

DRAINAGE STRATEGY REPORT

PROPOSED PHASE 3 DEVELOPMENT AT
YSGOL GYFUN YSTALYFERA, SWANSEA.

Project Reference

6685

Report Reference

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Client

Andrew Scott Construction Ltd.

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1. INTRODUCTION

This Drainage Strategy Report outlines the preliminary research undertaken by Bingham Hall Partnership Limited (BHPL) up to Planning Process and is intended to outline the research undertaken to date, known facts and the design intent for the proposed foul and surface water drainage systems serving the proposed new building to the north of the site. Further investigation and discussion with Dwr Cymru/Welsh Water and the SAB Officer will be required to finalise the drainage solution and SuDs requirements for the proposed development.

1.1 BACKGROUND

BHPL has been commissioned as part of Andrew Scott Ltd.'s design team to undertake the Civil & Structural Engineering aspects of the proposed development which involves demolition of various existing buildings to create room for a new two storey teaching block with hall on the site. The area affected by the proposal has been highlighted in red in Figure 1-1 below; whilst the proposed site plan, indicating the new structure has been shown in Figure 1-2. The extent of the demolition has been highlighted in Figure 1-1 and includes the disposal of the following existing buildings / facilities: 'Tawe' building, Maths and Glasshouse, Swimming Pool and Gymnasium. Following completion of the new building, demolition of the existing Canteen and Music / Drama building will be undertaken.

The ambition of the development is to construct a new two storey teaching block on the site of the YGG Ystalyfera, to BREEAM "Excellent" and "Secure by Design" standards. The new development will connect with the former Phase I development. Figure 1-1 below shows the site area (edged in red) and the extent of existing buildings which are to be demolished. Proposed development plans can be found in **Appendix A** of this report.



Figure 1-1. Existing Site Plan Showing Extent of Demolition

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1.2 SITE LOCATION

The site area forms part of the existing Ysgol Gyfun Ystalyfera School central to the town of Ystalyfera, in the upper Swansea Valley, some 13 miles north-east of Swansea City centre.

The National Grid reference for the development site is E277066, N208839. The development site covers an approximate area of 100.0m x 50.0m. The development is located in the north-western corner of the school premises; the site is bounded to the north by residential housing and a 'spiritualistic church', directly north of the proposed building; the site is bounded to the immediate west by Ynisyddarren Road, which is also used as the main access / bus route for the school and will also be used for the construction works. The completed Phase I school building lies to the immediate south to which the new building will be connected via a small linkway structure at both ground and first floor. The remainder of the school, including the Phase II works (primary school), lies to the south east of the site. The closest watercourse is the River Twrch which lies some 100.0m east of the school site on the eastern side of Glanyrafon Road. The river flows in north-south direction and converges with the River Tawe 350.0m south of the site.

The existing school site is fully developed by existing buildings and external concrete / tarmac hardstanding areas; the exception to this are small areas of grassed verges to a number of the existing buildings which are to be demolished as part of this development. see Figure 1-1.

1.3 PROPOSED DEVELOPMENT

The proposed development will comprise the construction of a new two-storey teaching block with sports hall / changing room / canteen facilities. The construction will include a new steel framed building located towards the north of the site as shown by Fig 1-2 below. The works are to include demolition of several existing buildings to free up the area to allow construction of the new two storey structure. The new building shall house a double storey height Hall / Activity Hall, Kitchen / Dining area / Bathroom facilities and Classrooms, situated on the first floor. The planning application and Phase III development comprises solely of the proposed building described above.

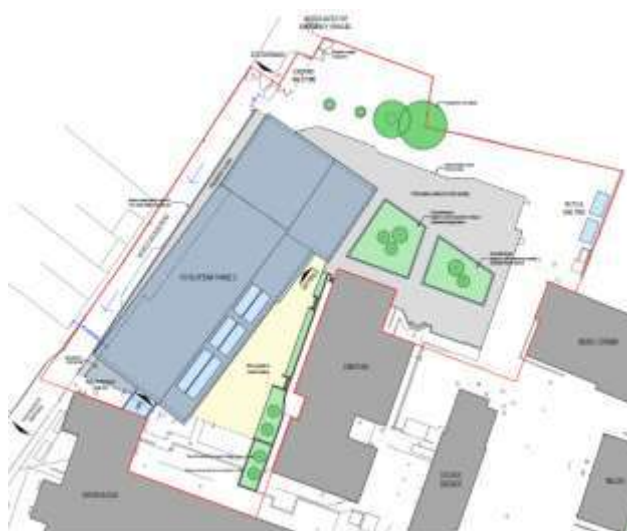


Figure 1-2. Proposed Site Plan with New Building Shaded Blue

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2. SUMMARY OF GROUND CONDITIONS

A desk top study investigation has been undertaken by Quantum Geotech in March 2020; additionally, reference has been made to the Ground Investigation produced by Environmental Scientifics Group for the entire site during September 2014; the results of which have been summarised below. The desk top study report by Quantum Geotech shall be submitted as part of the planning application with the following references:

- Quantum Geotech's Preliminary Risk Assessment / Desk Study; reference: Q022 / PRA

The report indicates Made Ground can be expected across the site, with a maximum thickness of 1.20m below ground level, although in most areas it's typically no thicker than 0.60 m. The natural, superficial Drift deposits, encountered across the site, are considered to be a combination of Glaciofluvial Deposits and more recent Alluvium; although distinction between the two is unclear. The coarser materials, often dominated by gravel and containing cobbles, have been taken to represent Glaciofluvial Deposits, whereas those typically dominated by soft, fine-grained soils, which are locally found to overlie the coarser materials, are thought more likely to be associated with rivers that currently occupy the valley. The coarser grained Drift materials, taken to represent Glaciofluvial deposits, were encountered beneath most of the site area. A summary of the ground conditions is shown in Table 2-1 below:

Table 2-1: Summary of Ground Conditions

Stratum Encountered	Range of Thicknesses
Topsoil / Made Ground	0.20 to 1.20m
Alluvium	0.20 to >0.75m (base of stratum not proved)
Glaciofluvial Deposits	>0.35 to >28.90m (base of stratum provided in two locations only)
South Wales Middle Coal	>2.40 to >31.30m (base of stratum not proved)

Infiltration

The viability of infiltration drainage / soakaways was considered as part of the ground investigation referenced above; two trial pits were excavated with three tests undertaken for each of the pits. Two of the three tests in each trial pit were successful, giving soil infiltration rates of 1.1×10^{-3} and 4.6×10^{-4} m/s in TP1 and 1.3×10^{-4} m/s and 1.5×10^{-4} m/s in TP2. The tests were carried out within the Glaciofluvial deposits which, being dominated by coarse and very coarse materials, were anticipated to possess relatively high permeability characteristics, as demonstrated by the test results. The two trial pits above were undertaken as part of the Phase II development; the lower bound value of 1.3×10^{-4} m/s will be used as a preliminary value for the initial sizing of the proposed soakaway for this Phase III development. Due to the lateral variations in ground conditions across the site, further targeted infiltration tests local to the proposed soakaway will be undertaken as the project develops.

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3. PLANNING POLICY AND GUIDANCE

Technical Advice Note 15 (TAN15) provides guidance which supplements the policy set out in Planning Policy Wales (PPW) in relation to development and flooding. A precautionary framework is set out which advises caution in respect of new development in areas at high risk of flooding and this is used as a guide for planning decisions. The overall aim of the precautionary framework is to direct new development away from those areas that have a high risk of flooding; and development will only be justified in these areas if it meets the criteria and tests specified in this guidance.

The operation of the precautionary framework is governed by Development Advice Maps (DAMs), which are made up of three zones (Table 3-1), used to trigger the appropriate planning test and definitions of vulnerable developments. The DAMs are based on the best available information considered adequate to determine when flood risk needs to be taken into consideration with future development.

Table 3-1: Flood Zone designations, their associated flood risk definition and use with the precautionary framework (Source: TAN 15)

Zone	Definition	Use within precautionary framework
A	Little or no risk of fluvial / tidal flooding	Justification test is not applied and do not need to consider further
B	Areas known to have flooded historically evidenced by sedimentary deposits	Used as part of the precautionary approach to indicate where site levels should be checked against the extreme (0.1% annual probability) flood. No need to consider flood risks further if site levels are greater than the extreme flood level
C	Based on Environment Agency extreme flood outline (0.1% annual probability)	Indicates that flooding issues should be considered as an integral part of the decision making by the application of the justification test, including FCA.
C1	Areas of Zone C which are developed and served by significant infrastructure, including flood defences	Indicates that development can take place subject to the application of the justification test, including acceptability of consequences
C2	Areas of Zone C without significant flood defence infrastructure	Indicates that only 'less vulnerable' development should be considered, subject to the application of the justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered

The precautionary framework identifies the vulnerability of different land uses to flooding and classifies proposed uses accordingly, as detailed in Table 3-2. This is because certain flooding consequences may not be acceptable for certain types of development.

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Table 3-2: Development Categories (Source TAN 15)

Flood Zone Definition	Use within precautionary framework
Emergency Services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood.
Highly vulnerable development	All residential premises (including hotels and caravan parks), public buildings (e.g. <u>schools</u> , libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites

According to TAN 15, new development should be directed away from Zone C and towards more suitable land in Zone A, otherwise to Zone B, where river or coastal flooding will present less risk than Zone C.

Built development tends to increase the surface area of impermeable ground, thus reducing percolation and increasing rapid surface runoff. The following drainage strategy for the proposed development will demonstrate how runoff will be sustainably managed, preventing increased risk to both the site and surrounding area.

4. FLOOD RISK TO DEVELOPMENT

A Flood Risk Statement for the site has been prepared by JBA Consulting; a copy of the technical note has been submitted as part of the planning application and can be made available upon request and should be referenced regarding all matters relating to flood risk. The technical note concludes that the proposed development is at a low risk of flooding from all sources and meets the requirements of TAN15.

