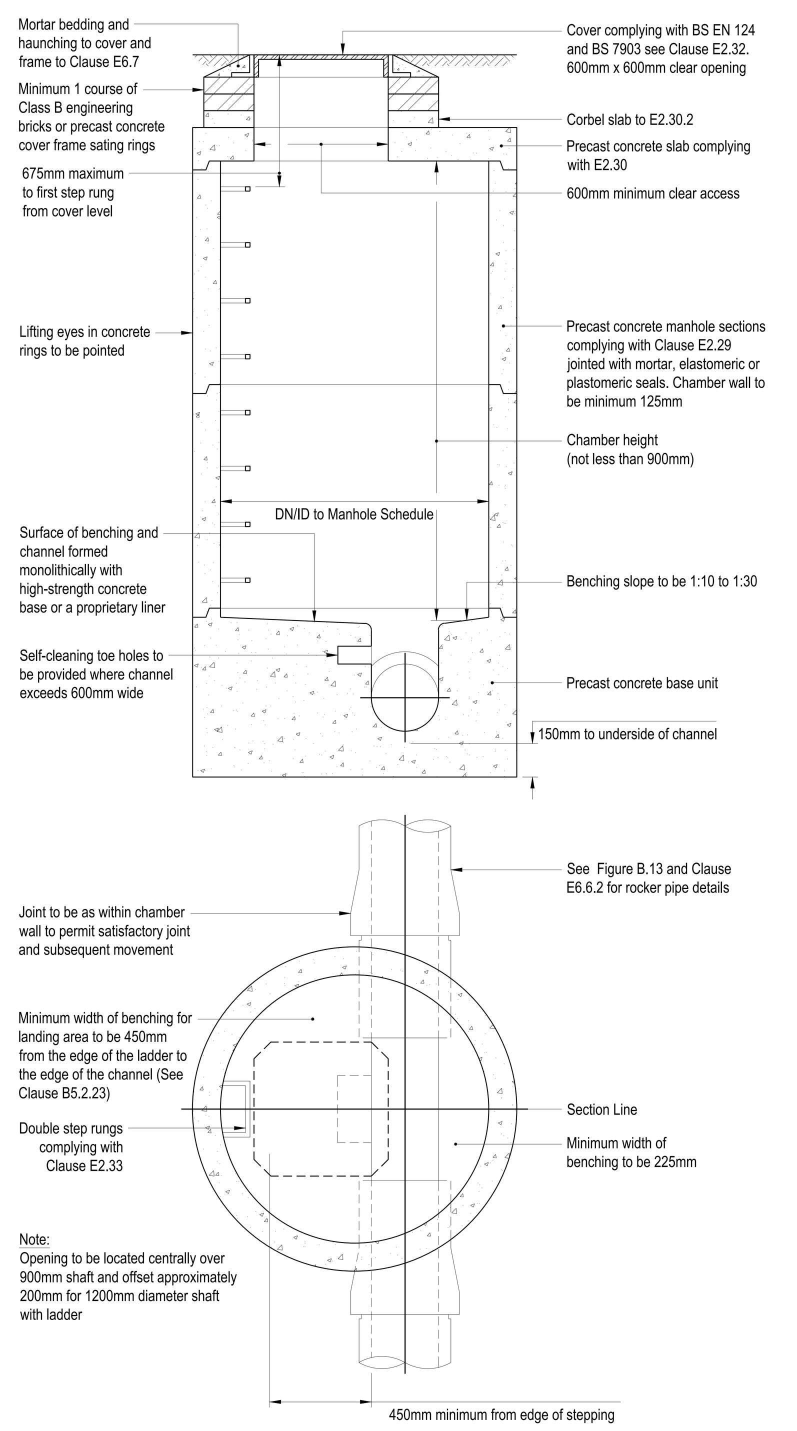
Project: MILLOM IRON LINE

Drg Title: DRAINAGE STRATEGY SHEET 3

Drawn By	Designed By	Checked By
CC	CC	GW
	Date 07/04/25	Scales @ A1 1:1000

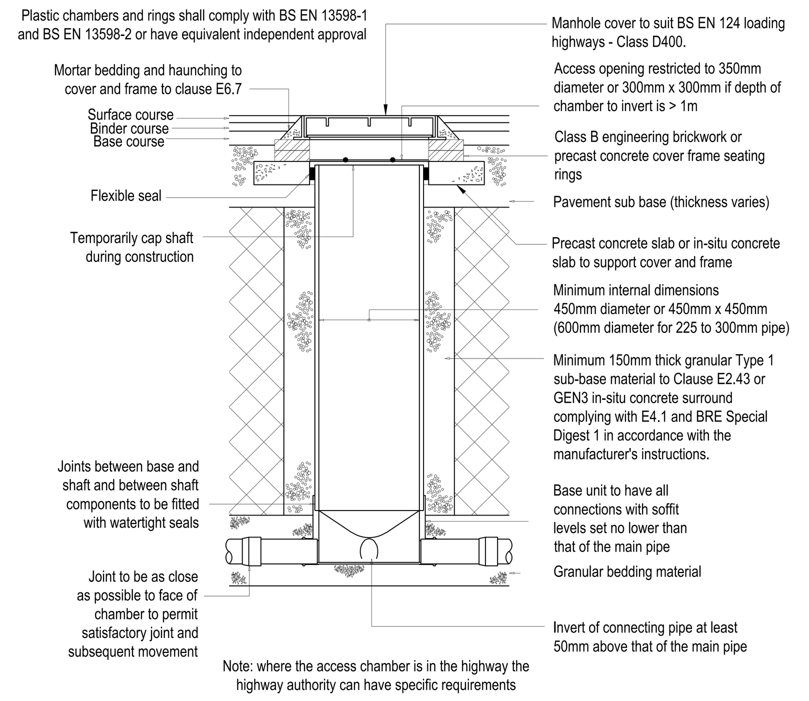
Project No - Originator - Function - Spatial - Form - Discipline - Number / Revision

081617 - CUR - 01 - ZZ - D - C - 92003 | P01



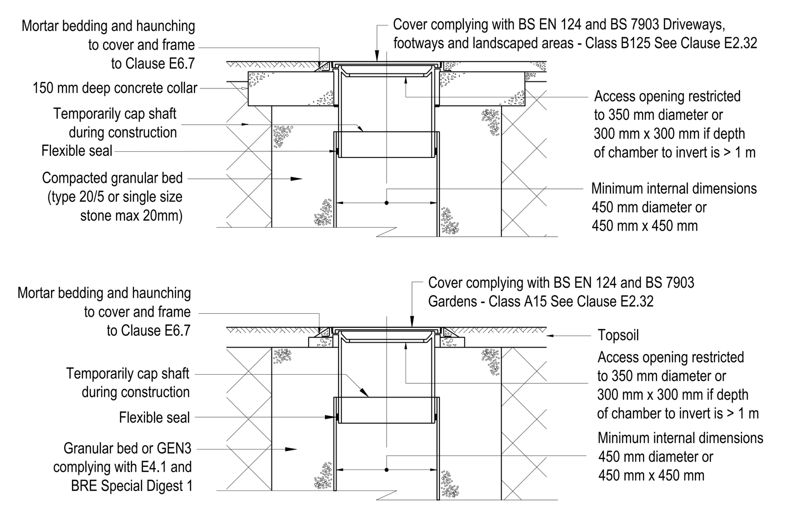
TYPICAL MANHOLE DETAIL - TYPE B

Design code: SSG Appendix C Figure B 9 (See SSG for noted Clauses)
Depth from cover level to soffit of pipe 1.5m to 3m
Rigid material construction without concrete surround
(Scale 1:20)



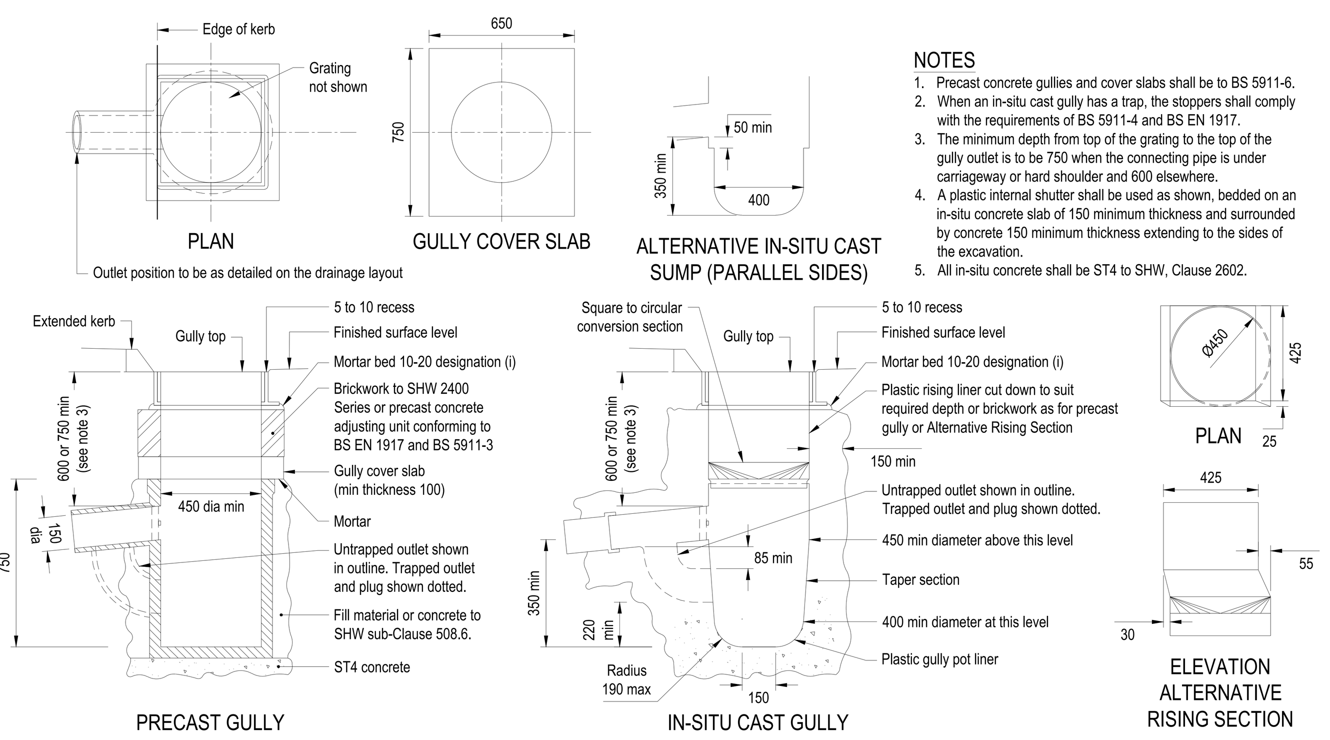
TYPICAL INSPECTION CHAMBER DETAIL - TYPE D

