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PARTNERSHIP LIMITED
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

Buckley Wells

Baron Street, Bury

Flood Risk Assessment Report

For

East Lancashire Railway Trust

Document Control

Status	Rev	Date	Prepared by	Approved by	Revision Details
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Executive Summary

Site Setting	The site comprises circa 5.6 hectare approximately brownfield site located off Barton Street in Bury. National Grid Reference 379933, 410130 located approximately at the centre of the site, with the nearest address and postcode: Baron Street, Buckley Wells, Bury, Greater Manchester, England, BL9 0TY.
Flood Risk	The EA fluvial and tidal flood map shows that the site is wholly contained within an area designated as Flood Zone 1.
SUDS, Surface Water Management & Preliminary Drainage Strategy	Surface water flows generated by the development's hard surfaces will be attenuated into the wider system. According to the SUDS hierarchy consideration has been given to sustainable methods such as infiltration/soakaways. Based on available information infiltration is not expected to be viable due to the nature of the site and the potential risk of contamination. The development will include a cellular attenuation tank and porous carpark build up(lined). Residual flows are proposed to be discharged into the public sewer network operated by United Utilities.
Controlled Water Pollution	The underlying ground/groundwater beneath the site should be protected from pollution. This will be aided by carrying out the recommendations within this report and by using best practice construction techniques.

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References

1 Introduction

Booth King Partnership Ltd. (BKP) were commissioned by East Lancashire Railway Trust to carry out a Flood Risk Assessment (FRA) for a 5.6 hectare approximately brownfield site located off Barton Street in Bury.

The report was undertaken in support of discharging planning conditions 6 and 7 for the development of the ELR's historic locomotive and carriage works site including repair and restoration of the 1857 locomotive work building, the construction of the new locomotive running shed, incorporation of associated new workshops and training facilities and construction of a standalone carriage shed.

This report presents the findings of the FRA, which has been carried out in accordance with the National Planning Policy Framework (NPPF), Technical Guidance to the NPPF and Planning Practice Guidance. Other documents consulted have included Environment Agency (EA) FRA Guidance Note 1, the local Strategic Flood Risk Assessment Level 1 (March 2019) and Level 2 (October 2020) (SFRA) and the local surface water management plans (SWMP). A full list of documents used to inform this report is shown in the reference section.

This FRA aims to identify and assess the risks of all forms of flooding to and from the site and demonstrate how these flood risks will be managed, taking climate change into account. The FRA also considers the management of surface water run-off and outlines the proposed drainage strategy.

As the site has an area of more than 1 hectare, an FRA is compulsory in accordance with the NPPF. The proposed development should not increase the risk of flooding elsewhere and this FRA has therefore been prepared to demonstrate that this has been achieved. Consideration has also been given to BREEAM accreditation, including the requirements of Pol 03, the risk of pollution to controlled waters and the site conditions prior to, during and after development.

It is the assumption wherever possible that ground levels post-development will remain as close to existing as is practical. If this or other key assumptions change, then the conclusions within this report may need to be reassessed to check that they are still applicable.

This report is based on information obtained from the site topographical survey, drainage record plans and latest architect's plan.

2 Site Setting

2.1 Site Description

The site is located in Bury off Burton Street, southwest of Bury town centre. National Grid Reference 379933, 410130 located approximately at the centre of the site, with the nearest address and postcode: Baron Street, Buckley Wells, Bury, Greater Manchester, England, BL9 0TY.

Access to the site is located on Baron Street. The site is bounded by residential areas and Bury CE High School to the east, St Gabriels Roman Catholic High School and its associated sports pitches to the West and Baron Street to the North.

Figure 1 below provides an aerial view of the site location. Approximate development boundary is shown in red (also in Appendix A).

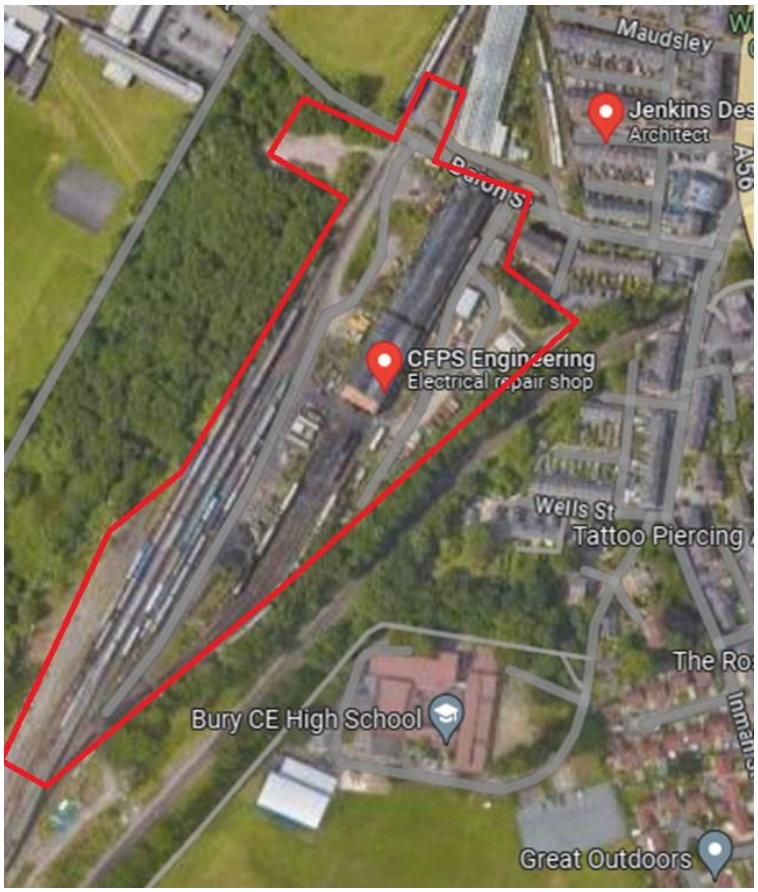


Figure 1 - Site Location

2.2 Site Levels

Existing site levels include a significant overall fall in site levels from north-east to south-west of the site. The top height is approximately 86.350 meters above ordinance datum (AOD) in the northeast part of the site and falls to the southwest to approximately 81.100m AOD. The topographical survey can be found in Appendix B.

2.3 Current Land Use

Site

The site comprises of several buildings, the 1857 locomotive work building, 2 more smaller in size buildings (2 sheds), railway tracks, storages containers and hardstanding carpark areas. The site is in a mixed residential and commercial area. Hardstanding areas cover 95% of the site and vegetated landscaping including trees areas comprise the remaining 5% of the site.

Surrounding Area

The site is bounded by residential areas and Bury CE High School to the east, St Gabriels Roman Catholic High School and its associated sports pitches to the West and Baron Street to the North.

2.4 Proposed Development

The proposed development consists of the erection a new carriage shed, landscaping works to accommodate the revised ground levels across the site, and the associated drainage works. Also, the restoration and extension of the existing 1857 locomotive building, carparking areas for the staff, volunteers and visitors.

The proposed new access road to the new standalone carriage shed from enters the site from the east on Baron Street. It runs south along the eastern face of the existing carriage shed and a new unmarked parking and external storage area (shipping containers proposed location). It then runs along the Eastern edge of the site boundary and turns West along the Southern edge of the new shed.

Architect's layout can be found Appendix C.

2.5 Underlying Ground

A Ground Investigation Report was compiled in 2006, and an Infiltration Test Report compiled in 2009, by Leyden Kirby Associates. Both reports indicated that the ground on site was not free draining or suitable for drainage design by infiltration.

Made ground in the eastern part of the site comprised ash and clinker or reworked clay which was present to depths up to 11.0m. Made ground in the lower western site areas generally comprised ash and clinker or re-worked topsoil.

Natural ground comprised stiff boulder clay which was overlain over parts of the site by sands and gravels which are thought to represent river terrace deposits. Lower Coal Measures solid geology comprising interspersed layers of sandstone, mudstone and coal seams were encountered at depths between 14.5 and 19.0m.

2.6 Hydrology

The nearest surface water feature is identified as River Irwell, approximately 250m to the west of the site.

There are no current surface water abstractions listed within at least 2km of the site.

3 Flood Risk

As an initial phase in identifying whether a site is potentially at risk of flooding, BKPL has consulted the Environment Agency's (EA) website Flood Zone Mapping. This mapping is (often) based on coarse scale modelling and provides only an initial indication of the flood risk to a site. The Environment Agency Flood Zone maps were developed using a very coarse Digital Elevation Map (DEM) and are superseded by a more detailed analysis of modelled flood levels and topographic survey levels.

3.1 Flood Zones

3.1.1 Fluvial/Tidal

Flood maps are produced by the EA for the whole of the UK to highlight areas at particular risk of flooding by categorising them into different Zones according to the likelihood of flooding. These maps are based on a broad assessment of areas using digital mapping techniques and extracts from the EA flood maps for the site and its surroundings are included in the figures below.
The EA fluvial and tidal flood map in figure 1, below, shows that the site and its surroundings is wholly contained within an area designated by the EA as Flood Zone 1 (unshaded areas).

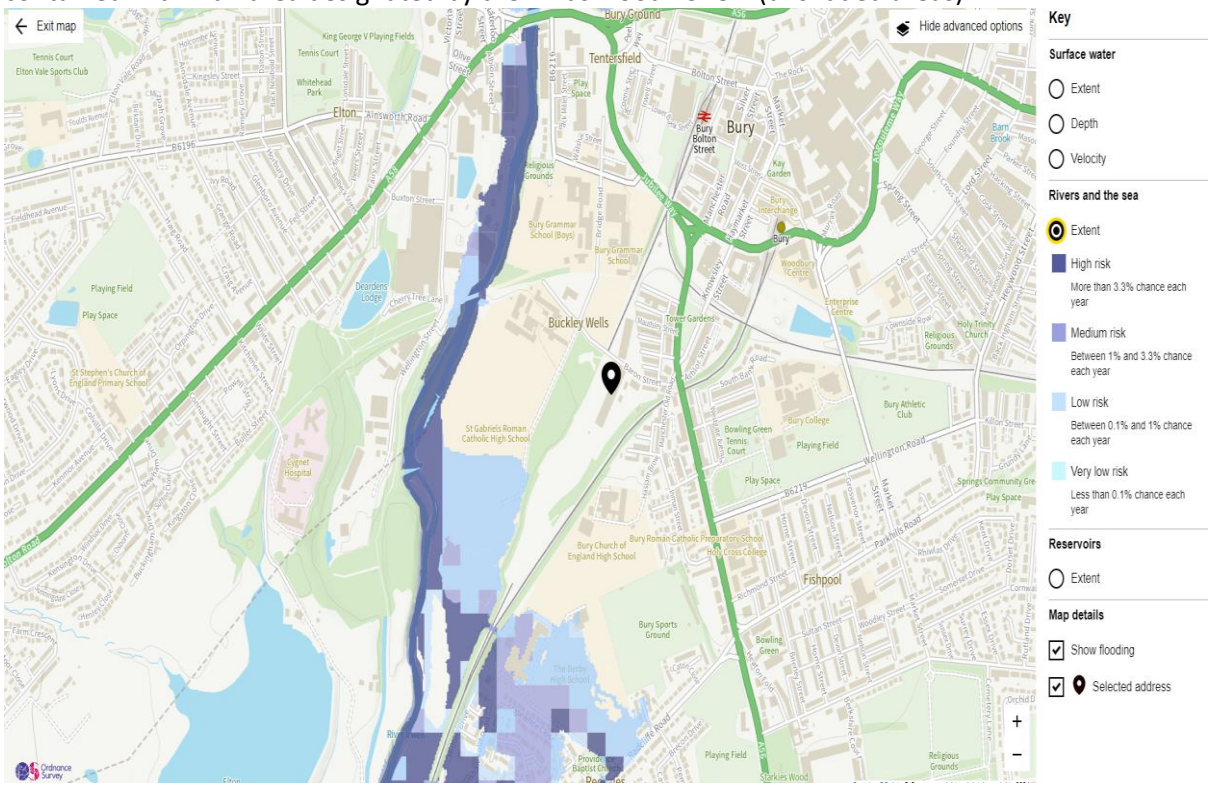


Figure 2 – Environment Agency Flood Map - River and Sea

Zone 1 areas are defined in NPPF Table 1 as "land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%)". The compatibility of different end uses with the various Flood Zones is shown in NPPF Table 3 (see Figure 2 below).

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

Notes to table 3:
This table does not show:
a. the application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2, and then Zone 3;
b. flood risk assessment requirements; or
c. the policy aims for each flood zone.

Figure 3 – NPPF Table

The site is proposed to be used for general industrial use, shops, cafes and non-residential institutions not included in the 'more vulnerable' calss which falls within the 'less vulnerable' classification within Table 2. All uses, including residential, are deemed appropriate in Flood Zone 1.

The NPPF also includes a Sequential Test, the aim of which is to locate areas of development in areas at lowest risk from flooding. However, as the entirety of the site is located within Flood Zone 1 it is already located within an area at lowest risk of flooding from tidal and fluvial sources.

3.1.2 Surface Water

The EA's surface water flood map shown in Figure 4 rates the surface water flooding risk at the site as high with depth varying between 300mm to 900mm. it can be seen that there is water accumulating in the area west of the existing 1857 locomotive building.

Surface water flood risks usually result from pooling of surface waters and overland flow during heavy rainfall that is not able to drain away.

Post development the introduction of permeable paving and biodiverse areas within the site (as well as repair and overdue maintenance of the existing buried network) will significantly reduce the existing overland flows being discharged into the separate networks, which may contribute to a reduction in surface water flood risk there.

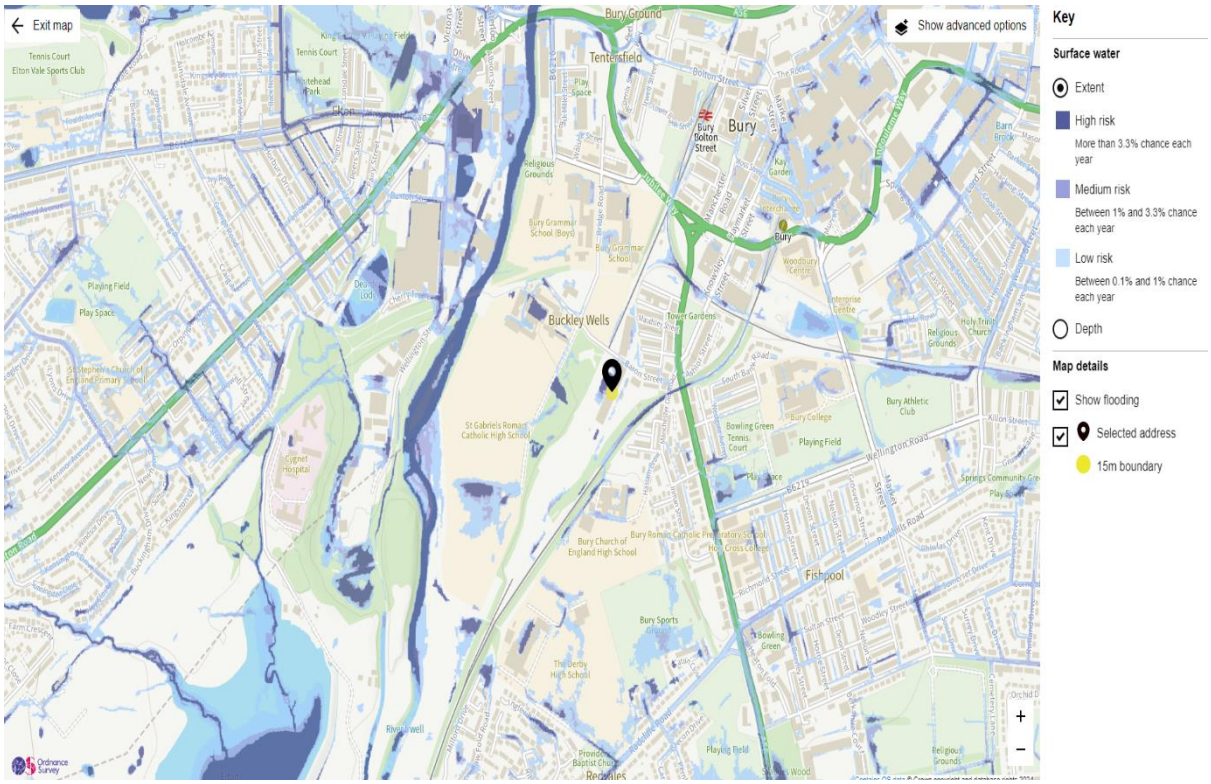


Figure 4 – Environment Agency Flood Map – Surface Water

Management of surface water is being considered as part of the development proposals and a preliminary drainage strategy is outlined within Section 5 of this FRA report.

3.1.3 Groundwater

The Bury Local Plan Topic Paper 6 Flood Risk commissioned by Bury Council (October 2018) states that:

"2.18 Groundwater flooding occurs when the water held underground rises to a level where it breaks the sur ace in areas away from usual channels and drainage pathways. It is generally as a result o exceptional extended periods of heavy rain but can also occur as a result of reduced abstraction, underground leaks or the displacement of underground lows. Once groundwater flooding has occurred and particularly if soils are impermeable, the water can be in situ or a lengthy period of time.

2.19 Local understanding of groundwater flooding is limited, and often groundwater is not identified as a distinct event. The Environment Agency's national dataset, 'Areas Susceptible to Groundwater Flooding (AStGWF), provides a limited basis or assessing flood risk from groundwater."

An extract of the Map can be seen in Figure 4.

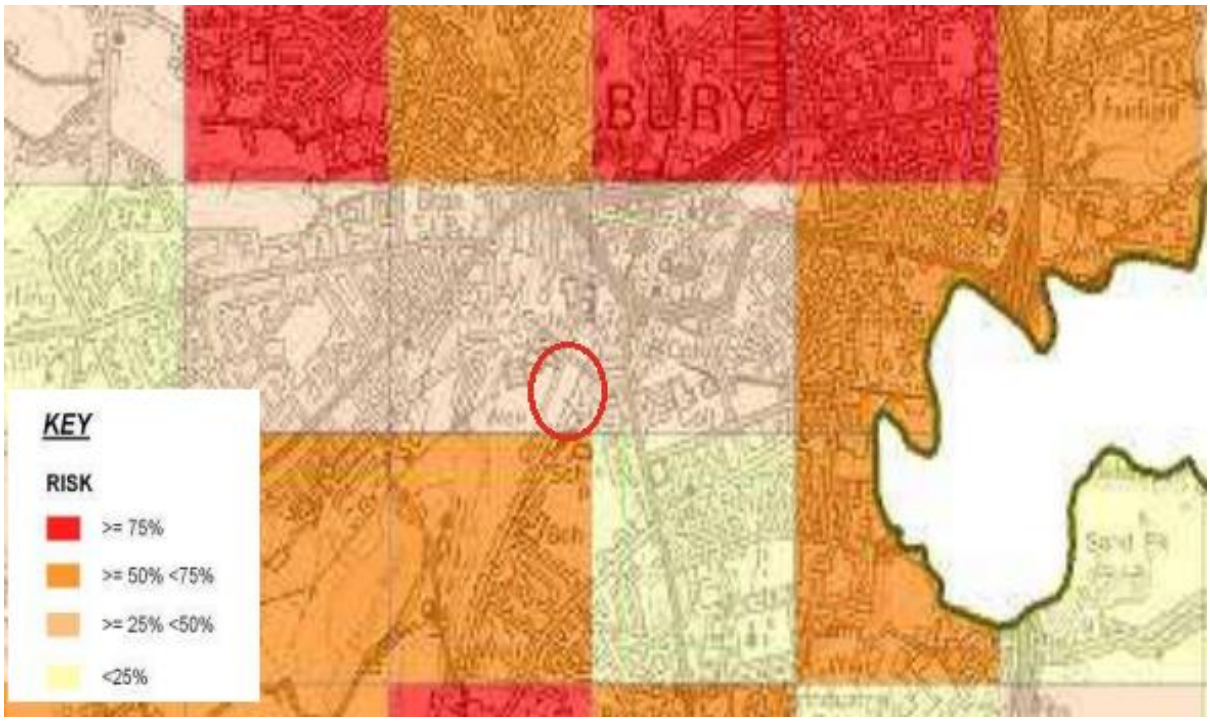


Figure 5 – mangomap - groundwater

3.1.4 Anthropogenic Sources

An extract from the EA's reservoir flood map. Shown in figure 6, indicates that the site is not at risk from reservoir flooding in the unlikely event of reservoir failure.

