

**COMMUNITY DIAGNOSTICS CENTRE (CDC), PLYMOUTH
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY**

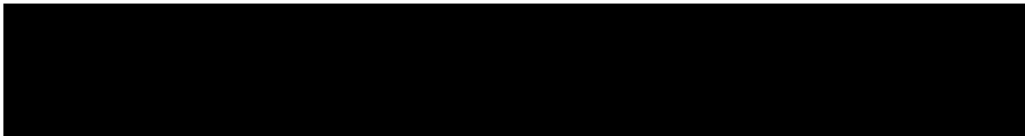
Rev:
P1

Date:
08.12.23

Notes:
Planning Issue

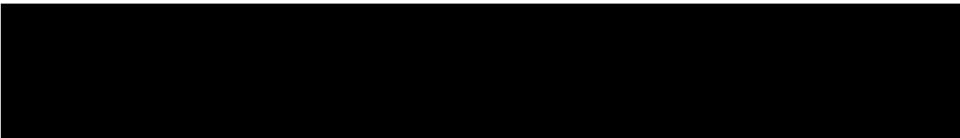
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APPENDICES

APPENDIX A | EXISTING SITE LAYOUT, PROPOSED SITE LAYOUT & INDICATIVE DRAINAGE

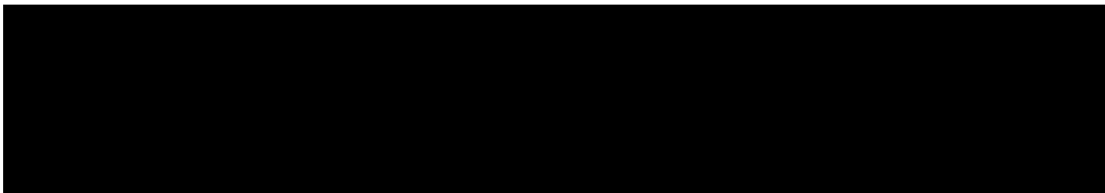
APPENDIX B | PROPOSED DEVELOPMENT DRAINAGE MODEL REPORTS

APPENDIX C | SOUTH WEST WATER CORRESPONDENCE *(To be included if required and once made available)*

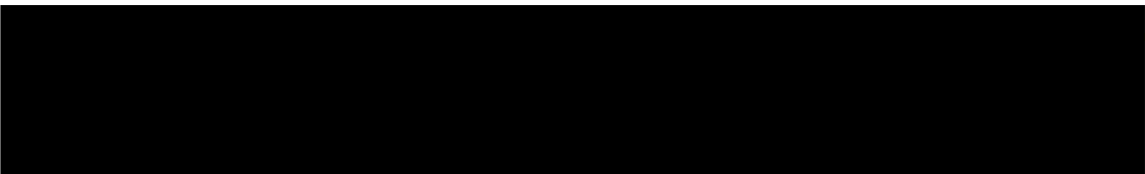
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1.0 INTRODUCTION

- 1.0.1 This Flood Risk Assessment and Drainage Strategy relates to the proposed redevelopment within Colin Campbell Court car park, Plymouth. The brownfield site is referred to as the Community Diagnostics Centre, Plymouth (CDC in this document). The site was previously demolished as part of the former West End Health and Wellbeing Centre (WEHWC) application.
- 1.0.2 Due to a lack of national funding Plymouth's WEHWC was unable to be built. Following discussion between Plymouth City Council (PCC) and University Hospitals Plymouth NHS Trust (UHP) the Community Diagnostics Centre (planned for the former Two Trees site in Union Street) has been relocated to Colin Campbell Court. The CDC will need to fit within the wider PCC masterplan for the area.
- 1.0.3 The CDC proposals comprise a new 4 storey building which will accommodate MRI and Ultrasound imaging, CT and X-Ray imaging, Physiological measurement and Audiology facilities, and staff administration welfare and support services. A drop off area and accessible parking is to be located along the eastern building elevation. A proposed site plan is provided in **Appendix A**.
- 1.0.4 The CDC will allow for the relocation of audiology services from Derriford Hospital and provide additional capacity for imaging and physiological measurement services. This will ease demand on the main hospital and help to improve NHS patient waiting times.
- As the development proposes more than 1000m² of floor space, it is classified as a Major Development as defined by The Town and Country Planning (Development Management Procedure) (England) Order 2015. Major developments require an FRA to be submitted as part of the application process.
 - The development falls under 'non-residential uses for health services, nurseries and educational establishments' which has a Flood Risk Vulnerability Classification of 'More Vulnerable'.
 - The site lies within the Plymouth Critical Drainage Area (CDA), as defined and notified to the Local Planning Authority (LPA) by the Environment Agency (EA).
- 1.0.5 It is therefore a formal requirement to submit a site-specific Flood Risk Assessment and Drainage Strategy in support of the Planning Application for this development. This document meets the requirements of the National Planning Policy Framework (NPPF) and is submitted as part of the Planning Application to assist decision makers. It considers the direct flood risks to the site and potential impacts to the surrounding areas. Flood risks from rivers and the sea, together with surface water, have been investigated and mitigation measures are provided where deemed necessary.
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2.0 SITE LOCATION, EXISTING LEVELS AND DRAINAGE

2.1 Site Location

2.1.1 The Community Diagnostics Centre site, identified as CDC is located in the Centre of Plymouth (South West Devon), approximately 750m south of Plymouth train station, 800m north of Plymouth Hoe and 600m north-east of Millbay. It is bound to the west by Western Approach, to the south by Union Street, to the north by shops on Frankfort Gate, and to the east by further retailers within Colin Campbell Court. The site is centred on National Grid Reference SX 47339 54516 and the post code is given as PL1 1TZ.

The wider area includes Plymouth Pavilions to the south-west and Theatre Royal Plymouth to the south-east. The east is largely commercial (central business district area) leading to Sutton Harbour approximately 850m away. The wider areas to the north, south and west are commercial mixed with residential and public open space along the southern coastline.

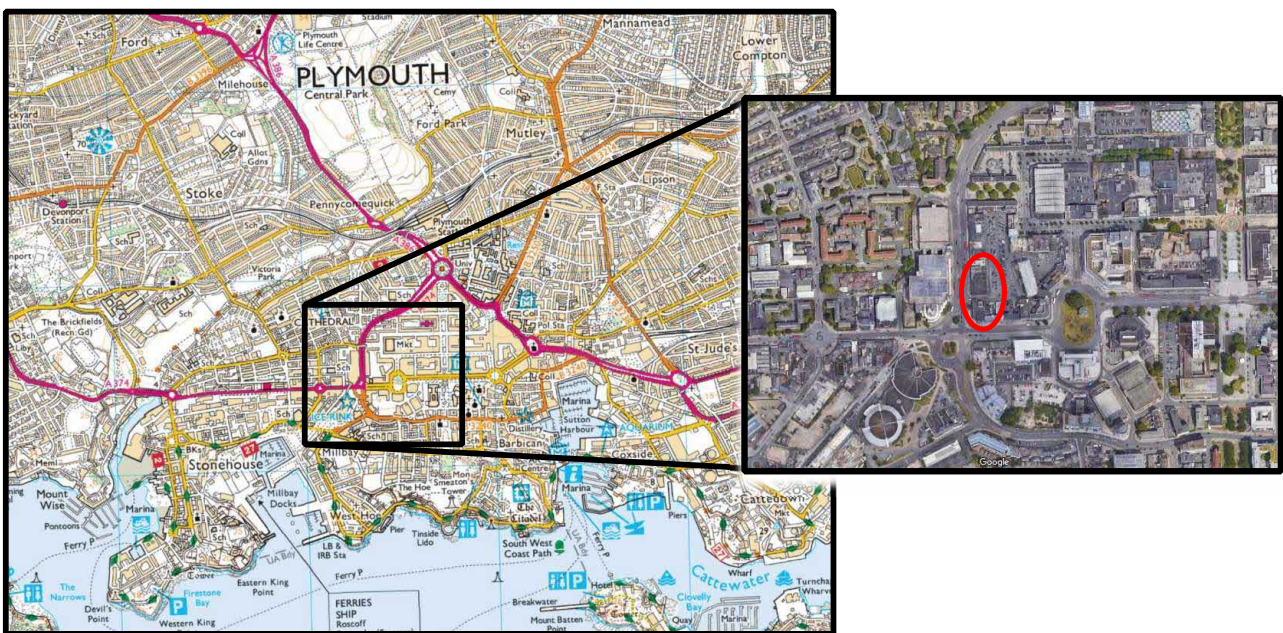


Figure 2.1 Site Location

2.2 Existing site Levels

2.2.1 A topographic survey of the wider car park has been completed which indicates the ground falls moderately from the west and north towards Western Approach and the application area. Levels across the CDC redevelopment vary between 3.75m AOD and 2.89m AOD, and the average gradient has been established as circa 1 in 80. An existing site plan including the surveyed levels is included in **Appendix A**.

2.3 Existing Drainage

- 2.3.1 Figure 2.2 below indicates significant South West Water (SWW) infrastructure within the vicinity of the proposed CDC. Combined sewers surround the wider Colin Campbell car park and are present within Union Street, Western Approach, Raleigh Street, New George Street, Frankfort Gate and Market Avenue. These combined sewers range from Ø300mm to Ø1500mm (strategic corridors) and are constructed in a variety of different materials.
- 2.3.2 A public designated foul water sewer is present at the southern site boundary running west towards Western Approach (discussions have commenced with PCC and SWW regarding designation and ownership of the existing sewerage infrastructure). The nearest available designated surface water sewer is further west within Flora Street. Other on site SWW infrastructure includes a mains distribution pipe which runs the perimeter of the existing car park.
- 2.3.3 A CCTV/utilities survey covering existing on-site drainage has been undertaken. This indicates a combined sewer to the rear of the former retail premises which will not be impacted by the redevelopment. The sewer is established as combined and runs south to connect into the SWW foul (combined) sewer linked to Western Approach. This drainage run will not require a diversion to allow the development to progress.

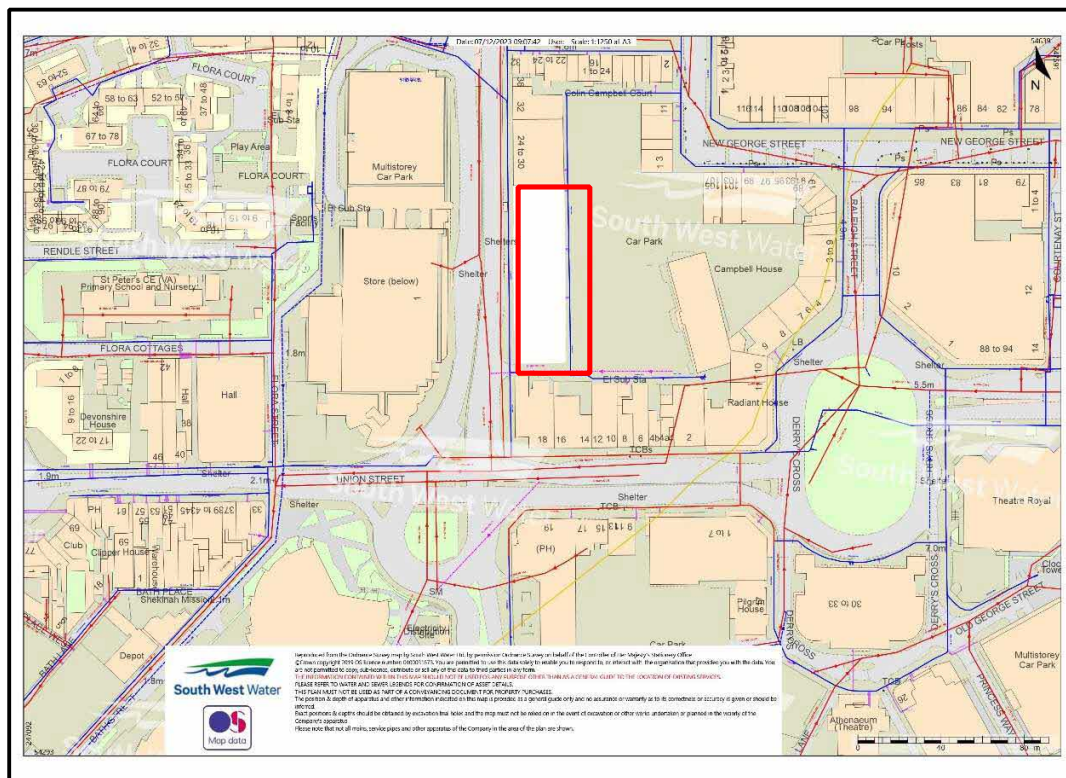


Figure 2.2 SWW Infrastructure Plan

3.0 SOURCES OF POTENTIAL FLOODING

3.1 Fluvial and Tidal Flood Risk

3.1.1 The EA flood risk from rivers or the sea map (Figure 3.1) shows the entire site is sufficiently far away from any tidal plain or fluvial flood extents to be at very low risk. As such, the site is considered to be located within Flood Zone 1 with less than a 1 in 1,000 annual probability of river or sea flooding. The Plymouth City Council (PCC) Strategic Flood Risk Assessment (SFRA) L2 discusses a discrepancy with the extents of Millbay Tidal Flood Zone, however it does confirm the site should be designated to lie within Flood Zone 1.



Figure 3.1 Extract from EA flood map for planning: Rivers and Sea

3.2 Surface Water Flood Risk

- 3.2.1 The EA surface water flood risk map suggests the CDC site is not at direct risk from surface water flooding. Figure 3.2a shows a very low to low risk of flooding from surface water within the site extents. Low risk overland flow originates outside Colin Campbell Court and heads southwest to join overland flow on Western Approach. Union Street, Western Approach and The Octagon are shown to be at high risk of surface water flooding, however these highways are deemed to be downstream of the proposals and act as a conduit confining surface water.
- 3.2.2 Raleigh Street also exhibits high surface water flood risk; however, Colin Campbell Court car park is protected by existing buildings which surround the perimeter. As such the development is considered to have between 1 in 1,000 and 1 in 100 annual probability of surface water flooding. The Catchment Flood Management Plan (CFMP) for Millbay & City Centre, developed as part of the PCC Local Flood Risk Management Strategy (LFRMS), aims to reduce the extent and frequency of surface water flooding by improving sewerage capacity.