TAN 15 requires that all potential flood sources that could affect the proposed development be considered. This includes flooding from rivers and the sea, directly from rainfall on the ground surface, rising groundwater, and overwhelmed sewers and drainage systems. Flooding from reservoirs, canals, lakes and other artificial sources should also be considered. There should be demonstration of how these should be managed so that the development remains safe throughout its lifetime, whilst taking climate change under consideration.

A summary of the findings of JBA Consulting's Technical Note, along with snapshots of NRW's Flood Maps can be seen below:

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4.1 FLOOD RISK FROM TIDAL / FLUVIAL SOURCES

BHPL have consulted NRW's Development Advice Map (DAM), Figure 4-1; formerly produced by Welsh Assembly Government based on the flood extents shown on the NRW's Flood Maps or amended resulting from any local studies that have been undertaken and approved by NRW. The snapshot of the advice map indicates the development site to lie wholly in Zone B; with reference to Table 4-1, an area known to have flooded historically, evidenced by sedimentary deposits; as a precautionary approach, site levels will be checked against the extreme (0.1% annual probability) flood; flood risks are not considered any further, providing site levels are greater than the extreme flood level.

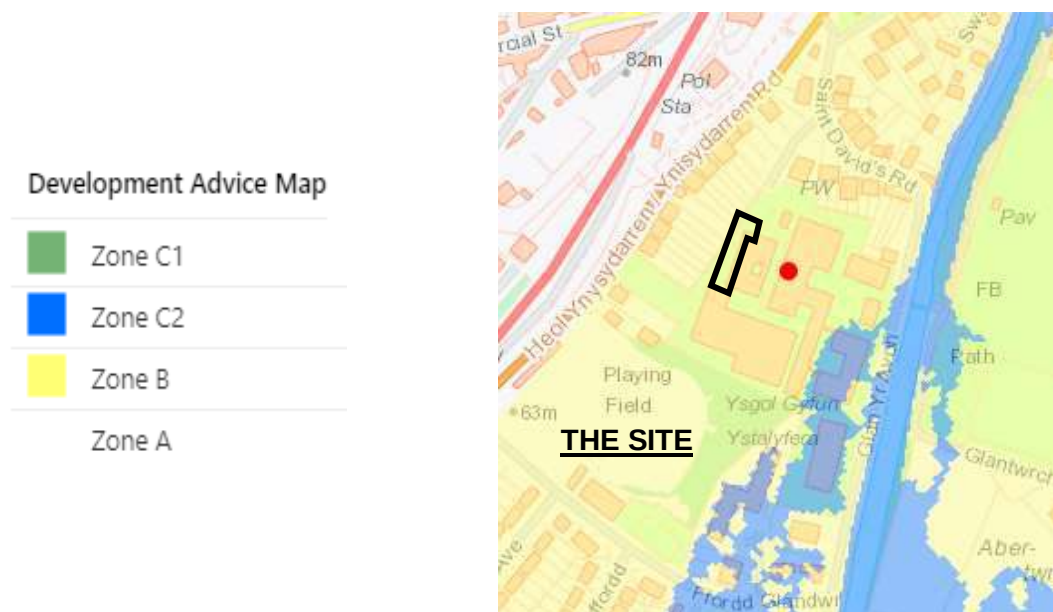


Figure 4-1. A Snapshot of NRW's Flood Development Advice Map (DAM)

Figure 4-2 below shows the NRW's flood risk map from Rivers and Sea; the map indicates that the site is located within Flood Zone 1, suggesting that there is less than a 0.1% Annual Exceedance Probability (AEP) of the site flooding from rivers or the sea in any year. In line with the precautionary principle set out within TAN-15, a Flood Risk Statement has been produced by JBA Consulting, for which the latest Extreme Sea Level data (2019) has been reviewed to determine the current extreme tidal levels within the River Ebbw. The dataset reviewed considered the predicted extreme tidal levels within the Swansea Bay area, with the nearest data point to the site being some 23km south. The 2020 0.1% AEP tidal level was found to be 6.66m AOD; as the development site level is at approximately 64.5m AOD, greater than the flood levels used to define the adjacent extreme flood outline.

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As a precautionary measure, JBA Consulting also calculated the 2095 0.1% AEP predicted tidal levels, which reflect 75 years of climate change related sea level rises. The current extreme levels described above were amended using the latest Welsh Government climate change guidance to predict 2095 levels. The 2095 predicted extreme tidal level is 7.39m AOD for the 0.1% AEP event. Both the proposed site (64.5m AOD) and the access (67.5m AOD) is predicted to be flood free during the extreme tidal events for the design life of the development.

In addition to this, JBA Consulting, has utilised the latest 1D-2D flood hazard model of the area, results indicate that the peak water level within the River Twrch during the 0.1% AEP event is 62.6m AOD, which is also below the level of the site (64.5mAOD). As the proposed development site does not flood in the 0.1% AEP event and the water levels calculated for the River Twrch is less than the site level, the development proposal complies with TAN-15 and there is no requirement to consider flood risk from fluvial / tidal sources further.

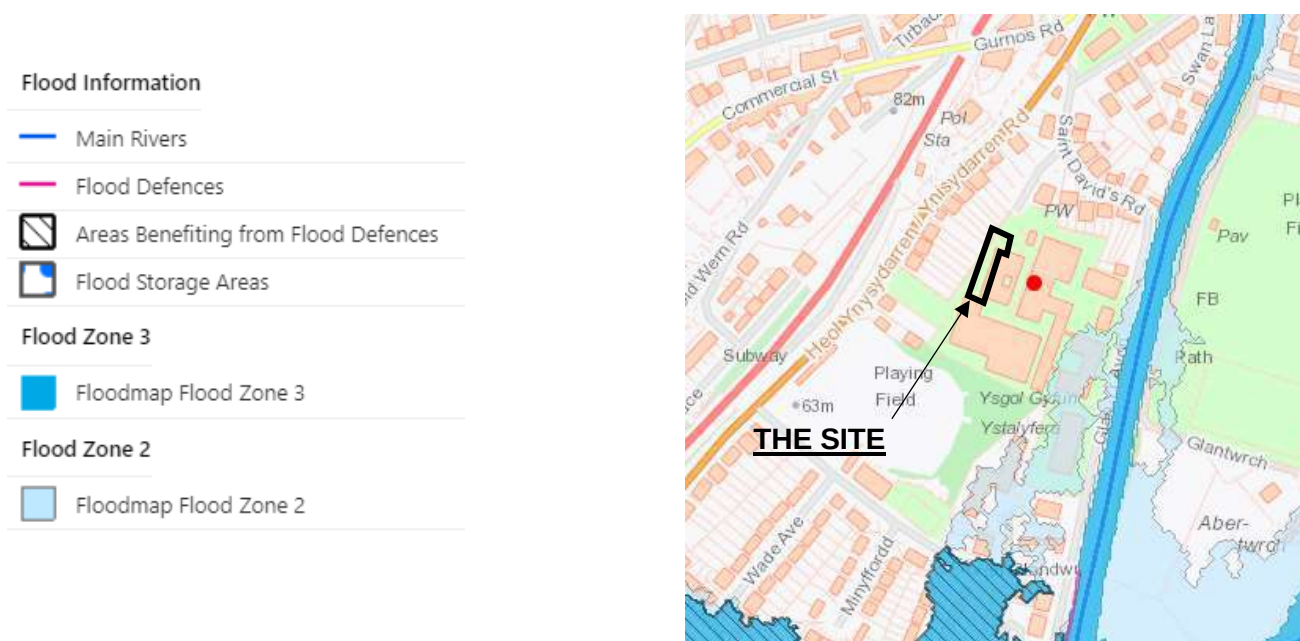


Figure 4-2. A Snapshot of NRW's Detailed Flood Map from Rivers and Sea

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4.2 FLOOD RISK TO DEVELOPMENT FROM SURFACE WATER

Overland flow routes can form from rainfall that fails to infiltrate the surface and travels over ground; this is exacerbated where the permeability of the ground is low due to the type of soil / geology or urban development. Surface water is also promoted in areas of steep topography which can rapidly convey water that has failed to penetrate the surface.

Figure 4-3 below shows NRW's Surface Water Flood Risk Map. The dark orange shading (high risk) shows areas that have a chance of flooding of greater than 3.33% Annual Exceedance Probability (AEP). The light orange shading (medium risk) shows areas that have a chance of flooding between 1% and 3.33% AEP. The yellow shading (low risk) shows areas that have a chance of flooding between 0.1% and 1% AEP.

According to NRW's Surface Water Flood Risk Map, the majority of the site under consideration is not considered to be at risk from surface water flooding. A small section from the north is shown to be at low risk; this is likely the result of the topography of the adjacent access road, along with the existing vehicular entrance to the northern part of the site. The construction of the new building will encompass a small portion of this 'low risk' area; however, as the new building shall be set a minimum of 150mm above the external hardscaped areas, along with new surface water drainage measures being introduced, the overall risk of surface water flooding for the development is considered **LOW**. Surface water developed on the site will be retained in the external car park area at the north of the site.



Figure 4-3. A Snapshot of NRW's Detailed Flood Map highlighting areas susceptible to surface water flooding

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4.3 FLOOD RISK TO DEVELOPMENT FROM GROUNDWATER

Ground water flooding occurs where groundwater levels rise above ground surface levels. The geology has a major influence on where this type of flooding takes place; it is most likely to occur in low lying areas underlain by permeable rocks.

The previous site investigations concluded that groundwater levels generally fluctuated between 4.95m and 6.80m below ground level. Groundwater was seen to flow roughly in a west to east direction, as anticipated, due to the presence of the river, located directly east of the site. It's appreciated that there may be seasonal fluctuations in groundwater levels, together with variations during periods of heavy rain (the full range of which was not observed during the monitoring period). Other effects, such as investigation and constructional excavation, may also have influenced groundwater levels. In addition, the possible presence of perched water in parts of the Made Ground or Alluvial deposits cannot be discounted. Despite this, with the range in depth of groundwater identified, the risk of flooding to the developed site from groundwater is considered **LOW**.