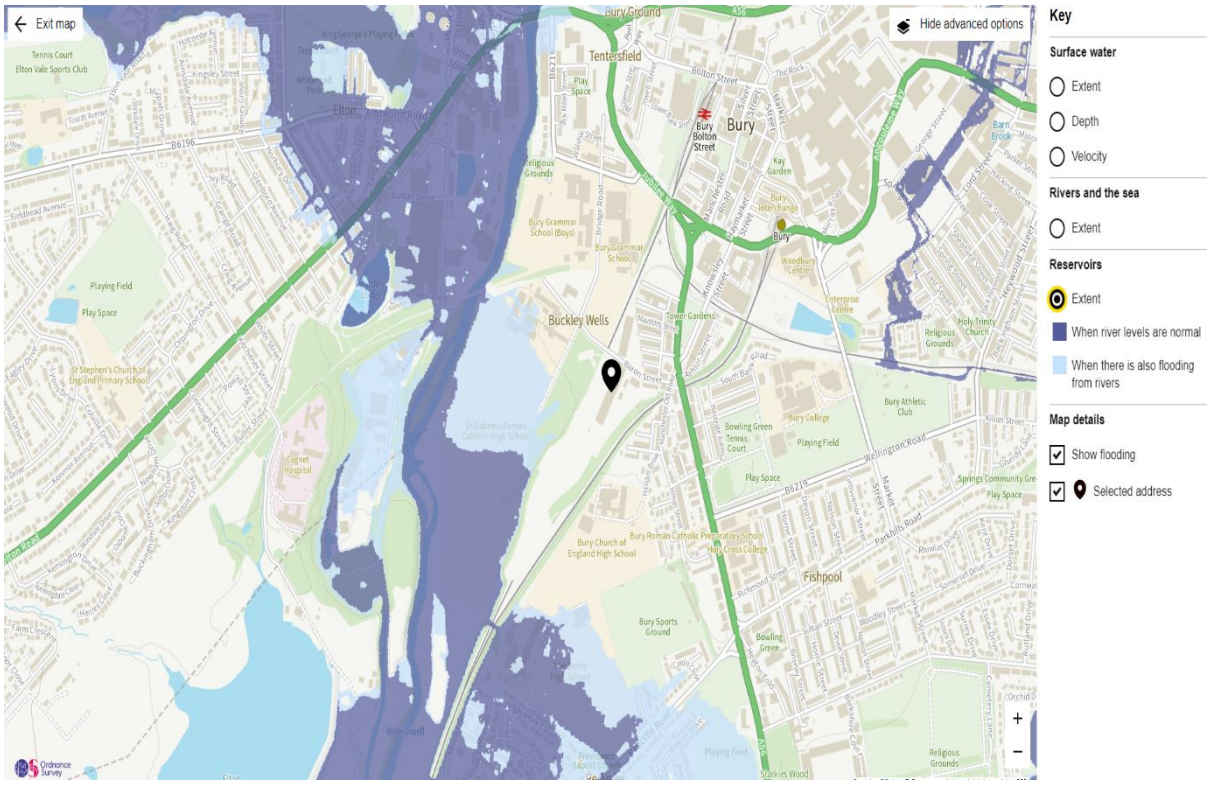


Figure 6 – Environment Agency Flood Map – Reservoirs

3.1.5 Groundwater Source Protection Zone

In addition to groundwater vulnerability the Environment Agency also defines groundwater Source Protection Zones (SPZs) around groundwater abstraction points. It states that SPZ's are defined:

"...based on the time it takes for pollutants to reach an abstraction point. Depending on the nature of the proposed development and the location of the development site with regards to the SPZs, restrictions may be placed on the types of SuDS appropriate to certain areas."

The definitions for each zone are included below:

- Inner zone – SPZ1 - This zone is 50-day travel time of pollutant to source with a 50 metres default minimum radius.
- Outer zone – SPZ2 - This zone is 400-day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.
- Total catchment – SPZ3 - This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

As shown in figure 7 below, the site is not located within any of the zones.

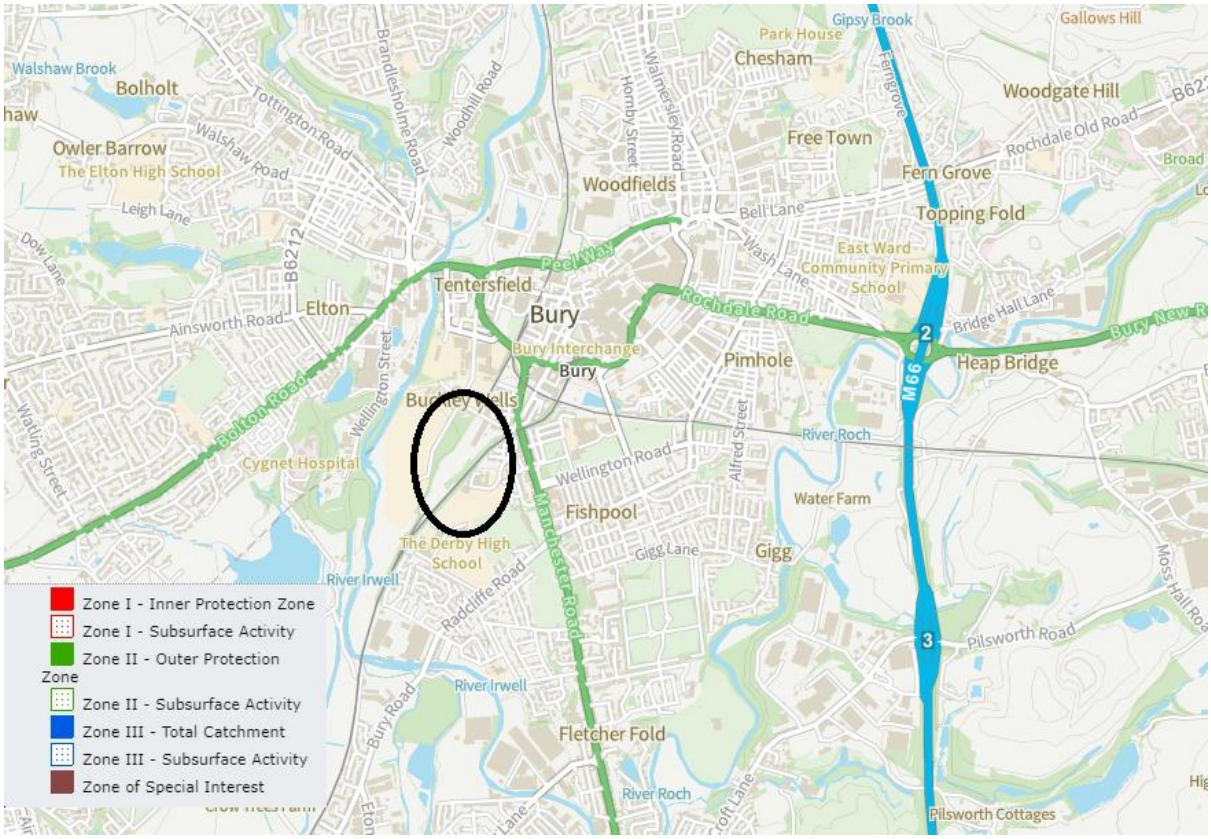


Figure 7 – Groundwater Source Protection Zone Vulnerability Map (Online Magic Map)

3.2 Correspondence

As part of the FRA process the Local Authorities Lead Local Flood Authority (Bury County Council) and the local public water utility company (United Utilities) were contacted to ascertain if they held flood risk information regarding the site, for example records relating to historic flooding or other relevant flooding information. A summary of each response is given below.

3.2.1 United Utilities (UU)

An email enquiry was issued to UU, and we are waiting for their detailed response.

3.2.2 Lead Local Flood Authority

The Level 1 Strategic Flood Risk Assessment for Greater Manchester – Update (March 2019states that:

Bury	50% less than pre-development	Current runoff up to 1 in 100 AEP event + climate change	Development should be designed so that there is no flooding to the development in a 1 in 30 AEP event and no property flooding in a 1 in 100 year plus climate change event

3.2.3 Internal Drainage Board

The Association of Drainage Authorities (ADA) confirmed that an internal drainage board does not operate within the study area, as can been seen by the absence of shaded areas in Figure 8. This implies that natural water levels within the area are not thought to have been artificially altered.

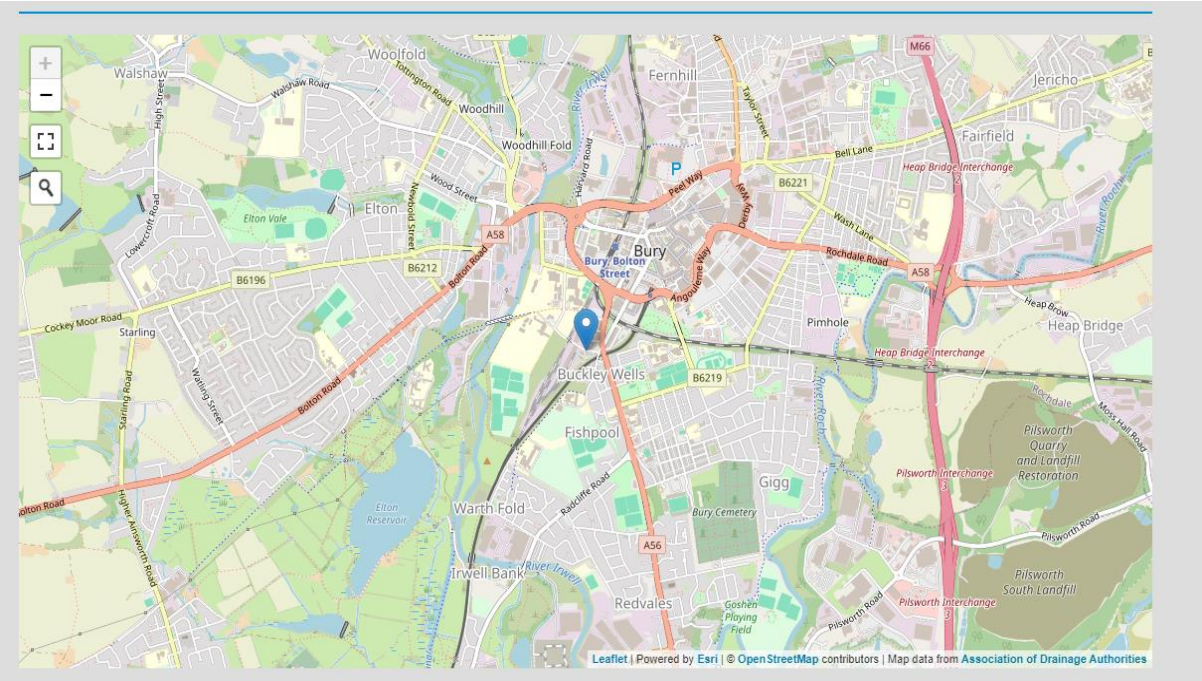


Figure 8 – Internal Drainage Board Interactive Map

4 Surface Water

In accordance with the NPPF and SFRA, consideration should be given to natural water flows at the site. The development should not adversely affect flow or increase flood risk elsewhere, including increasing run-off rates. The disposal of surface water should be dealt with in a sustainable way and climate change should also be accounted for. The site drainage strategy is discussed in Section 5.

4.1 Previous Situation and Development Proposals

The site comprises of several buildings, the 1857 locomotive work building, 2 more smaller in size buildings (2 sheds), railway tracks, storages containers and hardstanding carpark areas. The site is in a mixed residential and commercial area. Hardstanding areas cover most of the site and a small percentage of the overall site area is vegetated area including trees areas located mostly around the boundary of the site.

Post-development there will be an increase on the site's impermeable area with the introduction of the new shed building and the access road. Nevertheless, surface water collected from impermeable areas, such as roofs, will need to be managed.

Climate Change

There is evidence to suggest that the climate is changing with sea levels predicted to continue to rise along with more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall. The NPPF recommends that the effects of climate change be accounted for in FRA, with consideration of the EA flood maps and local authority SFRA.

Increased rainfall or higher intensity short-duration rainfall may increase as a result of climate change. The requirement is 45% for the 1 in 100-year event and 40% for the 1 in 30 year event within the new surface water drainage design to take account of climate change. Climate change may also lead to variations in groundwater level which will also be considered during the drainage design.

4.2 Sustainable Drainage Systems (SUDS)

SUDS are a desirable way to manage surface water disposal within new developments and SUDS methods for surface water drainage management are discussed further within the SUDS Manual.

The types of benefits that can be achieved by SUDS will be dependent on the site, but fit broadly into four categories: water quantity, water quality, amenity and biodiversity. These are also referred to as the four pillars of SuDS design (Figure 9) with a design objective.

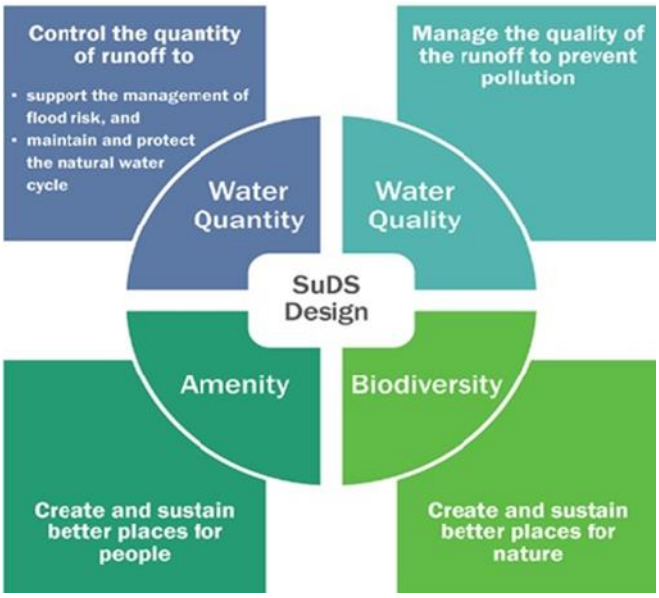


Figure 9 – Four Pillars of SuDS

The proposed development will address the above 4 pillars of SuDS design criteria with the inclusion of a range of sustainable features through a comprehensive treatment train.

- **Water Quantity**: the quantity of run-off from the site will be significantly reduced, as set out in more detail in the Drainage Strategy in Section 5, whilst taking account of likely increases in future rainfall due to climate change.

- **Water Quality**: the quality of run-off from the site will be improved by the inclusion of a porous construction build-up(lined) for the carpark area and cellular attenuation tank.

  The flows arising from the buildings' roof will initially be treated via a network of pipes and oil interceptors and reduce the opportunity for pollution. Any flows arising from the hardstanding areas will be treated by porous carpark build-up to improve water quality prior to discharge oil interceptor. Then travel through a series of pipes to the cellular attenuation tank. Another series of pipes and an oil interceptor will carry flows arising from the western part of the site prior discharging to the cellular attenuation tank underneath the small carpark. Flows arising from the new carriage shed and wash area will slowly navigate through the carpark build-up that will provide an extra layer of water quality improvement, to the attenuation tank. Finally, all flows are discharged at a restricted rate to an existing manhole and a culvert prior reaching River Irwell.

- **Biodiversity** cannot directly be addressed due to the nature of the project. Introducing a low maintenance green planters to the site, can provide important refuge to flora and fauna in connection with surrounding green spaces.

  Planting regimes can be created with the purpose of providing sanctuary for wild bees, butterflies and other wildlife species.

- **Amenity** is provided through the project itself, which presents the opportunity to create attractive areas which have the ability to connect people others and history of the area and railways. Such projects have been shown to improve the well-being of people that live around the area and beyond.

5 Drainage Strategy

5.1 Existing Drainage Arrangements

The development is consisting of the erection a new carriage shed and the restoration and extension of the existing 1857 locomotive building, it is expected that the site will have a network of existing manholes and pipes. Several CCTV Surveys (Appendix D) were commissioned in 2022 and 2023, which located a point of surface water discharge, manhole MH6(CCTV Survey label) located at the corner of southwest boundary of the site, making use of the existing drain which runs beneath the sports fields to the west and outfalls into the River Irwell.

Similarly, a foul manhole FW1(CCTV Survey label) near the northeast boundary was found during the surveys, through a network of manholes and pipes at the adjacent property before discharging to UU Asset 0103.

5.2 Surface Water Drainage Strategy

In accordance with the SUDS hierarchy, it is proposed that each of the development areas will be provided with a significant treatment train prior to discharge into the river Irwell.

In following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration. Review of currently available geological information, ground investigation and the nature of the site suggests that ground conditions within the site may not support infiltration. For the purpose of this report, infiltration has been excluded from the calculations.

There are two methods for calculating the greenfield run-off rate: the IH124 method and the ICP method. The IH124 method calculates the peak greenfield run-off flow rates by correlation of the Soil Index Value, the Average Annual Rainfall and the Site Area (SOIL, SAAR and AREA). The IH124 Method should be used for sites in excess of 50 hectares and the resulting discharge is linearly interpolated for the required area. The ICP method uses the IH124 method and automatically interpolates the discharge for sites less than 50 hectares and therefore this is the method that has been used extract shown in Figure 11 below.

Q_{BAR} (l/s):	44.66	44.66
1 in 1 year (l/s):	38.85	38.85
1 in 30 years (l/s):	75.92	75.92
1 in 100 year (l/s):	92.89	92.89
1 in 200 years (l/s):	105.85	105.85

Figure 10 – Greenfield Run Off Calculation

The carpark will be surfaced in permeable paving/porous asphalt as per architect's details and will be laid to fall towards the parking bays on a sub-base of single size stone to provide attenuation storage. A series of porous pipes and inspection chambers will drain the underground build-up.

The site is currently discharging into two separate manholes, two 2-pipe systems (Figure 10 below) have been employed to calculate the flows arising from the exiting site. The maximum discharge for 828.1/s. Results for the critical storms can be found in Appendix F.

CAUSEWAY	Booth King Partnership Limitec	File: Existing Drainage.pfd Network: Storm Network Eleni Zachara 07/03/2024	Page 4

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	17	85.550	1.550	427.8	36.8559	67.0765	FLOOD
120 minute summer	2	76	74.604	0.304	182.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	1.000	2	189.2	2.850	1.088	27.4843	557.6

Figure 11 – Brownfield Run Off Calculation – 2 Pipe Method

As mentioned above in Section 3.2.2, according to SFRA Level 1, for brownfield sites discharges rates to be limited to 50% less than pre-development. Baded on the existing flows using two-pipe method, 50% of the existing discharge rate is 94.6/s. Peak greenfield run-off rate was calculated for the 1 in 100 year storm 92.89l/s. Peak greenfield run-off was used for the purposed of this report.

Attenuation will be provided within a range of individual features shown on drawing reference 14550-BKP-V1-XX-DR-C-0500 - Drainage GA shown in Appendix E.

The site drainage network will be designed in accordance with current best practice to have sufficient capacity not to flood both during the critical 1 in 30 year storm (plus 40% allowance for climate change) and 1 in 100 year storm event (plus 45% allowance for climate change). In this way the risk of off-site flooding, which could result in damage to other buildings and essential services, will be minimised and the risk of flooding elsewhere should not be increased as a result of the development proposals.