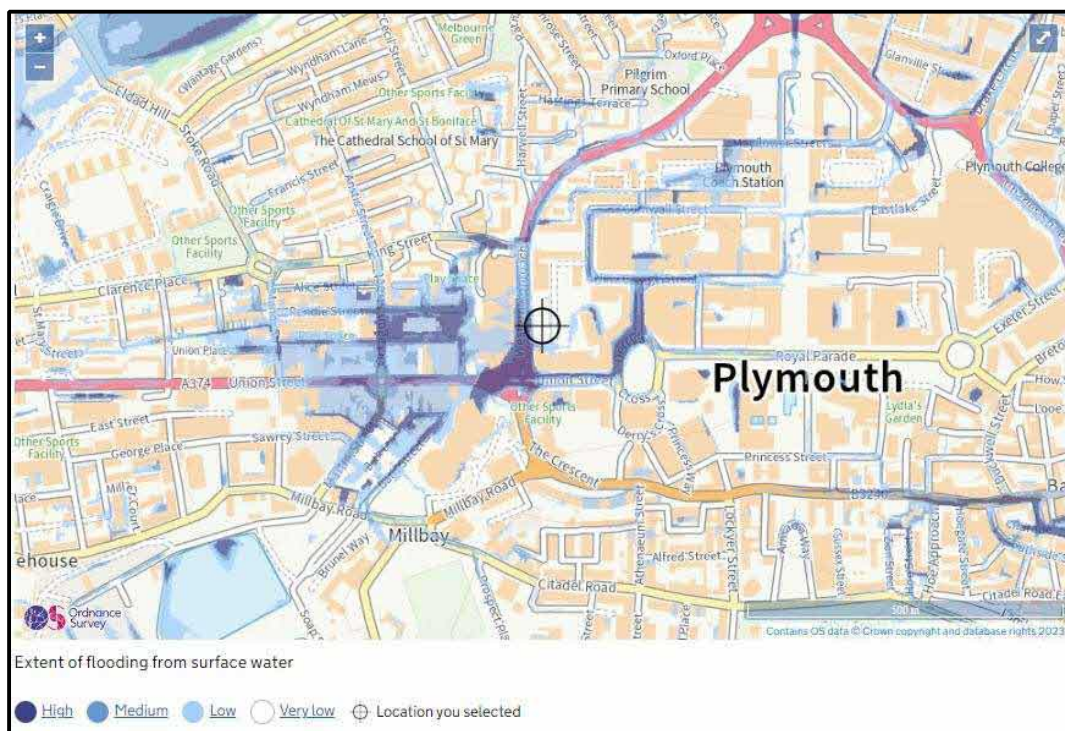


Figure 3.2a Extract from EA flood map for planning: Surface Water

3.2.3 PCC have provided (pre-application) information on surface water flood risk. Figure 3.2b indicates that the southwestern extent of the planning application area is at risk of water levels between 0.15m and 0.3m. This reflects the hydraulic limitations of the existing sewers which are known to be tidally influenced. The building will be elevated above these levels to provide resilience to offsite surface water flood risk. Levels in the southwestern corner of the site are circa 2.9-3.0m AOD, therefore the building will be set at 3.4m AOD or higher to provide freeboard above projected flood depths. This will be reviewed to ensure compliance with access requirements and resilience to surface water flood risk are both maintained.

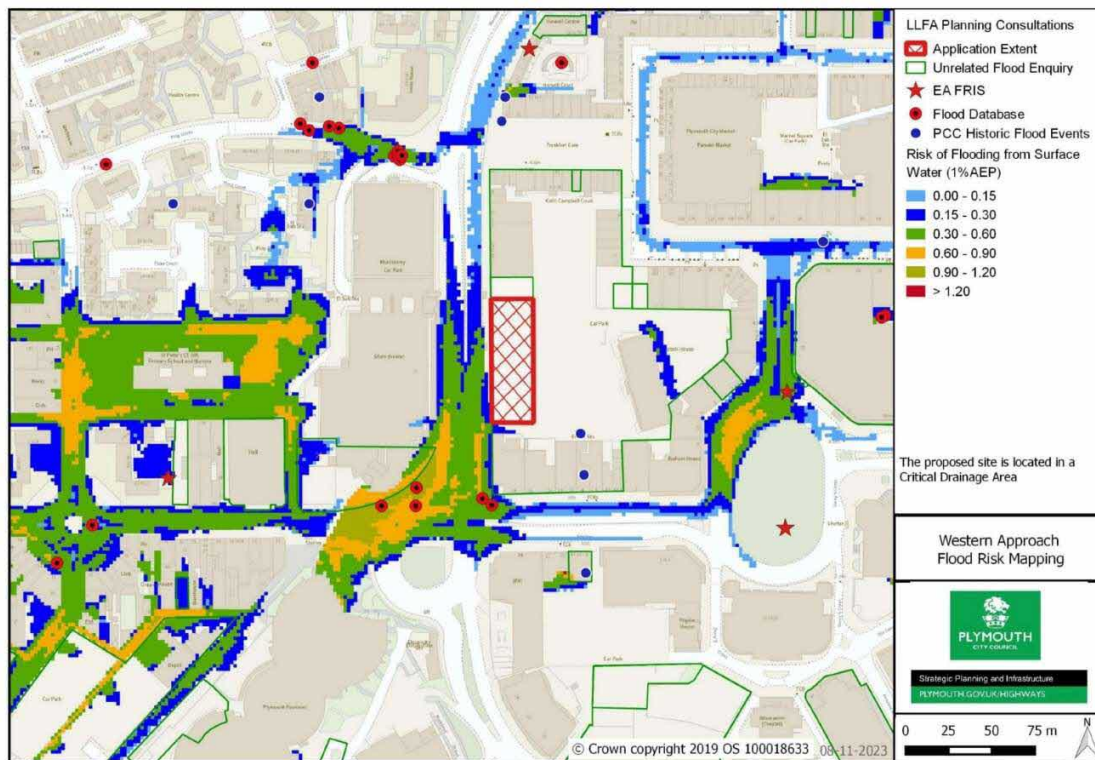


Figure 3.2b Extract from PCC Pre-App Response: Surface Water

3.2.4 The Lead Local Flood Authority (LLFA) pre-application response also states that “Surface water flood risk mapping provided by the Environment Agency indicates the site itself is at low risk of surface water flooding from a 1% AEP (1 in 100 year return period) flood event, however Western Approach to the west of the proposed site is at a high risk from surface water flooding. Unmanaged surface water runoff from this site has the potential to increase the risk of flooding in Western Approach and Union Street”. The proposals are not anticipated in any way to exacerbate off site surface water flood risk.

3.3 Groundwater Flood Risk

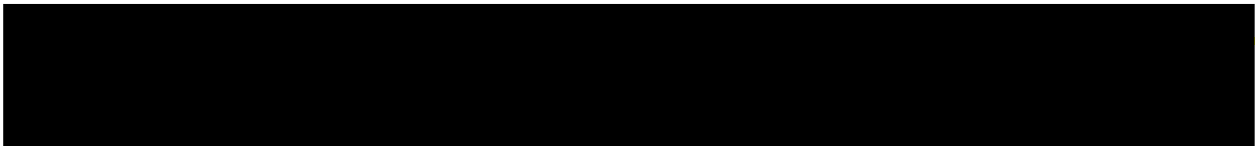
- 3.3.1 Accurately establishing groundwater flood risk is more difficult as there is generally little information available, however a thorough ground investigation has been carried out at the site. The Magic Map application from DEFRA designates a 'Secondary A' aquifer with permeable layers capable of supporting water supplies at a local rather than strategic scale. British Geological Survey (BGS) mapping indicates the site bedrock geology is largely the Saltash Formation - Slate and Siltstone Sedimentary Bedrock, superficial deposits of Alluvium - Clay, Silt, Sand and Gravel are also recorded.
- 3.3.2 Geo-Environmental Investigations were carried out from February 2023 and groundwater was not encountered within any of the dynamic windowless sampling boreholes to depths of 3.45m below ground level . Extracts from the Geotechnical and Geo-Environmental Report RP7951 are available in **Appendix D**. The EA Long Term Flood Risk Summary states that flooding from groundwater is unlikely in this area. Given the site-specific information above, groundwater flooding is likely to reflect average sea level and not anticipated to pose a significant risk to the site.

3.4 Sewers

- 3.4.1 As described in Section 2.3, the site and wider car park are surrounded by public infrastructure. Union Street is downstream of the proposals and therefore poses no flood risk to the development. Combined sewers and a designated surface water within Western Approach are upstream of the development, along with combined sewers within Frankfort Gate, Market Avenue, New George Street and Raleigh Street. The PCC LFRMS identifies these highways as Strategic Surface Water Drainage Corridors which are intended to provide long term capacity and protection during sewerage flood risk scenarios.
- 3.4.2 There are existing combined sewers on site which are known to discharge to the public combined sewers within Western Approach. This significant existing infrastructure broadly suggests a low risk of flooding to the site from sewer failure. The southernmost existing drainage is downstream of the proposed CDC minimising flood risk to the redevelopment.
- 3.4.3 Significant undertakings have been made by SWW and PCC to alleviate some of the issues faced within this catchment, including the provision of large-scale attenuation within the Millbay basin and the improvements made through the Millbay Boulevard development completed by PCC. These improvements and measures are supported by planning policies designed to further alleviate pressure on the existing networks.
- 3.4.4 The site is not shown in the Environment Agency Risk of Flooding from Reservoirs map to be at risk from this source. There is also no known risk of flooding from canals or any other artificial source and therefore the site is at a negligible risk of flooding from other infrastructure failure.

3.5 Summary

- 3.5.1 The site is at very low risk from fluvial or tidal flooding and surface water flooding is shown as very low risk to low risk within the redevelopment boundary. The surrounding area and some areas within the wider application boundary are indicated to be at high risk of both surface water and potentially sewer flooding.
- 3.5.2 A CFMP for the area provides strategies to reduce the extent and frequency of surface water flooding and increase sewerage capacity. This is largely delivered by Integrated Urban Drainage Modelling (IUDM) and Strategic Surface Water Drainage Corridors designated for the City Centre.
- 3.5.3 All other anticipated flood risk mechanisms have been investigated and have been found to be low risk to the site.
- 3.5.4 Through appropriate mitigation and design, the development is considered to be at low risk and does not increase flood risk off-site.



4.0 NATIONAL AND LOCAL PLANNING AND FLOOD RISK POLICIES

4.1 National Planning Policy Framework

- 4.1.1 The National Planning Policy Framework (NPPF) produces a sequential risk-based approach to developing in areas at risk from flooding or affecting flood risk areas. The site has been shown to lie within an area classified as Flood Zone 1 and therefore has a low risk of fluvial and tidal flooding; further investigation has shown that all other anticipated flood risk mechanisms are also low risk.
- 4.1.2 The Flood Risk Assessment confirms that the annual probability of flooding for the entirety or part of the site is less than 0.1%, with little or no risk of flooding. Accordingly, the site does not need to be sequentially assessed by the Local Planning Authority (LPA) in respect of its allocation and appropriateness for the proposed development at this location.
- 4.1.3 The proposals to develop the site will not increase the risk of flooding off site assuming the proposed drainage strategy is constructed, and therefore the proposed development is exempt from the risk-based Sequential Test. The proposed development of the site is consistent with the required criteria of the National Planning Policy Framework.
- 4.1.4 The development is considered to be 'More Vulnerable' in-line with NPPF - Annex 3: Flood risk vulnerability classification. Table D.3 Annex D of Planning Policy Statement (PPS) 25 Flood Risk Vulnerability and Flood Zone 'Compatibility' confirms more vulnerable development within Flood Zone 1 is appropriate (see extract in Figure 4.1 below).

PPS 25 – Table D.3 Annex D: The Sequential Test and Exception Test

Table D.3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	X	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	X	X	X

Key:
 ✓ Development is appropriate
 X Development should not be permitted

Figure 4.1. Extract from PPS 25 - Table D.3 Annex D

4.2 Local Policies

4.2.1 The site lies within the Plymouth City Council authority area. Generally, where local plans differ from national policy, the local plan should be adhered to; in this case the drainage has been designed to guidance provided by PCC and the EA. The Plymouth and South West Devon Joint Local Plan (2014 - 2034) was adopted by Plymouth City Council in 2019 and forms part of the Development Plan for the Plymouth authority area. Policy DEV35 Managing flood risk and water quality impacts states but is not limited to the following:

- A sequential approach will be used in areas known to be at risk of any form of flooding.
- Where development cannot be located in zones with a lower probability of flooding an Exception Test must be undertaken.
- Development within Flood Zones 2 or 3 should minimise flood risk and be resilient to flooding through design, layout and mitigation measures. It should also provide sufficient space for drainage and flood alleviation and promote the safety of people.
- Development should incorporate sustainable water management measures concerning water use, surface water run-off and impact on flood risk and water quality elsewhere.
- Surface water should be discharged to a separate surface water drainage system in accordance with the hierarchy set out in the Plymouth and Devon Local Flood Management Strategies.
- Developments located within a CDA should a Drainage Strategy justifying the option(s) proposed.
- Confirmation of sewage treatment facilities capacity must be confirmed prior to the development taking place.

4.3 Environment Agency Policies

4.3.1 The site is located with the Plymouth Critical Drainage Area as identified by the Environment Agency guidance, which states *“All new developments will have to play their part in reducing current rainfall runoff rates. This requirement also applies to brownfield sites that will have to match the same standards. The surface water drainage hierarchy should be followed by using infiltration as far as is practicable. Further guidance on such systems can be found in the CIRIA SuDS Manual and in Lead Local Flood Authority guidance.*

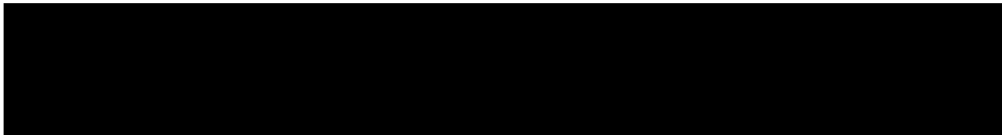
4.3.2 *All off-site surface water discharges from developments should mimic greenfield performance up to a maximum 1 in 10 year discharge rate. On site all surface water should be safely managed up to the 1 in 100 plus climate change conditions. This will require additional water storage areas to be created thereby contributing to a reduction in flooding downstream.”*

4.4 Sewerage Sector Guidance

4.4.1 Although this site will not likely be offered for adoption this drainage design has incorporated the criteria outlined in Design and Construction Guidance (Sewerage Sector Guidance - Appendix C) where possible, as is best practice.