Depth from cover level to soffit of pipe up to 3m
Flexible material construction for use in areas subject to vehicle loading
Design code: SSG Appendix C Figure B 18 (see Part E for clauses)
(Scale 1:20)



TYPICAL INSPECTION CHAMBER DETAIL - TYPE D

Flexible material construction alternative top details for use in areas of light vehicle loading or landscaped areas
Design code: SSG Appendix C Figure B 19 (see Part E for clauses)
(Scale 1:20)

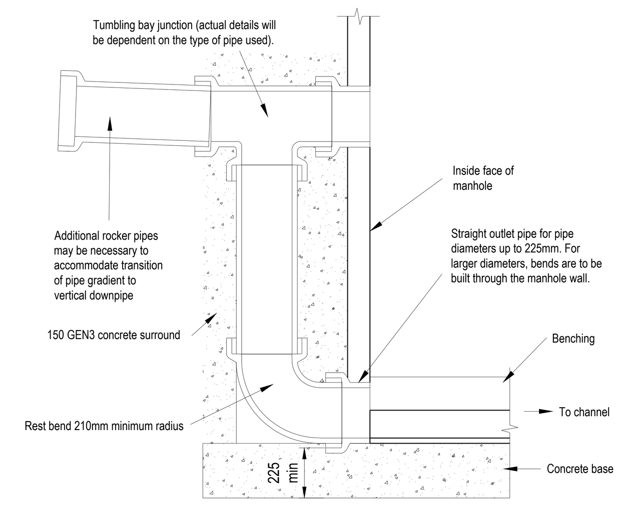


NOTES

1. Precast concrete gullies and cover slabs shall be to BS 5911-6.
2. When an in-situ cast gully has a trap, the stoppers shall comply with the requirements of BS 5911-4 and BS EN 1917.
3. The minimum depth from top of the grating to the top of the gully outlet is to be 750 when the connecting pipe is under carriageway or hard shoulder and 600 elsewhere.
4. A plastic internal shutter shall be used as shown, bedded on an in-situ concrete slab of 150 minimum thickness and surrounded by concrete 150 minimum thickness extending to the sides of the excavation.
5. All in-situ concrete shall be ST4 to SHW, Clause 2602.

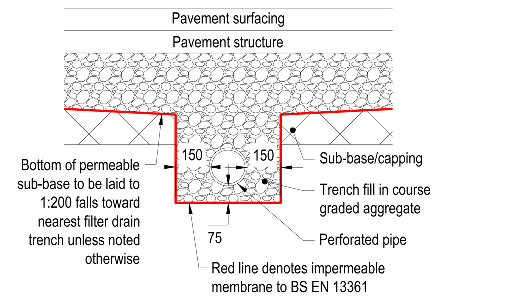
HIGHWAY GULLIES

Design code: MHCW Volume 3 Section 1 - Highway Construction Details - F Series - Drainage - Figures F13 and F14
Preferred gully material is precast concrete.
(Scale 1:20)



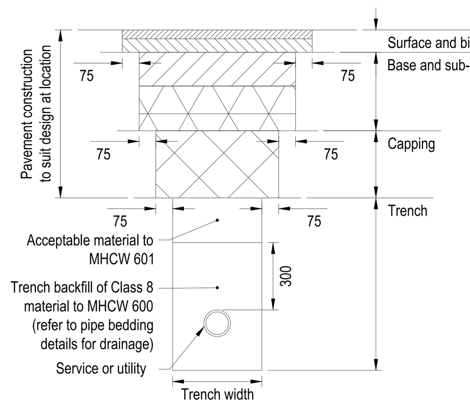
TYPICAL VERTICAL BACKDROP DETAIL (RIGID MATERIALS)

For use in manhole types A to D
Design code: SSG Appendix C Figure 16
(Scale 1:20)



PERVIOUS PAVING FILTER DRAIN

See drainage layout for pipe locations and levels
(Scale 1:20)

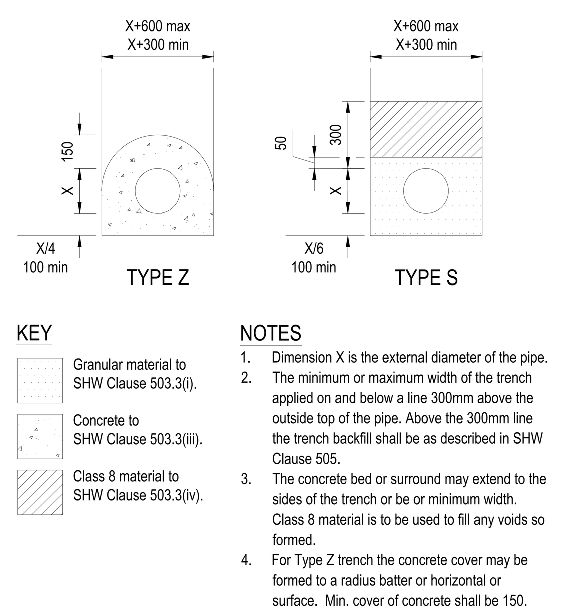


Notes:

1. Trench reinstatements shall be carried out in accordance with Clause 706 of the Specification for Highway Works
2. Where compaction is made impossible due to trench width, lower strength concrete to MHCW Vol Clause 1030 may be used in place of capping and sub-base.
3. Minimum depth of reinstatement to be 450mm, any additional depth to be made up in Type 1 sub-base.
4. Immediately before bituminous layers are reinstated, he edges of existing material shall be cleaned of all loose material and be coated with an appropriate hot bituminous binder or equivalent treatment.

TRENCH REINSTATEMENT - BITUMINOUS PAVEMENT

Design code: MHCW Vol 1 Clause 706
(Scale 1:20)



KEY

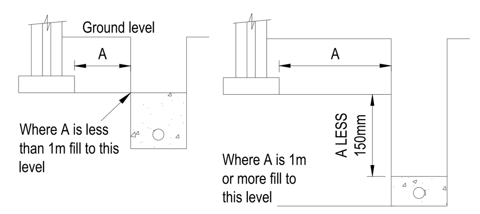
- Granular material to SHW Clause 503.3(i).
- Concrete to SHW Clause 503.3(iii).
- Class 8 material to SHW Clause 503.3(iv).

NOTES

1. Dimension X is the external diameter of the pipe.
2. The minimum or maximum width of the trench applied on and below a line 300mm above the outside top of the pipe. Above the 300mm line the trench backfill shall be as described in SHW Clause 505.
3. The concrete bed or surround may extend to the sides of the trench or be or minimum width. Class 8 material is to be used to fill any voids so formed.
4. For Type Z trench the concrete cover may be formed to a radius batter or horizontal or surface. Min. cover of concrete shall be 150.

TRENCH AND BEDDING DETAILS

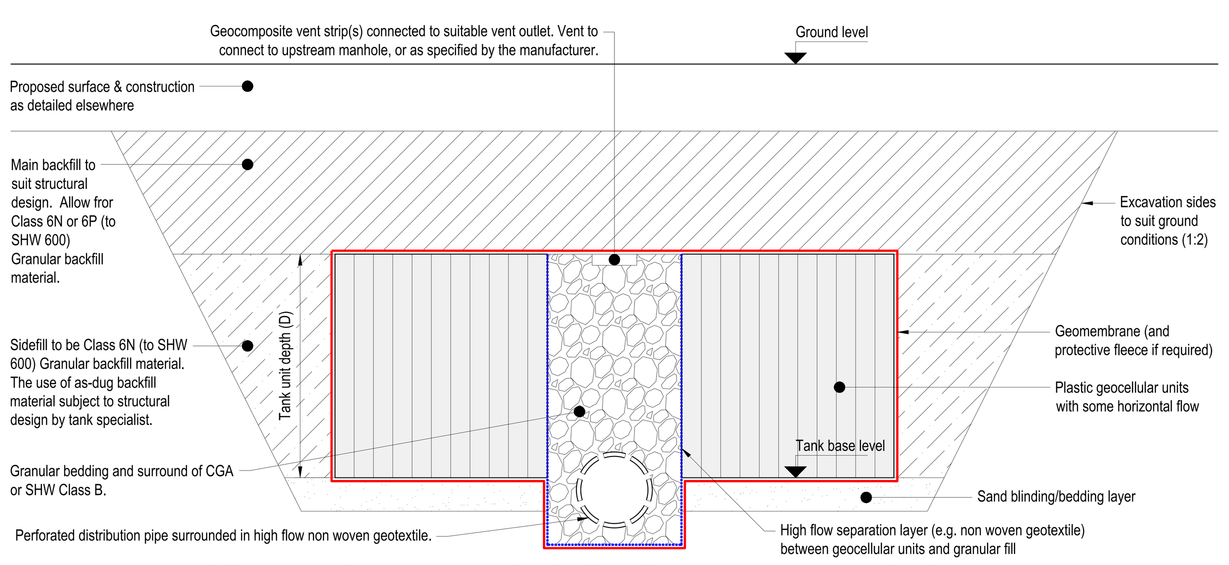
Design code: MHCW Volume 3 Section 1 - Highway Construction Details - F Series - Drainage - Figures F1
(Scale 1:20)