4.4 FLOOD RISK TO DEVELOPMENT FROM SEWERS

Flooding can occur as a result of infrastructure failure e.g. blocked sewers or failed pumping stations. Sewer flooding can occur when the system surcharge due to the volume or intensity of rainfall exceeding the capacity of the sewer, or if the system becomes blocked by debris or sediment.

With the exception of the existing and proposed on site drainage, which will be maintained by Neath Port Talbot County Borough Council (in line with the maintenance plan provided by Bingham Hall Partnership), the only existing sewers local to the site are the two adopted foul water sewers. A snapshot of the DC/WW sewer records for the area can be seen in Figure 5-1 below.

Firstly, the foul water sewer located directly west of the proposed site and running within the access road; the network primarily serves residential developments north of the site. As there are no existing chambers located on the site, any surcharged sewers / chambers will be contained within the adjacent access road. Additionally, due to this foul water sewer primarily serving residential properties it is likely that several inspection chambers exist upstream of the site which could be used for repair and to isolate the foul water network, thus minimising the risk of downstream blockages, i.e. local to the development site.

Secondly, the foul water sewer that runs centrally through the site. DC/WW records indicate one chamber on the school site; located in the north / north-east school yard. The sewer is a 300mm diameter and similarly to above, primarily serves the residential developments north of the site. Although, there is potential for the chamber to surcharge, foul water flows will be contained within the school yard area. Additionally, as discussed above, the extent of inspection chambers associated with residential developments will result in surcharging occurring upstream, more local to the blocked sewer.

Consequently, the risk of flooding to this development site, along with the surrounding existing buildings, is considered extremely **LOW**.

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4.5 FLOOD RISK TO DEVELOPMENT FROM ARTIFICIAL SOURCES

Artificial flood sources include raised channels such as canals or storage features, such as ponds and reservoirs. Figure 4-4 is a snapshot taken from NRW's reservoir flood risk map; the shading on the map shows the worst-case scenario for the area that could be flooded if a large reservoir were to fail and release the water it holds. Despite this, NRW state that reservoir flooding is extremely unlikely to happen; all large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for Reservoirs Act 1975 in Wales, NRW ensure that reservoirs are inspected regularly, and essential safety work is undertaken.

The reservoir flood maps do not indicate any likelihood of a flood occurring, as a result, the risk of flooding occurring from artificial sources is **LOW**.



Figure 4-4. Snapshot of NRW's Detailed Flood Map indicating Reservoir Flood Risk

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5. EXISTING SITE DRAINAGE

A plan showing the adopted drainage local to site area has been obtained from Dwr Cymru / Welsh Water see Figure 5-1 below. The plan indicates two foul water sewers local to the site, one running central to the site, whilst the second sewer runs within the access road along the western boundary of the site. Foul water flows for both Phase I & Phase II works have been directed to the adopted foul water sewer running through the centre of the site.

With regards to the existing surface water discharge, flows associated with both the Phase I and Phase II works have been directed to separate, below ground soakaway tanks, positioned local to their respective buildings. Drainage layouts for the two sites, produced by BHPL, can be found in **Appendix B** of this report.

At the time this report was produced there was no information available regarding the offsite discharge of the existing foul and surface water sewers local to the existing buildings to be demolished. It is considered that the existing below ground sewers to the perimeters of the existing buildings will not be reused (due to their age & likely poor condition) and new foul & surface water sewers will be provided as part of the works.

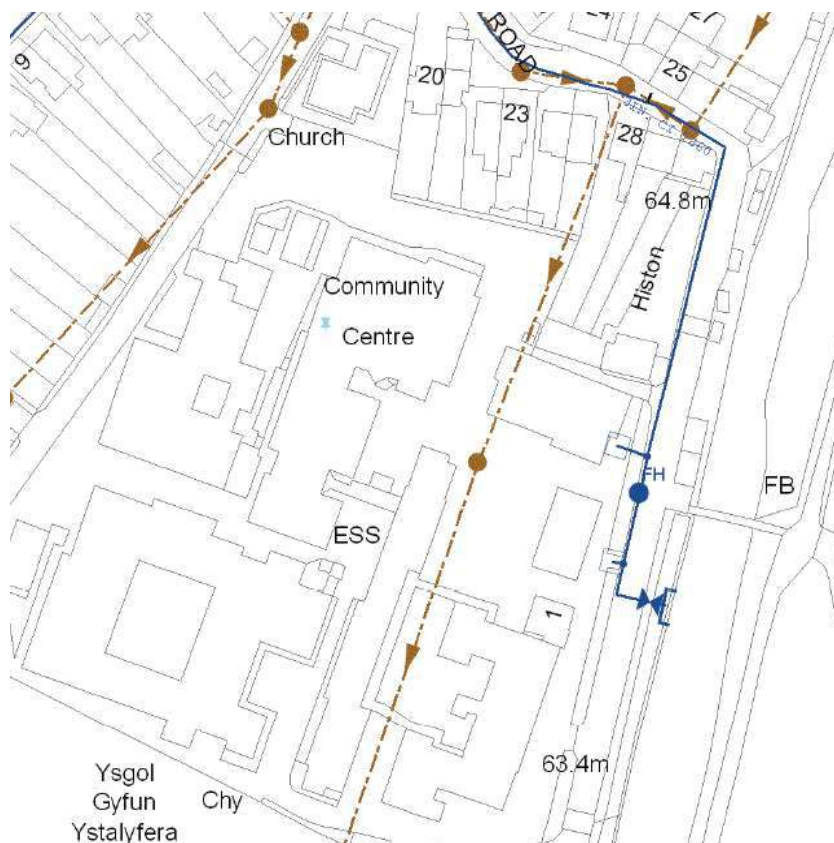


Figure 5-1. A Snapshot of DCWW's Sewer Map Local to Pre-developed Ystalyfera School

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6. PROPOSED SURFACE WATER DRAINAGE

6.1 OVERVIEW

The proposed surface water drainage design will have to consider the sequential approach as defined by the National Planning Policy Framework (NPPF), the Sustainable Urban Drainage Manual and Part H of Building Regulations.

From 7th January 2019, all new developments of more than 1no. dwelling house or where the construction area is 100m² or more, will require Sustainable Drainage Systems (SuDS) for surface water. From this date, SuDS on new developments must be designed and built in accordance with the Statutory SuDS Standards published by Welsh Ministers and SuDS schemes must be approved by the local authority acting in its SuDS Approving Body (SAB) role, before construction work begins.

The principles which underpin the design of surface water management schemes to meet the Standards are as follows;

SuDS schemes should aim to address the following:

- Manage water on or close to the surface and as close to the source of the runoff as possible
- Treat rainfall as a valuable natural resource
- Ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it
- Manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development
- Take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep
- Use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system (rather than using a single “end of pipe” feature, such as a pond, to serve the whole development)
- Maximise the delivery of benefits for amenity and biodiversity
- Seek to make the best use of available land through multifunctional usage of public spaces and the public realm
- Perform safely, reliably and effectively over the design life of the development considering the need for reasonable levels of maintenance
- Avoid the need for pumping where possible
- Be affordable, considering both construction and long term maintenance costs and the additional environmental and social benefits afforded by the system

There are six mandatory standards to be achieved within the National SuDS standards, S1 to S6. The following sections demonstrate compliance with each of these standards.

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6.2 STANDARD S1 – SURFACE WATER RUN-OFF DESTINATION

The Statutory Standards for Sustainable Drainage Systems published by the Welsh Government sets out five priority levels regarding the destination of runoff from sites; see Table 6-1 below:

Table 6-1: Priority Levels for Surface Water Runoff Destination

Priority Level and Definition	Assessment
Priority Level 1: Collected for use	It is a requirement of the Welsh Statutory National Standards for Sustainable Drainage Systems that as far as possible there will be no discharge from the site for the majority of rainfall events of less than 5mm. The following has been suggested to manage this rainfall within the boundaries of the site; collecting surface water runoff for use should be considered in the design. Table 6-2 below shows the various SuDS techniques that have been assessed for the proposed development:
Priority Level 2: Infiltrated to ground	The findings of Environmental Scientific Group Ltd.'s Ground Investigation Report indicate that the site is underlain by Glaciofluvial Deposits (formerly referred to as Glacial Sand and Gravel) with Alluvium deposits, over bedrock of South Wales Middle Coal Measures. The Glaciofluvial Deposits are seen to vary with depth, in the upper levels, they are dominated by coarse and very coarse materials, typically being described as grey and brown gravel, cobbles and boulders. At lower depths (between 6.10 and 7.90m), the very coarse fragments were seen to be less dominant, typically described as sandy gravel deposits. The coarse and permeable underlying strata suggest infiltration to be a feasible solution; former infiltration testing (for Phase II works) provided a lower bound value of 1.3×10^{-4} m/s. Further, localised testing is to be undertaken.
Priority Level 3: Discharged to a surface water body	There is only one watercourse local to the site, this being the River Twrch, located some 100.0m east of the development.
Priority Level 4: Discharged to surface water sewer.	Research indicates there are no surface water sewers or highway drains or any other form of surface water discharge points local to the site.
Priority Level 5: Discharged to a combined sewer	Research indicates there are no combined sewers local to the site.