4.5 The SuDS Manual CIRIA 753

- 4.5.1 Where possible the design adheres to the guidance outlined within The SuDS Manual. This document provides guidance for planning, design, construction and maintenance of Sustainable Drainage Systems (SuDS). The guidance looks to maximise alternative ecology benefits whilst managing flood risk and water quality.



5.0 PROPOSED DRAINAGE STRATEGY

5.0.1 The proposed development requires a surface water drainage strategy that complies with current best practices and must gain the approval of the Local Planning Authority (LPA) and Lead Local Flood Authority (LLFA). Options were reviewed for achieving such a strategy as follows: The Plymouth City Council Local Flood Risk Management Strategy (2019) provides a hierarchical approach to the disposal of rainwater with the preferred option to discharge to an adequate watercourse. If this is not possible, the next favoured option is to discharge to a soakaway or other infiltration system, subject to investigation of groundwater flow paths. Only, if neither of these options is possible, should the site discharge to a sewer.

5.1 Discharge to a Watercourse

5.1.1 There is no local watercourse to which it is feasible to make a direct discharge. As such this technique of surface water disposal has been discounted.

5.2 Infiltration Drainage

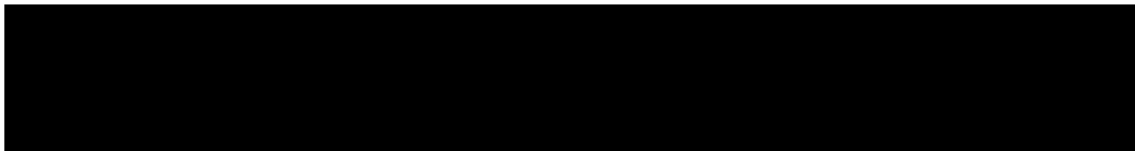
5.2.1 In-situ soakaway tests were not included within the scope of works for the CDC intrusive ground investigations. The following commentary is from the ground investigation report (RP7951): "It is considered that the non-fissured relatively impermeable cohesive nature of the soils encountered beneath the made ground, together with the high water table, is unlikely to provide sufficient percolation to make soakaway drainage of surface water runoff a feasible option". It is also known that soakaway testing undertaken for the WEHWC failed.

5.2.2 Building Regulations Part H 2010 (2015) require that a soakaway is not located within 5m of a building or highway, or where the presence of any contamination in the runoff could result in the pollution of groundwater resources. There is clearly no available space to locate a soakaway within the application boundary. Infiltration on sites with significant made ground have potential to cause pollution; new pathways for pollutants to groundwater must not be created and contaminants must not be mobilised.

5.2.3 Infiltration has been discounted as the preferred method of surface water disposal due to the known bedrock geology and associated poor infiltration rates; spatial constraints and building regulations requirements, and the presence of made ground.

5.3 Discharge to Existing Surface Water Sewer

5.3.1 The nearest available dedicated Surface Water Drainage (SWD) is within Flora Street. This public asset was designated by SWW for a surface water connection following the WEHWC Point of Connection Enquiry. It is proposed that storm water from the development will be conveyed to this dedicated surface water sewer via a new positive drainage network and onsite attenuation. Previous correspondence from SWW regarding the WEHWC application suggests they would agree in principle to the CDC site connecting to their designated surface water asset.



5.4 Discharge to Existing Combined Sewer

5.4.1 As discussed within this report (Section 2.3), there are combined sewers draining the site which are known to ultimately discharge to the wider combined public infrastructure present within Western Approach. In line with the surface water hierarchy and LLFA requirements, connection to a designated surface water sewer shall take precedence over connection to a combined sewer as a last resort.

5.5 Climate Change

5.5.1 In accordance with the NPPF, EA climate change allowances, Plymouth LLFA and Best Practice, all storm water drainage on site will be designed with adequate capacity for the 100 year Design Storm Event plus 50% at peak rainfall intensities to allow for sensitivity to climate change (upper end allowance in the 1% annual exceedance probability event for development with a lifetime beyond 2100).

5.6 Preferred Drainage Design

5.6.1 The preferred solution is attenuated discharge to a large diameter SWW designated surface water sewer, approximately 120m to the west of the site within Flora Street (at the junction with Union Street). This provides direct discharge to a designated surface water sewer which satisfies the hierarchical approach to surface water disposal within the Plymouth CDA and meets with local policy.

5.6.2 The proposed site plan (11409-FRA2) comprises 2,545m² of impermeable area, this encompasses the building footprint and includes all hard landscaped areas within the application boundary. For modelling purposes, a limited amount of impermeable area has not been allocated to the network, it is anticipated this area will continue to make use of the existing drainage provisions.

5.6.3 Flows from the site should be restricted to a calculated 1 in 10 year Greenfield runoff rate, as set out in the EA CDA minimum drainage standards and historically by the LLFA. Greenfield rates have been calculated for the redevelopment area and the 1 in 10 year Greenfield rate has been established as 1.0l/s (**Appendix B**). However, given the site spatial constraints, scale of development and increased potential for blockages associated with lower order flows, a more practical 1.5l/s is proposed.

5.6.4 A 1.0l/s discharge rate is not deemed reasonably practicable considering the 1 in 10 year Brownfield rate for the site (the existing free drainage scenario) is 60.0l/s. Furthermore, the proposed 1.5l/s is in line with the PCC LFRMS (2019) as “this is the minimum rate considered technically practicable with flow control devices”.

5.6.5 Due to the layout of the site and other site-specific constrictions, the most efficient design is for a single crated attenuation tank situated immediately north of the proposed CDC building. Design was carried out using Causeway Flow software which indicated that a minimum storage volume of 137m³ shall be required. A tank plan area of 120m² with a depth of 1.2m is

proposed. The design report from the modelled network can be found in **Appendix B** and an indicative drainage layout has been provided in **Appendix A**. Connection to the public surface water drainage is subject to detailed design and confirmation of location and levels.

5.6.6 The Simple Index Approach Land Use Hazard Indices for Non-residential parking with infrequent change and Low Traffic Roads (< 300 traffic movements per day) have been established as follows - Suspended Solids 0.5, Metals 0.4 and Hydrocarbons 0.4. Naylor Smart Gullies can be installed as new to provide sufficient pollution mitigation. Alternatively, parking could be constructed as pervious pavement (underdrained with no infiltration) to provide more than sufficient pollution mitigation.

5.8 Responsibilities and Maintenance

5.8.1 During construction the contractor will be responsible for the maintenance and management of the drainage system until handover, where it is anticipated that routine maintenance of the drainage system including the geocellular attenuation tank would be undertaken by the CDC building owners UHP.

5.8.2 Maintenance will consist of regular inspection and cleaning of guttering, down-pipes, and silt traps throughout the site to prevent build-up of silt and debris. Regular inspection of the attenuation, including cleaning of debris and sediment etc. is required to ensure optimum performance.

5.8.4 The below ground piped drainage network and attenuation tank should require very little maintenance assuming correct installation. Should a problem occur, this can be dealt with using a company that specialises in clearing and cleaning below ground drainage. The owners shall be responsible for providing maintenance to all the drainage systems throughout their development site. A maintenance plan has been provided in **Appendix F**.

6.0 FOUL WATER MANAGEMENT

6.1 Pre-Development

6.1.1 A previous utility and CCTV survey confirms combined drainage is present within the Colin Campbell Court car park. The utility and CCTV survey indicates the former retail premises were served by combined sewers which are known to discharge to the SWW combined sewer infrastructure located to the southwest of the site.

6.2 Post-Development

6.2.1 The proposed CDC requires discharge of domestic waste only, should this change over the life cycle of the building a trade effluent licence will be sought from SWW.

6.2.2 Due to the removal of a significant volume of surface water from the combined network, the increase in foul flows resulting from the development are not a cause for concern.

6.2.3 The public combined asset within Western Approach was designated by SWW for a foul water connection following the WEHWC Point of Connection Enquiry. Therefore, a preferred route with connection to the existing combined sewer at the southern boundary of the redevelopment is deemed an appropriate connection point.

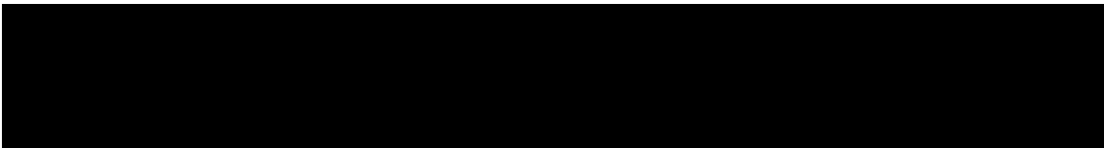
6.2.4 Section B3 of Sewerage Sector Guidance Appendix C - Design and Construction Guidance covers the Hydraulic Design of Foul Sewers and Lateral Drains and states that (method at the discretion of the designer) design flow rates should be calculated in accordance with BS EN 12056-2:2000 System II for this application.

6.2.5 N.B This is a design peak flow rate not a daily average water usage and represents the peak flow rate from a number of appliances. In this case for the CDC, the design peak flow rate has been calculated below as 4.5 l/s. This method is significantly more conservative than Flows and Loads 4 (2013).

	WC	WHB	SH	KS	WM
DU	1.8	0.3	0.4	0.6	1.2
NO. GROUND FLOOR	4	12	0	1	2
NO. FIRST FLOOR	3	12	0	0	2
NO. SECOND FLOOR	5	12	5	2	0
NO. TOTAL	12	36	5	3	4
ΣDU	21.6	10.8	2	1.8	4.8
	K= 0.7				
	$Q_{WW} = K\sqrt{\Sigma DU}$				
	$Q_{WW} = 0.7 \cdot \sqrt{41}$				
	$Q_{WW} = 4.5$				

7.0 EXCEEDANCE EVENTS

- 7.0.1 The proposed site surface water drainage network is based on 50mm/Hr rainfall in accordance with the Building Regulations 2010 Part H (2015). The network model has been assessed up to a 100 year design storm event with a 50% increase in rainfall intensity to allow for climate change. Rainfall exceeding events defined above would result in overland flood flows from the failing positive surface water drainage network. Exceedance Flow Routes can be seen in **Appendix E**.
- 7.0.3 Exceedance flows will be directed away from the development towards the PCC designated surface water corridors to the southwest. The building itself will be positioned above surrounding topography, with landscaping levels tailored to prevent ponding within otherwise captive areas. Due to the setting and nature of the redevelopment it is not practical to provide greater levels of containment on site, as this would detract from the public realm benefits offered by the scheme.
- 7.0.4 The proposal offers betterment from the existing free discharge scenario by providing a reduced peak flow rate and significant attenuation storage. The proposals also remove surface water flows from the existing combined sewerage which is unable to accommodate modern design events. This will contribute to the LLFA and SWW strategic goals to reduce flooding occurrences within the CFMP Millbay & City Centre catchment.



8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Flood Risks

- 8.1.1 All anticipated flood risk mechanisms have been investigated and have been found to be low risk to the site with appropriate mitigation.
- 8.1.2 The development will be placed above the existing topography to the southwest to provide additional resilience to surface water ponding in this area.

8.2 Surface Water Disposal

- 8.2.1 The potential to dispose of surface water by means of a soakaway has been eliminated by site spatial constraints, underlying ground conditions and uncertainty around infiltration rates. Surface water from the new CDC shall be attenuated on site and discharge to a public designated surface water sewer via a new positive drainage network.
- 8.2.2 Peak flow rates will be restricted to 1.5l/s in line with LLFA and EA policy. The exact location, levels and capacity of the existing surface water drainage infrastructure will need to be determined prior to laying any new drainage for connection.
- 8.2.3 The surface water drainage strategy has been designed for the 1 in 100 year event including a 50% allowance for climate change. This will ensure that there is sufficient capacity within the network and attenuation tank to manage a storm event of this magnitude.

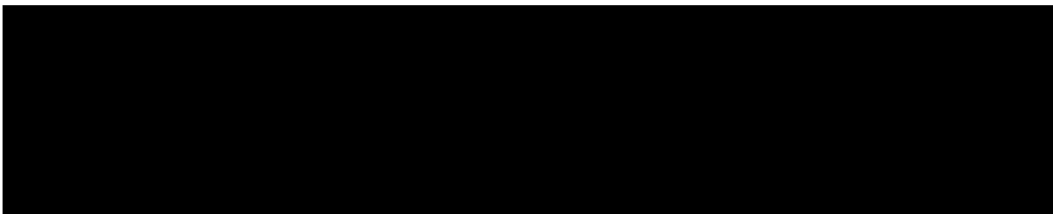
8.3 Foul Water Disposal

- 8.3.1 The preferred point of connection is to the combined sewer at the southern boundary of the redevelopment which runs out to Western Approach. No trade effluent agreement is required currently. The exact location, levels and condition of the existing foul water drainage infrastructure will need to be confirmed prior to laying any new drainage for connection.


8.4 Planning Policy

- 8.4.1 The proposed development and associated infrastructure was found to be located within Flood Zone 1 (low risk). Therefore, the development is deemed to be appropriate in-line with the National Planning Policy Framework and its associated Planning Practice Guidance.
- 8.4.2 Should minor amendments as part of the planning process be required to the site layout currently there will be no impact on the drainage philosophy as laid out in this report. Exceedance flood flow will follow the same route as the existing scenario which will not pose additional risk to any offsite properties. The new drainage network will allow for storm water drainage to be safely retained and discharged to surrounding sewers.