Minimum 150mm GEN3 concrete surround/trench fill with 13mm thick compressible board movement joints provided at each socket/sleeve joint face or at not more than 5m intervals

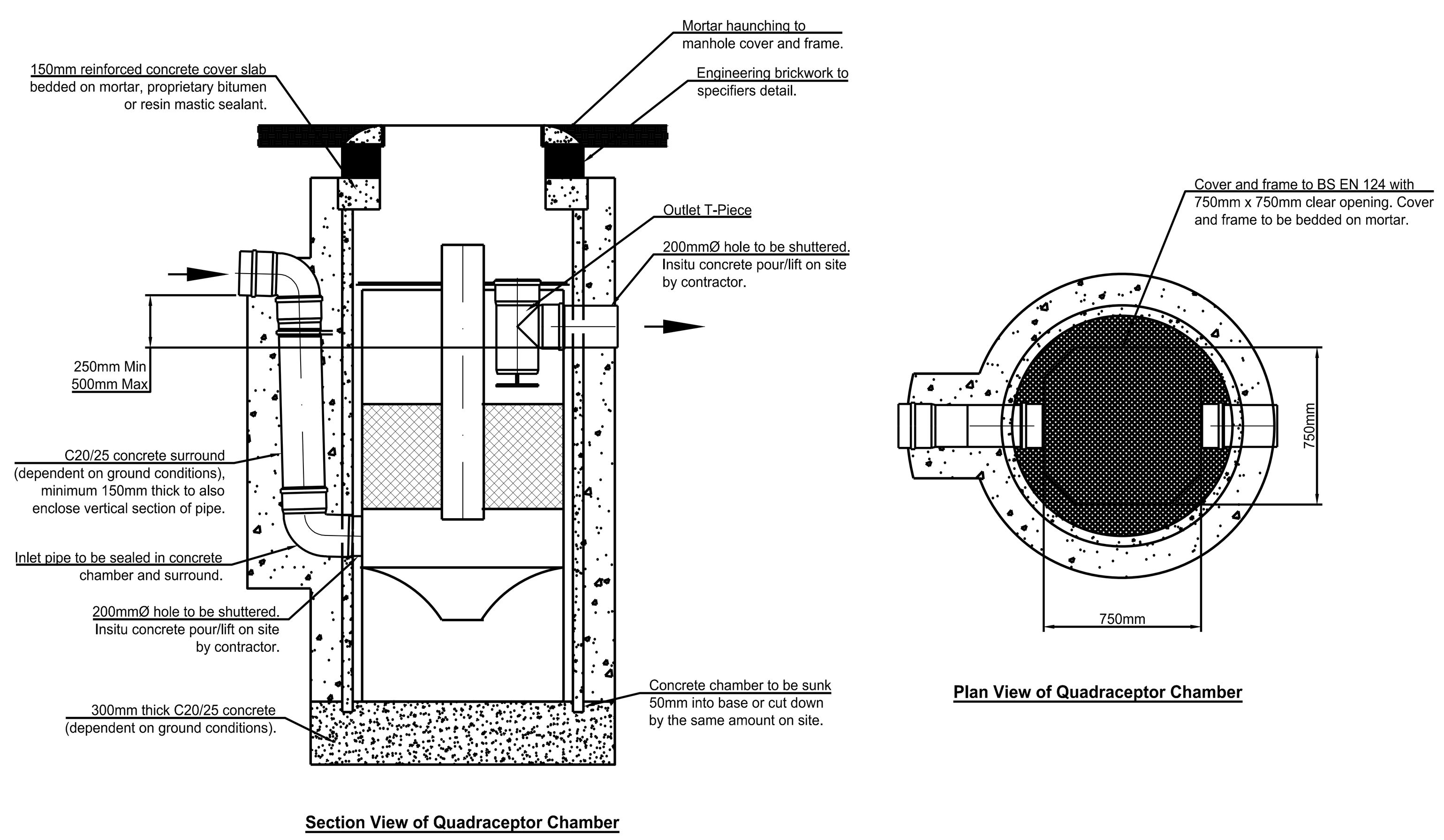
PIPE RUNS NEAR BUILDINGS

Based on Building Regulations H1 Diagrams 8 & 12
(not to scale)



SCHEMATIC ATTENUATION STORAGE TANK WITH THROUGH PIPE

Design code: Adapted from C753 Figure 21.6
(Scale 1:20)



VORTEX SEPARATOR - ACO QUADRACEPTOR

ACO Quadraceptor shown as example. To be installed to manufacturers' instructions.
(Scale 1:20)

Drainage Notes:

1. This drawing is to be read in conjunction with all relevant architects and engineers drawings and specifications.
2. Do not scale this drawing. Any ambiguities, omissions or errors on drawings shall be brought to the engineers attention immediately. All dimensions must be checked / verified on site.
3. Design based on available topographical survey and cctv survey information at the time of design.
4. All drainage works to be in accordance with the Civil Engineering Specification for the Water Industry (**CESWI**) as included in Sewer Sector Guidance (**SSG**), the requirements of The Building Regulations: Approved Document H (**Part H**) and Curtins drainage Specification.
5. All dimensions are in mm and levels in m above ordnance datum unless otherwise noted. Diameters are expressed in millimeters and denoted by a Ø symbol.
6. It is advised that the contractor survey retained existing drainage prior to commencement to confirm location and condition, with cleansing to facilitate survey if required.
7. Existing sewer locations where the proposed drainage is to connect, are to be surveyed and exact levels confirmed and provided to engineer prior to commencement of works.
8. All existing services to be located prior to commencement of any drainage works, and where necessary protection or diversions to be undertaken to avoid conflict with the proposed work.
9. All existing drains to be abandoned shall be either removed or grouted up if not possible. Grouting to be performed by capping all ends / connections and filling the retaining void with grout, in accordance with **CESWI**.
10. All soft spots to be removed from bottom of excavations and to be refilled to formation level in accordance with groundworks specifications.
11. Raised ground must be filled in accordance with groundworks specifications and consolidated before any sewer works are carried out.
12. All adoptable drainage works including works to existing public sewers to be undertaken in accordance with **SSG**, **CESWI** and the relevant statutory undertakers details.
13. All private drainage works to be in accordance with **CESWI**, BS EN 752 2017 'Drain And Sewer Systems Outside Buildings' and the **Part H**.
14. All drains, unless agreed otherwise stated, shall be:
   - 100mm to 300mm diameter to be vitrified clay.
15. All diameters given are nominal internal pipe diameters.
16. Pipe materials in accordance with the following:
   - all vitrified clay pipes to BS EN 295-1:
   - all concrete pipes to be to BS EN 1916.
   - all concrete manholes to be to BS EN 1917.
17. As an alternative the contractor may use an approved unplasticised polyvinyl chloride (uPVC).
18. All private drainage pipes with a cover of less than 600mm in non-trafficked areas and less than 1200mm in trafficked areas to have a concrete protection slab or be bedded and surrounded in concrete (Class Z). Compressible material shall be provided at every pipe joint. Where cover exceeds this depth, pipes are typically bedded and surrounded in Class S. Refer to pipe embedment details drawing for specific types.
19. Backfill to drainage trenches under hardstanding areas to be Type 1 sub base material, elsewhere backfill to be free draining readily compatible material free from detritus, organic matter, frozen soil clay lumps and large stones. To be compacted in layers not exceeding 150mm thick.
20. Bedding and backfill materials to conform to the requirements of WIS 4-08-02 (Table A2).
21. Where foul drains run above surface drains, concrete protection may be required at crossovers to prevent any potential contamination.
22. The first pipe out of manholes to be as short as practicable so as to provide a flexible joint as close as possible to the outside face of the concrete surround and connected to a length of rocker pipe.
23. All connections passing through bases or edge beams to be in sealed sleeves. Alternatively connections may be cast-in with flexible joints not greater than 150mm from face of concrete.
24. Where drainage pipes are less than 300mm below the underside of the ground floor slab, concrete encasement is required (Class Z). Compressible joints are to be provided at every pipe joint within the concrete.
25. Where pipes are more than 300mm below the underside of the slab, Class S bedding is acceptable.
26. Drain pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer lengths.
27. Plastic channel sections will not be permitted within manhole chambers. Clayware channels shall be used within manholes for pipe sizes up to and including 300mm diameter.
28. All new connections into existing manholes (or into existing sewers) to be 'soffits level' unless otherwise noted.
29. Sulphate resistant cement (C20-DC2) and precast concrete products must be used or a laboratory report provided to prove that such precautions are not required subject to SI.
30. Sewers must have 5m clearance from trees and hedges or to have suitable root protection in accordance with **SSG** requirements.
31. The chamber size of manholes with more than one connection in them may need to be increased to accommodate the connections and bends.
32. All internal drainage connections are provided to the penetration positions shown on architect and M&E drawings. Refer to dimensioned locations on architect's ground floor setting-out plans.
33. Rainwater and foul water pop up locations and sizes to be confirmed by others.
34. All underground foul drainage should be suitably vented at or near to the head of runs.
35. All access fittings, stacks, RWPs and gullies to be roddable. All to have low level rodding access plates unless an alternative means of access is agreed. Access point to be above any ground floor connected appliance spill level.
36. Large access fitting required above ground where greater than 12m up to 22m to a junction. Small access fitting required up to 12m to a junction.
37. All gully and channel drain outlets and termination points to be trapped and roddable. Internal gullies and channel drains to be specified by others.
38. All branch connections to be made with swept bends in the direction of flow in the main sewer.
39. Where no WCs are connected upstream, under slab foul water drainage to be laid at 1:40 min. After the connection of at least 1no WC, a min. fall of 1:80 applies.
40. All internal covers to have mechanically jointed corners and be double sealed with recessed tray suit finishes.
41. All manhole covers in block/slab and external paving areas to have recessed covers of the appropriate grade to accept architect's paving proposal.
42. Unless noted otherwise in the manhole schedule, all manhole, gully and channel covers (ironwork) should be the following specification:
   - B125 load class in pedestrian areas
   - D400 load class in vehicular areas.
44. Cover levels, gully positions, and building location are approximate and shall be confirmed by architect/landscape architect. Contractor to allow for adjustment to suit agreed positions and finished levels, and confirm all cover levels on site.
45. Outfall connection(s) subject to agreement with the approving authority.
46. The contractor shall comply with the following:-
   (i). All operations should be carried out in accordance with the general health and safety policy of the developer as required by sections 2 of the Health and Safety at Work Act 1974 and in particular The Construction (Health, Safety and Welfare) Regulations 1996.
   (ii). The local authority and utilities companies are to be notified prior to commencement of work on site.
   (iii). Prior to construction the actual positions and depths of services likely to be affected by the works should be established by means of hand dig in close liaison with the utility companies. The contractor shall immediately advise the engineer of any services exposed which may affect the design.
   (iiii). All operatives working on the highway works must have street works accreditation.
47. The contractor shall be responsible for ensuring that pipes are adequately protected from concentrated loading by construction traffic during the construction period.
48. The contractor shall allow for the protection, temporary and permanent support, and temporary and permanent diversion works, as necessary to all existing services.
49. The contractor shall allow for keeping trenches and excavations as dry as practicable by pumping from temporary sumps and de-watering as appropriate. The point and method of discharge to be agreed with the drainage authority & LLFA and environment agency.
50. It is advised that drainage works are to be constructed from the outfall towards the head of run to ensure the outfall can be achieved.
51. All drains to be CCTV surveyed on completion of the works.
52. Grease traps should be provided above ground within an enzyme treatment system, by appropriate specialist designer.