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		Report By	:	RC
		Checked By	:	DTH
		Revision No	:	-
		Page No	:	DSR 16

Table 6-2: SuDS On-site Water Management Techniques and Assessment

System	Assessment
Rainwater Harvesting	Typically, the function of the new school offers very few uses for harvested water with the exception of toilet facilities. With this in mind, the current proposal for the scheme is to use a small rainwater harvesting tank to serve new toilet facilities for the phase 3 building only.
Green Roofs	As the management of surface water will involve discharge via infiltration, a green roof has not been considered. Additionally, a large extent of the proposed roof shall be utilised for PV panels and M&E equipment due to the limited space on site.
Rain Garden	Rain gardens can be used to collect runoff from storms for the purposes of irrigation to help reduce potable water use for landscape maintenance as well as reducing surface water runoff from the site. Rain gardens implemented with means to overflow to other SuDS features can enable a varied runoff management system which provides benefits to pollution control and biodiversity. As this development will comprise solely of the new building, described in Section 1.3 of this report, there are no external areas that can be utilised for a rain garden. Despite this, 'SuDs planters' have been proposed for the site. The 'SuDs Planter' is designed to capture rainwater run-off from roofs by directing downpipes to bypass specially designed garden planters, prior to entering the below ground surface water network. The planters are considered as small isolated rain gardens which will be situated around the perimeter of the building. The soil contained will be utilised as a filter layer, thus offering a degree of treatment, storage, as well as slowing the flow of surface water.
Water Detentions	Infiltration, detention basins can be designed with capacity to retain the initial 5mm of runoff from the impermeable areas of the site. This can give the water the opportunity to evaporate off over time and pollutants to be retained. As discussed above, the Phase III development, the focus of this report, comprises of the new teaching block building only, with no external areas being available to provide any water detentions.

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6.3 STANDARD S2 – SURFACE WATER RUN-OFF HYDRAULIC CONTROL

Based on the assessments undertaken in Tables 6-1 & 6-2 of this report, a preliminary drainage scheme has been developed for the site, see Figure 6-1 below and **Appendix B** of this report.

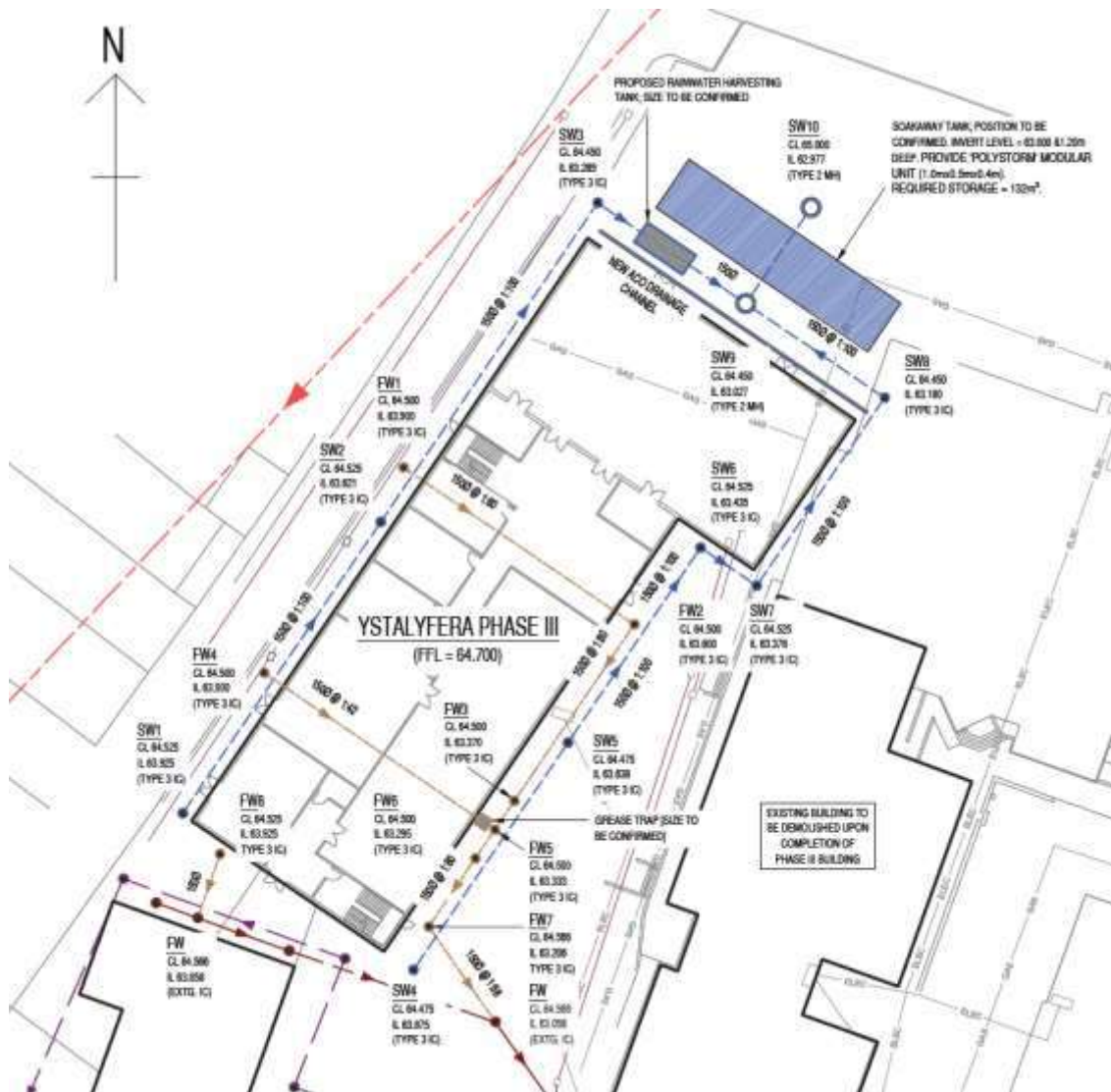


Figure 6-1. Preliminary Drainage Scheme

The proposed surface water strategy for the site utilises rainwater pipes and suitably positioned yard and drainage channels to collect any surface water runoff developed from the following impermeable areas: New building roof, existing external play / dining area local to the building, and due to the topography of the site, the existing vehicular access / parking to the north of the site. Traditional gravity sewers shall then direct flows toward a below ground infiltration tank which will be sized to accommodate all storm durations for the 1:100 year return period, along with a 40% allowance for climate change; urban creep has not been considered in this analysis given the size of the site under consideration along with it being 100% impermeable.

Job No	:	6685
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Post Development Network Design & Parameters: -

The following preliminary calculations focus on the sizing of the soakaway tank for the proposed development, considering the impermeable areas described above. The drainage scheme shown in Figures 6-1 & 6-2 has been analysed using WinDes design software by MicroDrainage; the figures shown below demonstrate the network input, design parameters, and simulation results for the critical storm duration for the 1:100 return period, with the 40% allowance for climate change. Refer to Appendix C for further calculations.

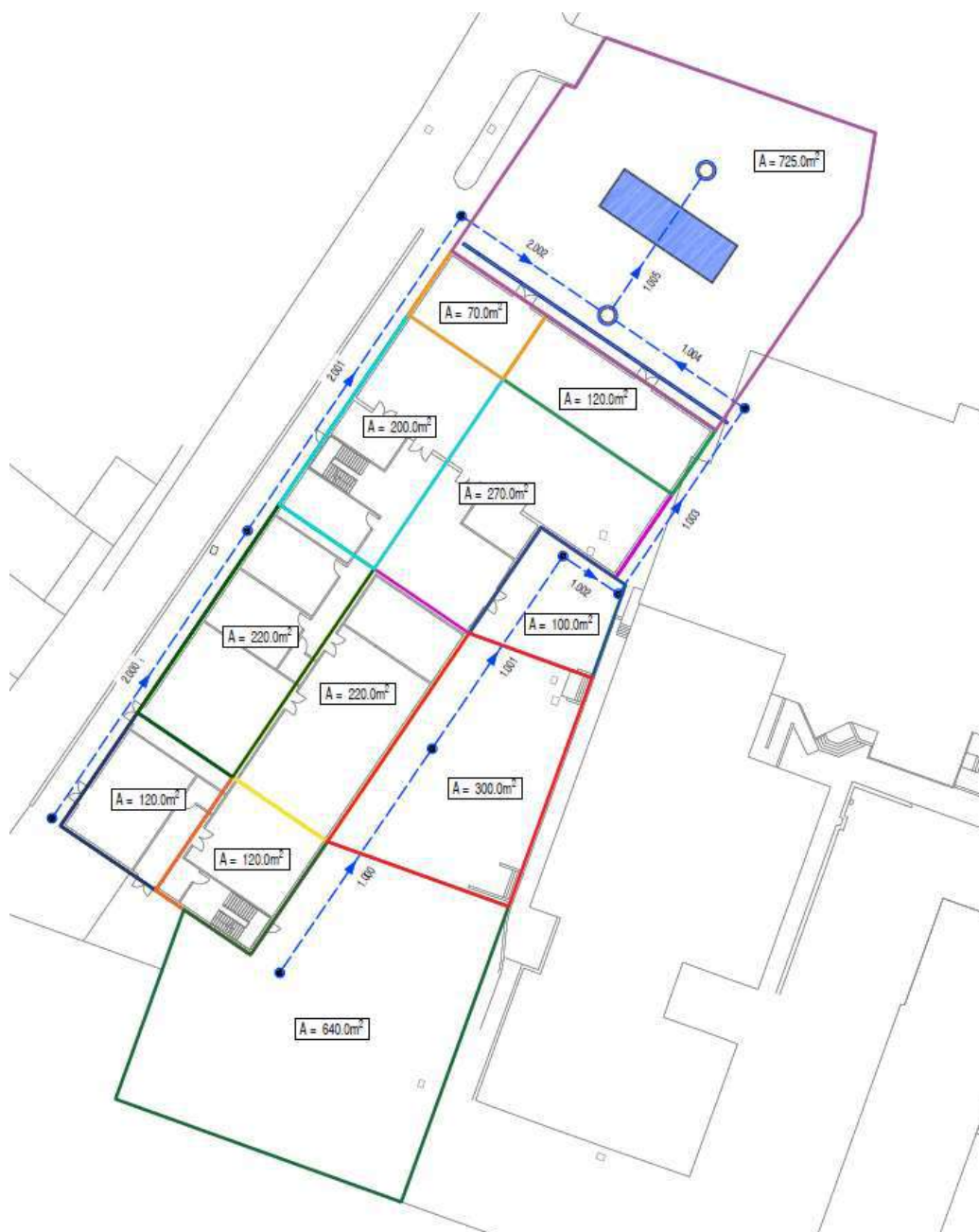


Figure 6-2. Modelled Network and Associated Impermeable Areas

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Figure 6-3. Simulation and Network Parameters