Two manholes will house hydrobrake flow control devices which will control the rate of discharge into the dedicated surface water sewer to the proposed discharge rate.

Further discussion with the appropriate approving bodies will be required to finalise the Drainage Strategy.

Causeway Flow output for the Critical Storm is enclosed in Appendix F.

5.3 Foul Water Drainage Strategy

Foul water from the new carriage shed and carriage wash will be discharged via a pump to the existing combined sewer within the site boundary to the northern edge of the site, with a new connection being made into the foul manhole FW1(CCTV Survey label).

A pre-development inquiry has been submitted to United Utilities to confirm that the foul flows can be accommodated within their network.

An enquiry email has also been sent to the LLFA; Bury Council.

6 Maintenance Plan

The Drainage network has been designed with minimal maintenance in mind. The maintenance is generally of a 'common sense' approach and is to comprise:

- Regular day to day care: - litter collection, grass cutting and checking the inlets and outlets where water enters or leaves a drainage feature.
- Occasional tasks: - managing vegetation in wet areas and removing any silt that builds up in the drainage features.
- Remedial work: - repairing damage when, and where, necessary.

Specific recommendations for each feature are provided in the following sections and should be referred to in the first instance if there are any issues. Please contact Booth King Partnership Ltd. if any further advice is required.

During the works the Contractor, subject to agreement from their client, will ensure that all drains on which the proposed drainage works rely will be jetted out and made good as required to ensure correct operation.

Maintenance Activity	Required Action	Frequency
Inspection	Inspect for sediment and debris in pre-treatment component such as gullies, sump units and catch pits.	Monthly for the first year and on a 6-monthly basis thereafter.
Gutters	Clear gutters and any leaf guards.	On a 6-monthly basis or as required following inspection regime.
Sump Units	Remove all obstructions and debris from all sump units (gullies, channels and catch pits).	On a 6-monthly basis or as required following inspection regime.
Pipe Work	Inspect all pipework for all silt accumulation and high pressure jet any pipe work which has silt accumulation. Care is to be taken that any silts within the pipework are not flushed using chamber bungs.	On a 6-monthly basis or as required following inspection regime.
Manholes	Covers should be lifted and inspected for litter and debris to ensure that the runs are free-flowing.	On a 6-monthly basis or as required following inspection regime.
Flow Control	Check flow control manhole to ensure emptying is occurring. Little to no water should be present after consecutive days of dry weather). Check function of the emergency drain down. Check for build-up of debris and silt. Clear and remove as necessary.	6 monthly basis. After extreme events.
Attenuation Tank	Ensure that ventilation pipework is free of obstruction. If jetting through the tank is required, this must be done following the jetting and clearance of upstream sumps.	6 monthly basis. After extreme events.
Oil Interceptor	Check the integrity of the interceptor and all its mechanical parts. Inspect the filters and repair or replace, where necessary. Assess the amount of contaminants that have collected in the tank. Service all electrical systems, interceptor management systems and alarms etc. Examine the coalescing device (if there is one) and replace, if required. Have all silt and contaminants removed and disposed in accordance with regulations. Maintain industry standard documentation. Keep logs of any inspections, maintenance, incidents, services and contaminant removal activities. Ensure any contaminants are removed and transported in accordance with relevant legislation.	6 monthly basis. After extreme events. As per manufacturer's recommendations.

7 Conclusions

1. The site is wholly contained within in EA Flood Zone 1. Reference to NPPF Table 3 shows that an Exception Test is not required as residential end-use is deemed appropriate in Zone 1.
2. The site is considered to be at low overall risk of flooding. EA mapping indicates that surface water flooding does not occur in the vicinity of the proposed site and this potential risk has been considered as part of the preliminary site surface water drainage strategy.
3. The risk of flooding elsewhere will not be increased as a result of the development.
4. The nearest surface water feature is located approximately 250m to the west.
5. Attenuation will be provided on the site to ensure that the maximum run off rate of 92.86 l/s is not exceeded during a 1 in 100-year storm event, inclusive of a 45% allowance for climate change and during the 1 in 30-year storm event plus 40% climate change allowance.
6. The risk of off-site flooding would not increase as a result of the development and safe access and egress will be maintained.
7. Foul flows are proposed to be taken to the public network operated by United Utilities.

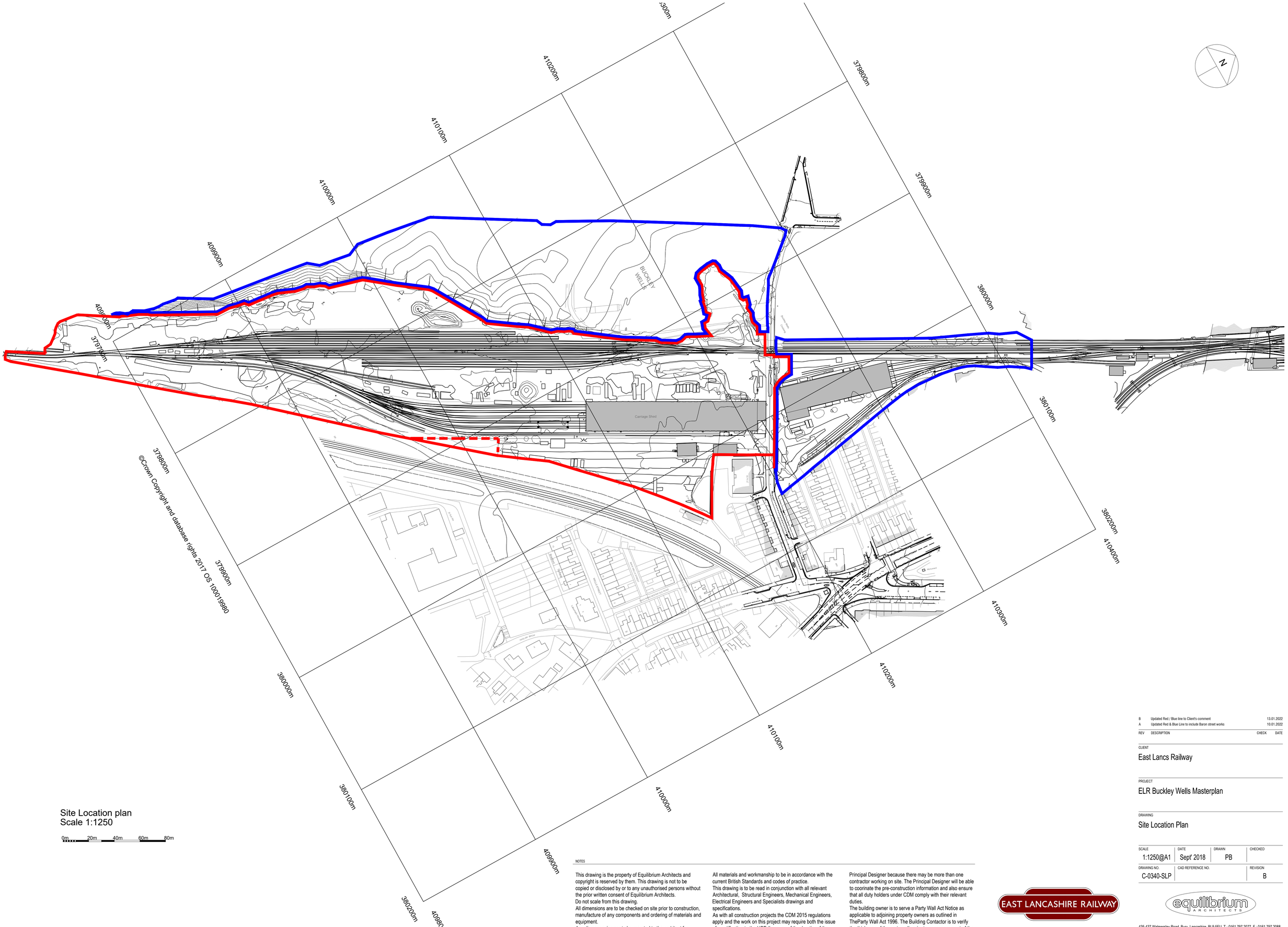
References

1. C753. The SuDS Manual. CIRIA. 2015.
2. Level 1 Strategic Flood Risk Assessment for Greater Manchester – Update. Final Report, March 2019
3. Greater Manchester Surface Water Management Plan Stage 1 – A Strategic Assessment of Surface Water Flood Risk. Final Report, January 2012
4. Bury Local Plan Topic Paper 6 Flood Risk. October 2018
5. National Planning Policy Framework. March 2012.
6. Planning Practice Guidance.

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

7. Technical Guidance to the National Planning Policy Framework. March 2012.
8. Topographical survey.
9. Bury Local Flood Risk Management Strategy. April 2018
10. Climate change allowances for peak rainfall (data.gov.uk) – Climate Allowance.
11. Magic Map Application (defra.gov.uk) – Source Protection Zones.
12. BUCKLEY WELLS LOCOMOTIVE WORKS BARON STREET, BURY INTERIM GROUND INVESTIGATION & RISK ASSESSMENT REPORT. Leyden Kirby Associates Ltd October 2006
13. Greater Manchester Level 2 Hybrid Strategic Flood Risk Assessment – Main Report. Final Report. October 2020

Appendix A – Site Plan



Site Location plan
Scale 1:1250

0m 20m 40m 60m 80m

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The building owner is to serve a Party Wall Act Notice as applicable to adjoining property owners as outlined in TheParty Wall Act 1996. The Building Contactor is to verify the thickness of the party walls prior to commencement of the proposed works.

EAST LANCASHIRE RAILWAY

REV	DESCRIPTION	CHECK	DATE
B	Updated Red / Blue line to Client's comment		13.01.2022
A	Updated Red & Blue Line to include Baron street works		10.01.2022

CLIENT
East Lancs Railway

PROJECT
ELR Buckley Wells Masterplan

DRAWING
Site Location Plan

SCALE	DATE	DRAWN	CHECKED
1:1250@A1	Sept' 2018	PB	

DRAWING NO.	CAD REFERENCE NO.	REVISION
C-0340-SLP		B

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Appendix B – Topographical Survey

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REV	DESCRIPTION	CHECK	DATE

CLIENT
East Lancs Railway

PROJECT
ELR Buckley Wells Masterplan

DRAWING
Existing Site Layout

SCALE	DATE	DRAWN	CHECKED
1:500 A0	Sept' 2018	MH	
DRAWING NO.	CAD REFERENCE NO.		REVISION
C-0340-01			

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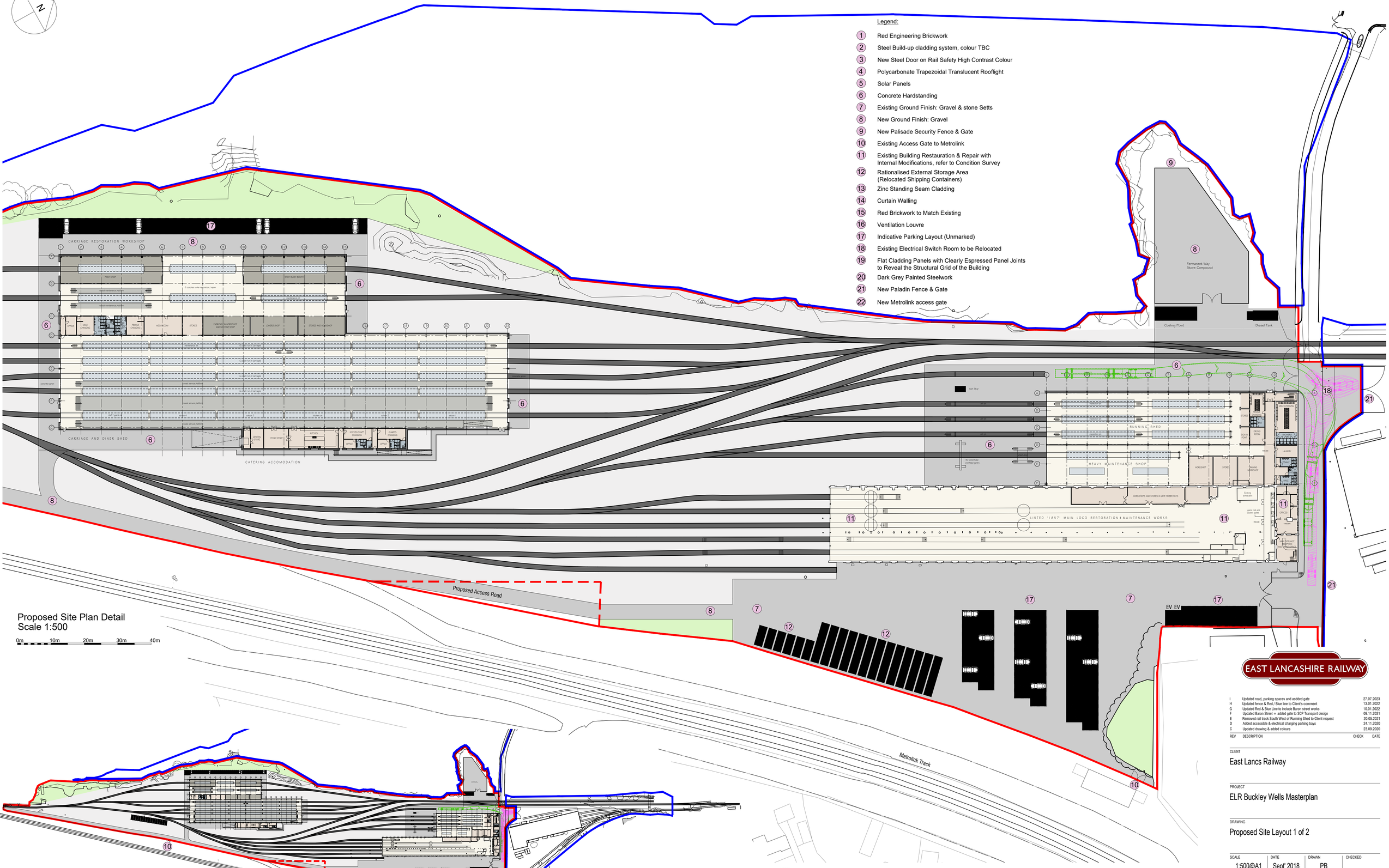
Existing Site Layout

Appendix C – Architect's Proposed Layout

Legend:

1. Red Engineering Brickwork
2. Steel Build-up cladding system, colour TBC
3. New Steel Door on Rail Safety High Contrast Colour
4. Polycarbonate Trapezoidal Translucent Rooflight
5. Solar Panels
6. Concrete Hardstanding
7. Existing Ground Finish: Gravel & stone Setts
8. New Ground Finish: Gravel
9. New Palisade Security Fence & Gate
10. Existing Access Gate to Metrolink
11. Existing Building Restauration & Repair with Internal Modifications, refer to Condition Survey
12. Rationalised External Storage Area (Relocated Shipping Containers)
13. Zinc Standing Seam Cladding
14. Curtain Walling
15. Red Brickwork to Match Existing
16. Ventilation Louvre
17. Indicative Parking Layout (Unmarked)
18. Existing Electrical Switch Room to be Relocated
19. Flat Cladding Panels with Clearly Espressed Panel Joints to Reveal the Structural Grid of the Building
20. Dark Grey Painted Steelwork
21. New Paladin Fence & Gate
22. New Metrolink access gate



Proposed Site Plan Detail
Scale 1:500

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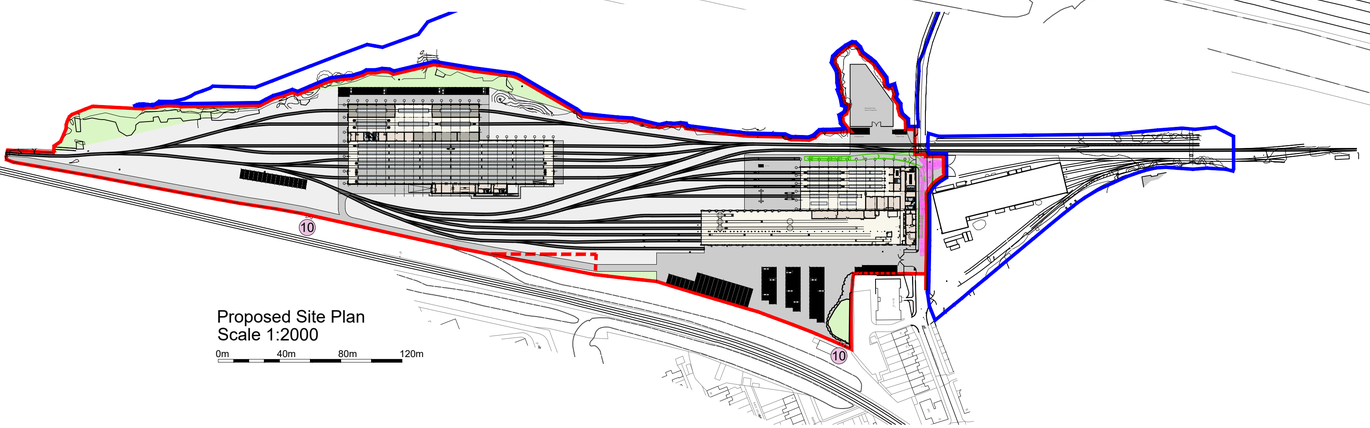

Proposed Site Plan
Scale 1:2000

0m 40m 80m 120m

EAST LANCASHIRE RAILWAY

REV	DESCRIPTION	CHECK	DATE
I	Updated road, parking spaces and asdded gate		27.07.2023
H	Updated fence & Red / Blue line to Client's comment		13.01.2022
G	Updated Red & Blue Line to include Baron street works		10.01.2022
F	Updated Baron Street + added gate to SCP Transport design		09.11.2021
E	Removed rail track South West of Running Shed to Client request		20.05.2021
D	Added accessible & electrical charging parking bays		24.11.2020
C	Updated drawing & added colours		23.09.2020

CLIENT
East Lancs Railway

PROJECT
ELR Buckley Wells Masterplan

DRAWING
Proposed Site Layout 1 of 2

SCALE	DATE	DRAWN	CHECKED
1:500@A1	Sept' 2018	PB	

DRAWING NO.	CAD REFERENCE NO.	REVISION
C-0340-08		I

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Legend:

1. Red Engineering Brickwork
2. Steel Build-up cladding system, colour TBC
3. New Steel Door on Rail Safety High Contrast Colour
4. Polycarbonate Trapezoidal Translucent Rooflight
5. Solar Panels
6. Concrete Hardstanding
7. Existing Ground Finish: Gravel & stone Setts
8. New Ground Finish: Gravel
9. New Palisade Security Fence & Gate
10. Existing Access Gate to Metrolink
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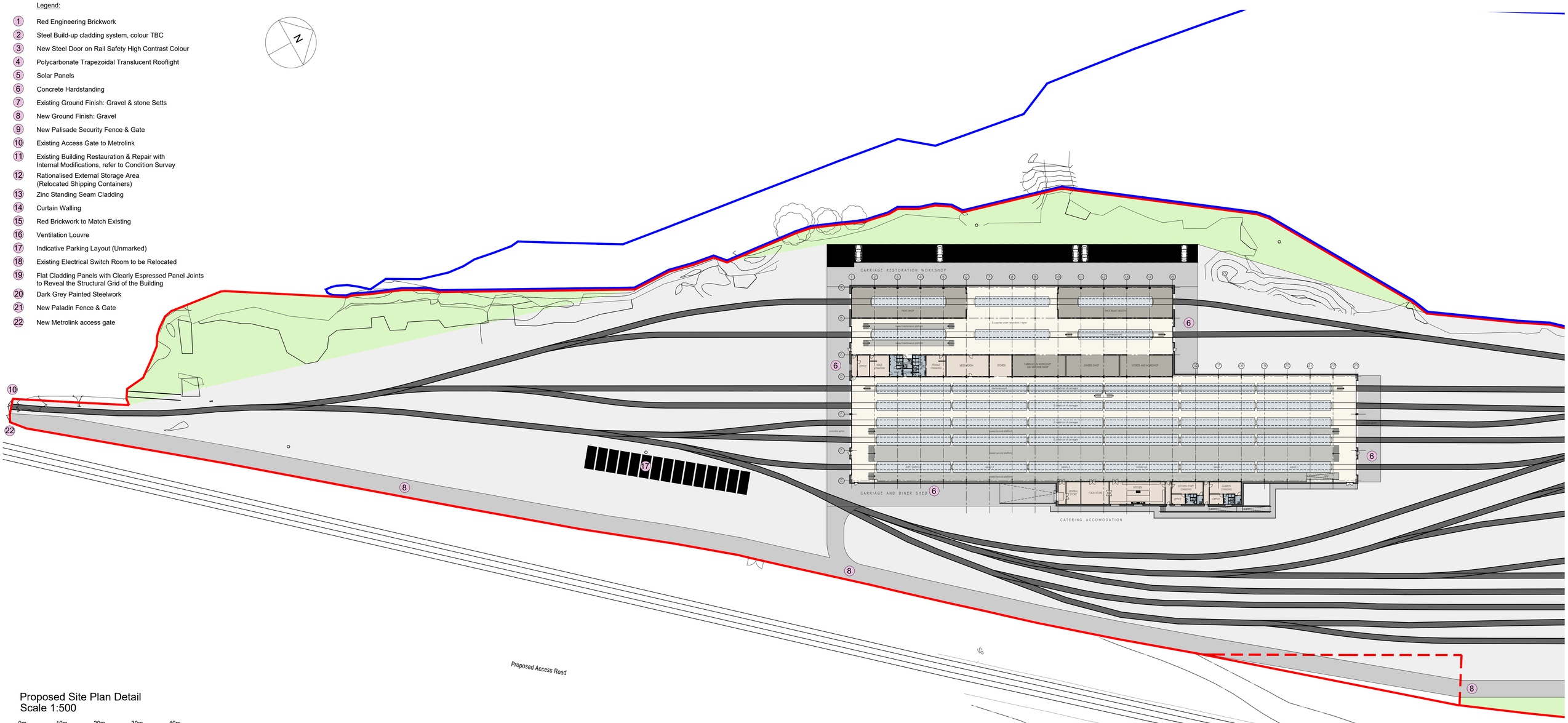
19. Flat Cladding Panels with Clearly Espressed Panel Joints to Reveal the Structural Grid of the Building
20. Dark Grey Painted Steelwork
21. New Paladin Fence & Gate
22. New Metrolink access gate



Proposed Site Plan Detail
Scale 1:500

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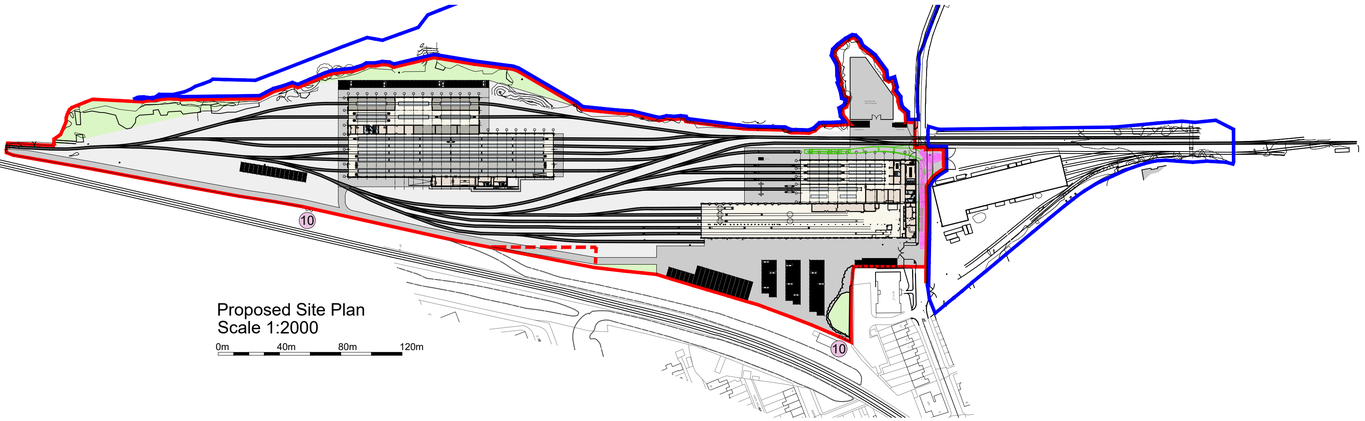

Proposed Site Plan
Scale 1:2000

0m 40m 80m 120m

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EAST LANCASHIRE RAILWAY

REV	DESCRIPTION	CHECK	DATE
-	-		-

CLIENT
East Lancs Railway

PROJECT
ELR Buckley Wells Masterplan

DRAWING
Proposed Site Layout 2 of 2

SCALE	DATE	DRAWN	CHECKED
1:500@A1	July 2023	PM	

DRAWING NO.	CAD REFERENCE NO.	REVISION
C-0340-12		-

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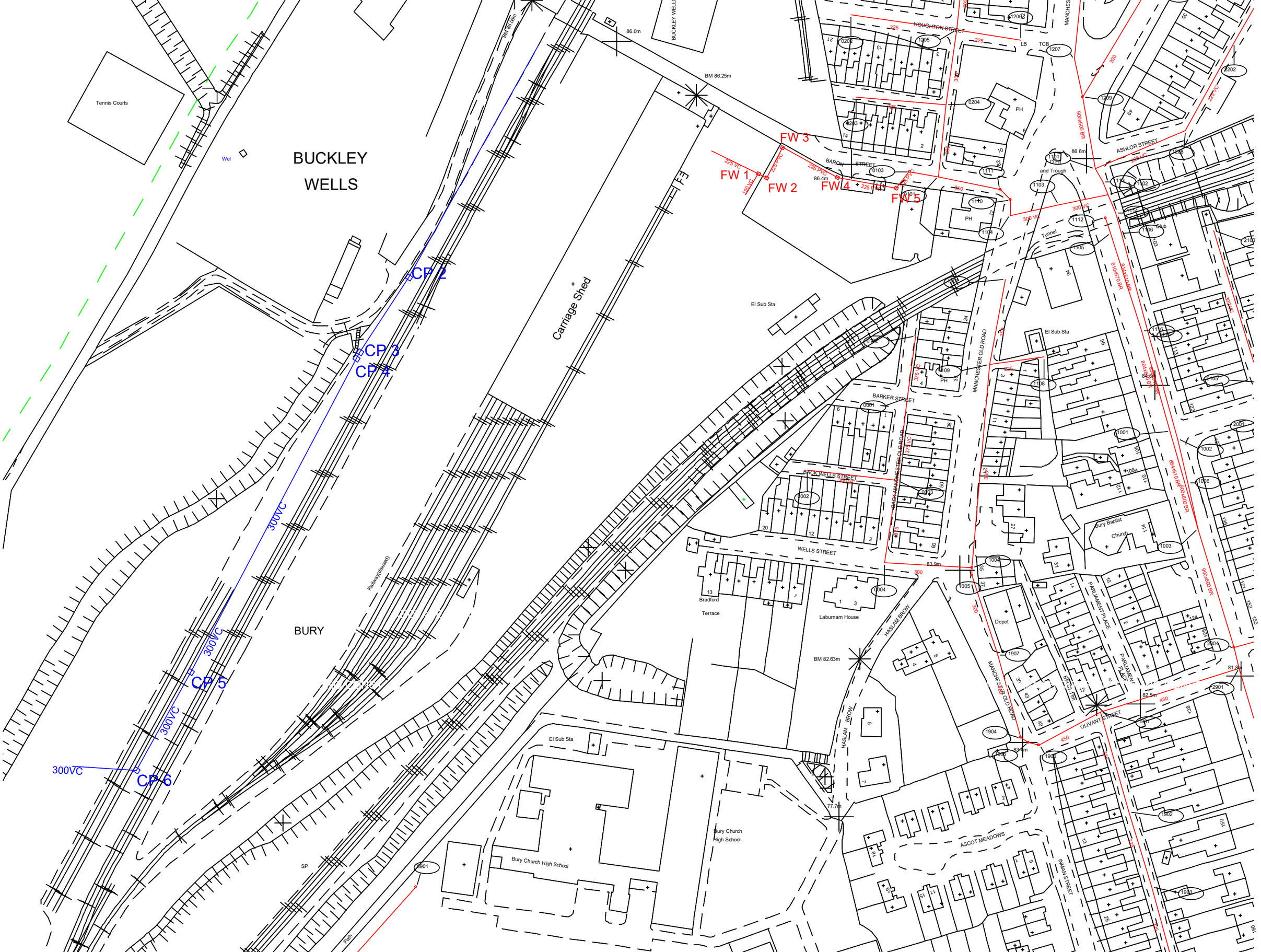
Appendix D – CCTV Survey


BUCKLEY WELLS
BURY
Tennis Courts
Wel
Carriage Shed
Railway(disused)
BUCKLEY WELLS
BM 86.25m
86.0m
BM 86.30m
HOUGHTON STREET
BARON STREET
ASHLOR STREET
BARKER STREET
BACKWELLS STREET
WELLS STREET
MANCHESTER OLD ROAD
HASLAM BROW
OLIVANT STREET
PARLIAMENT PLACE
IMMAN STREET
ASCOT MEADOWS
Bury Baptist Church
Bradford Terrace
Laburnam House
Depot
Bury Church High School
El Sub Sta
BM 82.63m
77.7m
83.9m
82.5m
83.4m
86.4m
86.6m
CP 2
CP 3
CP 4
CP 5
CP 6
300VC
FW 1
FW 2
FW 3
FW 4
FW 5

Manhole Record Card

Number	MHF1			Date Of Survey	29/03/2023
Status	PR	Function	F	Type	

Cover Details:

Square Recta ☐ Double Triang ☑ Single Triangl ☐ Circular ☐ Multiple ☐ Hinged ☐ Lockable ☐

CoverLevel 0.00 Cover Load Class M

Cover	600	X	600	Chamber	0	X	0	EvidenceOfSurcharge	☐
Shaft	0	X	0	ShaftDepth	0			ToxicAtmosphere	☐

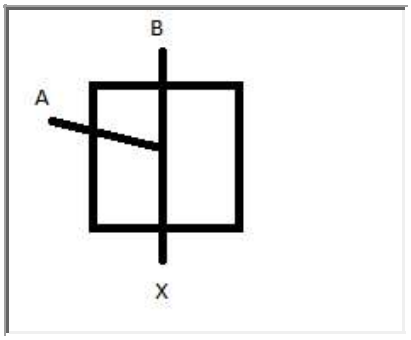
Brick ☐ Precast Concrete ☑ PVC ☐ Segments ☐ No.RegCourses

Reducing Slab ☐ Taper ☐ Side Entry ☐ No.Land 0 Step Irons ☐ Ladder ☑

PlanPhoto

LocationPhoto

PlanofManhol



Chamber Conditions:

Cover	OK	Shaft	OK
Irons/Ladder	OK	Chamber	OK
Benching/Channel	OK		

Pipe	Invert L	DepthFr	UpstreamRef	Downstream	Pipe Sha	SizeHeight	SizeWidth	Pipe Material	Lini
A	-1.260	1.26			C		150	VC	
B	-1.300	1.30			C		225	VC	
X	-1.310	1.31		MHF2	C		225	VC	

Disclaimer - Any dimensions and levels provided on this form should be checked before being relied upon. It is the responsibility of the customer to verify all information given with regards to the drainage prior to designing or commencing any work on site.

Manhole Record Card

Number	MHF2			Date Of Survey	29/03/2023
Status	PR	Function	F	Type	M

Cover Details:

Square Recta ☐ Double Triang ☑ Single Triangl ☐ Circular ☐ Multiple ☐ Hinged ☐ Lockable ☐

CoverLevel 0.00 Cover Load Class M

Cover	600	X	600	Chamber	0	X	0	EvidenceOfSurcharge	☐
Shaft	0	X	0	ShaftDepth	0			ToxicAtmosphere	☐

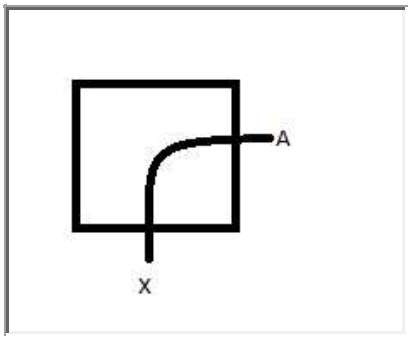
Brick ☐ Precast Concrete ☑ PVC ☐ Segments ☐ No.RegCourses

Reducing Slab ☐ Taper ☐ Side Entry ☐ No.Land 0 Step Irons ☐ Ladder ☑

PlanPhoto

LocationPhoto

PlanofManhol



Chamber Conditions:

Cover	OK	Shaft	OK
Irons/Ladder	OK	Chamber	OK
Benching/Channel	OK		

Pipe	Invert L	DepthFr	UpstreamRef	Downstream	Pipe Sha	SizeHeight	SizeWidth	Pipe Material	Lini
A	-1.380	1.38	MHF1		C		225	PVC	
X	-1.410	1.41		MHF3	C		225	PVC	

Disclaimer - Any dimensions and levels provided on this form should be checked before being relied upon. It is the responsibility of the customer to verify all information given with regards to the drainage prior to designing or commencing any work on site.

Manhole Record Card

Number	MHF3			Date Of Survey	29/03/2023
Status	PR	Function	F	Type	M

Cover Details:

Square Recta ☐ Double Triang ☑ Single Triangl ☐ Circular ☐ Multiple ☐ Hinged ☐ Lockable ☐

CoverLevel 0.00 Cover Load Class M

Cover	600	X	600	Chamber	0	X	0	EvidenceOfSurcharge	☐
Shaft	0	X	0	ShaftDepth	0			ToxicAtmosphere	☐

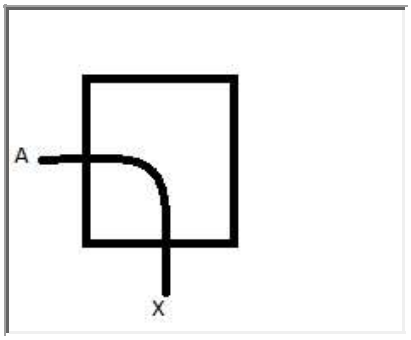
Brick ☐ Precast Concrete ☑ PVC ☐ Segments ☐ No.RegCourses

Reducing Slab ☐ Taper ☐ Side Entry ☐ No.Land 0 Step Irons ☐ Ladder ☑

PlanPhoto

LocationPhoto

PlanofManhol



Chamber Conditions:

Cover	OK	Shaft	OK
Irons/Ladder	OK	Chamber	OK
Benching/Channel	OK		

Pipe	Invert L	DepthFr	UpstreamRef	Downstream	Pipe Sha	SizeHeight	SizeWidth	Pipe Material	Linir
A	-1.630	1.63	MHF2		C		225	PVC	
X	-1.680	1.68		MHF4	C		225	PVC	

Disclaimer - Any dimensions and levels provided on this form should be checked before being relied upon. It is the responsibility of the customer to verify all information given with regards to the drainage prior to designing or commencing any work on site.

Manhole Record Card

Number	MHF4			Date Of Survey	29/03/2023
Status	PR	Function	F	Type	M

Cover Details:

Square Recta ☑ Double Triang ☐ Single Triangl ☐ Circular ☐ Multiple ☐ Hinged ☐ Lockable ☐

CoverLevel 0.00 Cover Load Class H

Cover	600	X	600	Chamber	0	X	0	EvidenceOfSurcharge	☐
Shaft	0	X	0	ShaftDepth	0			ToxicAtmosphere	☐

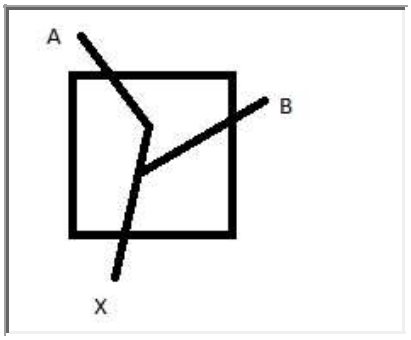
Brick ☐ Precast Concrete ☑ PVC ☐ Segments ☐ No.RegCourses

Reducing Slab ☐ Taper ☐ Side Entry ☐ No.Land 0 Step Irons ☐ Ladder ☑

PlanPhoto

LocationPhoto

PlanofManhol



Chamber Conditions:

Cover	OK	Shaft	OK
Irons/Ladder	OK	Chamber	OK
Benching/Channel	OK		

Pipe	Invert L	DepthFr	UpstreamRef	Downstream	Pipe Sha	SizeHeight	SizeWidth	Pipe Material	Lini
A	-2.260	2.26			C		225	PVC	
B	-2.240	2.24	MHF3		C		225	PVC	
X	-2.280	2.28		MHF5	C		225	PVC	

Disclaimer - Any dimensions and levels provided on this form should be checked before being relied upon. It is the responsibility of the customer to verify all information given with regards to the drainage prior to designing or commencing any work on site.

Manhole Record Card

Number	CP7			Date Of Survey	29/03/2023
Status	PR	Function	S	Type	M

Cover Details:

Square Recta ☑ Double Triang ☐ Single Triangl ☐ Circular ☐ Multiple ☐ Hinged ☐ Lockable ☐

CoverLevel 0.00 Cover Load Class H

Cover	1000	X	600	Chamber	0	X	0	EvidenceOfSurcharge	☐
Shaft	0	X	0	ShaftDepth	0			ToxicAtmosphere	☐

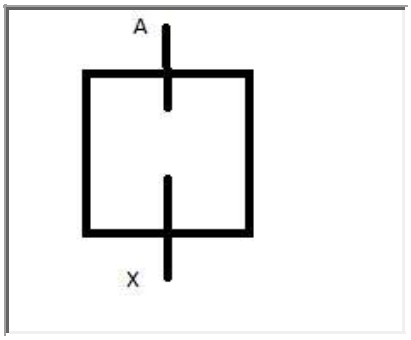
Brick ☐ Precast Concrete ☑ PVC ☐ Segments ☐ No.RegCourses

Reducing Slab ☐ Taper ☐ Side Entry ☐ No.Land 0 Step Irons ☐ Ladder ☑

PlanPhoto

LocationPhoto

PlanofManhol



Chamber Conditions:

Cover	OK	Shaft	OK
Irons/Ladder	OK	Chamber	OK
Benching/Channel	OK		

FULL OF WATER SURCHARGED

Pipe	Invert L	DepthFr	UpstreamRef	Downstream	Pipe Sha	SizeHeight	SizeWidth	Pipe Material	Linir
A	-1.900	1.90	CP6		C		375	VC	
X	-1.900	1.90		OUTFALL	C		375	VC	

Disclaimer - Any dimensions and levels provided on this form should be checked before being relied upon. It is the responsibility of the customer to verify all information given with regards to the drainage prior to designing or commencing any work on site.