GENERAL NOTES:

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Rev:	Description:	Date:	By:	Chkd:
P02	REVISED TO NEW PROPOSALS FOR PLANNING	08/04/25	CC	GW
P01	STAGE 3 ISSUE	07/07/23	AMG	GW

Curtins
Units 24-25 Riverside Place K Village Lound Road Kendal LA9 7FH
01539 724 823
kendal@curtins.com
www.curtins.com

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Status: SUITABLE FOR INFORMATION S2

Client: STORY; Cumberland Council

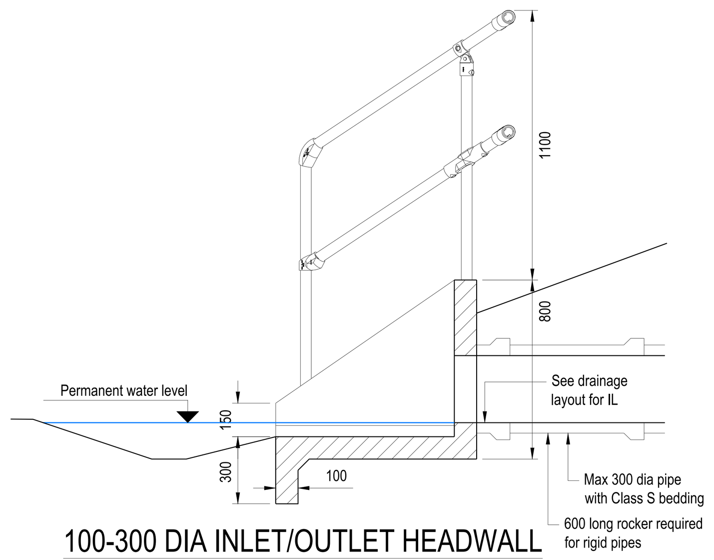
Project: MILLOM IRON LINE

Drg Title: DRAINAGE DETAILS SHEET 1

Drawn By	Designed By	Checked By
AMG	GW	GW
	Date: JULY 23	Scales @ A0: AS SHOWN

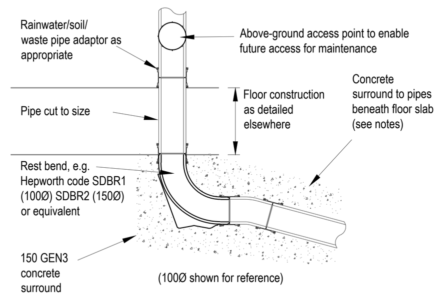
Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
081617 - CUR - XX - XX - D - C - 92200	P02

\\ke-fs-1\Projects\B081617 Millom Iron Line\Q4-Production\4A-Models-Drawings\C\CAD\92\



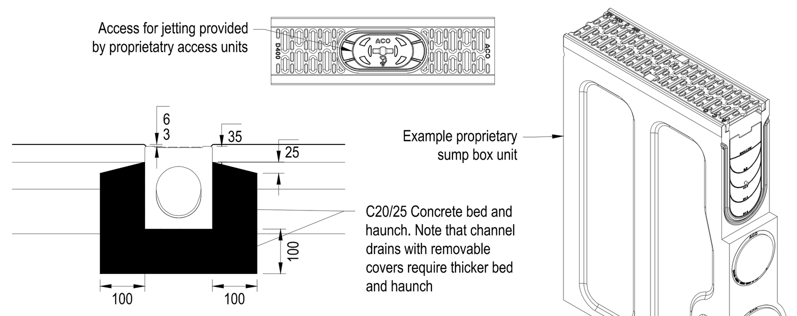
100-300 DIA INLET/OUTLET HEADWALL

Althon H3C Headwall shown as example. To be installed to manufacturers' instructions.
(Scale 1:20)



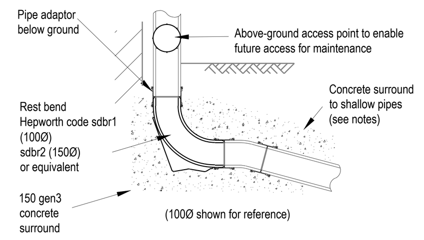
INTERNAL PIPE CONNECTION

Pipe run beneath ground floor slab
(Scale 1:20)



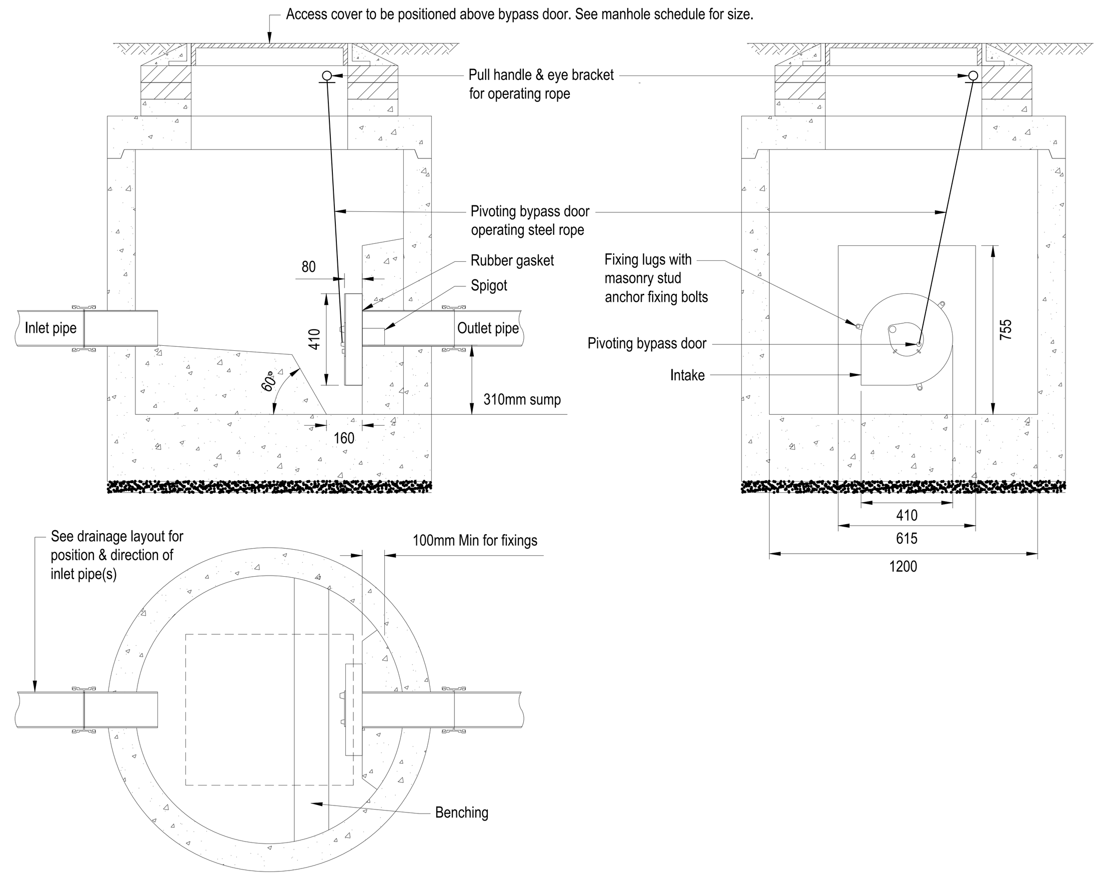
MONOLITHIC CHANNEL DRAINS

Example product: ACO MonoDrain, RoadDrain
Installed to manufacturer's instructions
(Scale 1:10)



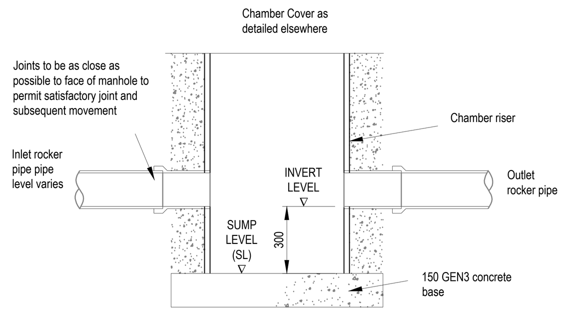
EXTERNAL PIPE CONNECTION

(Scale 1:20)