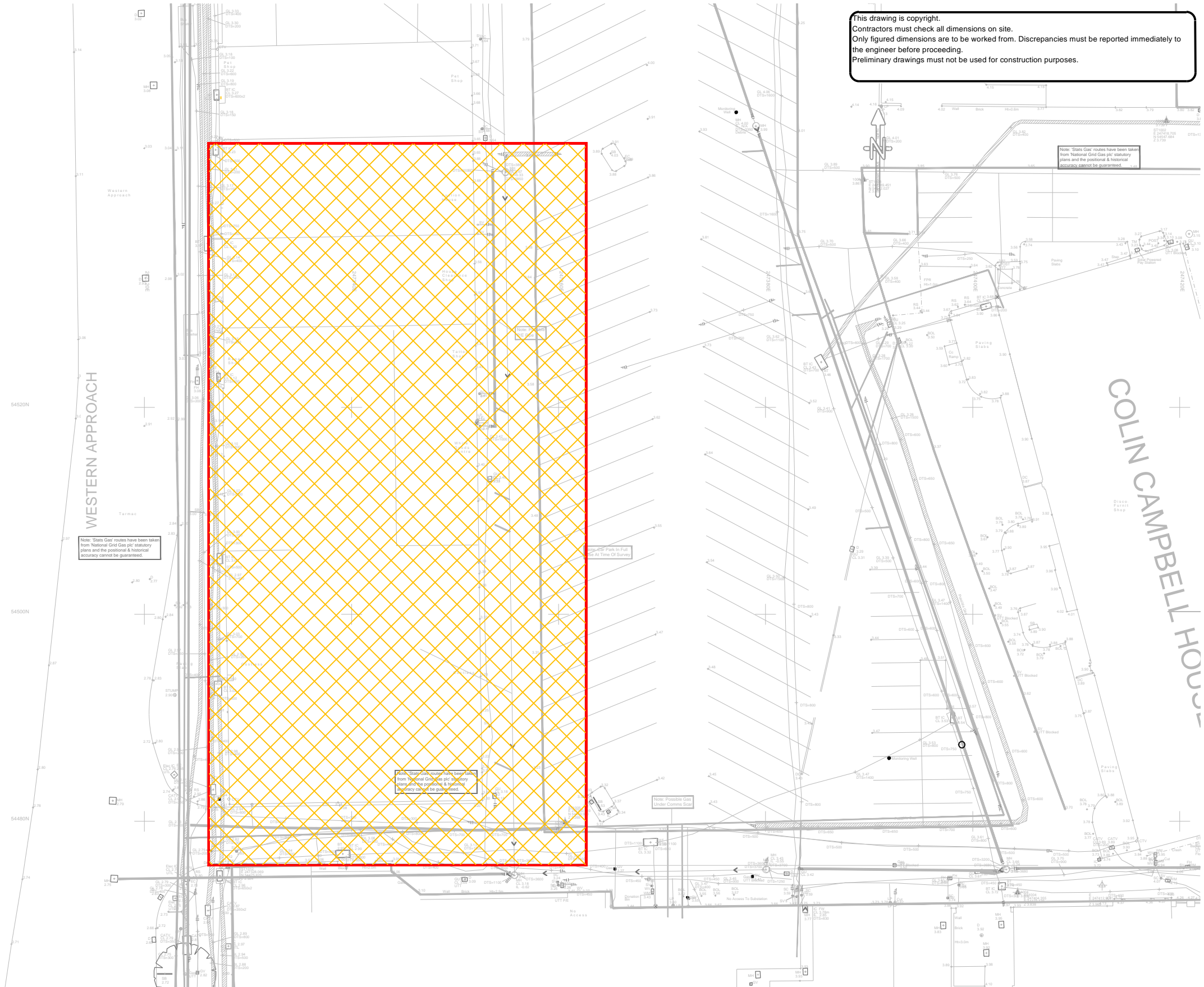
APPENDIX A
EXISTING SITE LAYOUT, PROPOSED SITE LAYOUT & INDICATIVE DRAINAGE



LEGEND

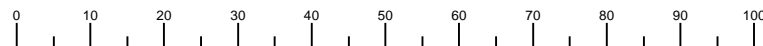
 **SITE BOUNDARY**
TOTAL AREA = 2,545m² 0.255ha

 **IMPERMEABLE AREA - 2,545m² 0.255ha**



This drawing is copyright.
Contractors must check all dimensions on site.
Only figured dimensions are to be worked from. Discrepancies must be reported immediately to the engineer before proceeding.
Preliminary drawings must not be used for construction purposes.

PRELIMINARY
NOT FOR CONSTRUCTION



P1	08.12.23	PRELIMINARY ISSUE	HB	JCF
REV.	DATE.	NOTE.	BY.	CHK.

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PROJECT
**COMMUNITY DIAGNOSTICS CENTRE
(CDC) PLYMOUTH**

DRAWING TITLE
**FLOOD RISK ASSESSMENT
EXISTING SITE LAYOUT**

SCALE
1/400

DATE
DEC 2023

DRAWN BY
HB

CHECKED BY
JCF

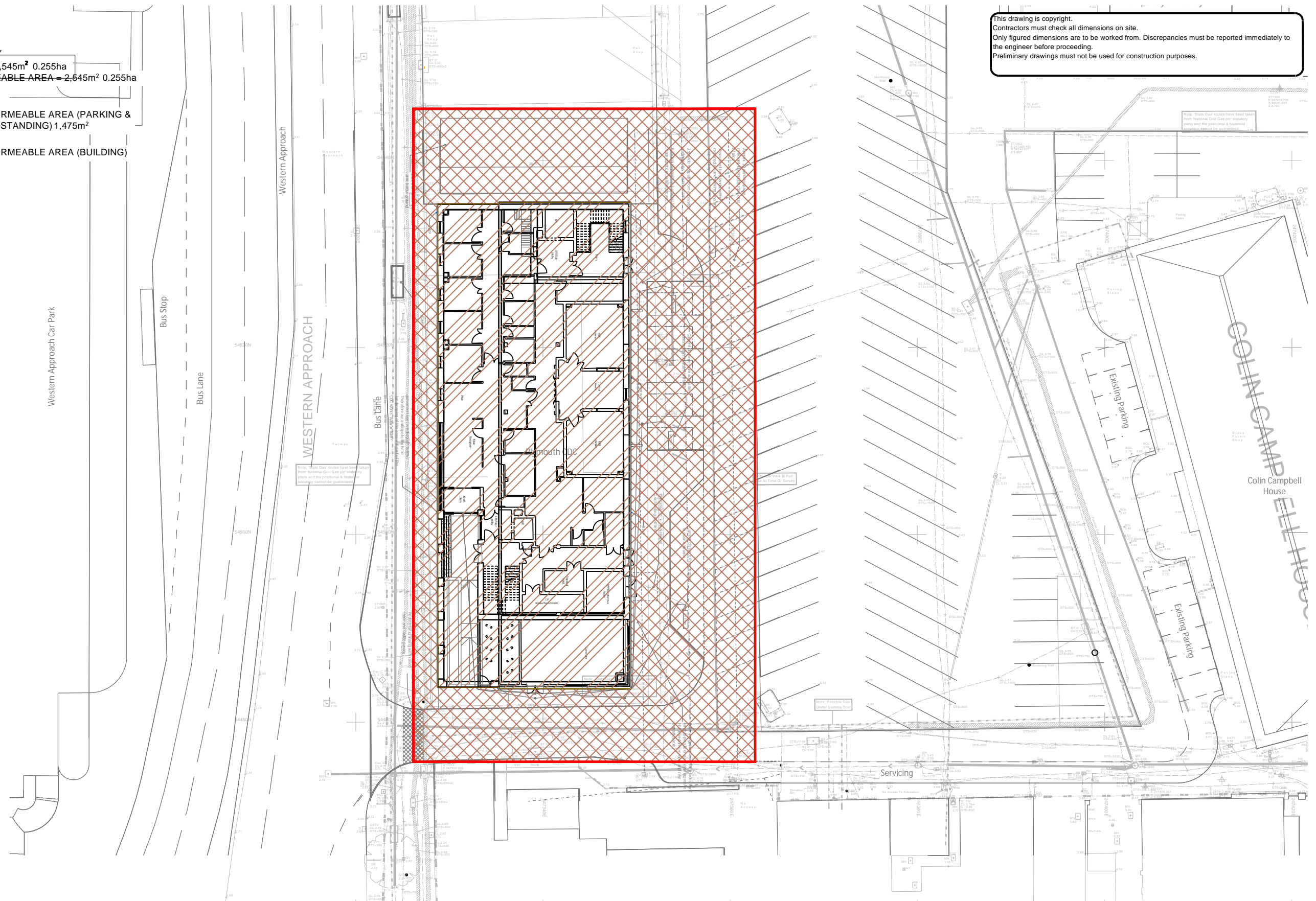
DRAWING NUMBER
11409 - FRA1

REVISION NO.
P1



LEGEND

- SITE BOUNDARY**
 TOTAL AREA = 2,545m² 0.255ha
 TOTAL IMPERMEABLE AREA = 2,645m² 0.255ha
- PROPOSED IMPERMEABLE AREA (PARKING & EXTERNAL HARDSTANDING) 1,475m²**
- PROPOSED IMPERMEABLE AREA (BUILDING) 1,070m²**



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P1	08.12.23	PRELIMINARY ISSUE	HB	JCF
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PROJECT
**COMMUNITY DIAGNOSTICS CENTRE
 (CDC) PLYMOUTH**

DRAWING TITLE
**FLOOD RISK ASSESSMENT
 PROPOSED SITE LAYOUT
 IMPERMEABLE AREAS**

SCALE
 1/400

DATE
 DEC 2023

DRAWN BY
 HB

CHECKED BY
 JCF

DRAWING NUMBER
11409 - FRA2

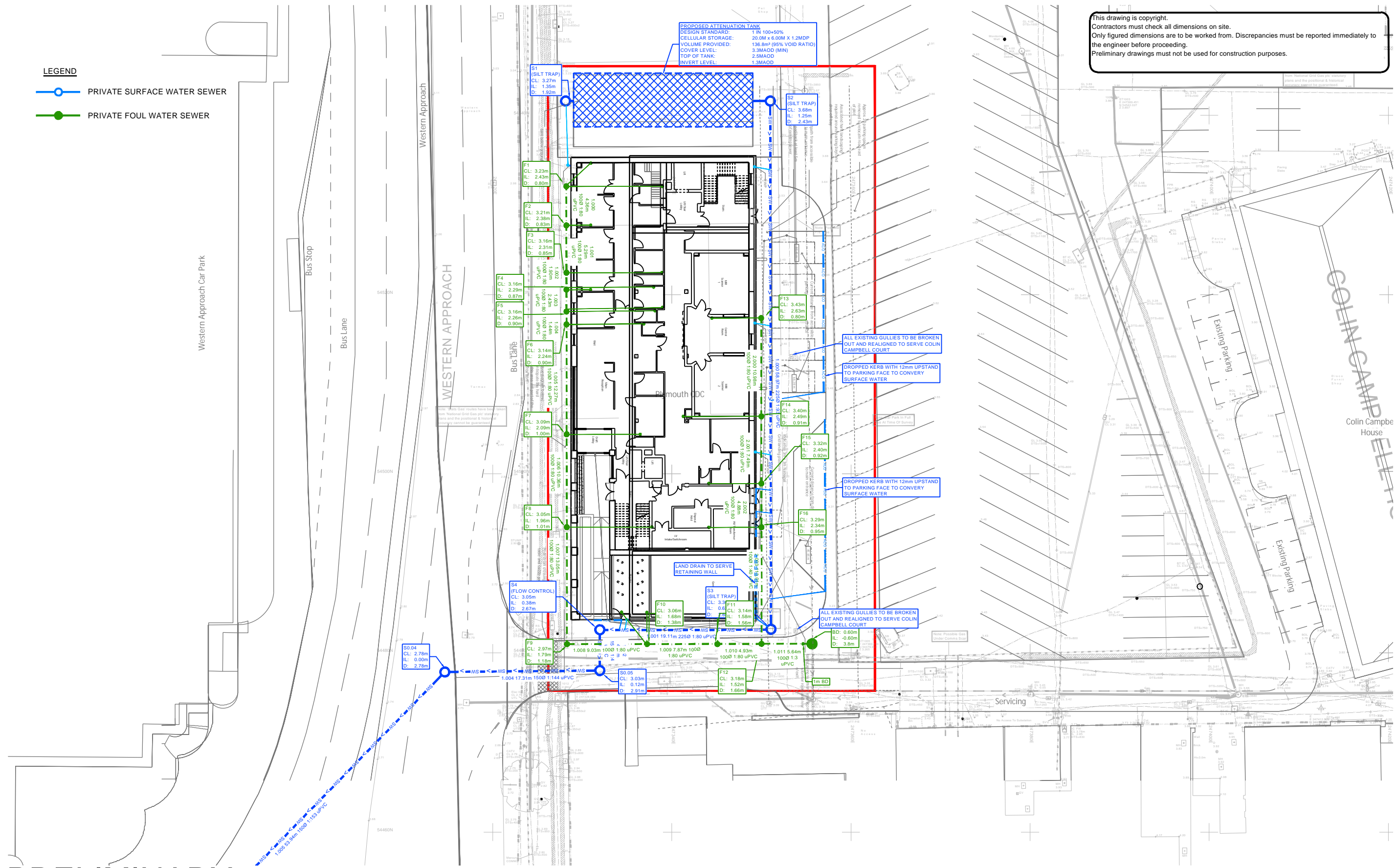
REVISION NO.
 P1



LEGEND

- PRIVATE SURFACE WATER SEWER
- PRIVATE FOUL WATER SEWER

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Contractors must check all dimensions on site.
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PRELIMINARY
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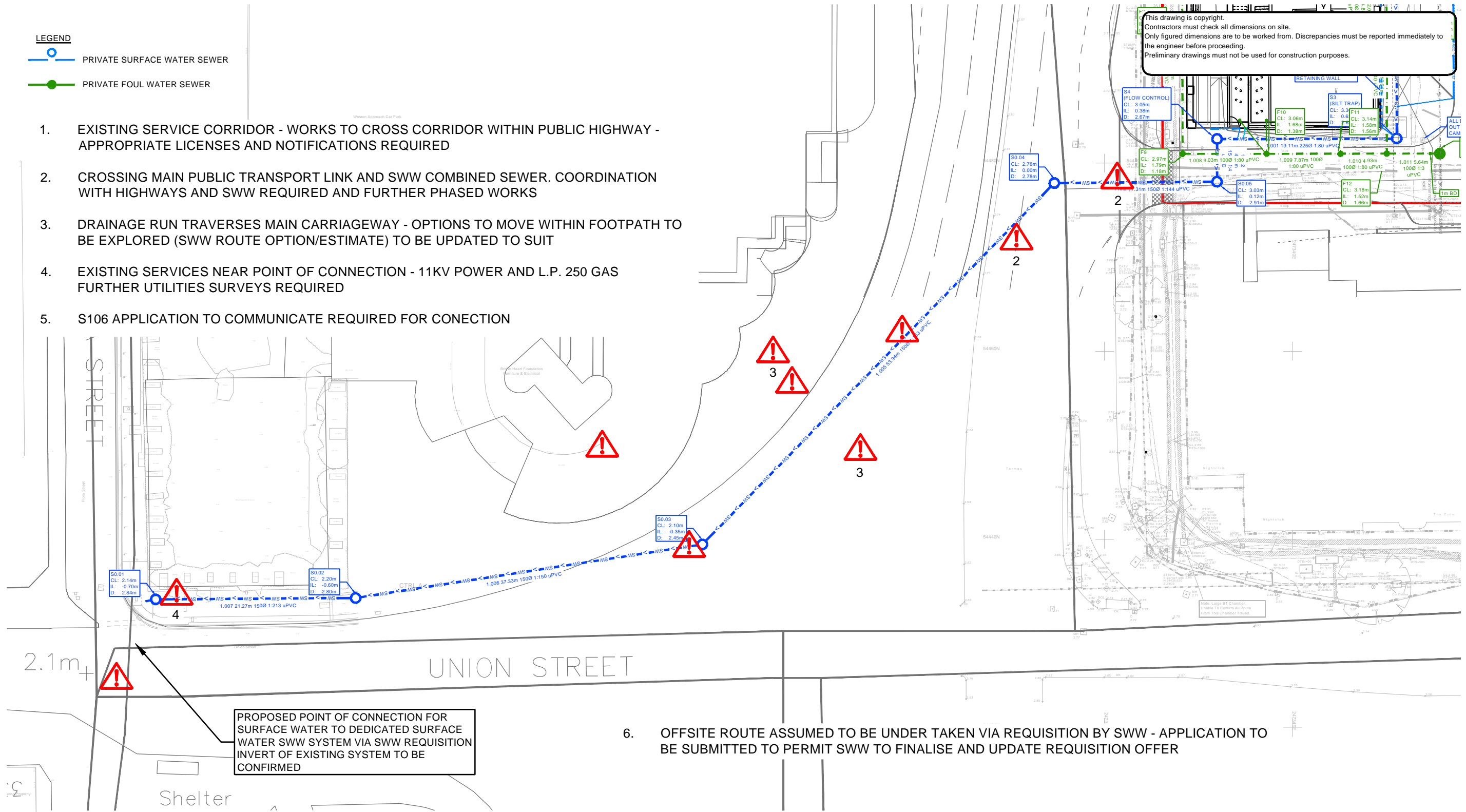
PROJECT
**COMMUNITY DIAGNOSTICS CENTRE
(CDC) PLYMOUTH**