Project

Project Name:	2022_08_04East Lancs Railway(32779)Bury Depo
Project Description:	Drainage Survey
Project Number:	32779
Project Status:	Complete
Project Date:	04/08/2022
Inspection Standard:	MSCC5 Sewers & Drainage GB (SRM5 Scoring)

Drain-Alert
Cripplegate Lane, Hoghton,Preston
Tel. 01254 851500
service@drain-alert.co.uk

Table of Contents

Project Name	Project Number	Project Date
2022_08_04East Lancs Railway(32779)Bury Depo	32779	04/08/2022

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Scoring Summary P-2
Section Profile P-3
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Section: 2; CP 2 > CP 3 (CP 2X) 3
Section: 3; CP 3 > CP4 (CP 3X) 4
Section: 5; F2 > F1 (F2X) 6
Section: 6; F1 > Sewer (F1X) 7

Drain-Alert
Cripplegate Lane, Hoghton,Preston
Tel. 01254 851500
service@drain-alert.co.uk

Project Information

Project Name	Project Number	Project Date
2022_08_04East Lancs Railway(32779)Bury Depo	32779	04/08/2022

Client

Company: East Lancs Railway
Contact: Andy Hardman
Street: Baron Street
Town or City: Bury
County: Lancs

Site

Company: As Client

Contractor

Company: Drain-Alert
Contact: Mr Stephen Ormisher
Department: Director
Street: Cripplegate Lane
Town or City: Hoghton,Preston
County: Lancashire
Phone: 01254 851500
Fax: 01254 854004
Mobile: 07973 436145
Email: service@drain-alert.co.uk

Drain-Alert
Cripplegate Lane, Hoghton,Preston
Tel. 01254 851500
service@drain-alert.co.uk

Scoring Summary

Project Name	Project Number	Project Date
2022_08_04East Lancs Railway(32779)Bury Depo	32779	04/08/2022

Structural Defects

Section	PLR	Grade	Description
All inspected pipes are in an acceptable structural condition (< grade 3).			

Service / Operational Condition

Section	PLR	Grade	Description
All inspected pipes are in an acceptable service condition (< grade 3).			

Abandoned Surveys

Section	PLR	Description
2	CP 2X	Survey abandoned
3	CP 3X	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRc.

Drain-Alert
Cripplegate Lane, Hoghton,Preston
Tel. 01254 851500
service@drain-alert.co.uk

Section Profile

Project Name	Project Number	Project Date
2022_08_04East Lancs Railway(32779)Bury Depo	32779	04/08/2022

Circular, 225 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
5	F2	F1	04/08/2022	Bury	Vitrified clay	4.50 m	4.50 m
6	F1	Sewer	04/08/2022	Bury	Vitrified clay	39.40 m	39.40 m

Total: 2 Inspections x Circular 225 mm = 43.90 m Total Length and 43.90 m Inspected Length

Rectangular, 450 mm, 600 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
1	CP 2	CP 1	04/08/2022	Bury	Brick	0.00 m	0.00 m

Total: 1 Inspection x Rectangular 450 mm, 600 mm = 0.00 m Total Length and 0.00 m Inspected Length

Total: 3 Inspections = 43.90 m Total Length and 43.90 m Inspected Length

Drain-Alert
Cripplegate Lane, Hoghton,Preston
Tel. 01254 851500
service@drain-alert.co.uk

Section Inspection - 04/08/2022 - CP 2X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	04/08/22	10:49	Not Specified	No Rain Or Snow	No	CP 2X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
M Gostelow	PN17AAK	P235 Tractor	Not Specified	Railways Drainage	Not Specified

Town or Village:	East Lancs Railway	**Inspection Direction:**	Upstream	**Upstream Node:**	CP 2
Road:	Bury	**Inspected Length:**	0.00 m	**Upstream Pipe Depth:**	
Location:	Verge	**Total Length:**	0.00 m	**Downstream Node:**	CP 1
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

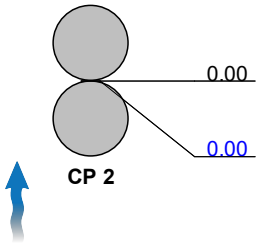
Use:	Surface water	**Pipe Shape:**	Rectangular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm	**Width:**	600 mm
Flow Control:	No flow control	**Material:**	Brick		
Year Constructed:	Not Specified	**Lining Type:**	No Lining		
Inspection Purpose:	Post completion condition survey	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:50

Depth: m

CP 1



CP 2

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: CP 1	00:00:19		
0.00	REM	General remark: line filled with stone	00:02:14	CP 2X_bd7d7 4fc-6cad-4	

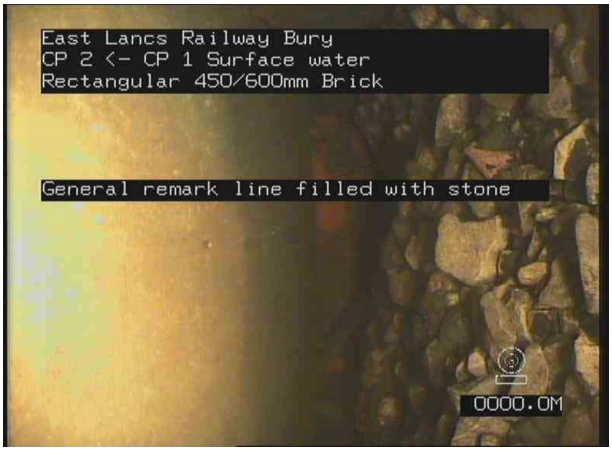
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0

Drain-Alert
Cripplegate Lane, Hoghton,Preston
Tel. 01254 851500
service@drain-alert.co.uk

Section Pictures - 04/08/2022 - CP 2X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Upstream	CP 2X		32779



CP 2X_bd7d74fc-6cad-487c-b973-052e306316b8_20220804_105144_067.jpg, 00:02:14, 0.00 m
General remark, line filled with stone

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service@drain-alert.co.uk

Section Inspection - 04/08/2022 - CP 2X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
2	1	04/08/22	11:20	Not Specified	No Rain Or Snow	No	CP 2X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
M Gostelow	PN17AAK	P235 Tractor	Not Specified	Railways Drainage	Not Specified

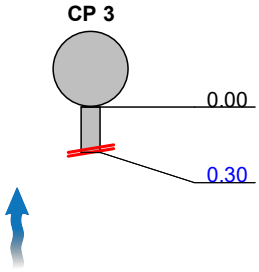
Town or Village:	East Lancs Railway	**Inspection Direction:**	Upstream	**Upstream Node:**	CP 2
Road:	Bury	**Inspected Length:**	0.30 m	**Upstream Pipe Depth:**	
Location:	Verge	**Total Length:**	0.30 m	**Downstream Node:**	CP 3
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Rectangular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	375 mm	**Width:**	300 mm
Flow Control:	No flow control	**Material:**	Brick		
Year Constructed:	Not Specified	**Lining Type:**	No Lining		
Inspection Purpose:	Post completion condition survey	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:50

Depth: m
CP 3



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: CP 3	00:00:27		
0.30	SA	Survey abandoned: due to water level	00:05:10		

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Inspection - 04/08/2022 - CP 3X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	04/08/22	11:32	Not Specified	No Rain Or Snow	No	CP 3X

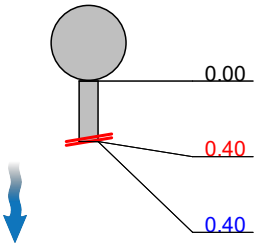
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
M Gostelow	PN17AAK	P235 Tractor	Not Specified	Railways Drainage	Not Specified

Town or Village:	East Lancs Railway	**Inspection Direction:**	Downstream	**Upstream Node:**	CP 3
Road:	Bury	**Inspected Length:**	0.40 m	**Upstream Pipe Depth:**	
Location:	Verge	**Total Length:**	0.40 m	**Downstream Node:**	CP4
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Rectangular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	300 mm	**Width:**	375 mm
Flow Control:	No flow control	**Material:**	Brick		
Year Constructed:	Not Specified	**Lining Type:**	No Lining		
Inspection Purpose:	Post completion condition survey	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:50 **Depth: m** **CP 3**



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: CP 3	00:00:50		
0.40	XP	Collapsed drain or sewer	00:00:40	CP 3X_ef2490 21-34c8-4	
0.40	SA	Survey abandoned: due to pipework	00:02:27		

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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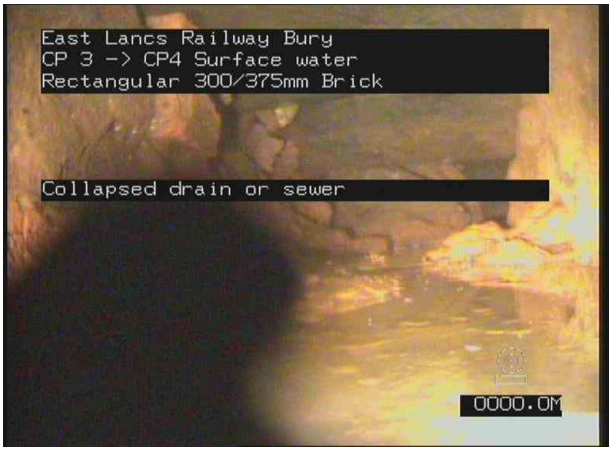
Section Pictures - 04/08/2022 - CP 3X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Downstream	CP 3X		32779



CP 3X_ef249021-34c8-46f4-af38-cbfb45f4356e_20220804_113230_036.jpg, 00:00:40, 0.40 m
Collapsed drain or sewer

Drain-Alert
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service@drain-alert.co.uk

Section Inspection - 04/08/2022 - F2X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
5	1	04/08/22	14:12	Not Specified	No Rain Or Snow	No	F2X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
M Gostelow	PN17AAK	P235 Flexi-Rod	Not Specified	Railways Drainage	Not Specified

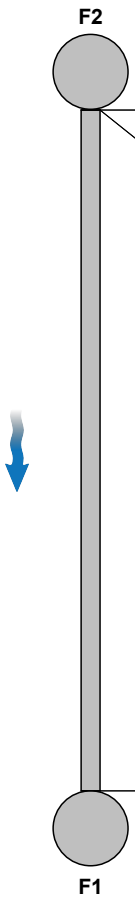
Town or Village:	East Lancs Railway	**Inspection Direction:**	Downstream	**Upstream Node:**	F2
Road:	Bury	**Inspected Length:**	4.50 m	**Upstream Pipe Depth:**	
Location:	Verge	**Total Length:**	4.50 m	**Downstream Node:**	F1
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:50

Depth: m



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F2	00:00:12		
0.00	WL	Water level, 0% of the vertical dimension	00:00:16		
4.50	MHF	Finish node, manhole, reference: F1	00:00:39		

Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Drain-Alert
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Section Inspection - 04/08/2022 - F1X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
6	1	04/08/22	14:14	Not Specified	No Rain Or Snow	No	F1X

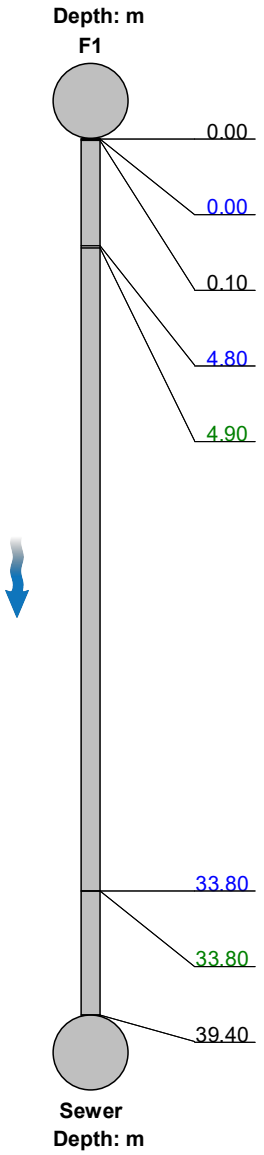
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
M Gostelow	PN17AAK	P235 Flexi-Rod	Not Specified	Railways Drainage	Not Specified

Town or Village:	East Lancs Railway	**Inspection Direction:**	Downstream	**Upstream Node:**	F1
Road:	Bury	**Inspected Length:**	39.40 m	**Upstream Pipe Depth:**	
Location:	Verge	**Total Length:**	39.40 m	**Downstream Node:**	SEWER
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:340



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F1	00:00:12		
0.00	WL	Water level, 0% of the vertical dimension	00:00:16		
0.10	MCPVC	Pipe material changes to polyvinyl chloride at this point	00:00:18		
4.80	REM	General remark: Manhole	00:00:40		
4.90	LR	Line deviates right	00:00:40		
33.80	REM	General remark: Manhole	00:02:47		
33.80	LL	Line deviates left	00:02:49		
39.40	MHF	Finish node, manhole, reference: Sewer	00:03:22	F1X_85c67a8b-65ef-4b02-8ba0	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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service@drain-alert.co.uk

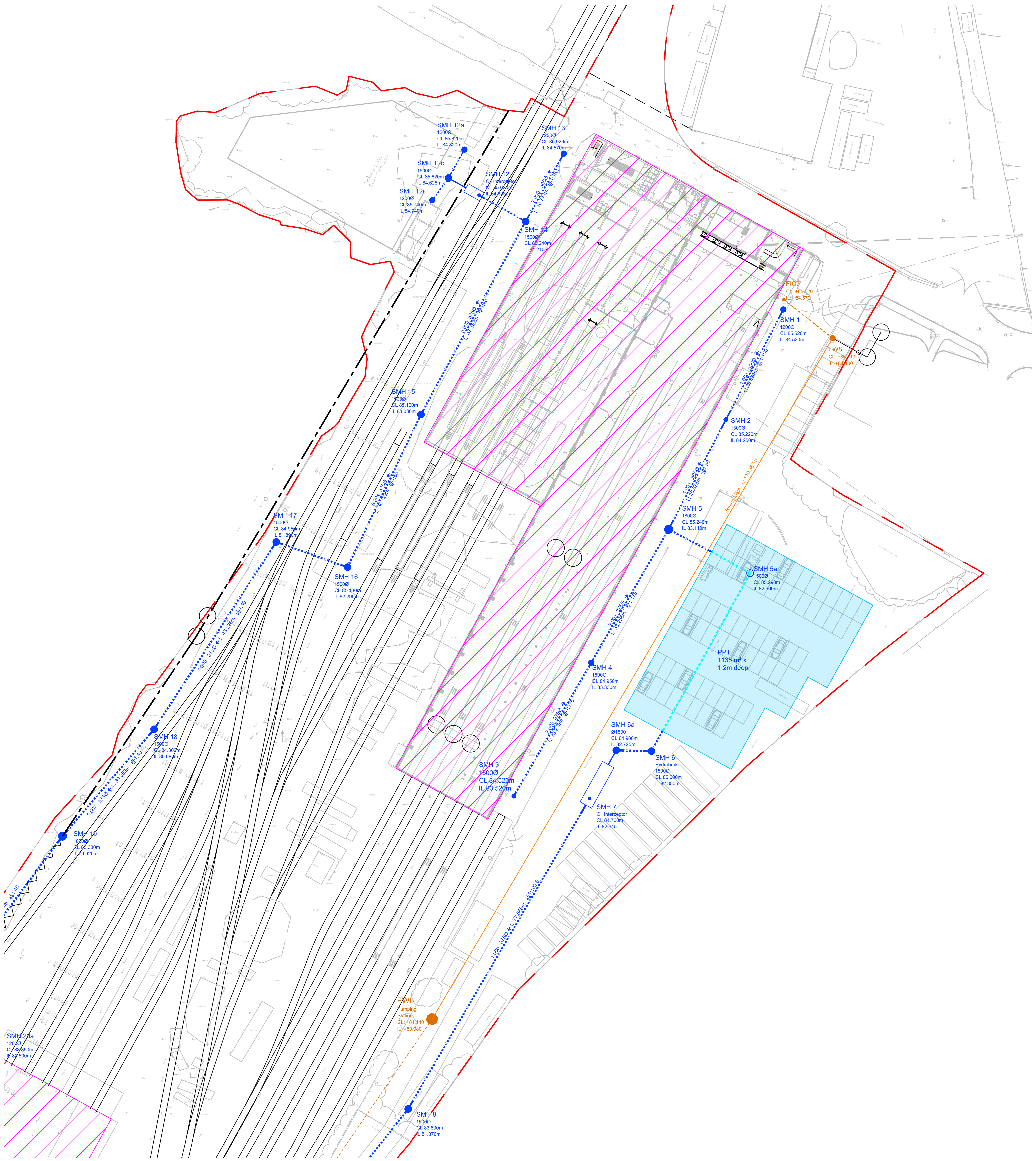
Section Pictures - 04/08/2022 - F1X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
6	Downstream	F1X		32779

F1X_85c67a8b-65ef-4b02-8ba0-c51a0bf90460_20220804_141811_469.jpg, 00:03:22, 39.40 m
Finish node, manhole, reference: Sewer

Appendix E – Proposed Drainage Arrangement

Online Control	Restricted Discharge Rate	Control Type
SMH6	100.0 l/s	Hydro-Brake
SMH23	90.0 l/s	Hydro-Brake



IMPORTANT NOTE:

Any existing drainage shown on this drawing to be confirmed and have it's condition assessed by drainage contractor onsite. Networks drawn are based on archive information and local authority information.

IMPORTANT NOTE:

The Topographical and buried services shown on this drawing were provided to Booth King by others. Booth King have not verified this information and therefore we can not guarantee its accuracy. The position and alignment of services may differ from that shown and other buried services may be present.

The contractor must verify the location of all buried services before any excavation or surfacing works begin. Damage to existing services could present a major health and safety risk plus associated commercial penalties.

DRAINAGE STRATEGY:

SURFACE WATER

- The existing surface water drainage network that provides drainage to the Phase roof areas are to be repaired, cleaned and maintained as necessary. These are to continue to discharge to the public sewer network at existing discharge rate.
-
- Existing external areas planned to be modified for the new development (as per the Landscape Architect's latest proposals) have been considered for the existing network modelled.
- Total attenuation via sub-base aggregates considering 33% void ratio.
- Surface water discharge rate needs to be agreed first with Unite Utilities and LLFA, and it would be restricted using a flow control unit.
- Stormwater will be collected via SuDS features and conveyed via the proposed storm network into a manhole fitted with a flow control device. This flow control devices will discharge into a public combined manhole adjacent to the site located in the avenue. Drainage hierarchy has been considered but was not possible with other options.
- Surface water flows arising from Burton Road have been included to the calculations.
- SMH 7 - Kingspan Oil Interceptor NSFA175 or similarly approved.
- SMH 12 - Kingspan Oil Interceptor NSFA030 or similarly approved.
- Proposed Surface Water network has been designed with capacity to include upstream flows.

FOUL WATER

- The existing foul water drainage network that provides drainage to the proposed development are to be repaired, cleaned and maintained as necessary. These are to continue to discharge to the public sewer network at existing discharge rate.
- FW6 - TT- Pumps Saturn Package Pumping Station or similarly approved.

DRAINAGE NOTES:

1. All adoptable works to be in accordance with SSC guidance.
2. All manhole cover levels to be confirmed by Architect.
3. Clay pipes to be flexibly jointed and comply with the requirements of BS EN 295.
4. Concrete pipes to be flexibly jointed and comply with the requirements of BSEN 1916 and BS 5911.
5. Plastic pipes (PVC-U) to be flexibly jointed and comply with the requirements of BS EN 1401-1 1998.
6. Where cover to pipes is less than 1200mm in roads and hardstandings or 900mm elsewhere, concrete surround is to be provided.
7. Until final surface is placed, heavy traffic is not to be allowed over pipe trenches without special precautions.
8. Pipes and fittings are to be laid in accordance with the manufacturers recommendations.
9. All Manholes should be concrete manhole rings.
10. Civil engineering contractor to arrange for:

    a) Own services and temporary supplies

    b) Pathway & partial closure as deemed required by their method statement. Including costs.
11. Protection to drains and gully connections may be concrete bed surround between cover depths of 450mm to 200mm.
12. The contractor should confirm the locations fo existing services prior construction.