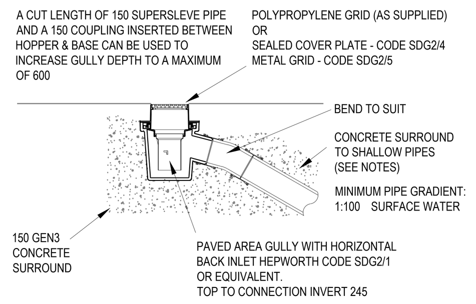
VORTEX FLOW CONTROL

To be constructed as per relevant typical manhole detail with the above differences.
Proprietary products to be installed in accordance with manufacturer's instructions.
Orange text represents dims likely to change for construction.
(Scale 1:20)



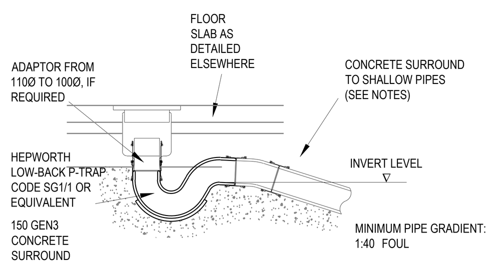
TYPICAL SILT TRAP

(SCALE 1:20)



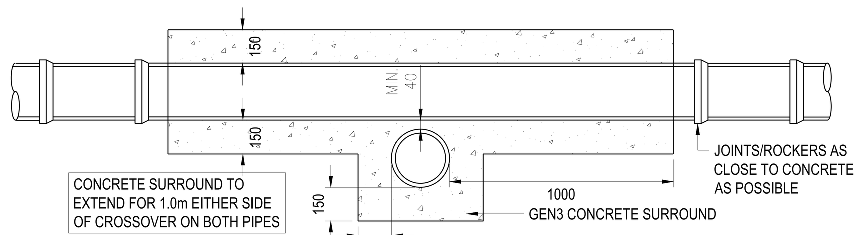
TYPICAL EXTERNAL AREA YARD GULLY

(SCALE 1:20)



TYPICAL INTERNAL ACCESS FLOOR GULLY

(SCALE 1:20)



PIPE CROSSOVER DETAIL

FOR PIPES WITH LESS THAN 150mm CLEARANCE
(SCALE 1:20)

PUMP STATION - TBC

Pump station to be designed and installed to specialist details.
(Scale 1:20)

GENERAL NOTES:

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Status: SUITABLE FOR INFORMATION S2

Client: STORY; Cumberland Council

Project: MILLOM IRON LINE

Drg Title: DRAINAGE DETAILS SHEET 2

Drawn By	Designed By	Checked By
AMG	GW	GW
	Date: JULY 23	Scales @ A0: AS SHOWN

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
081617 - CUR - XX - XX - D - C - 92201	P02

\\ke-fs-1\Projects\B081617 Millom Iron Line\Q4-Production\4A-Models-Drawings\C\CAD\92\

Appendix C Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.470	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW-023	0.041	4.00	15.590	450	317856.530	478989.854	1.420
SW-05	0.073	4.00	15.052	1200	317858.475	478981.611	2.937
SW-06			14.964	1200	317856.878	478978.679	2.869
SW-04	0.036	4.00	14.767	1200	317877.316	478980.023	2.537
SW-03	0.056	4.00	14.486	1200	317890.258	478991.464	1.946
SW-02	0.013	4.00	14.450	450	317903.571	478993.174	1.499
SW-01	0.026	4.00	14.434	450	317913.620	478989.659	1.305
SW-022	0.013	4.00	14.410	450	317890.431	478978.056	1.960
SW-020	0.006	4.00	14.141	450	317906.598	478967.391	1.305
SW-021	0.018	4.00	14.099	450	317894.853	478970.757	1.487
SW-07			13.886	450	317879.630	478963.111	2.159
SW-08			12.717	450	317913.440	478950.985	1.452
SW-033		4.00	11.619		317964.533	478943.649	2.434
SW-09	0.023	4.00	11.402	1200	317964.179	478941.510	2.332
SW-010			10.355	1350	318000.768	478935.337	1.665
SW-011			9.263	450	318027.787	478916.313	1.394
SW-012			8.104	450	318043.511	478907.497	1.802
SW-013			6.146	450	318056.398	478915.311	1.457
SW-014			4.449	1200	318057.059	478932.633	1.498
SW-024			3.353	450	318043.065	478968.403	1.466
SW-017			3.245	450	317987.052	479046.195	1.985
SW-015			3.221	1200	318029.719	479002.519	1.571
SW-018			3.208	450	317973.205	479046.931	2.033
SW-016			3.127	450	318010.709	479034.809	1.707
SW-019			1.362	450	317957.633	479075.192	0.382

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	SW-01	SW-02	10.646	0.600	13.129	12.951	0.178	59.8	100	4.18	50.0
1.002	SW-02	SW-03	13.422	0.600	12.951	12.720	0.231	58.1	150	4.35	50.0
1.003	SW-03	SW-04	17.274	0.600	12.540	12.230	0.310	55.7	225	4.51	50.0
1.004	SW-04	SW-05	18.908	0.600	12.230	12.115	0.115	164.4	225	4.82	50.0
1.005	SW-05	SW-06	3.339	0.600	12.115	12.095	0.020	167.0	225	4.88	50.0
1.006	SW-06	SW-07	27.568	0.600	12.095	11.728	0.367	75.1	225	5.18	50.0
1.007	SW-07	SW-08	35.919	0.600	11.727	11.285	0.442	81.3	225	5.59	50.0
1.008	SW-08	SW-09	51.616	0.600	11.265	9.070	2.195	23.5	225	5.91	50.0
1.009	SW-09	SW-010	37.106	0.600	9.070	8.690	0.380	97.6	150	6.52	50.0
1.0010	SW-010	SW-011	33.044	0.600	8.690	7.889	0.801	41.3	150	6.87	50.0
1.0011	SW-011	SW-012	18.027	0.600	7.869	6.302	1.567	11.5	150	6.97	50.0
1.0012	SW-012	SW-013	15.071	0.600	6.302	4.795	1.507	10.0	150	7.05	50.0
1.0013	SW-013	SW-014	17.335	0.600	4.689	2.971	1.718	10.1	150	7.14	50.0
1.0014	SW-014	SW-024	38.410	0.600	2.951	1.887	1.064	36.1	150	7.52	50.0
1.0015	SW-015	SW-016	37.470	0.600	1.650	1.420	0.230	162.9	225	8.71	50.0
1.0016	SW-016	SW-017	26.254	0.600	1.420	1.260	0.160	164.1	225	9.14	50.0
1.0017	SW-017	SW-018	13.867	0.600	1.260	1.175	0.085	163.1	225	9.37	50.0
1.0018	SW-018	SW-019	32.267	0.600	1.175	0.980	0.195	165.5	225	9.90	50.0
2.004	SW-020	SW-021	12.218	0.600	12.836	12.612	0.224	54.5	100	4.19	50.0
2.005	SW-021	SW-022	8.534	0.600	12.612	12.470	0.142	60.1	100	4.34	50.0
2.006	SW-022	SW-04	13.262	0.600	12.450	12.230	0.220	60.3	150	4.51	50.0
3.001	SW-023	SW-06	11.180	0.600	14.170	13.583	0.587	19.0	150	4.08	50.0
1.0014 (1)	SW-024	SW-015	36.634	0.600	1.887	1.650	0.237	154.6	225	8.10	50.0
3.0041	SW-033	SW-09	14.639	0.600	9.185	9.070	0.115	127.3	225	4.21	50.0

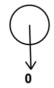
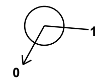
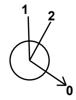
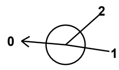
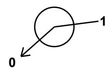
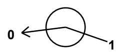
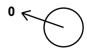
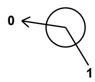
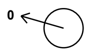
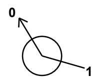
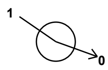
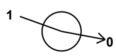
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	0.998	7.8	3.5	1.205	1.399	0.026	0.0	47	0.974
1.002	1.322	23.4	5.3	1.349	1.616	0.039	0.0	48	1.070
1.003	1.755	69.8	12.9	1.721	2.312	0.095	0.0	65	1.350
1.004	1.017	40.4	22.8	2.312	2.712	0.168	0.0	121	1.046
1.005	1.009	40.1	32.7	2.712	2.644	0.241	0.0	154	1.120
1.006	1.510	60.0	38.2	2.644	1.933	0.282	0.0	131	1.597
1.007	1.451	57.7	38.2	1.934	1.207	0.282	0.0	134	1.549
1.008	2.709	107.7	38.2	1.227	2.107	0.282	0.0	93	2.488
1.009	1.017	18.0	41.3	2.182	1.515	0.305	0.0	150	1.036
1.0010	1.571	27.8	41.3	1.515	1.224	0.305	0.0	150	1.600
1.0011	2.987	52.8	41.3	1.244	1.652	0.305	0.0	100	3.295
1.0012	3.204	56.6	41.3	1.652	1.201	0.305	0.0	95	3.490
1.0013	3.190	56.4	41.3	1.307	1.328	0.305	0.0	96	3.480
1.0014	1.680	29.7	41.3	1.348	1.316	0.305	0.0	150	1.712
1.0015	1.021	40.6	41.3	1.346	1.482	0.305	0.0	189	1.158
1.0016	1.018	40.5	41.3	1.482	1.760	0.305	0.0	190	1.153
1.0017	1.021	40.6	41.3	1.760	1.808	0.305	0.0	189	1.157
1.0018	1.013	40.3	41.3	1.808	0.157	0.305	0.0	191	1.148
2.004	1.045	8.2	0.8	1.205	1.387	0.006	0.0	21	0.667
2.005	0.995	7.8	3.3	1.387	1.840	0.024	0.0	45	0.949
2.006	1.297	22.9	5.0	1.810	2.387	0.037	0.0	48	1.043
3.001	2.318	41.0	5.6	1.270	1.231	0.041	0.0	37	1.626
1.0014 (1)	1.049	41.7	41.3	1.241	1.346	0.305	0.0	183	1.190
3.0041	1.157	46.0	0.0	2.209	2.107	0.000	0.0	0	0.000