DRAWING TITLE
**FLOOD RISK ASSESSMENT
INDICATIVE DRAINAGE LAYOUT**

P1	08.12.23	PRELIMINARY ISSUE	HB	JCF
REV.	DATE.	NOTE.	BY.	CHK.
SCALE	DATE	DRAWN BY	CHECKED BY	
1/400	DEC 2023	HB	JCF	
DRAWING NUMBER	REVISION NO.			
11409 - FRA3A	P1			

- LEGEND**
-  PRIVATE SURFACE WATER SEWER
 -  PRIVATE FOUL WATER SEWER

1. EXISTING SERVICE CORRIDOR - WORKS TO CROSS CORRIDOR WITHIN PUBLIC HIGHWAY - APPROPRIATE LICENSES AND NOTIFICATIONS REQUIRED
2. CROSSING MAIN PUBLIC TRANSPORT LINK AND SWW COMBINED SEWER. COORDINATION WITH HIGHWAYS AND SWW REQUIRED AND FURTHER PHASED WORKS
3. DRAINAGE RUN TRAVERSES MAIN CARRIAGEWAY - OPTIONS TO MOVE WITHIN FOOTPATH TO BE EXPLORED (SWW ROUTE OPTION/ESTIMATE) TO BE UPDATED TO SUIT
4. EXISTING SERVICES NEAR POINT OF CONNECTION - 11KV POWER AND L.P. 250 GAS FURTHER UTILITIES SURVEYS REQUIRED
5. S106 APPLICATION TO COMMUNICATE REQUIRED FOR CONECTION



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Contractors must check all dimensions on site.
Only figured dimensions are to be worked from. Discrepancies must be reported immediately to the engineer before proceeding.
Preliminary drawings must not be used for construction purposes.

PROPOSED POINT OF CONNECTION FOR SURFACE WATER TO DEDICATED SURFACE WATER SWW SYSTEM VIA SWW REQUISITION INVERT OF EXISTING SYSTEM TO BE CONFIRMED

6. OFFSITE ROUTE ASSUMED TO BE UNDER TAKEN VIA REQUISITION BY SWW - APPLICATION TO BE SUBMITTED TO PERMIT SWW TO FINALISE AND UPDATE REQUISITION OFFER


PRELIMINARY
NOT FOR CONSTRUCTION

AIREY & COLES consulting engineers

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PROJECT
COMMUNITY DIAGNOSTICS CENTRE (CDC) PLYMOUTH

DRAWING TITLE
FLOOD RISK ASSESSMENT INDICATIVE DRAINAGE LAYOUT

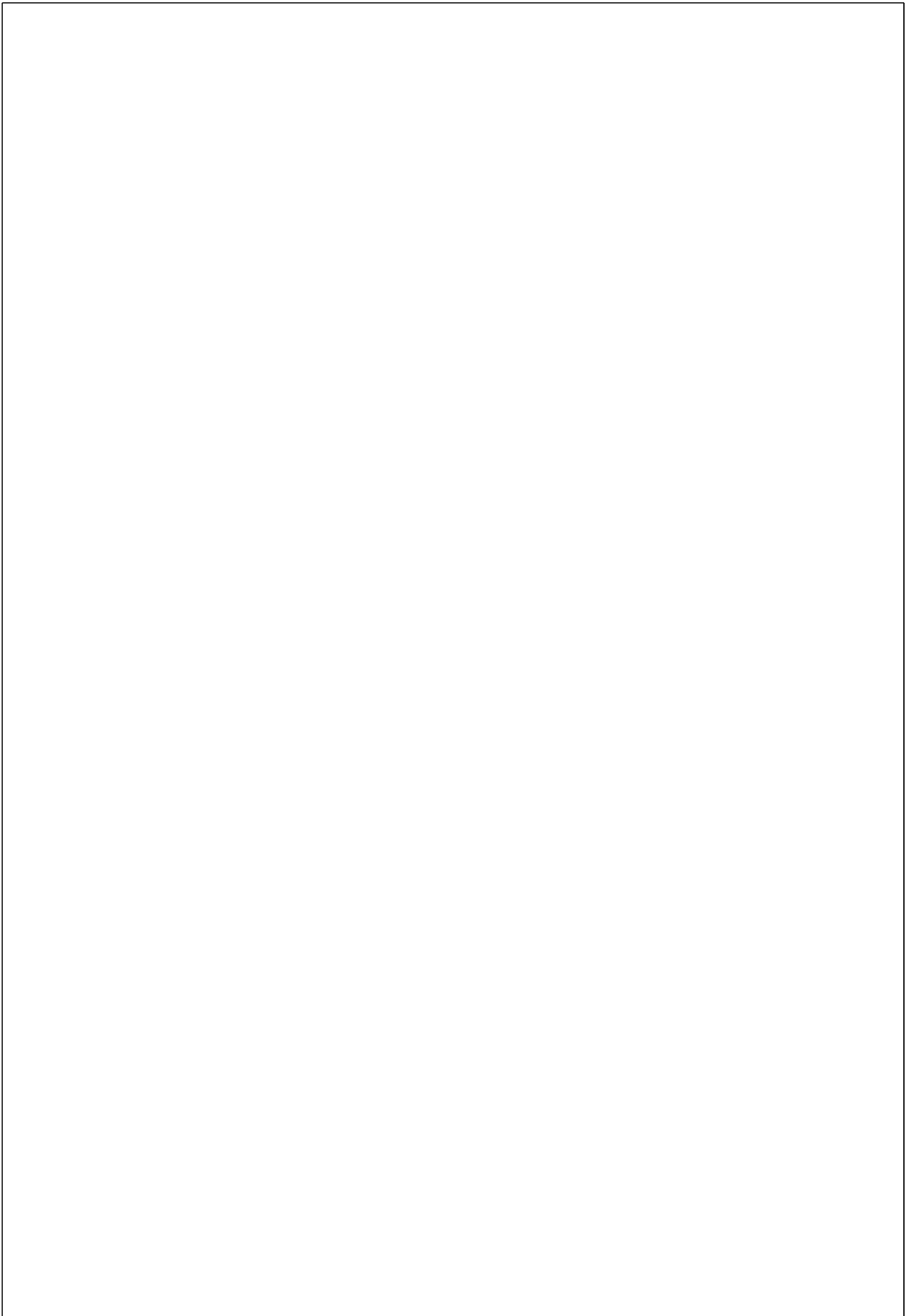
P1	08.12.23	PRELIMINARY ISSUE	HB	JCF
REV.	DATE.	NOTE.	BY.	CHK.
SCALE	DATE	DRAWN BY	CHECKED BY	
1/400	DEC 2023	HB	JCF	
DRAWING NUMBER	REVISION NO.			
11409 - FRA3B	P1			

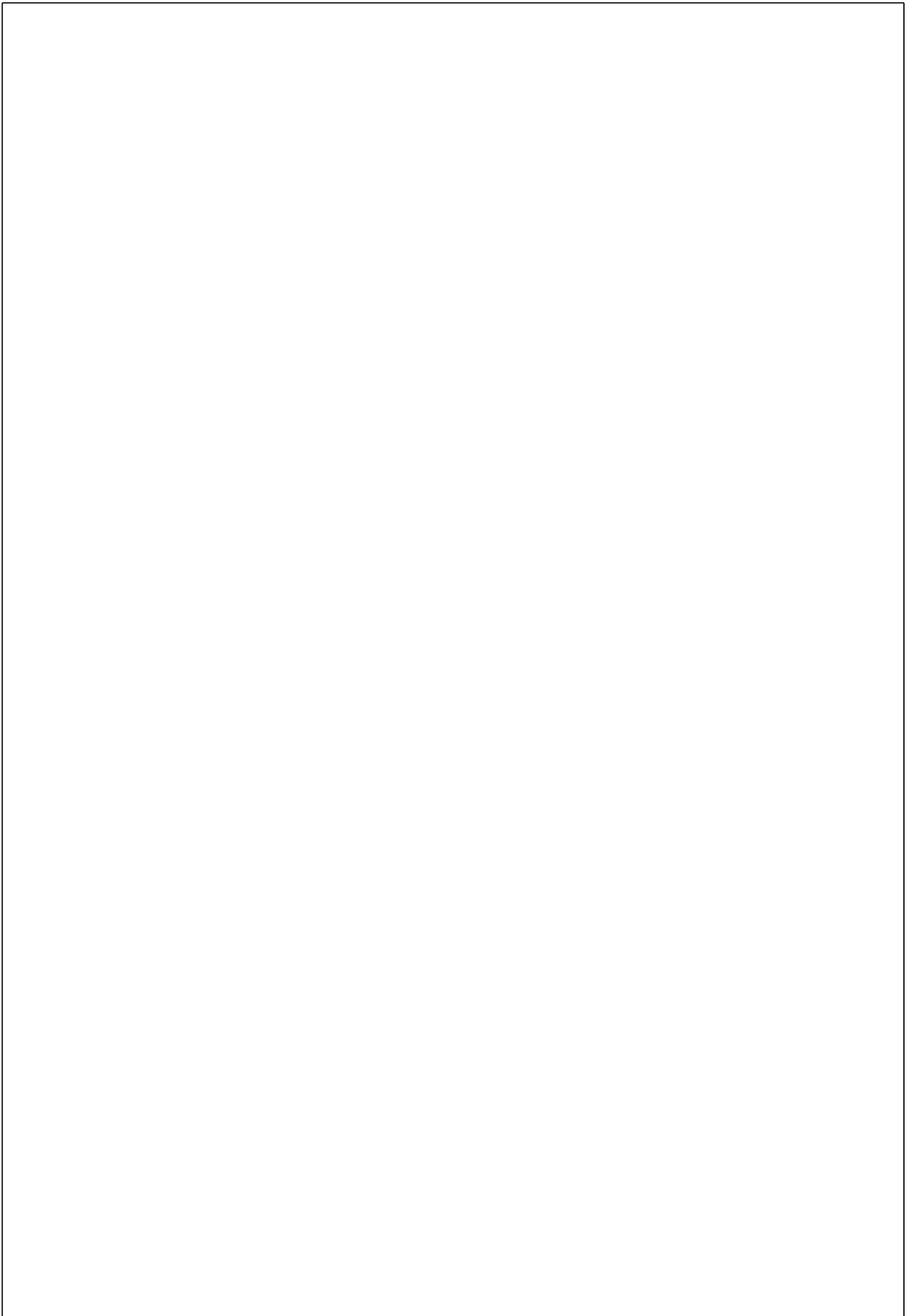
APPENDIX B

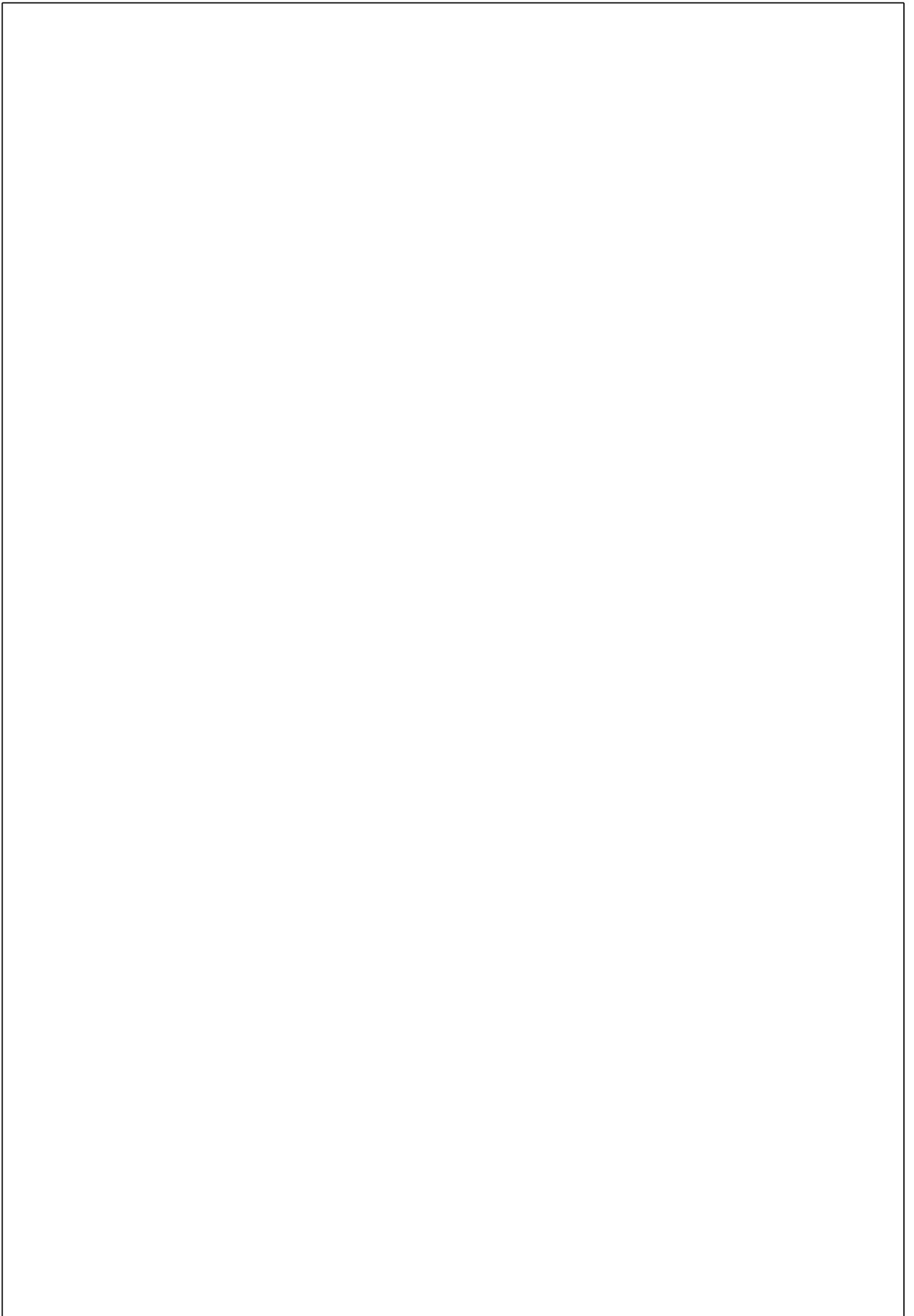
PROPOSED DEVELOPMENT DRAINAGE MODEL REPORTS