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Cellular Storage Manhole: 10, DS/PN: 1.006

Invert Level (m) 62.950 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.46800 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.46800

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	110.0	110.0	5.200	0.0	160.4
0.400	110.0	126.8	5.600	0.0	160.4
0.800	110.0	143.6	6.000	0.0	160.4
1.200	110.0	160.3	6.400	0.0	160.4
1.201	0.0	160.4	6.800	0.0	160.4
2.000	0.0	160.4	7.200	0.0	160.4
2.400	0.0	160.4	7.600	0.0	160.4
2.800	0.0	160.4	8.000	0.0	160.4
3.200	0.0	160.4	8.400	0.0	160.4
3.600	0.0	160.4	8.800	0.0	160.4
4.000	0.0	160.4	9.200	0.0	160.4
4.400	0.0	160.4	9.600	0.0	160.4
4.800	0.0	160.4	10.000	0.0	160.4

Figure 6-4. Storage Input & Parameters

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		Page No	:	DSR 21

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	180 Winter	100	+40%					64.155
1.001	2	180 Winter	100	+40%	100/60 Winter				64.152
1.002	3	180 Winter	100	+40%	100/15 Summer				64.147
1.003	4	180 Winter	100	+40%	100/15 Summer				64.144
1.004	5	180 Winter	100	+40%	100/15 Summer				64.138
2.000	6	180 Winter	100	+40%	100/15 Summer				64.147
2.001	7	180 Winter	100	+40%	100/60 Winter				64.140
2.002	8	180 Winter	100	+40%	100/30 Summer				64.135
1.005	6	180 Winter	100	+40%	100/15 Winter				64.132
1.006	10	180 Winter	100	+40%	100/15 Summer				64.128

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
1.000	1	-0.020	0.000	0.13		12.6	OK	
1.001	2	0.214	0.000	0.22		21.1	SURCHARGED	
1.002	3	0.412	0.000	0.42		25.8	SURCHARGED	
1.003	4	0.468	0.000	0.26		25.2	SURCHARGED	

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
1.004	5	0.658	0.000	0.34		32.0	SURCHARGED	
2.000	6	0.072	0.000	0.33		5.6	SURCHARGED	
2.001	7	0.294	0.000	0.18		8.9	SURCHARGED	
2.002	8	0.546	0.000	0.12		14.1	SURCHARGED	
1.005	6	0.655	0.000	0.28		46.7	SURCHARGED	
1.006	10	0.728	0.000	0.00		0.0	SURCHARGED	

Figure 6-4. Summary of the Critical Storm Results

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		Job Ref	:	Ystalyfera
		Report By	:	RC
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5 Ty-Nant Court, Morganstown, Cardiff, CF15 8LW		Revision No	:	-
Tel: 02920 488588		Page No	:	DSR 22

6.4 STANDARD S3 – WATER QUALITY

The development site consists of impermeable roof area only, existing surrounding external playground / open dining area along with a small area for vehicular access and car parking to the north of the site will also be served by the new drainage scheme. Given the size of the car park, minimal pollutants are anticipated to enter the system; consequently, no special measures have been provided. Despite this as the surface water will be discharged via infiltration, a process known as natural attenuation will occur. Natural attenuation refers to the reduction in mass or concentration of a compound in groundwater over time or distance due to naturally occurring physical, chemical, and biological processes. These can include biodegradation, dispersion, dilution, adsorption, and volatilization; and are often performed by bacteria that naturally inhabit the soil and groundwater environments. Components of gasoline such as benzene, toluene, ethylbenzene, and xylene (BTEX) will be biodegraded to carbon dioxide and water. The process is widely becoming a preferred form of treatment for tackling contaminants as it doesn't transfer pollutants from one location to another but rather, breaks them down in place, often into non-toxic end products. Additionally, surface water collected from the roof of the proposed building shall be directed through SuDs Planters (described in Table 6-2 of this report). The soil within these containers will act as a natural filter for removing bird faeces and other contaminants, thus offering an additional level of treatment for this area.

6.5 STANDARD S4 & S5 – AMENITY & BIODIVERSITY

The Phase III development focuses on the provision of a new teaching block building only and excludes any external softscape areas, with existing hardstanding areas remaining in place and where necessary be extended to the new building's footprint; the hardstanding areas will continue to be utilised as playground and external dining area. As discussed above, planters shall be utilised in the proposed discharge of surface water; these planters will be situated around the perimeter of the new building and house a variety of plant species, thus offering both amenity and biodiversity benefits to a site with limited feasibility.

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		Job Ref	:	Ystalyfera
		Report By	:	RC
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6.6 STANDARD S5 – DESIGN OF DRAINAGE FOR CONSTRUCTION, OPERATION AND MAINTENANCE AND STRUCTURAL INTEGRITY

The foul and surface water networks will comprise of traditional, gravity fed, below ground pipework. The networks will be designed to remain as shallow as possible whilst remaining in recommending parameters. Suitable access will be provided to all elements in the form of inspection chambers and manholes, thus allowing for regular inspection and maintenance work.

Construction: The method of construction has been taken in account in the design, including specific programming requirements, thus minimising the potential for poor construction of any part of the drainage network. Additionally, health and safety risks associated with the construction of the drainage network system in line with the requirements of the Construction (Design and Management) Regulations 2015 have been considered during the design.

Maintenance: Maintenance plans for all drainage elements will be provided by BHPL.

Structural Integrity: All materials and components used in the construction will have a minimum design life equivalent to the design life of the development (50 years) and be suitable for all imposed design loadings, including an appropriate factor of safety. Control structures will be located on the surface (protected from blockage and damage) or within easily accessible chambers.

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		Job Ref	:	Ystalyfera
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		Revision No	:	-
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7. PROPOSED FOUL WATER DISCHARGE

Foul water flows from the development shall be served by a new, below ground, gravity sewers running parallel with the new building, see Figure 6-1 above and connect to the existing foul sewer as shown. Flows shall be directed to the existing on-site foul water network, specifically the network constructed during the Phase 1 building works. This existing network connects to DC/WW's adopted foul water sewer, that runs centrally through the site.

The proposed foul water network shall serve toilets and kitchen facilities for the new building only. Wastewater developed from the kitchen area of the development will pass through a below ground grease trap, prior to making connection to the existing on-site network.

8. CONCLUSIONS

SURFACE WATER

The philosophy underpinning the management of surface water for the development is to discharge via infiltration, thus mimicking the greenfield runoff rate for the site; consequently, the pre-development discharge rates and volumes have not been considered within this report. The below ground soakaway tank will be sized to accommodate all storm durations for the 1 in 100 return period, along with a 40% allowance for climate change. Preliminary analysis, based on the lower bound infiltration rate obtained during the Phase II site investigation works, has resulted in a preliminary storage volume of 132.0m³. The surface water storage / soakaway system will comprise of a high strength and high void ratio, geocellular crate system, surrounded in a permeable membrane. Access for maintenance will be provided via manholes either end of the crate system.

The surface water drainage strategy will incorporate SuDs planters, situated around the perimeter of the building; whereby, flows from the roof of the building will be directed to these SuDs Planters via standard downpipes. The SuDs Planters offer various amenity and biodiversity benefits to the proposed site whilst slowing the flow of surface water and offering a degree of treatment.

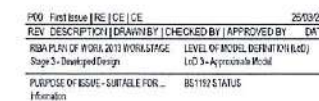
In addition to this, a rainwater harvesting tank has been proposed for the new teaching block. The aspiration for which is to re-use the surface water accumulated on the new roof for the toilet facilities of the proposed building only.

FOUL WATER

The philosophy underpinning the management of the foul water flows for the development is to discharge all developed foul water flows from the proposed development via below ground, gravity sewers. Foul flows bearing grease deposits from the kitchen appliances will pass through a below ground grease trap. The new network will make connection to an existing on-site network, associated with the Phase I scope of works prior to being discharged to DC/WW's adopted foul water sewer that runs centrally through the site.

APPENDIX A

ARCHITECTURAL DRAWINGS ASSOCIATED WITH THE DEVELOPMENT



DRAWING TITLE
Existing Site Plan

DRAWING No	PROJECT - OPERATOR - VOLUME - LEVEL - TYPE - ROLE - NUMBER	REVISION
21-101-2007 4-22-2016 100-000000	YGYJAW-Y-X-DR- A-039001	P00

DO NOT
SCALE



P01 - Site Boundaries amended RE CE CE	26/03/20
P02 - Final Issue RE CE CE	16/03/20
REV DESCRIPTION DRAWN BY CHECKED BY APPROVED BY DATE	
FIBA PLAN OF WORK 2019 WORKSTAGE	
Stage 3 - Developed Design	
	LEVEL OF MODEL DEFINITION (x0)
	LeD 3 - Approximate Model
PURPOSE OF ISSUE - Suitable for ...	ISSUE STATUS
Information	Stage 3 - Information



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LONDON 0207 138 3560
WREXHAM 01978 357 887
www.lantrax.co.uk

CLIENT
Neath Port Talbot Council

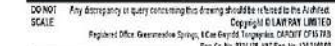
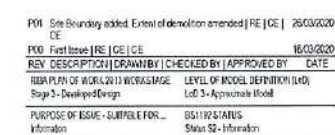
PROJECT TITLE
Yspol Gymraeg Ystalyfera - Phase 3

DRAWING TITLE
Location Plan - Ysgol Gymraeg Ystalyfera

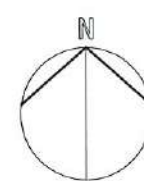
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01001.007	REVISIONS
02/09/06	YGY-LAW-X-X-DR- A-039101
02/01/2000	P0

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Fax Co No. 2224128, VAT No. 13411

Notes
Demolition stages are shown indicated in Architectural Brief - Yaffa/era Phase 3 document, issued by Neath Port Talbot Council.
Extent of demolition is shown indicatively only.
Principal Contractor to allow for removal of all associated services, landscaping and site features as agreed with NPCT Council and Teyd Gwyn Yaffa/era.