Pipeline Schedule

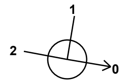
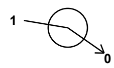
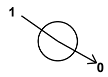
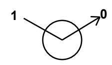
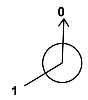
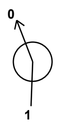
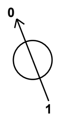
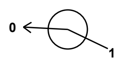
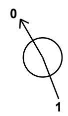
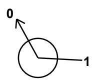
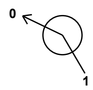
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	10.646	59.8	100	Circular	14.434	13.129	1.205	14.450	12.951	1.399
1.002	13.422	58.1	150	Circular	14.450	12.951	1.349	14.486	12.720	1.616
1.003	17.274	55.7	225	Circular	14.486	12.540	1.721	14.767	12.230	2.312
1.004	18.908	164.4	225	Circular	14.767	12.230	2.312	15.052	12.115	2.712
1.005	3.339	167.0	225	Circular	15.052	12.115	2.712	14.964	12.095	2.644
1.006	27.568	75.1	225	Circular	14.964	12.095	2.644	13.886	11.728	1.933
1.007	35.919	81.3	225	Circular	13.886	11.727	1.934	12.717	11.285	1.207
1.008	51.616	23.5	225	Circular	12.717	11.265	1.227	11.402	9.070	2.107
1.009	37.106	97.6	150	Circular	11.402	9.070	2.182	10.355	8.690	1.515
1.0010	33.044	41.3	150	Circular	10.355	8.690	1.515	9.263	7.889	1.224
1.0011	18.027	11.5	150	Circular	9.263	7.869	1.244	8.104	6.302	1.652
1.0012	15.071	10.0	150	Circular	8.104	6.302	1.652	6.146	4.795	1.201
1.0013	17.335	10.1	150	Circular	6.146	4.689	1.307	4.449	2.971	1.328
1.0014	38.410	36.1	150	Circular	4.449	2.951	1.348	3.353	1.887	1.316
1.0015	37.470	162.9	225	Circular	3.221	1.650	1.346	3.127	1.420	1.482
1.0016	26.254	164.1	225	Circular	3.127	1.420	1.482	3.245	1.260	1.760
1.0017	13.867	163.1	225	Circular	3.245	1.260	1.760	3.208	1.175	1.808
1.0018	32.267	165.5	225	Circular	3.208	1.175	1.808	1.362	0.980	0.157
2.004	12.218	54.5	100	Circular	14.141	12.836	1.205	14.099	12.612	1.387
2.005	8.534	60.1	100	Circular	14.099	12.612	1.387	14.410	12.470	1.840
2.006	13.262	60.3	150	Circular	14.410	12.450	1.810	14.767	12.230	2.387
3.001	11.180	19.0	150	Circular	15.590	14.170	1.270	14.964	13.583	1.231
1.0014 (1)	36.634	154.6	225	Circular	3.353	1.887	1.241	3.221	1.650	1.346
3.0041	14.639	127.3	225	Circular	11.619	9.185	2.209	11.402	9.070	2.107

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	SW-01	450	Manhole	Adoptable	SW-02	450	Manhole	Adoptable
1.002	SW-02	450	Manhole	Adoptable	SW-03	1200	Manhole	Adoptable
1.003	SW-03	1200	Manhole	Adoptable	SW-04	1200	Manhole	Adoptable
1.004	SW-04	1200	Manhole	Adoptable	SW-05	1200	Manhole	Adoptable
1.005	SW-05	1200	Manhole	Adoptable	SW-06	1200	Manhole	Adoptable
1.006	SW-06	1200	Manhole	Adoptable	SW-07	450	Manhole	Adoptable
1.007	SW-07	450	Manhole	Adoptable	SW-08	450	Manhole	Adoptable
1.008	SW-08	450	Manhole	Adoptable	SW-09	1200	Manhole	Adoptable
1.009	SW-09	1200	Manhole	Adoptable	SW-010	1350	Manhole	Adoptable
1.0010	SW-010	1350	Manhole	Adoptable	SW-011	450	Manhole	Adoptable
1.0011	SW-011	450	Manhole	Adoptable	SW-012	450	Manhole	Adoptable
1.0012	SW-012	450	Manhole	Adoptable	SW-013	450	Manhole	Adoptable
1.0013	SW-013	450	Manhole	Adoptable	SW-014	1200	Manhole	Adoptable
1.0014	SW-014	1200	Manhole	Adoptable	SW-024	450	Manhole	Adoptable
1.0015	SW-015	1200	Manhole	Adoptable	SW-016	450	Manhole	Adoptable
1.0016	SW-016	450	Manhole	Adoptable	SW-017	450	Manhole	Adoptable
1.0017	SW-017	450	Manhole	Adoptable	SW-018	450	Manhole	Adoptable
1.0018	SW-018	450	Manhole	Adoptable	SW-019	450	Manhole	Adoptable
2.004	SW-020	450	Manhole	Adoptable	SW-021	450	Manhole	Adoptable
2.005	SW-021	450	Manhole	Adoptable	SW-022	450	Manhole	Adoptable
2.006	SW-022	450	Manhole	Adoptable	SW-04	1200	Manhole	Adoptable
3.001	SW-023	450	Manhole	Adoptable	SW-06	1200	Manhole	Adoptable
1.0014 (1)	SW-024	450	Manhole	Adoptable	SW-015	1200	Manhole	Adoptable
3.0041	SW-033		Junction		SW-09	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SW-023	317856.530	478989.854	15.590	1.420	450		0	3.001	14.170	150
SW-05	317858.475	478981.611	15.052	2.937	1200		1	1.004	12.115	225
							0	1.005	12.115	225
SW-06	317856.878	478978.679	14.964	2.869	1200		1	3.001	13.583	150
							2	1.005	12.095	225
							0	1.006	12.095	225
SW-04	317877.316	478980.023	14.767	2.537	1200		1	2.006	12.230	150
							2	1.003	12.230	225
							0	1.004	12.230	225
SW-03	317890.258	478991.464	14.486	1.946	1200		1	1.002	12.720	150
							0	1.003	12.540	225
SW-02	317903.571	478993.174	14.450	1.499	450		1	1.001	12.951	100
							0	1.002	12.951	150
SW-01	317913.620	478989.659	14.434	1.305	450		0	1.001	13.129	100
SW-022	317890.431	478978.056	14.410	1.960	450		1	2.005	12.470	100
							0	2.006	12.450	150
SW-020	317906.598	478967.391	14.141	1.305	450		0	2.004	12.836	100
SW-021	317894.853	478970.757	14.099	1.487	450		1	2.004	12.612	100
							0	2.005	12.612	100
SW-07	317879.630	478963.111	13.886	2.159	450		1	1.006	11.728	225
							0	1.007	11.727	225
SW-08	317913.440	478950.985	12.717	1.452	450		1	1.007	11.285	225
							0	1.008	11.265	225
SW-033	317964.533	478943.649	11.619	2.434			0	3.0041	9.185	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SW-09	317964.179	478941.510	11.402	2.332	1200		1	3.0041	9.070	225
							2	1.008	9.070	225
							0	1.009	9.070	150
SW-010	318000.768	478935.337	10.355	1.665	1350		1	1.009	8.690	150
							0	1.0010	8.690	150
SW-011	318027.787	478916.313	9.263	1.394	450		1	1.0010	7.889	150
							0	1.0011	7.869	150
SW-012	318043.511	478907.497	8.104	1.802	450		1	1.0011	6.302	150
							0	1.0012	6.302	150
SW-013	318056.398	478915.311	6.146	1.457	450		1	1.0012	4.795	150
							0	1.0013	4.689	150
SW-014	318057.059	478932.633	4.449	1.498	1200		1	1.0013	2.971	150
							0	1.0014	2.951	150
SW-024	318043.065	478968.403	3.353	1.466	450		1	1.0014	1.887	150
							0	1.0014 (1)	1.887	225
SW-017	317987.052	479046.195	3.245	1.985	450		1	1.0016	1.260	225
							0	1.0017	1.260	225
SW-015	318029.719	479002.519	3.221	1.571	1200		1	1.0014 (1)	1.650	225
							0	1.0015	1.650	225
SW-018	317973.205	479046.931	3.208	2.033	450		1	1.0017	1.175	225
							0	1.0018	1.175	225
SW-016	318010.709	479034.809	3.127	1.707	450		1	1.0015	1.420	225
							0	1.0016	1.420	225
SW-019	317957.633	479075.192	1.362	0.382	450		1	1.0018	0.980	225

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
Rainfall Events	Singular	Additional Storage (m³/ha)	0.0
FSR Region	England and Wales	Starting Level (m)	
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	5.7
Summer CV	0.750	30 year (l/s)	5.7
Winter CV	0.840	100 year (l/s)	5.7
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +35% 360 minute (m³)	123

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	30	0	0
100	35	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.281	Betterment (%)	0
SAAR (mm)	1020	QBar	2.1
Soil Index	4	Q 1 year (l/s)	1.8
SPR	0.47	Q 30 year (l/s)	4.1
Region	10	Q 100 year (l/s)	5.2
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	35
Positively Drained Area (ha)	0.281	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.532
CWI	125.050	Runoff Volume (m³)	123

Node SW-09 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	9.070	Product Number	CTL-SHE-0105-5700-1500-5700
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.7	Min Node Diameter (mm)	1200

Node SW-033 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	9.185
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	28