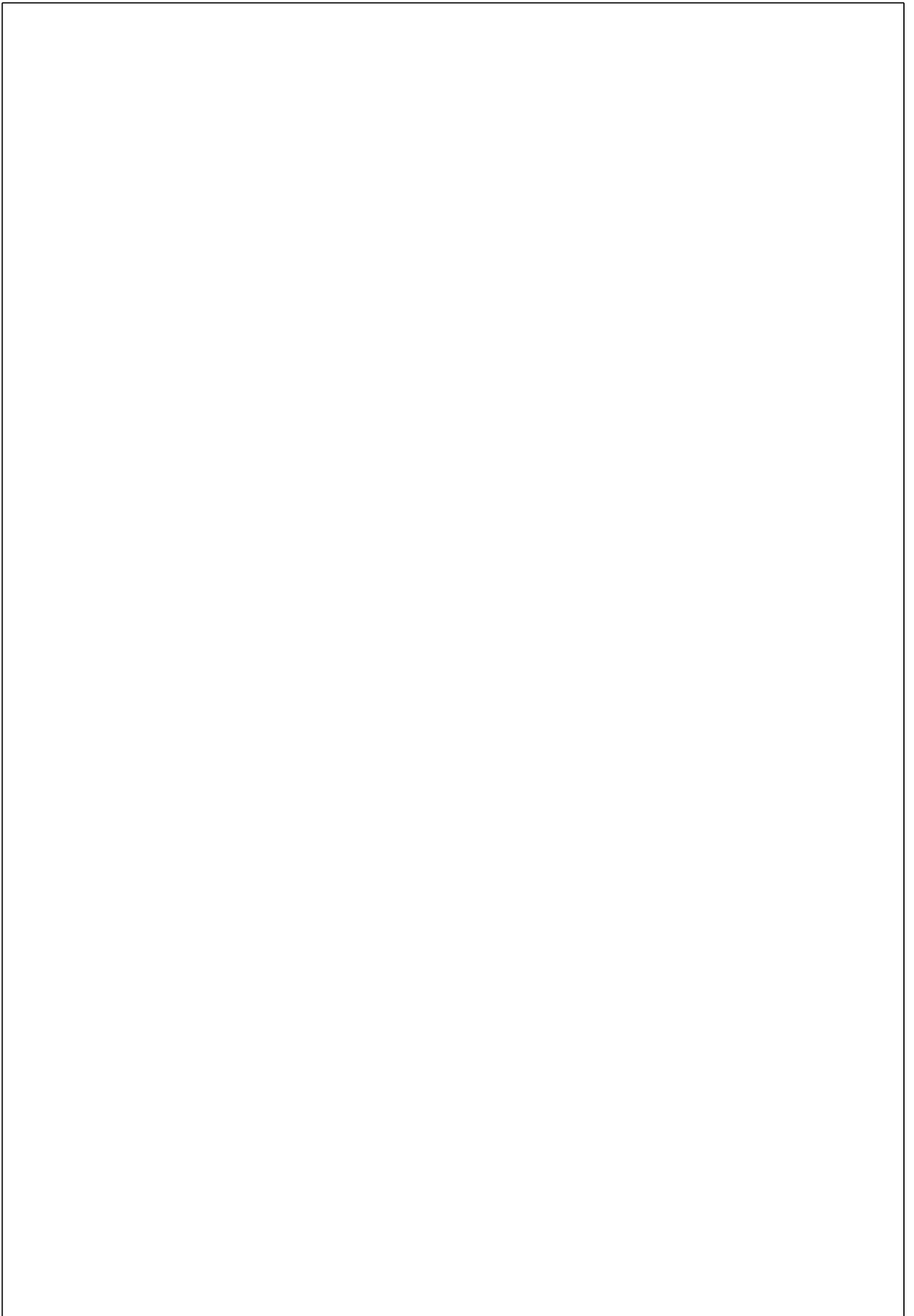
11409 - C150 Proposed SWD Network


11409 - C151 Greenfield Runoff Rates









Airey & Coles		Page 1
1st Floor Ashleigh Court, As...	11409 - C151	
Langage Business Park Plympton, PL7 5JX	Community Diagnostics Centre Greenfield Runoff Rates	
Date 06/12/2023 15:58	Designed by CN	
File	Checked by JCF	
Innovyze	Source Control 2020.1	

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	50.000	Urban	0.000
SAAR (mm)	1000	Region Number	Region 8

Results 1/s

QBAR Rural 138.3
QBAR Urban 138.3

Q100 years 334.7

Q1 year 107.9
Q2 years 122.2
Q5 years 170.1
Q10 years 206.1
Q20 years 241.9
Q25 years 253.9
Q30 years 263.7
Q50 years 292.9
Q100 years 334.7
Q200 years 394.2
Q250 years 412.2
Q1000 years 540.8

$$Q_{BAR} = 138.3 \times \frac{0.25}{50} = 0.7 \text{ l/s}$$

$$Q_{10} = 206.1 \times \frac{0.25}{50} = 1.0 \text{ l/s}$$

$$Q_{30} = 263.7 \times \frac{0.25}{50} = 1.3 \text{ l/s}$$

$$Q_{100} = 334.7 \times \frac{0.25}{50} = 1.7 \text{ l/s}$$

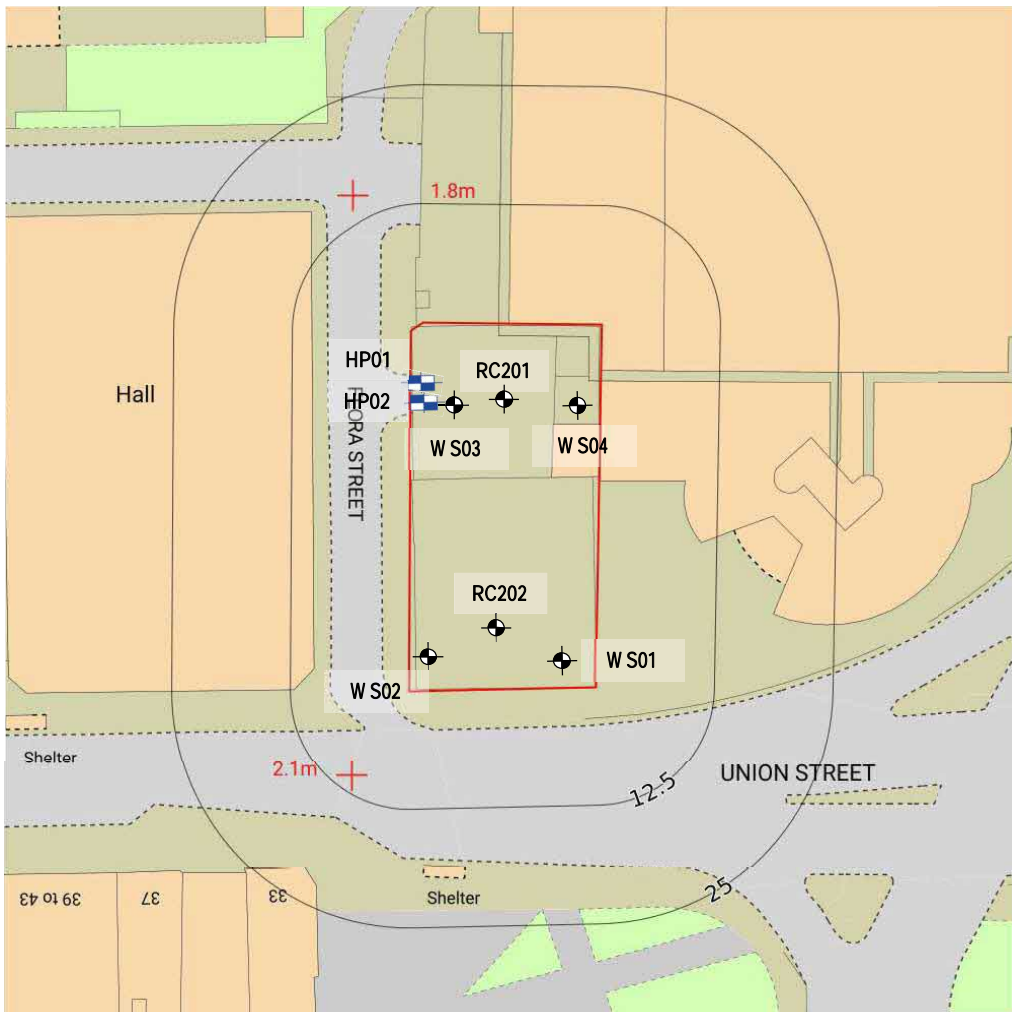
(11409 - FRA2)

* PROPOSED IMPERMEABLE AREA = 2,545 m² = 0.25 ha


APPENDIX C


SOUTH WEST WATER CORRESPONDENCE *(To be included if required and once made available)*


APPENDIX D
GROUND INVESTIGATION EXTRACTS



Key:

 Hand-excavated service inspection pits

 Borehole locations:
 RC = rotary cored
 WS = dynamic windowless sampling

Project	CDC Plymouth
Title	Exploratory Hole Location Plan
Drawing no	RP7951_D01
Revision	R01
Scale	Not To Scale
	
<small>Red Rock Geoscience Ltd East Wing, Station House Broadclyst Station Exeter EX5 3AS</small>	



Trial Pit Log

Trial Pit No
HP01
Sheet 1 of 1

Project Name: CDC Plymouth Project No. RP7951 Co-ords: Date 20/02/2023

Location: Plymouth Dimensions (m): 0.30 x 0.30 Scale 1:50
Client: NHS Depth 1.00 Logged JS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.10			Concrete. (MADE GROUND)
				0.70			Grey and black sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse concrete. Cobbles are subangular to subrounded concrete. (MADE GROUND)
				1.00			Greyish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse mudstone, concrete, brick and glass. Cobbles are subangular to subrounded brick. (MADE GROUND)
							End of Pit at 1.00m

Remarks: CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Backfilled with arisings and made safe upon completion.

Stability: Stable





Trial Pit Log

Trial Pit No
HP02
Sheet 1 of 1

Project Name: CDC Plymouth Project No. RP7951 Co-ords: Date 21/02/2023

Location: Plymouth Dimensions (m): 0.30 Scale 1:50

Client: NHS Depth 1.00 Logged CF

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.10			Concrete. (MADE GROUND)
				0.20			Grey and black sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse concrete. Cobbles are subangular to subrounded concrete. (MADE GROUND)
				0.80			Grey and brown gravelly SAND with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse mudstone and concrete. Cobbles are subangular to subrounded concrete and brick. (MADE GROUND)
				0.90			Greyish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse mudstone, brick and glass. Cobbles are subangular to subrounded brick and mudstone. (MADE GROUND)
				1.00			Orangish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse mudstone. Cobbles are subangular to subrounded mudstone. (MADE GROUND)
							End of Pit at 1.00m

Remarks: CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Backfilled with arisings and made safe upon completion.

Stability: Stable





Borehole Log

Borehole No.

WS01

Sheet 1 of 1

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
WS

Location: Plymouth

Level:

Scale
1:35

Client: NHS

Dates: 17/02/2023

Logged By
LC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES				Loose becoming medium dense greyish brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to coarse, subangular to angular, of concrete, brick, mudstone and glass (MADE GROUND).	
		0.70	ES		0.86			
		1.00	ES		1.20		Firm brown slightly sandy gravelly CLAY. Gravel is fine to coarse, subangular to angular, predominantly of platy mudstones of variable colour, with brick fragments and mortar. Material has a slight odour (MADE GROUND).	
		1.00	SPT (S)	N=13 (5,5/3,4,3,3)				
		1.80	D		1.90		Medium dense multicoloured slightly clayey gravelly SAND. Contains lenses of mottled red and yellow slightly sandy gravelly clay. Sand is coarse. Gravel is fine to coarse, subangular to angular, of mudstone, limestone and brick (MADE GROUND).	
		2.00	SPT (S)	N=4 (1,1/1,1,1,1)				
		2.50	D					
		2.60	HSV	Peak=9kPa				
		2.80	D					
		3.00	SPT (S)	N=56 (10,10/13,13,15,15)	3.00		Soft grey slightly sandy CLAY. Sand is coarse, of platy mudstone. Contains fragments of rotting wood and black organic material to 2.5 m and bivalve and snail shells beneath. Material has an odour and is wet from 2.0 m (ALLUVIUM).	
				3.45		Between 2.80m and 2.90m, horizon of sandy gravelly clay. Sand is coarse, gravel is fine, of subangular to angular platy mudstone.		
						Extremely weak, thinly laminated purplish red slaty MUDSTONE (WEATHERED TORPOINT FORMATION). End of Borehole at 3.00m		

Remarks
CAT scanned prior to excavation. UXO scanned at 1 m intervals. No groundwater encountered. Terminated due to SPT refusal. Reinstated with arisings.





Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
WS

Location: Plymouth

Level:

Scale
1:35

Client: NHS

Dates: 17/02/2023

Logged By
LC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES				Loose greyish brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to coarse, with one cobble 7 cm in diameter, subangular to angular, of concrete, brick, mudstone (MADE GROUND).	
		0.80	ES		0.65 0.75		Soft greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse, subangular to angular, of concrete, brick, mudstone, and quartz (MADE GROUND).	
		1.00	SPT (S)	N=5 (1,2/2,1,1,1)	1.10		Firm dark brown sandy gravelly CLAY. Gravel is fine to coarse, subangular to angular, of brick, mudstone, glass, charcoal, and clinker. Material has a slight odour (MADE GROUND).	
		1.10 - 1.30	D		1.40		Firm to stiff brown slightly sandy gravelly CLAY. Gravel is fine to coarse, subangular to angular, predominantly of platy mudstones of variable colour, with brick fragments, charcoal and mortar (MADE GROUND).	
		1.40	ES				Soft with firmer intervals, grey slightly sandy slightly gravelly CLAY. Gravel is fine, angular to subangular, platy mudstone. Contains black organic material, snail and bivalve shells and has an organic odour (ALLUVIUM).	
		1.90 - 2.00	D	Peak=10kPa				
		1.90	HSV	N=2 (0,0/0,0,1,1)				
		2.00	SPT (S)					
		2.20 - 2.30	D	Peak=13kPa				
		2.40	HSV					
		2.50 - 2.70	D					
		3.00	SPT (S)	N=53 (4,5/8,15,15,15)	3.00		Extremely weak, thinly laminated purplish red slaty MUDSTONE (WEATHERED TORPOINT FORMATION).	
					3.45		End of Borehole at 3.00m	

Remarks
CAT scanned prior to excavation. UXO scanned at 1 m intervals. No groundwater encountered. Terminated due to SPT refusal. Installed with ground gas monitoring well and reinstated with gravel and bentonite.





Borehole Log

Borehole No.

WS03

Sheet 1 of 1

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
WS

Location: Plymouth

Level:

Scale
1:35

Client: NHS

Dates: 17/02/2023

Logged By
LC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
Well		0.20	ES		0.30		Loose light brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to medium, subangular to angular, mudstone, brick and concrete (MADE GROUND).	
		0.50	ES				Firm greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse, subangular to angular, mudstone, mortar, brick and charcoal (MADE GROUND).	
		0.70	D		1.00		<i>Between 0.80m and 0.90m, cobble of thinly laminated mudstone</i>	
		0.80	ES				Firm greyish brown sandy gravelly CLAY. Gravel is fine to medium, subangular to angular, mudstone, mortar and brick, with one 8 cm diameter cobble of limestone (MADE GROUND).	
		1.00	SPT (S)	N=9 (1,2/2,3,2,2)				
			2.00	SPT (S)	N=0 (0,0/0,0,0,0)	1.90		Very soft dark grey slightly sandy CLAY. Sand is coarse platy mudstone. Shells and shell fragments including bivalves and snails appear below 2.6 m (ALLUVIUM).
			2.20	D				<i>Between 2.60m and 3.00m, slightly sandy slightly gravelly clay.</i>
			2.80	D		2.90		Stiff, becoming very stiff, dark grey slightly sandy CLAY. Sand is coarse platy mudstone. Contains shells and shell fragments (ALLUVIUM). <i>End of Borehole at 3.00m</i>
			2.80	HSV	Peak=12kPa			
			3.00	SPT (S)	N=55 (8,10/14,14,14,13)			
					3.45			

Remarks
CAT scanned prior to excavation. UXO scanned at 1 m intervals. No groundwater encountered. Terminated due to SPT refusal. Reinstated with arisings.





Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
WS

Location: Plymouth

Level:

Scale
1:35

Client: NHS

Dates: 17/02/2023

Logged By
LC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.30		Loose greyish brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to medium, subangular to angular, of concrete, brick, mudstone. Contains fragments of rotting wood (MADE GROUND).	
		0.60	ES				Firm becoming stiff greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse, subangular to angular, of brick, mortar, charcoal, and mudstone (MADE GROUND).	
		0.90	ES				Medium dense greyish brown sandy very clayey GRAVEL. Gravel is medium to coarse, occasionally fine, subangular to angular platy mudstones (MADE GROUND).	
		1.00	SPT (S)	N=9 (4,3/3,3,2,1)				
		1.30 - 1.60	B		1.30			Soft grey slightly sandy CLAY with firmer intervals. Sand is coarse subangular to angular platy mudstone. snail and bivalve shells appear below 2.3 m (ALLUVIUM).
		1.80	HSV	Peak=30kPa	1.60			
		2.00	SPT (S)	N=1 (0,0/0,0,0,1)				Extremely weak, thinly laminated purplish red slaty MUDSTONE (WEATHERED TORPOINT FORMATION). End of Borehole at 3,00m
	2.60	D		3.00				
	2.80	D						
	3.00	SPT (S)	N=54 (7,8/12,13,14,15)	3.00				
					3.45			

Remarks
CAT scanned prior to excavation. UXO scanned at 1 m intervals. No groundwater encountered. Terminated due to SPT refusal. Installed with groundwater monitoring well and reinstated with gravel and bentonite.





Rotary Core Log

Borehole No.

RC201

Sheet 1 of 4

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023 - 21/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.25			Grey and brown sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse mudstone, brick and concrete. Cobbles are subangular to subrounded brick and concrete. (MADE GROUND)	
							1.40			Greyish brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse mudstone, brick, concrete and quartz. Cobbles are subangular to subrounded mudstone, brick and a copper tap (MADE GROUND).	1
							1.50			Firm to stiff greenish blue CLAY (ALLUVIUM).	
										Very soft bluish grey silty CLAY (ALLUVIUM).	2
							2.80			Firm dark grey slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse mudstone, bivalve and gastropoda fossils (ALLUVIUM).	
		3.00	SPT (S)				3.00 N=20 (1,0/1,3,4,12)			Soft becoming firm dark grey slightly gravelly silty CLAY. Gravel is subangular to subrounded mudstone (ALLUVIUM).	3
							3.70			Hard brownish purple weathered slaty MUDSTONE (WEATHERED TORPOINT FORMATION).	4
Continued on Next Sheet											

Remarks

CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Backfilled with arisings, gravel and bentonite and made safe upon completion.





Rotary Core Log

Borehole No.

RC201

Sheet 2 of 4

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023 - 21/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description			
				TCR	SCR	RQD							
Well		4.50	SPT (S)				4.50 50 (12,13/50 for 215mm)		Legend	<p>Very weak purplish brown slaty MUDSTONE (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, inclined at 65-75 degrees, extremely to very closely spaced (05/ 09/ 21) incipient to open, undulating smooth, frequent <1.00mm clay infill with rare quartz mineralisation. Discontinuity set 2, joint set, inclined 55-60 degrees, closely to medium spaced (30/38/350) partly open to open, planar smooth/ stepped rough, occasional <1.00mm clay infill with mudstone gravel.</p> <p><i>Between 4.50m and 5.00m, extremely weak.</i></p> <p><i>From 5.70m, discontinuity set 2, joint set, no longer present</i></p> <p><i>Between 5.90m and 6.30m, discontinuity set 1, bedding and cleavage, extremely to very closely (11/ 30/ 50)</i></p> <p><i>Between 6.00m and 6.10m, greyish green discolouration.</i></p> <p><i>Between 6.40m and 6.45m, soft clay.</i></p> <p><i>From 6.70m, discontinuity set 2 is no longer present.</i></p> <p><i>Between 6.90m and 7.10m, single fracture inclined at 45 degrees, stepped, open, clean.</i></p> <p><i>Between 7.00m and 7.40m, greyish green discolouration.</i></p> <p>Very weak greenish grey slaty MUDSTONE with brownish purple beds. (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, inclined at 60 degrees, closely</p>			
		4.50 - 5.70	NI	100	33	0							5
		5.70 - 6.70	NI	100	45	0							6
		6.70 - 7.70	NI	100	40	0							7
		7.70											8

Continued on Next Sheet

Remarks

CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Backfilled with arisings, gravel and bentonite and made safe upon completion.





Rotary Core Log

Borehole No.

RC201

Sheet 3 of 4

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023 - 21/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description							
				TCR	SCR	RQD											
		7.70 - 9.30	29	100	75	0	9.30			<p>spaced (15/ 40/ 66), incipient to open, smooth planar, clean. Discontinuity set 2, joint set, 40-50 degrees, unknow spacing, partly open, planar, clean. Discontinuity set 3, joint set, 80-90 degrees, unknown spacing, incipient, stepped to planar, infill with quartz mineralisation.</p>	9						
			16									<i>At 6.05m, quartz boudinage (1.00mm)</i>					
		9.30 - 10.80	NI	98	85	11						<p>Extremely weak grey to dark grey organic-rich slaty MUDSTONE (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, inclined at 45-50 degrees, very closely to closely spaced (30/ 50/ 90), very tight to tight, undulating smooth to planar smooth, clean. Discontinuity set 3, joints, 20-30 degrees, unknow spacing (250/300), tight to moderately wide, planar smooth to rough stepped, infilled with gravelly mudstone sometimes quartz mineralisation or occasionally clean.</p>	10				
			25											<p><i>Between 9.30m and 10.80m, Discontinuity set 1 comprised predominatly bedding. Discontinuity set 5, cleavage, 75-85 degrees, extremely to very closely spaced (10/ 25/ 33) incipient to tight, smooth planar, clean with occasional quartz vein mineralisation infill.</i></p> <p><i>At 9.80m, joint, inclined at 70 degrees crosscuts bedding and cleavage</i></p> <p><i>Between 9.80m and 10.05m, soft to firm dark grey organic rich clay.</i></p> <p><i>Between 10.50m and 10.80m, dark black discolouration.</i></p>			
		10.80 - 12.30	28	100	85	18					11						
												<i>Between 11.80m and 11.95m, quartz vein.</i>					
Continued on Next Sheet										12							

Remarks

CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Backfilled with arisings, gravel and bentonite and made safe upon completion.





Rotary Core Log

Borehole No.

RC201

Sheet 4 of 4

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023 - 21/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
*			12				12.30					
		12.30 - 13.80	NI	100	80	22						
			50									
		13.80 - 15.30	15	100	93	29						
					15.30			End of Borehole at 15.30m				

Very weak to weak grey to dark grey slaty MUDSTONE (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, inclined at 45 degrees, closely spaced (30/ 80/ 100), tight to partly open, planar smooth, clean sometimes infilled with quartz and chalcopyrite mineralisation. Discontinuity set 3, joints, 20-30 degrees, unknow spacing (250/300), tight to moderately wide, planar smooth to rough stepped, infilled with gravelly mudstone sometimes quartz mineralisation or occasionally clean.

Between 12.30m and 12.90m, joint inclined at 80 degrees, open, undulating, rough, quartz infill.

Between 13.60m and 13.80m, quartz infill.

From 13.80m, discontinuity set 1, very closely to closely spaced (50/85/130).
From 13.90m, joints, inclined between 40 to 50 degrees in the opposite orientation to discontinuity set 1, partly open, planar, rough to smooth, clean.

Remarks
CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Backfilled with arisings, gravel and bentonite and made safe upon completion.





Rotary Core Log

Borehole No.

RC202

Sheet 1 of 3

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							2.00			Light grey sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse brick and concrete. Cobbles are subangular to rounded brick and concrete. (MADE GROUND)	1
		3.00	SPT (S)				N=4 (1,0/1,1,0, 2)			Soft bluish grey silty CLAY (ALLUVIUM).	2
							3.80			Hard bluish grey with orange staining weathered MUDSTONE (WEATHERED TORPOINT FORMATION).	3
	▼									Continued on Next Sheet	4

Remarks

CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Installed with 50mm diameter ground gas and groundwater monitoring standpipe to depth and reinstated with gravel filter pack and bentonite.





Rotary Core Log

Borehole No.

RC202

Sheet 2 of 3

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		4.30	SPT (S)				50 (14,11/50 for 225mm) 4.40				
		4.40 - 5.40	50	100	10	0	5.40			Very weak bluish greenish grey slaty MUDSTONE with occasional orange mottling (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, bedding typically more steeply inclined than cleavage, inclined between 55 and 65 degrees, very closely to closely spaced (23/ 50/ 100) incipient to very tight, rough to smooth planar. Discontinuity set 2, joint set, inclined at 20 degrees, very closely to closely spaced (40/ 45/ 60) open to moderately wide rough to smooth planar, infilled with clay coarse sand of mudstone.	5
		5.40 - 6.50	35	100	11	0	6.50			Very weak greenish bluish grey slaty MUDSTONE (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, inclined at 55-65 degrees (10/ 40/ 70), very tight to open, planar rough to undulating smooth, predominantly fracturing along cleavage. Discontinuity set 2, joint set inclined at 20 degrees, medium to widely spaced (40/ 30/ 60), partly open, planar to undulating, 3mm clay infill.	6
		6.50 - 7.70	35	100	13	0				Very weak brownish purple with bluish greenish grey bands slaty MUDSTONE (TORPOINT FORMATION). Discontinuity set 3, cleavage, inclined at 40-50 degrees, very closely to medium spaced (20/ 70/ 200), partly open smooth, stepped to smooth planar, clean with occasional granular infill. Discontinuity set 4, bedding inclined at 30-40 degrees, extremely closely to medium spaced (3/ 30/ 60), incipient to tight, rough to smooth planar, clean with occasional granular infill.	7
											8

Continued on Next Sheet

Remarks

CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Installed with 50mm diameter ground gas and groundwater monitoring standpipe to depth and reinstated with gravel filter pack and bentonite.





Rotary Core Log

Borehole No.

RC202

Sheet 3 of 3

Project Name: CDC Plymouth

Project No.
RP7951

Co-ords:

Hole Type
RC

Location: Plymouth

Level:

Scale
1:20

Client: NHS

Dates: 20/02/2023

Logged By
CF

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description
				TCR	SCR	RQD				
		7.70 - 8.70	40	100	42	0	8.70			
		8.70 - 9.70	35	100	55	10				Very weak brownish purple with bluish greenish grey bands slaty MUDSTONE (TORPOINT FORMATION). Discontinuity set 1, bedding and cleavage, inclined at 30-40 degrees, extremely closely to closely spaced (15/ 45/ 90), incipient to tight, rough to smooth planar. Discontinuity set 2, joints inclined at 10-20 degrees (60/ 100/ 160), closely spaced, open, stepped to undulating, smooth to rough, 2mm clay infill.
		9.70 - 10.30	10	83	65	17				
		10.30 - 11.30	19	100	30	34				
		11.30 - 11.80	14	100	33	0				
							11.80			
End of Borehole at 11.80m										

Remarks

CAT scanned prior to excavation. No groundwater encountered. Terminated upon reaching target depth. Installed with 50mm diameter ground gas and groundwater monitoring standpipe to depth and reinstated with gravel filter pack and bentonite.