NOTES

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5. All dimensions shown on this drawing are in millimeters unless noted otherwise.
6. If the Contractor consider that they do not have sufficient information to safely complete the works detailed on this drawing, they should contact the Engineer.
7. All works are to be carried out in accordance with the Building Regulations (as amended) and to the approval of Building Standards.

LEGEND:

- Existing Private SW Network
- Existing Private FW Network
- Existing Private CW Network
- Proposed SW Network
- Bio-Retention Area
- Site Boundary
- Perforated Pipe
- Porous Carpark
- Rising Main - Foul
- Building Outline
- Culvert to be abandoned

REV.	DATE	REVISION DETAILS	INITIALS
P01	06.03.24	Stage 2 - Issued For Planning	EZ

boothking PARTNERSHIP LIMITED

CONSULTING CIVIL & STRUCTURAL ENGINEERS

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MANCHESTER Tel: 0161 694 7087 | **RAMSBOTTOM** Tel: 01706 822 022 | **EDINBURGH** Tel: 0131 229 1547

PROJECT:

Buckley Wells
Bury

TITLE:

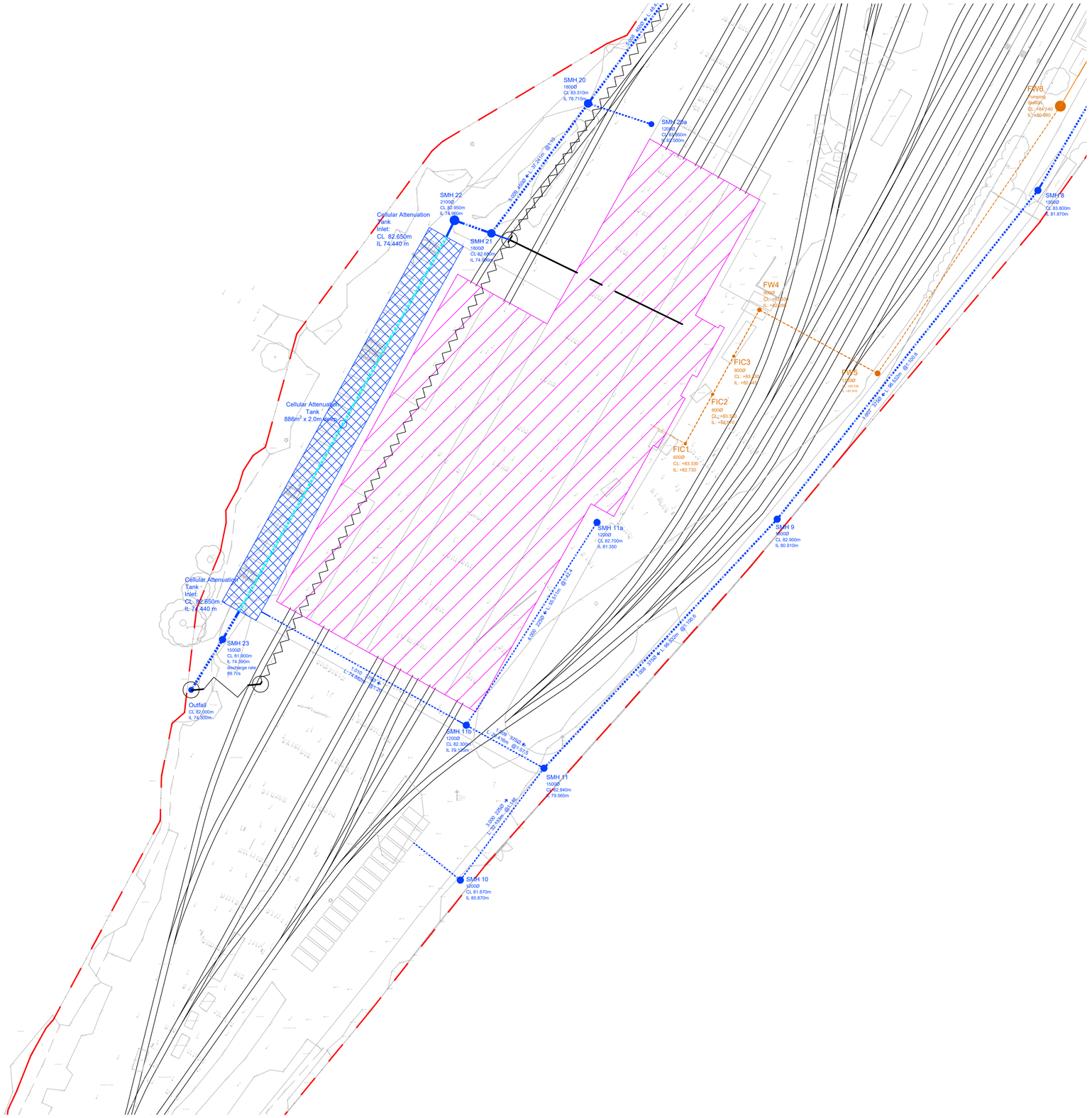
Proposed SW and FW Drainage GA

SCALE @ A1:	DRAWN:	DATE:	REVISION:	STATUS:
1:500	EZ	Mar 2024	P1	S2

DRAWING No:

14550-BKP-V1-XX-DR-C-0500

Online Control	Restricted Discharge Rate	Control Type
SMH6	100.0 l/s	Hydro-Brake
SMH23	100.0 l/s	Hydro-Brake



IMPORTANT NOTE:

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DRAINAGE STRATEGY:

SURFACE WATER

- The existing surface water drainage network that provides drainage to the Phase roof areas are to be repaired, cleaned and maintained as necessary. These are to continue to discharge to the public sewer network at existing discharge rate.
-
- Existing external areas planned to be modified for the new development (as per the Landscape Architect's latest proposals) have been considered for the existing network modelled.
- Total attenuation via sub-base aggregates considering 33% void ratio.
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- Surface water flows arising from Burton Road have been included to the calculations.
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- SMH 12 - Kingspan Oil Interceptor NSFA030 or similarly approved.
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DRAINAGE NOTES:

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6. Where cover to pipes is less than 1200mm in roads and hardstandings or 900mm elsewhere, concrete surround is to be provided.
7. Until final surface is placed, heavy traffic is not to be allowed over pipe trenches without special precautions.
8. Pipes and fittings are to be laid in accordance with the manufacturers recommendations.
9. All Manholes should be concrete manhole rings.
10. Civil engineering contractor to arrange for:

    a) Own services and temporary supplies

    b) Pathway & partial closure as deemed required by their method statement. Including costs.
11. Protection to drains and gully connections may be concrete bed surround between cover depths of 450mm to 200mm.
12. The contractor should confirm the locations fo existing services prior construction.

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LEGEND:

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- Existing Private FW Network
- Existing Private CW Network
- Proposed SW Network
- Bio-Retention Area
- Site Boundary
- Perforated Pipe
- Porous Carpark
- Rising Main - Foul
- Building Outline
- Culvert to be abandoned

REV.	DATE	REVISION DETAILS	INITIALS
P01	06.03.24	Stage 2 - Issued For Planning	EZ

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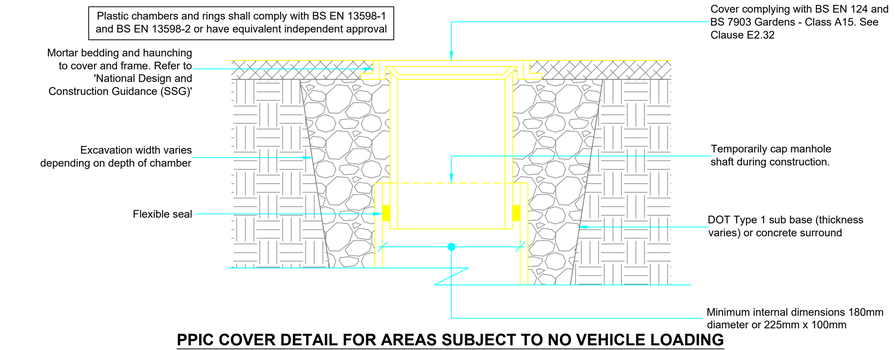
PROJECT:
Buckley Wells
Bury

TITLE:
Proposed SW and FW
Drainage GA - Sheet 2

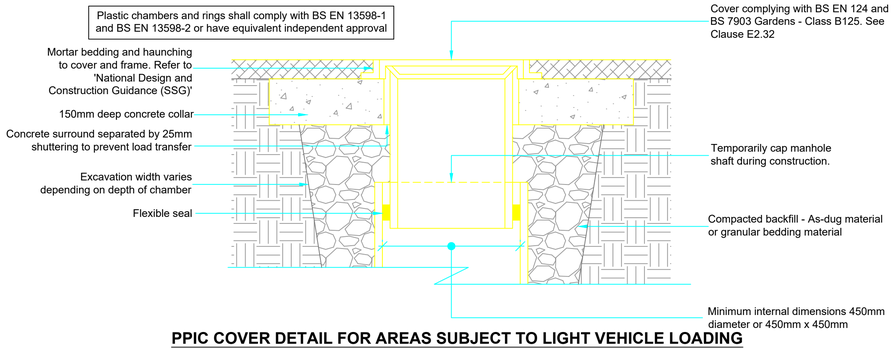
SCALE @ A1:	DRAWN:	DATE:	REVISION:	STATUS:
1:500	EZ	Mar 2024	P1	S2

DRAWING No:
14550-BKP-V1-XX-DR-C-0501



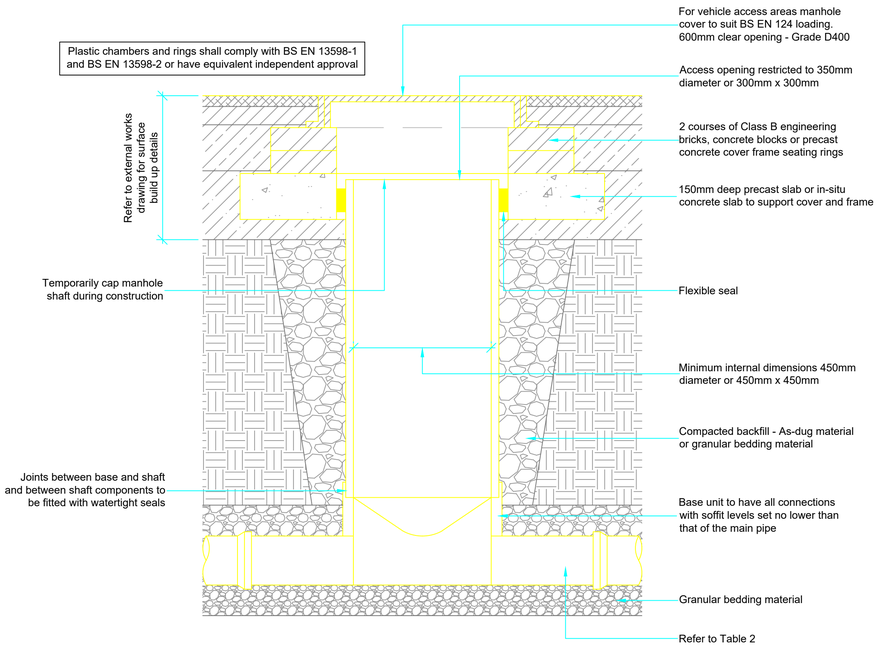
PPIC COVER DETAIL FOR AREAS SUBJECT TO NO VEHICLE LOADING (SUITABLE FOR SOFT LANDSCAPING AREAS)

SCALE 1:10



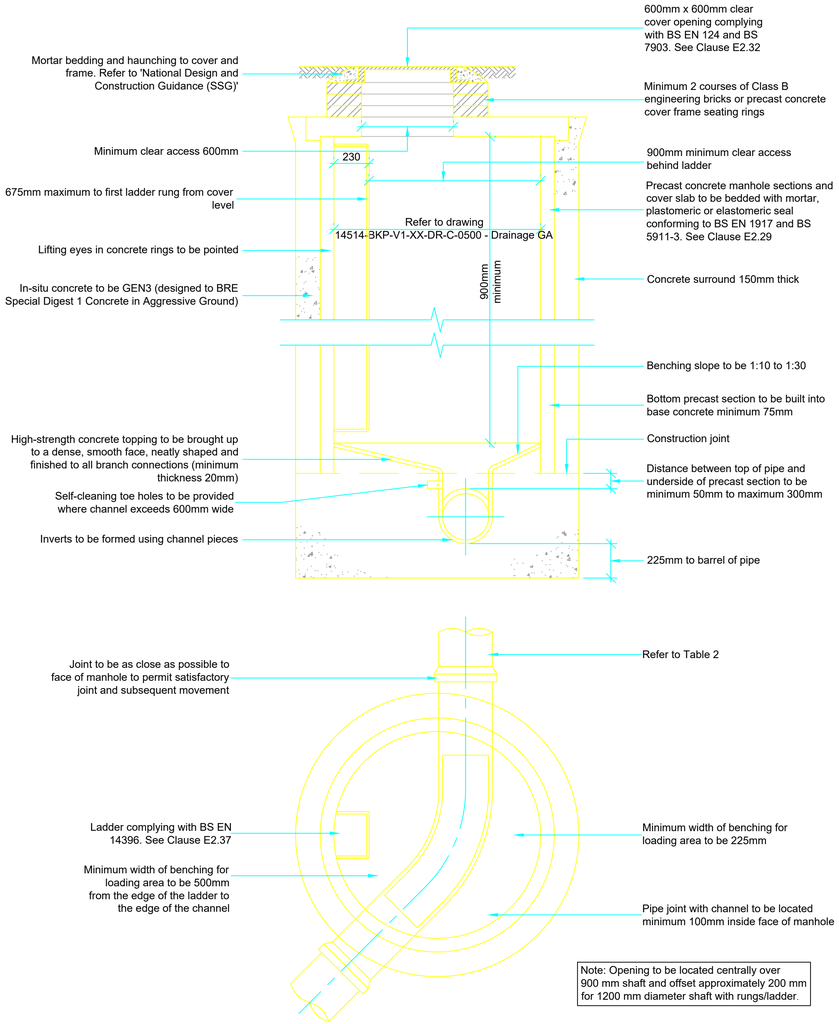
PPIC COVER DETAIL FOR AREAS SUBJECT TO LIGHT VEHICLE LOADING (DOMESTIC DRIVEWAYS OR FOOTWAYS)

SCALE 1:10



PPIC COVER DETAIL FOR AREAS SUBJECT TO HEAVY VEHICLE LOADING

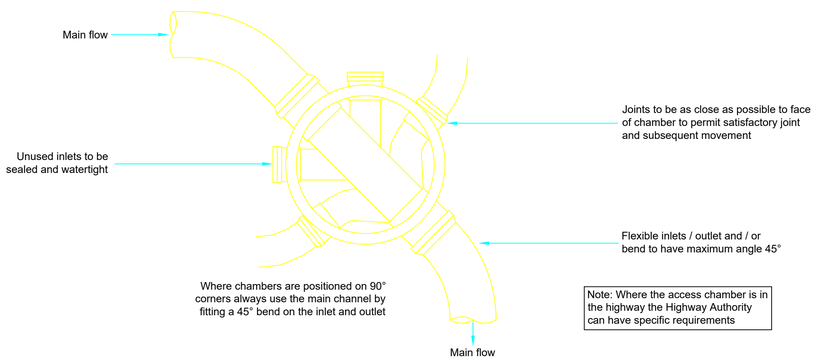
SCALE 1:10



TYPICAL PRECAST CONCRETE MANHOLE DETAIL - 'TYPE B'

(MAXIMUM DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3.0m)

SCALE 1:20



TYPICAL PPIC ACCESS CHAMBER DETAIL - 'TYPE 3' (FLEXIBLE MATERIAL DETAIL)

(DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3.0m)

SCALE 1:10

DRAINAGE NOTES

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TABLE Z - GRADING FOR LAYING & JOINTING MATERIAL

Sieve size (mm)	Percentage passing
14	100
10	98 - 100
6.3	80 - 99
2.0	0 - 20
1.0	0 - 5

These gradings are typical, advice should be sought from block manufacturer on specific gradings suitable for their products/system.

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< 375	1200
375 - 450	1350
500 - 700	1500
750 - 900	1800

TABLE 2 - ROCKER PIPE LENGTH

Nominal diameter of pipe (mm)	Maximum effective length (m)
150 - 600	0.60
675 - 750	1.00
> 750	1.25

TABLE 3 - MANHOLE COVER TYPE

Location of manhole	Cover class
Landscape areas	A15
Footpaths and driveways	B125
Highway (including areas with HGV access)	D400

COMPRESSIBLE FILLER & PACKING FOR PIPELINES

Nominal diameter of pipe (mm)	Thickness of compressible filler (mm)
< 450	18
450 - 1200	36
> 1200	54

REV.	DATE	REVISION DETAILS	INITIALS
P01	06.03.24	Stage 2 - Issued for Planning	EZ

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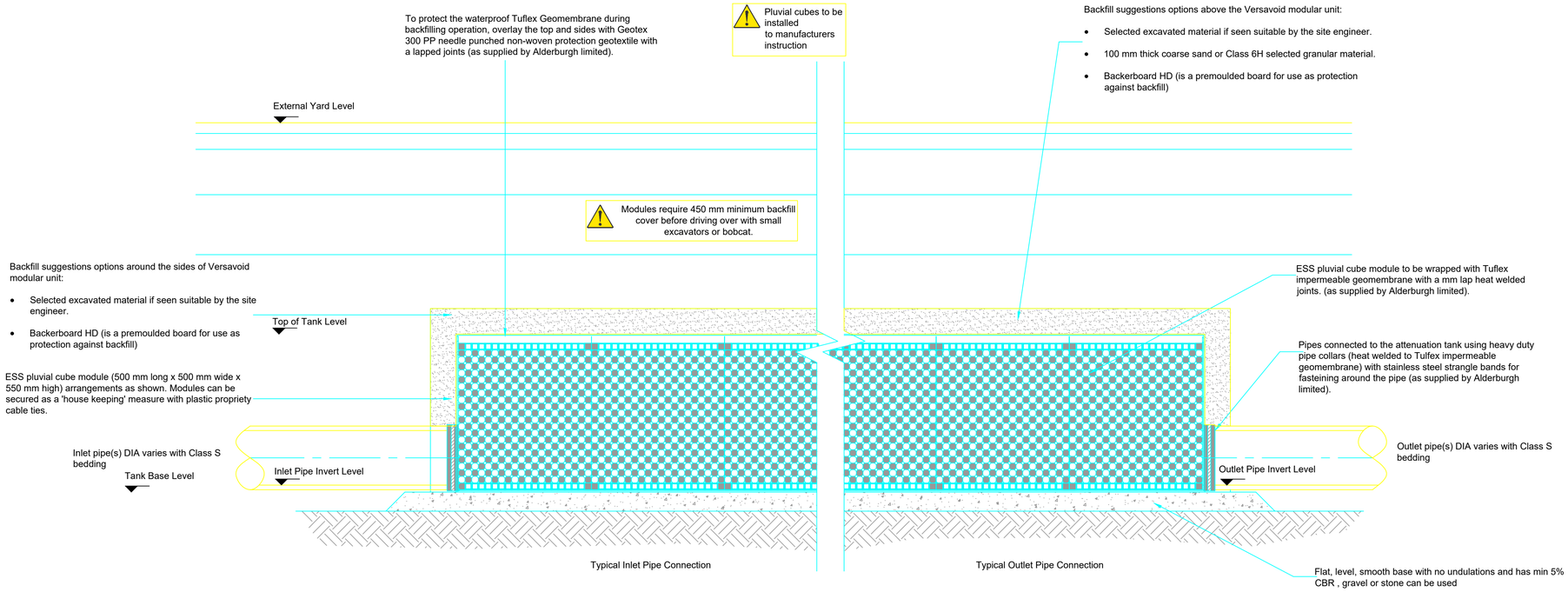
MANCHESTER Tel: 0161 694 7087 | RAMSBOTTOM Tel: 01706 822 022 | EDINBURGH Tel: 0131 229 1547