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	106.0	106.0	1.500	106.0	160.7

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-023	10	14.205	0.035	4.7	0.0056	0.0000	OK
15 minute winter	SW-05	10	12.262	0.147	27.5	0.1665	0.0000	OK
15 minute winter	SW-06	10	12.217	0.122	32.0	0.1377	0.0000	OK
15 minute winter	SW-04	10	12.343	0.113	19.3	0.1278	0.0000	OK
15 minute winter	SW-03	10	12.600	0.060	10.9	0.0676	0.0000	OK
15 minute summer	SW-02	10	12.997	0.046	4.5	0.0073	0.0000	OK
15 minute summer	SW-01	10	13.173	0.044	3.0	0.0070	0.0000	OK
15 minute winter	SW-022	10	12.494	0.044	4.3	0.0070	0.0000	OK
15 minute winter	SW-020	10	12.856	0.020	0.7	0.0031	0.0000	OK
15 minute winter	SW-021	10	12.655	0.043	2.8	0.0069	0.0000	OK
15 minute winter	SW-07	11	11.850	0.123	31.8	0.0195	0.0000	OK
15 minute winter	SW-08	11	11.348	0.083	31.6	0.0132	0.0000	OK
60 minute winter	SW-033	49	9.305	0.120	13.7	12.6824	0.0000	OK
15 minute winter	SW-09	12	9.339	0.269	34.0	0.3045	0.0000	SURCHARGED
15 minute winter	SW-010	13	8.734	0.044	5.2	0.0635	0.0000	OK
15 minute winter	SW-011	13	7.901	0.032	5.1	0.0051	0.0000	OK
15 minute winter	SW-012	13	6.333	0.031	5.1	0.0050	0.0000	OK
30 minute summer	SW-013	21	4.720	0.031	5.1	0.0050	0.0000	OK
15 minute winter	SW-014	14	2.993	0.042	5.1	0.0478	0.0000	OK
15 minute winter	SW-024	12	1.941	0.054	5.1	0.0085	0.0000	OK
15 minute winter	SW-017	16	1.316	0.056	5.1	0.0088	0.0000	OK
15 minute winter	SW-015	14	1.704	0.054	5.1	0.0616	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-023	3.001	SW-06	4.7	1.514	0.115	0.0347	
15 minute winter	SW-05	1.005	SW-06	27.3	1.102	0.680	0.0825	
15 minute winter	SW-06	1.006	SW-07	31.8	1.468	0.530	0.5973	
15 minute winter	SW-04	1.004	SW-05	19.1	0.801	0.471	0.4488	
15 minute winter	SW-03	1.003	SW-04	10.9	0.785	0.156	0.2452	
15 minute summer	SW-02	1.002	SW-03	4.5	1.002	0.192	0.0602	
15 minute summer	SW-01	1.001	SW-02	3.0	0.875	0.383	0.0365	
15 minute winter	SW-022	2.006	SW-04	4.3	0.459	0.186	0.1228	
15 minute winter	SW-020	2.004	SW-021	0.7	0.331	0.085	0.0264	
15 minute winter	SW-021	2.005	SW-022	2.8	0.887	0.356	0.0268	
15 minute winter	SW-07	1.007	SW-08	31.6	1.465	0.548	0.7749	
15 minute winter	SW-08	1.008	SW-09	31.7	1.015	0.294	1.3702	
60 minute winter	SW-033	3.0041	SW-09	-13.7	-0.521	-0.298	0.4481	
15 minute winter	SW-09	1.009	SW-010	5.2	1.005	0.287	0.1964	
15 minute winter	SW-010	1.0010	SW-011	5.1	1.194	0.185	0.1425	
15 minute winter	SW-011	1.0011	SW-012	5.1	1.892	0.097	0.0490	
15 minute winter	SW-012	1.0012	SW-013	5.1	1.967	0.091	0.0393	
30 minute summer	SW-013	1.0013	SW-014	5.1	1.965	0.091	0.0453	
15 minute winter	SW-014	1.0014	SW-024	5.1	1.239	0.173	0.1863	
15 minute winter	SW-024	1.0014 (1)	SW-015	5.1	0.796	0.123	0.2675	
15 minute winter	SW-017	1.0017	SW-018	5.1	0.734	0.126	0.1044	
15 minute winter	SW-015	1.0015	SW-016	5.1	0.753	0.126	0.2775	

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-018	16	1.230	0.055	5.1	0.0087	0.0000	OK
15 minute winter	SW-016	15	1.475	0.055	5.1	0.0087	0.0000	OK
15 minute winter	SW-019	17	1.034	0.054	5.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-018	1.0018	SW-019	5.1	0.696	0.127	0.2370	14.5
15 minute winter	SW-016	1.0016	SW-017	5.1	0.697	0.127	0.1975	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-023	10	14.237	0.067	14.9	0.0106	0.0000	OK
15 minute winter	SW-05	11	13.026	0.911	62.7	1.0307	0.0000	SURCHARGED
15 minute winter	SW-06	11	12.919	0.824	74.1	0.9314	0.0000	SURCHARGED
15 minute winter	SW-04	12	13.174	0.944	43.5	1.0678	0.0000	SURCHARGED
15 minute winter	SW-03	12	13.224	0.684	33.0	0.7735	0.0000	SURCHARGED
15 minute winter	SW-02	12	13.285	0.334	12.9	0.0532	0.0000	SURCHARGED
15 minute winter	SW-01	12	13.444	0.315	9.4	0.0502	0.0000	SURCHARGED
15 minute winter	SW-022	12	13.217	0.767	10.6	0.1220	0.0000	SURCHARGED
15 minute winter	SW-020	12	13.300	0.464	4.8	0.0737	0.0000	SURCHARGED
15 minute winter	SW-021	12	13.292	0.680	8.6	0.1081	0.0000	SURCHARGED
15 minute winter	SW-07	12	12.272	0.545	72.7	0.0866	0.0000	SURCHARGED
15 minute winter	SW-08	12	11.399	0.134	72.4	0.0214	0.0000	OK
180 minute winter	SW-033	152	9.882	0.697	22.8	73.9019	0.0000	SURCHARGED
180 minute winter	SW-09	152	9.882	0.812	29.4	0.9186	0.0000	SURCHARGED
30 minute summer	SW-010	46	8.737	0.047	5.7	0.0670	0.0000	OK
30 minute summer	SW-011	46	7.903	0.034	5.7	0.0054	0.0000	OK
30 minute summer	SW-012	47	6.335	0.033	5.7	0.0052	0.0000	OK
30 minute summer	SW-013	47	4.722	0.033	5.7	0.0052	0.0000	OK
30 minute summer	SW-014	47	2.996	0.045	5.7	0.0504	0.0000	OK
15 minute winter	SW-024	10	1.944	0.057	5.7	0.0090	0.0000	OK
15 minute winter	SW-017	13	1.319	0.059	5.7	0.0094	0.0000	OK
15 minute winter	SW-015	11	1.708	0.058	5.7	0.0651	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-023	3.001	SW-06	14.9	2.052	0.364	0.0812	
15 minute winter	SW-05	1.005	SW-06	60.8	1.530	1.517	0.1328	
15 minute winter	SW-06	1.006	SW-07	72.7	1.828	1.210	1.0964	
15 minute winter	SW-04	1.004	SW-05	44.0	1.108	1.090	0.7520	
15 minute winter	SW-03	1.003	SW-04	27.4	0.888	0.392	0.6870	
15 minute winter	SW-02	1.002	SW-03	12.7	1.242	0.545	0.2363	
15 minute winter	SW-01	1.001	SW-02	8.2	1.087	1.051	0.0833	
15 minute winter	SW-022	2.006	SW-04	13.4	0.760	0.583	0.2335	
15 minute winter	SW-020	2.004	SW-021	3.8	0.479	0.457	0.0956	
15 minute winter	SW-021	2.005	SW-022	8.6	1.103	1.104	0.0668	
15 minute winter	SW-07	1.007	SW-08	72.4	1.822	1.255	1.4085	
15 minute winter	SW-08	1.008	SW-09	72.6	2.018	0.674	1.6640	
180 minute winter	SW-033	3.0041	SW-09	-22.8	-0.574	-0.496	0.5822	
180 minute winter	SW-09	1.009	SW-010	5.7	1.002	0.317	0.2115	
30 minute summer	SW-010	1.0010	SW-011	5.7	1.228	0.205	0.1533	
30 minute summer	SW-011	1.0011	SW-012	5.7	1.946	0.108	0.0528	
30 minute summer	SW-012	1.0012	SW-013	5.7	2.027	0.101	0.0424	
30 minute summer	SW-013	1.0013	SW-014	5.7	2.025	0.101	0.0488	
30 minute summer	SW-014	1.0014	SW-024	5.7	1.216	0.192	0.2006	
15 minute winter	SW-024	1.0014 (1)	SW-015	5.7	0.813	0.137	0.2892	
15 minute winter	SW-017	1.0017	SW-018	5.7	0.766	0.141	0.1131	
15 minute winter	SW-015	1.0015	SW-016	5.7	0.772	0.141	0.2999	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-018	14	1.233	0.058	5.7	0.0092	0.0000	OK
15 minute winter	SW-016	13	1.478	0.058	5.7	0.0092	0.0000	OK
15 minute winter	SW-019	14	1.037	0.057	5.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-018	1.0018	SW-019	5.7	0.717	0.142	0.2566	46.8
15 minute winter	SW-016	1.0016	SW-017	5.7	0.714	0.141	0.2140	