Construction Design and Management Regulations
 Design and construction are considered throughout the design stage of the project. The design team will ensure that the design meets the requirements of the Construction Design and Management Regulations 2015 and will ensure that the design is compliant with the relevant legislation.



- LEGEND:**
- Site Boundary
 - Land owned by Client
 - Existing buildings
 - Proposed buildings / structures
 - Soft landscaping
 - Brick pavers to match existing (blue)
 - Brick pavers to match existing (yellow)
 - Hardstanding - tarmac

PO1 Detailed design, issued for comment/consultation	RECEIVED	26/03/2020
PO2 First issue, indicative layout only	RECEIVED	21/03/2020
REV DESCRIPTION / DRAWN BY / CHECKED BY / APPROVED BY	DATE	
RISK PLAN OF WORK 2019 WORK STAGE	LEVEL OF MODEL DEFINITION (LUG)	
Stage 3 - Developed Design	Level 3 - Approximate Model	
PURPOSE OF ISSUE - SUITABLE FOR...	BS1150 PART 10	
Employer / User Group Approval		

lawray architects
penseiri

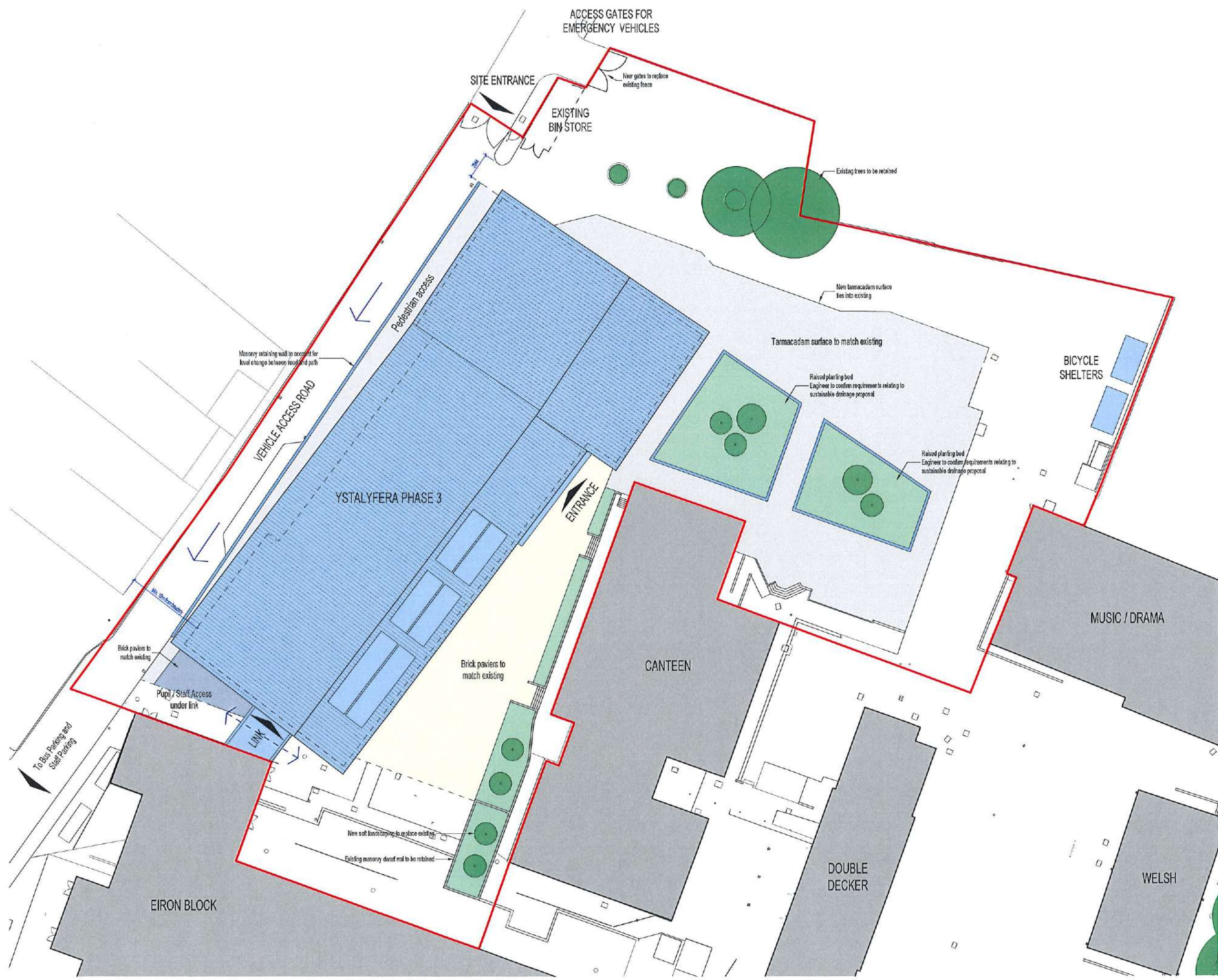
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 Neath Port Talbot Council

PROJECT TITLE
 Ysgol Gymraeg Ystalyfera - Phase 3

DRAWING TITLE
 Proposed Site Plan

PROJECT NO. 19194	SCALE 1:200
DRAWING NO. 19194-01	PROJECT - DRAWING - ISSUE - DATE - FILE - PLOT - NUMBER - REVISION
PROJECT NAME YG-Y-LAW-X-X-DR-	A-059001 P01
DATE 09/03/20	Any discrepancy or error concerning this drawing shall be referred to the Project Manager.
SCALE	Copyright © LAWRA Y ARCHITECTS LTD Registered Office: Oceanview Square, 1 Deerpark Road, Porthcawl, CARDIFF CF34 1JF Reg. Co. No. 20201111. VAT Reg. No. 154 2445 91



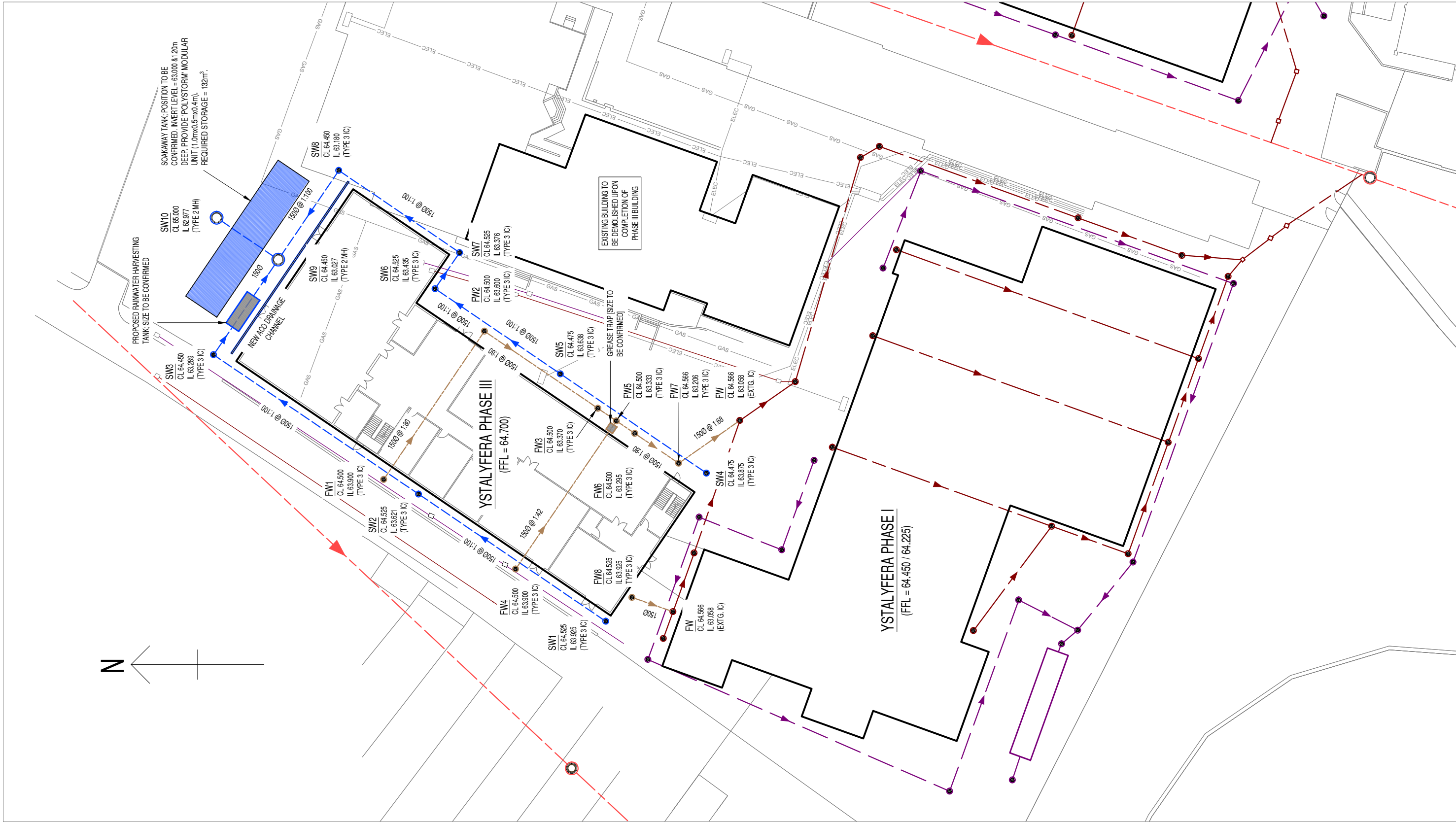
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Print Date: 25/03/2020 16:50:24