PROJECT: Buckley Wells Bury

TITLE: Drainage Details Sheet 1

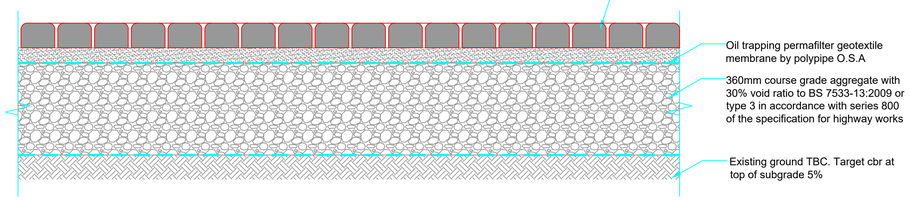
SCALE @ A1:	DRAWN:	DATE:	REVISION:	STATUS:
As Shown	EZ	Mar 2024	P01	S2

DRAWING No: 14550-BKP-V1-XX-DR-C-0520



TYPICAL DETAILS OF ATTENUATION TANK USING PLUVIAL CUBE MODULE UNITS

SCALE 1:10

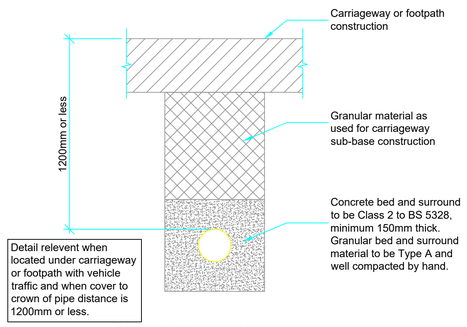


CARPARK DETAIL

SCALE 1:10

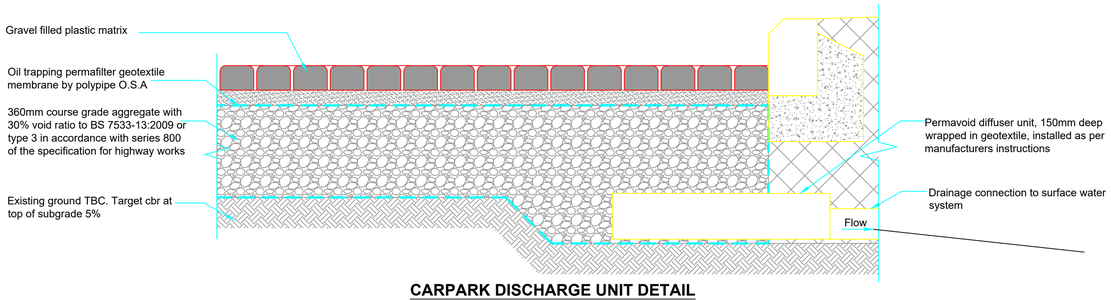
PIPE BEDDING DETAILS NOTE:
At each flexible pipe joint a joint filler (E.G fibreboard or polystyrene) shall be used, and shall extend through the full thickness of any concrete in contact with the pipe. The concrete bed shall be cut away at each joint to give a clearance of at least 50mm, so that the joint does not bear on the road.

PIPE BEDDING DETAILS NOTE:
a = b/4, but with Min. 200mm around the barrels and 150mm around the sockets.



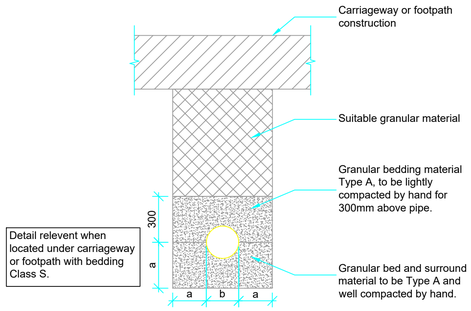
PIPE BEDDING DETAIL 1 - UPVC PIPEWORK

SCALE 1:20



CARPARK DISCHARGE UNIT DETAIL

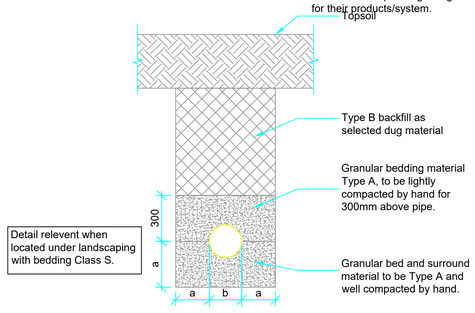
SCALE 1:10



PIPE BEDDING DETAIL 2 - UPVC PIPEWORK

SCALE 1:20

These gradings are typical, advice should be sought from block manufacturer on specific gradings suitable for their products/system.



PIPE BEDDING DETAIL 3 - UPVC PIPEWORK

SCALE 1:20

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500 - 700	1500
750 - 900	1800

TABLE 2 - ROCKER PIPE LENGTH

Nominal diameter of pipe (mm)	Maximum effective length (m)
150 - 600	0.60
675 - 750	1.00
> 750	1.25

TABLE 3 - MANHOLE COVER TYPE

Location of manhole	Cover class
Landscape areas	A15
Footpaths and driveways	B125
Highway (including areas with HGV access)	D400

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Nominal diameter of pipe (mm)	Thickness of compressible filler (mm)
< 450	18
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REV.	DATE	REVISION DETAILS	INITIALS
P01	06.03.24	Stage 2 - Issued for Planning	EZ

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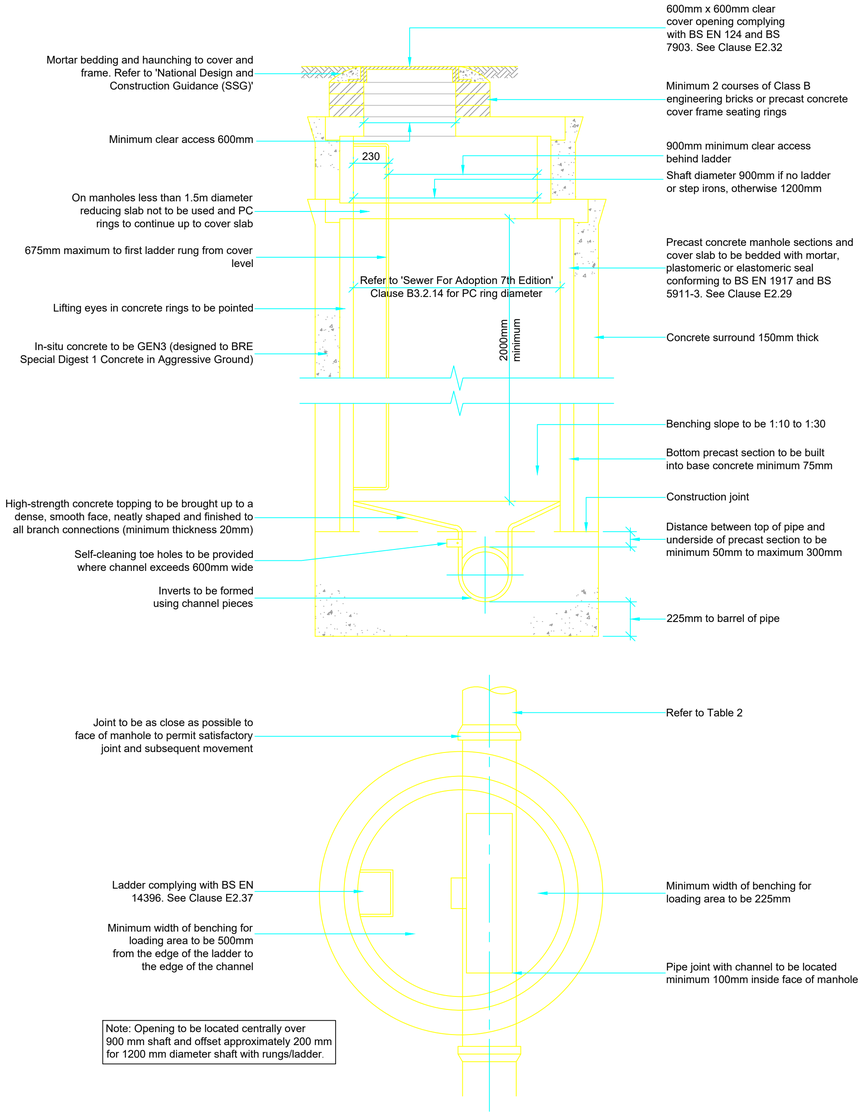
PROJECT:
Buckely Wells
Bury

TITLE:
Drainage Details
Sheet 2

SCALE @ A1:	DRAWN:	DATE:	REVISION:	STATUS:
As Shown	EZ	Mar 2024	P01	S2

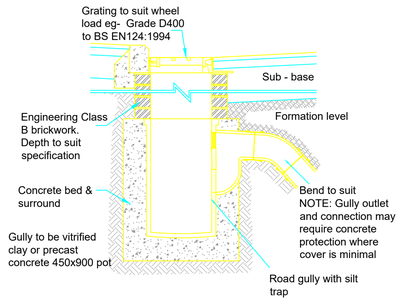
DRAWING No:
14550-BKP-V1-XX-DR-C-0521



TYPICAL PRECAST CONCRETE MANHOLE DETAIL - 'TYPE A'

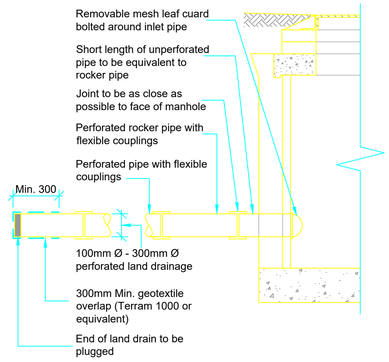
(DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3.0M TO 6.0M)

SCALE 1:20



GULLY DETAIL

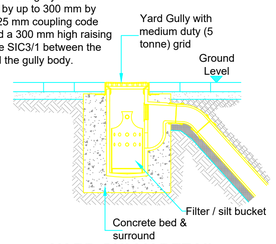
SCALE 1:20



FILTER DRAIN CONNECTION INTO CATCHPIT & LAND PLUG DETAIL

SCALE 1:20

NOTE:
The depth of the gully can be increased by up to 300 mm by fitting a 225 mm coupling code VC1/3 and a 300 mm high raising piece code SIC3/1 between the frame and the gully body.



YARD GULLY DETAIL

SCALE 1:20

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450 - 1200	36
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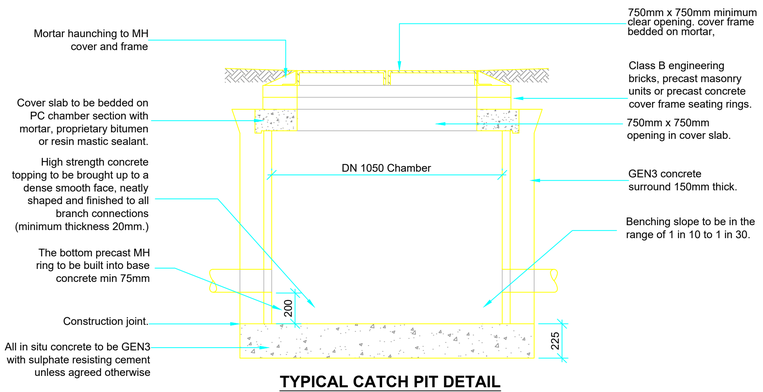
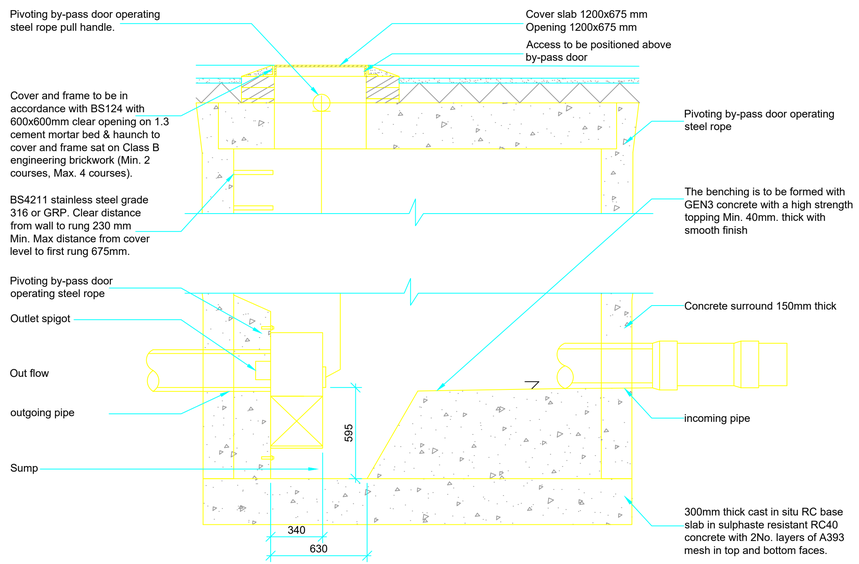


TYPICAL CATCH PIT DETAIL

SCALE 1:20



HYDROBRAKE CATCH PIT DETAIL

SCALE 1:20

REV.	DATE	REVISION DETAILS	INITIALS
P01	06.03.24	Stage 2 - Issued for Planning	EZ

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PROJECT:
Buckley Wells
Bury

TITLE:
Drainage Details
Sheet 3

SCALE @ A1:	DRAWN:	DATE:	REVISION:	STATUS:
As Shown	EZ	Mar 2024	P01	S2

DRAWING No:
14550-BKP-V1-XX-DR-C-0522

Appendix F – Causeway Flow Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Eleni Zachara
Site name:	Buckley Wells Bury TMD
Site location:	BUry

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.58785° N
Longitude:	2.30432° W
Reference:	2549910829
Date:	Mar 06 2024 11:48

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 5.6

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	1075	1075
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	44.66	44.66
1 in 1 year (l/s):	38.85	38.85
1 in 30 years (l/s):	75.92	75.92
1 in 100 year (l/s):	92.89	92.89
1 in 200 years (l/s):	105.85	105.85

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	84.217	0.217	165.9	5.1571	0.0000	OK
15 minute winter	2	11	74.514	0.214	151.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	151.7	2.809	0.872	21.5554	76.4

Flow+ v10.7 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	84.278	0.278	214.5	6.6163	0.0000	OK
30 minute summer	2	18	74.604	0.304	178.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	189.2	2.774	1.088	27.4274	98.9

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	85.550	1.550	406.1	36.8559	23.4072	FLOOD
60 minute winter	2	42	74.604	0.304	188.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	1	1.000	2	188.9	2.826	1.086	28.0418	334.9

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	17	85.550	1.550	427.8	36.8559	67.0765	FLOOD
120 minute summer	2	76	74.604	0.304	182.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	1.000	2	189.2	2.850	1.088	27.4843	557.6

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Node SMH6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	82.775	Product Number	CTL-SHE-0388-1000-1500-1000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.450
Design Flow (l/s)	100.0	Min Node Diameter (mm)	

Node SMH23 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	74.100	Product Number	CTL-SHE-0365-9000-2000-9000
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.450
Design Flow (l/s)	90.0	Min Node Diameter (mm)	

Node SMH5a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	82.960
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	12

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1135.0	0.0	0.800	1135.0	0.0	1.201	0.0	0.0
0.400	1135.0	0.0	1.200	1135.0	0.0			

Node Attenuation Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	74.290
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	56

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	886.0	0.0	0.800	886.0	0.0	1.600	886.0	0.0	2.001	0.0	0.0
0.400	886.0	0.0	1.200	886.0	0.0	2.000	886.0	0.0			

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH1	10	84.595	0.075	15.8	0.2692	0.0000	OK
15 minute winter	SMH2	11	84.361	0.111	31.3	0.4081	0.0000	OK
15 minute winter	SMH3	10	83.599	0.079	15.4	0.3283	0.0000	OK
15 minute winter	SMH4	11	83.447	0.117	30.8	0.3830	0.0000	OK
15 minute winter	SMH5	10	83.230	0.230	75.5	0.8388	0.0000	OK
60 minute winter	SMH5a	43	83.109	0.149	63.0	51.1855	0.0000	OK
60 minute winter	SMH6	44	83.027	0.252	32.6	0.4445	0.0000	OK
60 minute winter	SMH6a	44	82.845	0.121	32.5	0.2137	0.0000	OK
60 minute winter	SMH7	45	82.746	0.101	32.5	0.1791	0.0000	OK
60 minute winter	SMH8	44	81.978	0.109	35.1	0.2934	0.0000	OK
60 minute winter	SMH9	45	81.003	0.094	36.2	0.2051	0.0000	OK
15 minute winter	SMH10	11	80.912	0.042	3.3	0.0687	0.0000	OK
60 minute winter	SMH11	44	79.661	0.097	38.2	0.1932	0.0000	OK
15 minute winter	SMH11a	10	81.418	0.068	16.0	0.2019	0.0000	OK
15 minute winter	SMH11b	11	79.225	0.091	57.3	0.2549	0.0000	OK
15 minute winter	SMH12a	10	84.867	0.047	5.8	0.0948	0.0000	OK
15 minute winter	SMH12b	10	84.794	0.054	5.8	0.1099	0.0000	OK
15 minute winter	SMH12c	10	84.718	0.093	17.2	0.2489	0.0000	OK
15 minute winter	SMH12	10	84.641	0.066	17.0	0.1169	0.0000	OK
15 minute winter	SMH13	10	84.649	0.079	12.9	0.2080	0.0000	OK
15 minute winter	SMH14	11	84.303	0.091	42.3	0.3397	0.0000	OK
15 minute winter	SMH15	11	83.139	0.112	54.5	0.3062	0.0000	OK
15 minute winter	SMH16	11	82.427	0.130	70.4	0.3510	0.0000	OK
15 minute winter	SMH17	11	82.012	0.122	70.8	0.2161	0.0000	OK
15 minute winter	SMH18	11	80.810	0.126	71.1	0.2218	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH1	1.000	SMH2	15.5	0.835	0.139	0.5020	
15 minute winter	SMH2	1.001	SMH5	30.6	1.330	0.274	0.6144	
15 minute winter	SMH3	2.000	SMH4	15.0	0.667	0.099	0.7611	
15 minute winter	SMH4	2.001	SMH5	30.1	1.062	0.200	0.9432	
15 minute winter	SMH5	1.002	SMH5a	76.8	1.929	0.865	0.8359	
60 minute winter	SMH5a	1.003	SMH6	32.6	0.757	0.328	2.0079	
60 minute winter	SMH6	Hydro-Brake®	SMH6a	32.5				
60 minute winter	SMH6a	1.005	SMH7	32.5	1.192	0.199	0.3240	
60 minute winter	SMH7	1.006	SMH8	32.5	1.289	0.162	1.9558	
60 minute winter	SMH8	1.007	SMH9	35.0	1.464	0.176	2.3132	
60 minute winter	SMH9	1.008	SMH11	36.2	1.642	0.138	1.7305	
15 minute winter	SMH10	3.000	SMH11	3.2	0.634	0.074	0.1605	
60 minute winter	SMH11	1.009	SMH11b	38.1	1.896	0.131	0.4158	
15 minute winter	SMH11a	4.000	SMH11b	15.5	1.559	0.193	0.5507	
15 minute winter	SMH11b	1.010	Attenuation Tank	56.8	2.806	0.127	1.5166	
15 minute winter	SMH12a	5.000	SMH12c	5.7	1.004	0.084	0.0400	
15 minute winter	SMH12b	6.000	SMH12c	5.7	0.694	0.063	0.0486	
15 minute winter	SMH12c	5.001	SMH12	17.0	1.135	0.188	0.1136	
15 minute winter	SMH12	5.002	SMH14	16.8	1.531	0.096	0.1269	
15 minute winter	SMH13	7.000	SMH14	12.6	0.883	0.141	0.2401	
15 minute winter	SMH14	5.003	SMH15	41.9	1.751	0.132	1.1388	
15 minute winter	SMH15	5.004	SMH16	54.7	1.784	0.193	1.1223	
15 minute winter	SMH16	5.005	SMH17	70.8	2.175	0.223	0.5307	
15 minute winter	SMH17	5.006	SMH18	71.1	2.240	0.224	1.5302	
15 minute winter	SMH18	5.007	SMH19	70.4	2.267	0.222	0.9435	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH19	11	79.969	0.119	70.4	0.3037	0.0000	OK
15 minute winter	SMH20a	10	82.568	0.068	20.8	0.2817	0.0000	OK
15 minute winter	SMH20	11	78.727	0.088	89.6	0.2248	0.0000	OK
15 minute winter	SMH21	11	75.147	0.232	104.0	0.6649	0.0000	OK
15 minute winter	SMH22	12	75.066	0.181	102.2	0.6283	0.0000	OK
120 minute winter	Attenuation Tank	86	74.455	0.165	97.4	146.4420	0.0000	OK
120 minute winter	SMH23	86	74.389	0.289	65.3	1.1221	0.0000	OK
15 minute summer	Outfall	1	74.044	0.000	20.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH19	5.008	SMH20	69.9	2.551	0.136	1.3443	
15 minute winter	SMH20a	8.000	SMH20	20.5	1.794	0.102	0.1751	
15 minute winter	SMH20	5.009	SMH21	89.0	1.761	0.087	1.9411	
15 minute winter	SMH21	5.010	SMH22	102.2	1.457	0.550	0.6390	
15 minute winter	SMH22	5.011	Attenuation Tank	103.2	1.781	0.324	3.0976	
120 minute winter	Attenuation Tank	5.012	SMH23	62.1	0.697	0.222	5.0916	
120 minute winter	SMH23	Hydro-Brake®	Outfall	65.2				337.5