Results for 100 year +35% CC Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-023	10	14.250	0.080	19.9	0.0127	0.0000	OK
15 minute winter	SW-05	12	13.665	1.550	74.0	1.7531	0.0000	SURCHARGED
15 minute winter	SW-06	12	13.515	1.420	88.6	1.6055	0.0000	SURCHARGED
15 minute winter	SW-04	12	13.881	1.651	48.1	1.8676	0.0000	SURCHARGED
15 minute winter	SW-03	12	13.951	1.411	36.6	1.5954	0.0000	SURCHARGED
15 minute winter	SW-02	12	14.024	1.073	14.0	0.1706	0.0000	SURCHARGED
15 minute winter	SW-01	12	14.222	1.093	12.6	0.1737	0.0000	FLOOD RISK
15 minute winter	SW-022	12	13.925	1.475	11.2	0.2345	0.0000	SURCHARGED
15 minute winter	SW-020	13	14.012	1.176	7.1	0.1870	0.0000	FLOOD RISK
15 minute winter	SW-021	12	13.992	1.380	10.9	0.2194	0.0000	FLOOD RISK
15 minute winter	SW-07	12	12.605	0.878	86.1	0.1396	0.0000	SURCHARGED
15 minute winter	SW-08	13	11.431	0.166	86.4	0.0264	0.0000	OK
240 minute winter	SW-033	228	10.297	1.112	26.4	117.8913	0.0000	SURCHARGED
240 minute winter	SW-09	228	10.297	1.227	32.8	1.3879	0.0000	SURCHARGED
15 minute summer	SW-010	39	8.737	0.047	5.7	0.0670	0.0000	OK
15 minute summer	SW-011	40	7.903	0.034	5.7	0.0054	0.0000	OK
15 minute summer	SW-012	41	6.335	0.033	5.7	0.0052	0.0000	OK
15 minute summer	SW-013	41	4.722	0.033	5.7	0.0052	0.0000	OK
15 minute summer	SW-014	40	2.996	0.045	5.7	0.0504	0.0000	OK
15 minute winter	SW-024	10	1.944	0.057	5.7	0.0090	0.0000	OK
15 minute winter	SW-017	13	1.319	0.059	5.7	0.0094	0.0000	OK
15 minute winter	SW-015	11	1.708	0.058	5.7	0.0654	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-023	3.001	SW-06	19.9	2.196	0.486	0.1013	
15 minute winter	SW-05	1.005	SW-06	72.0	1.810	1.794	0.1328	
15 minute winter	SW-06	1.006	SW-07	86.1	2.165	1.434	1.0964	
15 minute winter	SW-04	1.004	SW-05	51.8	1.304	1.282	0.7520	
15 minute winter	SW-03	1.003	SW-04	28.9	0.880	0.414	0.6870	
15 minute winter	SW-02	1.002	SW-03	14.4	1.225	0.615	0.2363	
15 minute winter	SW-01	1.001	SW-02	8.6	1.107	1.103	0.0833	
15 minute winter	SW-022	2.006	SW-04	16.3	0.924	0.710	0.2335	
15 minute winter	SW-020	2.004	SW-021	5.2	0.662	0.630	0.0956	
15 minute winter	SW-021	2.005	SW-022	10.6	1.349	1.350	0.0668	
15 minute winter	SW-07	1.007	SW-08	86.4	2.172	1.497	1.4141	
15 minute winter	SW-08	1.008	SW-09	85.8	2.245	0.797	1.8384	
240 minute winter	SW-033	3.0041	SW-09	-26.4	-0.663	-0.573	0.5822	
240 minute winter	SW-09	1.009	SW-010	5.7	1.002	0.317	0.2115	
15 minute summer	SW-010	1.0010	SW-011	5.7	1.228	0.205	0.1533	
15 minute summer	SW-011	1.0011	SW-012	5.7	1.946	0.108	0.0528	
15 minute summer	SW-012	1.0012	SW-013	5.7	2.027	0.101	0.0424	
15 minute summer	SW-013	1.0013	SW-014	5.7	2.025	0.101	0.0488	
15 minute summer	SW-014	1.0014	SW-024	5.7	1.390	0.192	0.2006	
15 minute winter	SW-024	1.0014 (1)	SW-015	5.7	0.839	0.138	0.2898	
15 minute winter	SW-017	1.0017	SW-018	5.7	0.778	0.141	0.1130	
15 minute winter	SW-015	1.0015	SW-016	5.8	0.772	0.142	0.3001	

Results for 100 year +35% CC Critical Storm Duration. Lowest mass balance: 98.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW-018	44	1.233	0.058	5.7	0.0092	0.0000	OK
15 minute winter	SW-016	12	1.478	0.058	5.8	0.0092	0.0000	OK
15 minute summer	SW-019	44	1.037	0.057	5.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW-018	1.0018	SW-019	5.7	0.717	0.141	0.2564	56.9
15 minute winter	SW-016	1.0016	SW-017	5.7	0.719	0.142	0.2139	

Job Title:	**Millom Iron Line**						
Job No:	081617						
Made by:	CC	**Checked:**	GW	**Sheet No.**	1		
Date:	07/04/2025	**Date:**	14/11/2023	**of**	1		
Calculation		081617-CUR-ZZ-XX-T-C-92702		Revision:	P01		

Curtins

SOURCE OF WASTE: British Water Flows and Loads 4 BW COP: 18.11/14

Description	No.	FLOW (LITRES / DAY)		BOD (GRAMS / DAY)		NH_3	
		Per head	TOTAL	Per head	TOTAL	Per head	TOTAL
Canteen (provides hot drinks, pre-prepared sandwiches, cakes, confectionary etc) (Assumed Calc value of Restaurants - Snack Bars & bar meals)	58	15	870	19	1102	2.5	145
Staff workers - (Office / Factory without canteen)	10	50	500	25	250	5	50
Visitor toilets (Toilet (WC) (per use)	150	10	1500	12	1800	2.5	375
TOTAL LOADS	**218**	**75**	**2870**	**56**	**3152**	**10**	**570**

Average Discharge Rate - (l/s) (DWF) 0.089 *****
Design Peak Discharge Rate (l/s) (6DWF) 0.531

Notes:

1. ***Visitor centre operating hours 9am to 6pm (daily) - Discharge rates reflect demand over 9hr operating period.**
2. Effluent quality required to satisfy freshwater bathing water quality requirements (UK)
3. If discharging to ground, an Environment Agency Permit is required for daily discharge of 2 cubic metres (2,000 litres) a day
4. If discharging to ground, treated effluent must be discharged to a drainage field, designed in accrdance with BS 6297:2007
5. If discharging to a watercourse, an Environment Agency Permit is required for daily discharge of 5 cubic metres (5,000 litres) a day
6. Treatment plants should only be used where there is no foul water drain or sewer within "reasonable" distance. The EA has a formula to assess

Appendix D Water Quality Assessment

Curtins

Made By: GW
Checked By: AMB

Water Quality Assessment - Simple Index Approach - Options

Discharges to surface waters - Commerical Roof, footway/car park, carriageway/access and potentially an industrial access road (TBC)

Required for events up to 1:1 year Simple index approach (SuDs Manual, Ch 26)

Land use classification	Pollution Hazard Level	Note	TSS	Metals	HCs
Residential roofs	Very Low	Residential roofs	0.2	0.2	0.05
Commercial roofs	Low	Typically commercial/ industrial roofs	0.3	0.4	0.05
Individual property driveway	Low	Driveways/car parks, low traffic access roads, schools, offices, <300 movements/day	0.5	0.4	0.4
Commercial yards	Medium	Yards and delivery areas/access	0.7	0.6	0.7
Docks	Medium	Commerical loading docks/ramps	0.7	0.6	0.7
Car parking	Medium	Non residential car parks with frequent change areas - hospital, retail	0.7	0.6	0.7
Roads	Medium	All roads except for low traffic and trunk roads/motorways	0.7	0.6	0.7
Industrial Yards	High	Haulage yards, lorry parks, highly frequent industrial estates, sites with chemicals and fuel delivery, handled, stores, used or manufactured: industrial sites, trunk roads and motorways	0.8	0.8	0.9

Surface water protection measures

	Hazard Indices				SuDS Treatment Train			Mitigation Indices		
Catchment	Hazard	TSS	metals	HCs	Step 1	Step 2	Step 3	TSS.	metals.	HCs.
Footway, Car Park Option 1	Medium	0.7	0.6	0.7	Sediment trap			0.4	0.4	0.4
Footway, Car Park Option 2	Medium	0.7	0.6	0.7	Filter drain	Sediment trap		0.6	0.6	0.6
Footway, Car Park Option 3	Medium	0.7	0.6	0.7	Permeable pavement	Sediment trap	'Downstream Defener Adv	1.15	1	1.15
Footway, Carriageway Option 1	Medium	0.7	0.6	0.7	Sediment trap	'Downstream Defener Adv. Vortex'		0.65	0.6	0.65
Footway, Carriageway Option 2	Medium	0.7	0.6	0.7	Sediment trap	'QuadraCeptor'		0.8	0.8	0.8
Carrriageway - industrial access to tip Option 1 (if drained)	High	0.8	0.8	0.9	Sediment trap	'QuadraCeptor'		0.8	0.8	0.8
Carrriageway - industrial access to tip Option 2 (if drained)	High	0.8	0.8	0.9	Filter drain	Sediment trap	'QuadraCeptor'	1	1	1
Commercial roofs	Low	0.3	0.4	0.05	Sediment trap			0.4	0.4	0.4

Curtins

Our Locations

Birmingham
2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol
Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cambridge
50 Cambridge Place
Cambridge
CB2 1NS
T. 01223 631 799
cambridge@curtins.com

Cardiff
3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas
Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin
11 Pembroke Lane
Dublin 2
D02 CX82
Ireland
T. +353 1 507 9447
dublin@curtins.com

Edinburgh
1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow
Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal
Units 24 & 25 Riverside Place
K Village
Lound Road
Kendal
LA9 7FH
T. 01539 724 823
kendal@curtins.com

Leeds
Ground Floor
Rose Wharf
78-80 East Street
Leeds
LS9 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool
51-55 Tithebarn Street
Liverpool
L2 2SB
T. 0151 726 2000
liverpool@curtins.com

London
40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham
56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com