APPENDIX B

PROPOSED & AS-BUILT DRAWINGS FOR THE YSTALYFERA SCHOOL SITE

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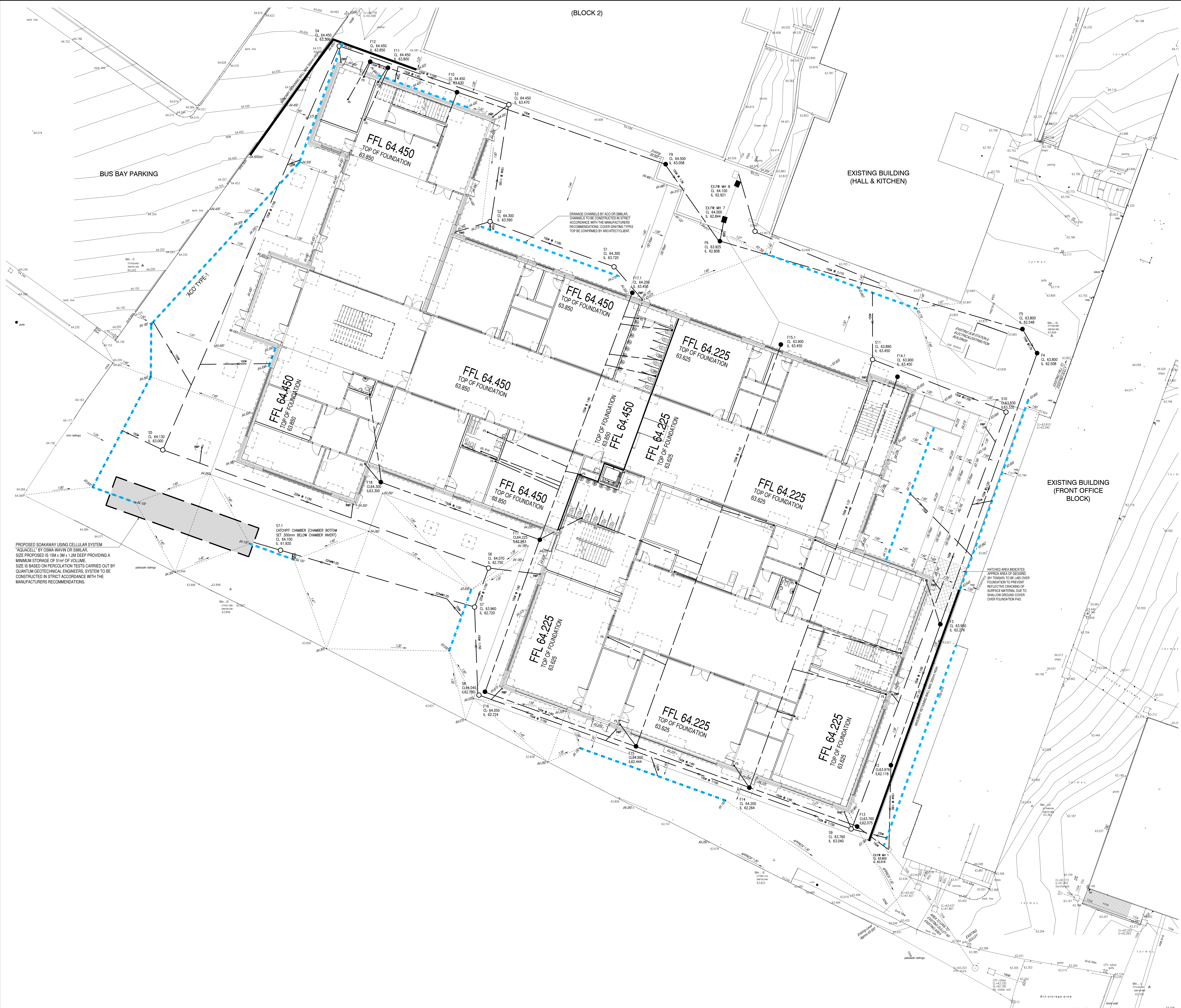
Rev	By	Date	Revision

Bingham Hall

PARTNERSHIP LTD

Consulting Civil & Structural Engineers
5 Ty-Nant Court
Morganstown
Cardiff
CF15 8LW
Telephone (029) 2048 8588

Project Title		YSTALYFERA PHASE III SCHEME			
Drawing Title		PROPOSED DRAINAGE LAYOUT			
Scale	Drawn	Drawing Size	Date	Checked	
1:500	RC	A3	APRIL 2020	DTH	
Project No.		Originator	Volume	Level	Type
6685		BHP	-	-	00
DR		C	-	(50)	001
Drawing Status				Rev	
PRELIMINARY				-	



LEGEND.

- STORM SEWER
- FOUL SEWER
- FOUL INSPECTION CHAMBER
- SURFACE INSPECTION CHAMBER
- DRAINAGE CHANNEL BY ACD TYPE MISSED OR SIMILAR, GENERALLY OVERALL DEPTH OF ACD TO BE 300mm EXCEPT ACD TYPE NOTED ON PLAN WHERE THE OVERALL DEPTH IS TO BE 200mm. REINFORCED GRATING GRADE B105 - TYPE BY ARCHITECT.
- ROAD GULLY
- RAINWATER PIPE
- FLOODING EYE
- FLOOR SOCKET FOR FOUL STACK

- ALL SIPP & RWP'S TO HAVE FLOODABLE TRAPS.
- WHERE DRAINAGE IS Laid IN THE ROAD A MINIMUM DISTANCE OF 1m TO BE MAINTAINED BETWEEN KERBLINES AND SEWER RUNS.
- ALL PIPES TO BE 1000 UALD Laid AT 1:40 MIN FOR FOUL PIPES AND 1:80 MIN FOR STORM PIPES Laid ON PLAN.
- ALL DRAINAGE RUNS UNDER BUILDING FOOTPRINT TO BE CONCRETE ENCASED.
- FOR POSITION OF ALL DRAIN POINT WITHIN THE BLOCKS REFER TO THE ARCHITECT'S DRAWINGS.

C	PH	28.11.15	LEVELS & GRADIENTS FINALISED.
B	PH	17.11.15	MINOR LEVEL ALTERATIONS, CATCHPIT ADDED PRIOR TO SOAKAWAY.
A	PH	13.11.15	PROPOSED LEVELS AND SURFACE WATER TO EXTERNALS ADDED.
Rev	No	Date	Revised

Bingham Hall

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East Moor Road,
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CP1 6TD.
Telephone (01293) 2548 0500
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Project Title			
Ystalyfera Secondary School			
Drawing Title			
DRAINAGE LAYOUT			
Architect			
Stride Treglown			
Client			
Dawnus			
Drawing Status			
CONSTRUCTION			
Scale	Drawing Size	Drawn	Checkd
1:125	A0	SM	AUG 2015 SRC
Project No.	Originator	Zone	Level
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Registered in England & Wales No: 05348301

APPENDIX C

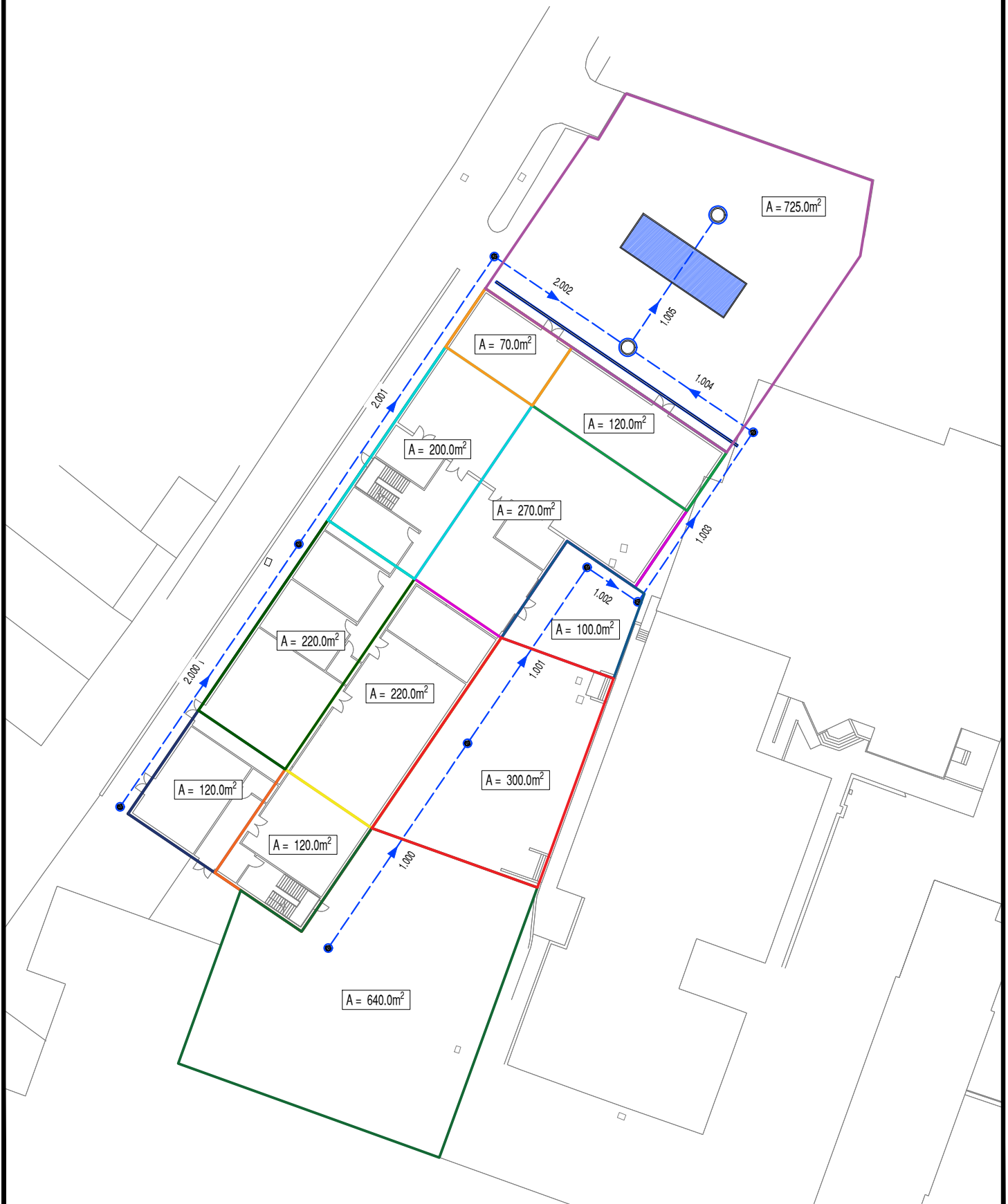
BHPL's PRELIMINARY SURFACE WATER CALCULATIONS