GAS MONITORING RECORD



Project: CDC Plymouth
Job Number: RP7951

Engineer: LC
Date: 07/03/23

Borehole No.		WS04	Parameter	Peak	Steady
Water Level (m/bgl):		1.55	CH ₄ %	0.0	0.0
Time:		10:15:00	CO ₂ %	0.2	0.2
			O ₂ %	20.7	20.7
			CO (ppm)	0	0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0	0
	NA	NA	Gas Flow (l/hr)	<0.1	<0.1

Borehole No.		RC02	Parameter	Peak	Steady
Water Level (m/bgl):		2.50	CH ₄ %	0.0	0.0
Time:		10:25:00	CO ₂ %	0.3	0.3
			O ₂ %	19.8	19.8
			CO (ppm)	0.0	0.0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0	0
	NA	NA	Gas Flow (l/hr)	<0.1	<0.1

Borehole No.		WS02	Parameter	Peak	Steady
Water Level (m/bgl):		1.20	CH ₄ %	N/A	N/A
Time:		10:32:00	CO ₂ %	N/A	N/A
			O ₂ %	N/A	N/A
			CO (ppm)	N/A	N/A
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	N/A	N/A
	NA	NA	Gas Flow (l/hr)	N/A	N/A

Notes: Gas monitor battery failed before completing visit. WS04 borehole measured depth 2.09 m.
Prevailing Weather Conditions: light rain
Average Daily Barometric Pressure (1): 999 hPa

Ambient Concentrations:
 CH₄ (%): 0.0 CO (ppm): 0.0
 CO₂ (%): 0.0 H₂S (ppm): 0.0
 O₂ (%): 20.8

Tidal Conditions (Devonport)
 High Tide: 5.23 m at 0548
 Low Tide: 1.02m at 1216

Monitoring techniques and proforma based on guidance from CIRIA document C665
 "Steady" reading achieved after 60sec of stable values
 (1) All barometric Pressures adjusted to mean sea level

GAS MONITORING RECORD



Project: CDC Plymouth **Engineer:** LC
Job Number: RP7951 **Date:** 22/03/23

Borehole No.		WS04	Parameter	Peak	Steady
Water Level (m/bgl):		1.33	CH ₄ %	0.0	0.0
Time:		09:30:00	CO ₂ %	0.4	0.4
			O ₂ %	17.9	20.5
			CO (ppm)	0	0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0	0
	NA	NA	Gas Flow (l/hr)	<0.1	<0.1

Borehole No.		RC02	Parameter	Peak	Steady
Water Level (m/bgl):		1.12	CH ₄ %	0.0	0.0
Time:		09:15:00	CO ₂ %	0.4	0.4
			O ₂ %	4.9	5.1
			CO (ppm)	2.0	1.0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0	0
	NA	NA	Gas Flow (l/hr)	<0.1	<0.1

Borehole No.		WS02	Parameter	Peak	Steady
Water Level (m/bgl):		0.42	CH ₄ %	0.0	0.0
Time:		09:06:00	CO ₂ %	0.1	0.0
			O ₂ %	20.6	21.0
			CO (ppm)	0.0	0.0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0	0
	NA	NA	Gas Flow (l/hr)	<0.1	<0.1

Notes: WS04 measured borehole depth 2.0 m.
Prevailing Weather Conditions: Sunny intervals
Average Daily Barometric Pressure (1): 997 hPa

Ambient Concentrations:
 CH₄ (%): 0.0 CO (ppm): 0.0
 CO₂ (%): 0.1 H₂S (ppm): 0.0
 O₂ (%): 21.2

Tidal Conditions (Devonport)
 High Tide: 5.7 m at 0602
 Low Tide: 0.3m at 1225

Monitoring techniques and proforma based on guidance from CIRIA document C665
 "Steady" reading achieved after 60sec of stable values
 (1) All barometric Pressures adjusted to mean sea level

GAS MONITORING RECORD



Project: CDC Plymouth
Job Number: RP7951

Engineer: LC
Date: 04/04/23

Borehole No.	WS04	Parameter	Peak	Steady
Water Level (m/bgl):	1.43	CH ₄ %	0.2	0.2
Time:	09:20:00	CO ₂ %	0.6	0.6
		O ₂ %	20.1	20.3
		CO (ppm)	0	0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0
	NA	NA	Gas Flow (l/hr)	<0.1
				<0.1

Borehole No.	RC02	Parameter	Peak	Steady
Water Level (m/bgl):	2.12	CH ₄ %	0.5	0.5
Time:	09:10:00	CO ₂ %	0.5	0.5
		O ₂ %	3.8	4.0
		CO (ppm)	1.0	1.0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0
	NA	NA	Gas Flow (l/hr)	<0.1
				<0.1

Borehole No.	WS02	Parameter	Peak	Steady
Water Level (m/bgl):	0.50	CH ₄ %	0.1	0.1
Time:	09:03:00	CO ₂ %	0.2	0.2
		O ₂ %	21.2	21.3
		CO (ppm)	0.0	0.0
VOC (ppm Isobutylene Eqv)	Peak	Steady	H ₂ S (ppm)	0
	NA	NA	Gas Flow (l/hr)	<0.1
				<0.1

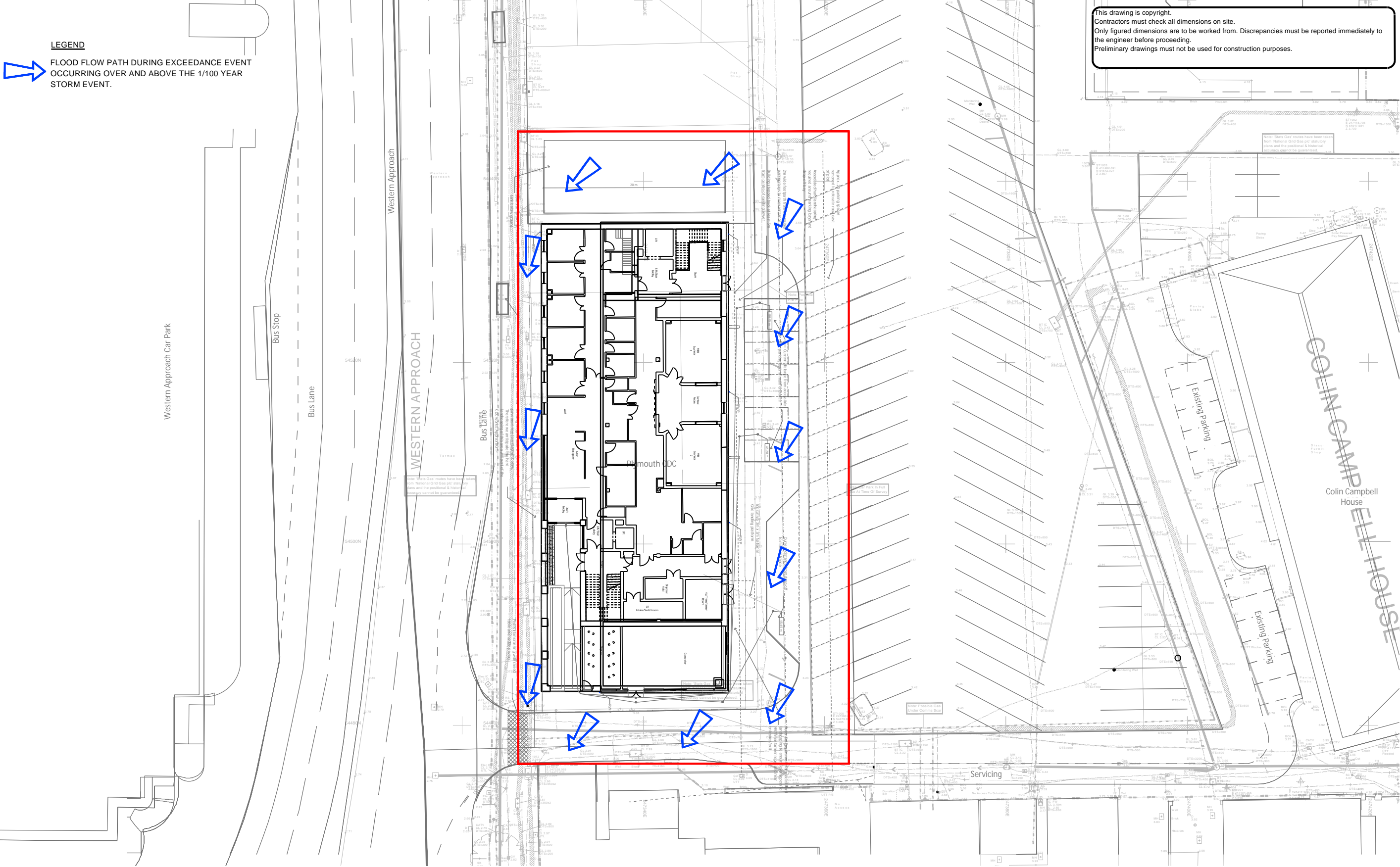
Notes: WS04 measured depth 2.0 m.
Prevailing Weather Conditions: Sunny intervals
Average Daily Barometric Pressure (1): 1022 hPa


Ambient Concentrations: CH₄ (%): 0.1 CO (ppm): 0.0
 CO₂ (%): 0.2 H₂S (ppm): 0.0
 O₂ (%): 21.3

Tidal Conditions (Devonport)
 High Tide: 5.0 m at 0539
 Low Tide: 1.2m at 1207

Monitoring techniques and proforma based on guidance from CIRIA document C665
 "Steady" reading achieved after 60sec of stable values
 (1) All barometric Pressures adjusted to mean sea level

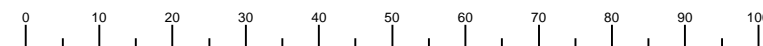
APPENDIX E
EXCEEDANCE FLOW ROUTES



LEGEND
 FLOOD FLOW PATH DURING EXCEEDANCE EVENT OCCURRING OVER AND ABOVE THE 1/100 YEAR STORM EVENT.

This drawing is copyright.
 Contractors must check all dimensions on site.
 Only figured dimensions are to be worked from. Discrepancies must be reported immediately to the engineer before proceeding.
 Preliminary drawings must not be used for construction purposes.

PRELIMINARY
 NOT FOR CONSTRUCTION



P1	08.12.23	PRELIMINARY ISSUE	HB	JCF
REV.	DATE.	NOTE.	BY.	CHK.

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PROJECT
**COMMUNITY DIAGNOSTICS CENTRE
 (CDC) PLYMOUTH**

DRAWING TITLE
**FLOOD RISK ASSESSMENT
 EXCEEDANCE FLOOD FLOWS**

SCALE
 1/400

DATE
 DEC 2023

DRAWN BY
 HB

CHECKED BY
 JCF

DRAWING NUMBER
11409 - FRA4

REVISION NO.
 P1



APPENDIX F
DRAINAGE MAINTENANCE PLAN

11409-A&C-XX-XX-C-FRA-DMP-01

COMMUNITY DIAGNOSTICS CENTRE (CDC), PLYMOUTH
DRAINAGE MAINTENANCE PLAN (DMP)

Rev:	Date:	Notes:	Prepared:	Checked
P1	08.12.23	Planning Issue	CN	JCF

Introduction

This intention of this document is to provide details of responsibilities for maintenance both during and post construction; in addition, a comprehensive maintenance scheme is provided for an attenuation-based system following completion of construction, through to routine maintenance following the bedding-in period.

Maintenance of SuDS based designs should be undertaken in accordance with current guidance found in CIRIA C753 - The SuDS Manual 2015, of particular interest is Section 32 Operation and Maintenance.

Maintenance Responsibilities

During the construction phase of the development until handover of the site is complete, the principal contractor will be responsible for the inspection and maintenance of the drainage systems in-line with the maintenance scheme outlined below.

Following handover, the site owners University Hospitals Plymouth NHS Trust (UHP) will provide routine inspection and maintenance of the drainage systems and geocellular attenuation tank in-line with the maintenance schedule below. It is anticipated that the building owners UHP shall be responsible for all drainage within the curtilage of the CDC development. This will likely be carried out by an in-house maintenance team or an appointed maintenance contractor.

Offsite drainage will likely be offered for adoption, South West Water (SWW) will ultimately provide the necessary routine inspection and maintenance to infrastructure within the wider public realm and public highway.

General Maintenance

CIRIA 753 recommends the following maintenance procedures as a basis for any maintenance plan:

- Litter, debris and silt/sand removal, this would reduce the chance of blockage of the network and flow control device(s) and is generally good practice.
- Sediment removal is required to ensure long term performance of SuDS. This is largely dependent on location, design, silt volume and many others. Sediment removal within pipe-lines can be jetted and picked up within the next chamber.
- Incorporation of silt traps and/or screens would aid in preventing sediment within the system, as well as, litter and debris removal.
- CCTV of the pipe network should be undertaken if the system is considered to not work at peak efficiency or if there are any concerns. Remedial works should be undertaken if any faults or issues occur.

Attenuation System - Crated System

In addition to the general maintenance above, CIRIA 753 states the following regarding attenuation storage tanks:

“Regular inspection and maintenance is required to ensure the effective long-term operation of below ground storage systems. Maintenance responsibility for systems should be placed with a responsible organisation”.

The document provides a comprehensive maintenance scheme (Table 21.3) appropriate for attenuation storage tanks which is as follows:

Table 21.3 Operation and maintenance requirements for attenuation storage tanks

<i>Maintenance Schedule</i>	<i>Required Action</i>	<i>Typical Frequency</i>
<i>Regular Maintenance</i>	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
<i>Remedial Actions</i>	Repair/rehabilitate inlets, outlet, overflows and vents.	As required
<i>Monitoring</i>	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Flow Control Devices

Extract from Hydro International document “Hydro international Warranty, Maintenance and COSHH Statement”.

Normally, little maintenance is required as there are no moving parts within the Flow Control. Experience has shown that if blockages occur, they do so at the intake and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. The Flow Control (where applicable) is fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. The smaller type conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes are standard.

Following installation of the Flow Control it is vitally important that any extraneous material i.e. Building materials are removed from the unit and the chamber. After the system is made live and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required.