PARTNERSHIP LTD

Consulting Civil & Structural Engineers
5 Ty Nant Court,
Morganstown,
Cardiff.
CF15 8LW.
Telephone (029) 2048 8588

Status	Project Title		
T-Tender I-Information P-Preliminary C-Construction	Project No./Dwg No. /	Drg Size	Rev

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Bingham Hall Partnership Ltd		Page 1
5 Ty Nant Court, Morganstown Cardiff CF15 8LW	Ystalyfera Phase III Scheme Surface Water Calculations	
Date 01/04/2020 File 6685 - SW Calcs.MDX	Designed by RC Checked by DTH	
Innovyze	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.236	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	100

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.250	4-8	0.067

Total Area Contributing (ha) = 0.317

Total Pipe Volume (m³) = 12.910

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	23.689	0.237	100.0	0.076	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	20.337	0.203	100.2	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	5.860	0.059	99.3	0.037	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	19.600	0.196	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	14.462	0.153	94.5	0.049	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	30.370	0.304	99.9	0.034	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	55.94	4.25	63.875	0.076	0.0	0.0	0.0	1.57	111.2	11.5
1.001	55.05	4.47	63.638	0.128	0.0	0.0	0.0	1.57	111.0	19.1
1.002	54.80	4.53	63.435	0.165	0.0	0.0	0.0	1.58	111.5	24.5
1.003	53.99	4.74	63.376	0.165	0.0	0.0	0.0	1.57	111.1	24.5
1.004	53.43	4.89	63.180	0.214	0.0	0.0	0.0	1.62	114.3	31.0
2.000	54.91	4.50	63.925	0.034	0.0	0.0	0.0	1.01	17.8	5.1

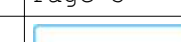
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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.001	33.256	0.333	99.9	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	15.438	0.261	59.1	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	15.311	0.077	198.8	0.007	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.001	53.27	4.93	63.621	0.054	0.0	0.0	0.0	1.31	52.0	7.8
2.002	52.81	5.05	63.288	0.096	0.0	0.0	0.0	2.05	144.8	13.7
1.005	52.18	5.23	63.027	0.317	0.0	0.0	0.0	1.44	228.7	44.8
1.006	51.77	5.35	62.950	0.317	0.0	0.0	0.0	1.43	228.1	44.8

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Storage Structures for Storm

Cellular Storage Manhole: 10, DS/PN: 1.006

Invert Level (m) 62.950 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.46800 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.46800

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	110.0	110.0	5.200	0.0	160.4
0.400	110.0	126.8	5.600	0.0	160.4
0.800	110.0	143.6	6.000	0.0	160.4
1.200	110.0	160.3	6.400	0.0	160.4
1.201	0.0	160.4	6.800	0.0	160.4
2.000	0.0	160.4	7.200	0.0	160.4
2.400	0.0	160.4	7.600	0.0	160.4
2.800	0.0	160.4	8.000	0.0	160.4
3.200	0.0	160.4	8.400	0.0	160.4
3.600	0.0	160.4	8.800	0.0	160.4
4.000	0.0	160.4	9.200	0.0	160.4
4.400	0.0	160.4	9.600	0.0	160.4
4.800	0.0	160.4	10.000	0.0	160.4

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Summary Wizard of 15 minute 100 year Winter I+40% for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.236
Region England and Wales Cv (Summer)	0.750		
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm Rank	Water			Surcharged		Flooded		Pipe Flow (l/s)	Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.000	1	6	64.010	-0.165	0.000	0.42		41.5	OK		
1.001	2	13	63.907	-0.031	0.000	0.67		65.2	OK		
1.002	3	17	63.816	0.081	0.000	1.35		82.5	SURCHARGED		
1.003	4	20	63.709	0.033	0.000	0.85		82.5	SURCHARGED		
1.004	5	22	63.568	0.088	0.000	1.12		106.3	SURCHARGED		
2.000	6	4	64.111	0.036	0.000	1.04		17.8	SURCHARGED		
2.001	7	20	63.745	-0.101	0.000	0.57		27.8	OK		
2.002	8	22	63.539	-0.049	0.000	0.41		50.2	OK		
1.005	6	22	63.535	0.058	0.000	0.94		158.9	SURCHARGED		
1.006	10	22	63.532	0.132	0.000	0.00		0.0	SURCHARGED		

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Summary Wizard of 30 minute 100 year Winter I+40% for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.236
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe		Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow / Overflow (l/s)	Flow (l/s)			
1.000	1	9	63.997	-0.178	0.000	0.34		34.0		OK	
1.001	2	20	63.820	-0.118	0.000	0.59		57.1		OK	
1.002	3	20	63.775	0.040	0.000	1.19		73.3		SURCHARGED	
1.003	4	17	63.770	0.094	0.000	0.74		71.7		SURCHARGED	
1.004	5	17	63.760	0.280	0.000	0.92		88.0		SURCHARGED	
2.000	6	9	64.036	-0.039	0.000	0.89		15.2		OK	
2.001	7	17	63.762	-0.084	0.000	0.49		24.0		OK	
2.002	8	17	63.755	0.167	0.000	0.34		42.0		SURCHARGED	
1.005	6	17	63.751	0.274	0.000	0.74		124.4		SURCHARGED	
1.006	10	17	63.747	0.347	0.000	0.00		0.0		SURCHARGED	

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Summary Wizard of 60 minute 100 year Winter I+40% for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.236
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440, 2160, 2880, 4320, 5760,
 7200, 8640, 10080
 Return Period(s) (years) 100
 Climate Change (%) 40

PN	US/MH Name	Storm Rank	Water	Surcharged	Flooded			Pipe	Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
1.000	1	10	63.996	-0.179	0.000	0.25		24.5	OK
1.001	2	6	63.992	0.054	0.000	0.42		41.1	SURCHARGED
1.002	3	6	63.986	0.251	0.000	0.85		52.4	SURCHARGED
1.003	4	6	63.982	0.306	0.000	0.53		51.0	SURCHARGED
1.004	5	6	63.974	0.494	0.000	0.66		63.0	SURCHARGED
2.000	6	11	64.013	-0.062	0.000	0.64		10.9	OK
2.001	7	6	63.976	0.130	0.000	0.35		17.2	SURCHARGED
2.002	8	6	63.969	0.381	0.000	0.22		27.4	SURCHARGED
1.005	6	6	63.966	0.489	0.000	0.53		89.9	SURCHARGED
1.006	10	6	63.963	0.563	0.000	0.00		0.0	SURCHARGED

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Summary Wizard of 180 minute 100 year Winter I+40% for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

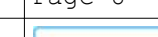
Rainfall Model	FSR	Ratio R	0.236
Region England and Wales	Cv (Summer)	0.750	
M5-60 (mm)	19.800 Cv (Winter)	0.840	

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe		Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow / Overflow (l/s)	Flow (l/s)			
1.000	1	1	64.155	-0.020	0.000	0.13		12.6		OK	
1.001	2	1	64.152	0.214	0.000	0.22		21.1		SURCHARGED	
1.002	3	1	64.147	0.412	0.000	0.42		25.8		SURCHARGED	
1.003	4	1	64.145	0.469	0.000	0.26		25.2		SURCHARGED	
1.004	5	1	64.139	0.659	0.000	0.34		32.0		SURCHARGED	
2.000	6	1	64.147	0.072	0.000	0.33		5.6		SURCHARGED	
2.001	7	1	64.140	0.294	0.000	0.18		8.9		SURCHARGED	
2.002	8	1	64.135	0.547	0.000	0.12		14.1		SURCHARGED	
1.005	6	1	64.132	0.655	0.000	0.28		46.8		SURCHARGED	
1.006	10	1	64.129	0.729	0.000	0.00		0.0		SURCHARGED	

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Summary Wizard of 360 minute 100 year Winter I+40% for Storm

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Synthetic Rainfall Details

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Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF
      Analysis Timestep   Fine Inertia Status OFF
      DTS Status          ON
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PN	US/MH Name	Storm Rank	Water	Surcharged	Flooded			Pipe	Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
1.000	1	4	64.108	-0.067	0.000	0.08		7.9	OK
1.001	2	4	64.105	0.167	0.000	0.14		13.3	SURCHARGED
1.002	3	4	64.100	0.365	0.000	0.27		16.5	SURCHARGED
1.003	4	4	64.098	0.422	0.000	0.17		16.2	SURCHARGED
1.004	5	4	64.092	0.612	0.000	0.21		20.4	SURCHARGED
2.000	6	6	64.101	0.026	0.000	0.21		3.5	SURCHARGED
2.001	7	4	64.093	0.247	0.000	0.11		5.6	SURCHARGED
2.002	8	4	64.088	0.500	0.000	0.07		9.0	SURCHARGED
1.005	6	4	64.085	0.608	0.000	0.18		29.9	SURCHARGED
1.006	10	4	64.082	0.682	0.000	0.00		0.0	SURCHARGED