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH1	10	84.641	0.121	38.6	0.4343	0.0000	OK
15 minute winter	SMH2	10	84.444	0.194	76.8	0.7102	0.0000	OK
15 minute winter	SMH3	10	83.645	0.125	37.7	0.5196	0.0000	OK
15 minute winter	SMH4	10	83.521	0.191	75.6	0.6263	0.0000	OK
15 minute winter	SMH5	11	83.462	0.462	188.3	1.6830	0.0000	SURCHARGED
60 minute winter	SMH5a	43	83.279	0.319	150.8	109.9904	0.0000	OK
60 minute winter	SMH6	43	83.221	0.446	74.9	0.7881	0.0000	OK
60 minute winter	SMH6a	43	82.917	0.193	74.9	0.3419	0.0000	OK
60 minute winter	SMH7	44	82.804	0.159	74.9	0.2809	0.0000	OK
60 minute winter	SMH8	41	82.043	0.174	83.3	0.4687	0.0000	OK
60 minute winter	SMH9	40	81.058	0.149	87.9	0.3267	0.0000	OK
15 minute winter	SMH10	10	80.936	0.066	8.2	0.1096	0.0000	OK
30 minute winter	SMH11	22	79.725	0.161	96.3	0.3202	0.0000	OK
15 minute winter	SMH11a	10	81.462	0.112	39.2	0.3336	0.0000	OK
30 minute winter	SMH11b	20	79.286	0.152	151.0	0.4280	0.0000	OK
15 minute winter	SMH12a	10	84.896	0.076	14.1	0.1540	0.0000	OK
15 minute winter	SMH12b	10	84.827	0.087	14.1	0.1762	0.0000	OK
15 minute winter	SMH12c	10	84.777	0.152	42.0	0.4054	0.0000	OK
15 minute winter	SMH12	10	84.684	0.109	41.7	0.1921	0.0000	OK
15 minute winter	SMH13	10	84.700	0.130	31.7	0.3418	0.0000	OK
15 minute winter	SMH14	10	84.358	0.146	104.1	0.5440	0.0000	OK
15 minute winter	SMH15	10	83.214	0.187	134.9	0.5114	0.0000	OK
15 minute winter	SMH16	11	82.525	0.228	173.4	0.6135	0.0000	OK
15 minute winter	SMH17	11	82.095	0.205	173.9	0.3625	0.0000	OK
15 minute winter	SMH18	11	80.900	0.216	175.1	0.3819	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH1	1.000	SMH2	38.3	1.023	0.343	1.0013	
15 minute winter	SMH2	1.001	SMH5	75.1	1.647	0.671	1.2175	
15 minute winter	SMH3	2.000	SMH4	37.0	0.842	0.245	1.4671	
15 minute winter	SMH4	2.001	SMH5	75.2	1.063	0.498	2.5991	
15 minute winter	SMH5	1.002	SMH5a	186.7	2.160	2.104	1.8244	
60 minute winter	SMH5a	1.003	SMH6	74.9	0.769	0.754	4.6128	
60 minute winter	SMH6	Hydro-Brake®	SMH6a	74.9				
60 minute winter	SMH6a	1.005	SMH7	74.9	1.474	0.459	0.6032	
60 minute winter	SMH7	1.006	SMH8	74.8	1.603	0.374	3.6470	
60 minute winter	SMH8	1.007	SMH9	83.2	1.837	0.417	4.3774	
60 minute winter	SMH9	1.008	SMH11	87.9	2.045	0.335	3.3766	
15 minute winter	SMH10	3.000	SMH11	7.9	0.824	0.185	0.3090	
30 minute winter	SMH11	1.009	SMH11b	96.3	2.326	0.331	0.8804	
15 minute winter	SMH11a	4.000	SMH11b	38.0	1.976	0.475	1.0717	
30 minute winter	SMH11b	1.010	Attenuation Tank	150.5	3.662	0.335	3.0790	
15 minute winter	SMH12a	5.000	SMH12c	14.0	1.211	0.206	0.0832	
15 minute winter	SMH12b	6.000	SMH12c	13.9	0.885	0.154	0.0934	
15 minute winter	SMH12c	5.001	SMH12	41.7	1.421	0.460	0.2217	
15 minute winter	SMH12	5.002	SMH14	41.3	1.923	0.234	0.2482	
15 minute winter	SMH13	7.000	SMH14	31.1	1.118	0.347	0.4672	
15 minute winter	SMH14	5.003	SMH15	103.3	2.193	0.326	2.2337	
15 minute winter	SMH15	5.004	SMH16	134.0	2.153	0.473	2.2725	
15 minute winter	SMH16	5.005	SMH17	173.9	2.641	0.548	1.0727	
15 minute winter	SMH17	5.006	SMH18	175.1	2.748	0.552	3.0727	
15 minute winter	SMH18	5.007	SMH19	175.1	2.825	0.552	1.8814	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH19	11	80.047	0.197	175.1	0.5015	0.0000	OK
15 minute winter	SMH20a	10	82.611	0.111	50.9	0.4608	0.0000	OK
15 minute winter	SMH20	11	78.779	0.140	223.1	0.3566	0.0000	OK
15 minute winter	SMH21	11	75.359	0.444	259.4	1.2717	0.0000	OK
15 minute winter	SMH22	12	75.208	0.323	253.6	1.1194	0.0000	OK
120 minute winter	Attenuation Tank	102	74.743	0.453	236.2	402.8761	0.0000	OK
120 minute winter	SMH23	102	74.725	0.625	91.5	2.4286	0.0000	SURCHARGED
15 minute summer	Outfall	1	74.044	0.000	84.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH19	5.008	SMH20	174.6	3.230	0.341	2.6344	
15 minute winter	SMH20a	8.000	SMH20	50.4	2.265	0.250	0.3405	
15 minute winter	SMH20	5.009	SMH21	222.5	2.133	0.217	3.7249	
15 minute winter	SMH21	5.010	SMH22	253.6	1.806	1.365	1.2572	
15 minute winter	SMH22	5.011	Attenuation Tank	254.6	2.187	0.799	6.2210	
60 minute winter	Attenuation Tank	5.012	SMH23	89.2	0.722	0.319	11.2559	
120 minute winter	SMH23	Hydro-Brake®	Outfall	89.7				821.2

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH1	10	84.665	0.145	54.1	0.5201	0.0000	OK
15 minute winter	SMH2	10	84.505	0.255	107.6	0.9343	0.0000	OK
15 minute winter	SMH3	11	83.782	0.262	52.7	1.0917	0.0000	OK
15 minute winter	SMH4	11	83.766	0.436	98.4	1.4328	0.0000	SURCHARGED
15 minute winter	SMH5	11	83.663	0.663	244.2	2.4141	0.0000	SURCHARGED
60 minute winter	SMH5a	44	83.421	0.461	211.3	158.8932	0.0000	SURCHARGED
60 minute winter	SMH6	44	83.306	0.531	92.9	0.9390	0.0000	SURCHARGED
60 minute winter	SMH6a	44	82.945	0.221	92.9	0.3898	0.0000	OK
60 minute winter	SMH7	45	82.825	0.180	92.9	0.3187	0.0000	OK
60 minute winter	SMH8	41	82.067	0.198	104.0	0.5345	0.0000	OK
30 minute winter	SMH9	21	81.081	0.172	114.1	0.3771	0.0000	OK
15 minute winter	SMH10	10	80.950	0.080	11.4	0.1314	0.0000	OK
30 minute winter	SMH11	21	79.758	0.194	131.0	0.3857	0.0000	OK
15 minute winter	SMH11a	10	81.489	0.139	54.9	0.4135	0.0000	OK
30 minute winter	SMH11b	20	79.324	0.190	219.6	0.5334	0.0000	OK
15 minute winter	SMH12a	10	84.914	0.094	19.8	0.1904	0.0000	OK
15 minute winter	SMH12b	10	84.850	0.110	19.8	0.2233	0.0000	OK
15 minute winter	SMH12c	10	84.810	0.185	59.0	0.4952	0.0000	OK
15 minute winter	SMH12	10	84.708	0.133	58.4	0.2349	0.0000	OK
15 minute winter	SMH13	10	84.729	0.159	44.4	0.4185	0.0000	OK
15 minute winter	SMH14	10	84.389	0.177	146.0	0.6617	0.0000	OK
15 minute winter	SMH15	10	83.262	0.235	189.2	0.6432	0.0000	OK
15 minute winter	SMH16	11	82.594	0.297	243.2	0.8005	0.0000	OK
15 minute winter	SMH17	11	82.150	0.260	244.1	0.4590	0.0000	OK
15 minute winter	SMH18	11	80.961	0.277	245.4	0.4893	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH1	1.000	SMH2	53.5	1.081	0.480	1.3069	
15 minute winter	SMH2	1.001	SMH5	105.1	1.733	0.940	1.6130	
15 minute summer	SMH3	2.000	SMH4	49.3	0.887	0.327	2.9384	
15 minute winter	SMH4	2.001	SMH5	96.6	1.024	0.640	3.6680	
15 minute winter	SMH5	1.002	SMH5a	238.1	2.431	2.684	2.1919	
60 minute winter	SMH5a	1.003	SMH6	92.9	0.842	0.935	4.8434	
60 minute winter	SMH6	Hydro-Brake®	SMH6a	92.9				
60 minute winter	SMH6a	1.005	SMH7	92.9	1.551	0.570	0.7102	
60 minute winter	SMH7	1.006	SMH8	92.8	1.690	0.464	4.3000	
60 minute winter	SMH8	1.007	SMH9	103.9	1.938	0.521	5.1868	
30 minute winter	SMH9	1.008	SMH11	114.1	2.141	0.435	4.1967	
15 minute winter	SMH10	3.000	SMH11	11.1	0.902	0.258	0.3943	
30 minute winter	SMH11	1.009	SMH11b	131.0	2.446	0.450	1.1542	
15 minute winter	SMH11a	4.000	SMH11b	53.4	2.136	0.666	1.3912	
30 minute winter	SMH11b	1.010	Attenuation Tank	219.8	4.027	0.489	4.0874	
15 minute winter	SMH12a	5.000	SMH12c	19.6	1.207	0.288	0.1231	
15 minute winter	SMH12b	6.000	SMH12c	19.6	0.886	0.216	0.1389	
15 minute winter	SMH12c	5.001	SMH12	58.4	1.540	0.645	0.2861	
15 minute winter	SMH12	5.002	SMH14	57.9	2.085	0.329	0.3210	
15 minute winter	SMH13	7.000	SMH14	43.7	1.215	0.486	0.6032	
15 minute winter	SMH14	5.003	SMH15	144.8	2.338	0.456	2.9320	
15 minute winter	SMH15	5.004	SMH16	188.2	2.257	0.664	3.0297	
15 minute winter	SMH16	5.005	SMH17	244.1	2.782	0.769	1.4267	
15 minute winter	SMH17	5.006	SMH18	245.4	2.909	0.774	4.0681	
15 minute winter	SMH18	5.007	SMH19	245.1	3.007	0.773	2.4702	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH19	11	80.092	0.242	245.1	0.6146	0.0000	OK
15 minute winter	SMH20a	10	82.635	0.135	71.2	0.5624	0.0000	OK
15 minute winter	SMH20	11	78.806	0.167	312.0	0.4256	0.0000	OK
15 minute winter	SMH21	12	75.700	0.785	363.1	2.2504	0.0000	SURCHARGED
15 minute winter	SMH22	12	75.474	0.589	346.5	2.0420	0.0000	SURCHARGED
180 minute winter	Attenuation Tank	152	75.039	0.749	258.5	666.7886	0.0000	SURCHARGED
180 minute winter	SMH23	152	75.018	0.918	91.4	3.5681	0.0000	SURCHARGED
15 minute summer	Outfall	1	74.044	0.000	88.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH19	5.008	SMH20	244.3	3.510	0.477	3.3959	
15 minute winter	SMH20a	8.000	SMH20	70.5	2.456	0.350	0.4396	
15 minute winter	SMH20	5.009	SMH21	311.4	2.491	0.303	3.9481	
15 minute winter	SMH21	5.010	SMH22	346.5	2.187	1.865	1.4254	
15 minute winter	SMH22	5.011	Attenuation Tank	348.1	2.288	1.092	8.2362	
30 minute summer	Attenuation Tank	5.012	SMH23	89.9	0.722	0.322	11.3728	
240 minute summer	SMH23	Hydro-Brake®	Outfall	89.7				1285.4

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH1	10	84.658	0.138	49.9	0.4969	0.0000	OK
15 minute winter	SMH2	10	84.486	0.236	99.3	0.8671	0.0000	OK
15 minute winter	SMH3	12	83.690	0.170	48.7	0.7102	0.0000	OK
15 minute winter	SMH4	11	83.690	0.360	97.8	1.1816	0.0000	OK
15 minute winter	SMH5	11	83.619	0.619	228.3	2.2533	0.0000	SURCHARGED
60 minute winter	SMH5a	44	83.391	0.431	198.8	148.2963	0.0000	SURCHARGED
60 minute winter	SMH6	44	83.286	0.511	88.7	0.9025	0.0000	SURCHARGED
60 minute winter	SMH6a	44	82.938	0.214	88.7	0.3789	0.0000	OK
60 minute winter	SMH7	45	82.820	0.175	88.7	0.3101	0.0000	OK
60 minute winter	SMH8	40	82.062	0.193	99.3	0.5199	0.0000	OK
30 minute winter	SMH9	21	81.076	0.167	108.7	0.3659	0.0000	OK
15 minute winter	SMH10	10	80.946	0.076	10.6	0.1258	0.0000	OK
30 minute winter	SMH11	21	79.751	0.187	123.5	0.3717	0.0000	OK
15 minute winter	SMH11a	10	81.482	0.132	50.8	0.3925	0.0000	OK
30 minute winter	SMH11b	20	79.316	0.182	204.0	0.5109	0.0000	OK
15 minute winter	SMH12a	10	84.909	0.089	18.3	0.1805	0.0000	OK
15 minute winter	SMH12b	10	84.844	0.104	18.3	0.2106	0.0000	OK
15 minute winter	SMH12c	10	84.802	0.177	54.5	0.4725	0.0000	OK
15 minute winter	SMH12	10	84.702	0.127	54.1	0.2241	0.0000	OK
15 minute winter	SMH13	10	84.722	0.152	41.0	0.3985	0.0000	OK
15 minute winter	SMH14	10	84.381	0.169	134.9	0.6314	0.0000	OK
15 minute winter	SMH15	10	83.249	0.222	174.8	0.6074	0.0000	OK
15 minute winter	SMH16	11	82.574	0.277	224.7	0.7464	0.0000	OK
15 minute winter	SMH17	11	82.135	0.245	225.4	0.4322	0.0000	OK
15 minute winter	SMH18	11	80.944	0.260	226.8	0.4593	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH1	1.000	SMH2	49.5	1.068	0.444	1.2247	
15 minute winter	SMH2	1.001	SMH5	97.0	1.720	0.867	1.5018	
15 minute winter	SMH3	2.000	SMH4	47.9	0.883	0.317	2.5756	
15 minute winter	SMH4	2.001	SMH5	90.5	1.044	0.599	3.6417	
15 minute winter	SMH5	1.002	SMH5a	227.9	2.310	2.569	2.1088	
60 minute winter	SMH5a	1.003	SMH6	88.7	0.805	0.893	4.8434	
60 minute winter	SMH6	Hydro-Brake®	SMH6a	88.7				
60 minute winter	SMH6a	1.005	SMH7	88.7	1.535	0.544	0.6859	
60 minute winter	SMH7	1.006	SMH8	88.7	1.672	0.443	4.1516	
60 minute winter	SMH8	1.007	SMH9	99.3	1.916	0.498	5.0111	
30 minute winter	SMH9	1.008	SMH11	108.1	2.123	0.412	4.0185	
15 minute winter	SMH10	3.000	SMH11	10.2	0.883	0.238	0.3719	
30 minute winter	SMH11	1.009	SMH11b	123.5	2.417	0.424	1.0922	
15 minute winter	SMH11a	4.000	SMH11b	49.4	2.100	0.616	1.3086	
30 minute winter	SMH11b	1.010	Attenuation Tank	204.5	3.957	0.455	3.8706	
15 minute winter	SMH12a	5.000	SMH12c	18.1	1.206	0.267	0.1126	
15 minute winter	SMH12b	6.000	SMH12c	18.1	0.892	0.200	0.1264	
15 minute winter	SMH12c	5.001	SMH12	54.1	1.512	0.597	0.2699	
15 minute winter	SMH12	5.002	SMH14	53.6	2.047	0.304	0.3025	
15 minute winter	SMH13	7.000	SMH14	40.3	1.192	0.449	0.5676	
15 minute winter	SMH14	5.003	SMH15	133.8	2.307	0.422	2.7475	
15 minute winter	SMH15	5.004	SMH16	173.8	2.239	0.613	2.8253	
15 minute winter	SMH16	5.005	SMH17	225.4	2.755	0.711	1.3312	
15 minute winter	SMH17	5.006	SMH18	226.8	2.876	0.715	3.8010	
15 minute winter	SMH18	5.007	SMH19	226.7	2.971	0.715	2.3143	

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH19	11	80.080	0.230	226.7	0.5853	0.0000	OK
15 minute winter	SMH20a	10	82.629	0.129	65.8	0.5361	0.0000	OK
15 minute winter	SMH20	11	78.799	0.160	288.6	0.4082	0.0000	OK
15 minute winter	SMH21	12	75.522	0.607	335.8	1.7416	0.0000	SURCHARGED
15 minute winter	SMH22	12	75.336	0.451	332.3	1.5608	0.0000	SURCHARGED
120 minute winter	Attenuation Tank	116	74.971	0.681	304.7	606.1961	0.0000	SURCHARGED
120 minute winter	SMH23	116	74.950	0.850	92.2	3.3020	0.0000	SURCHARGED
15 minute summer	Outfall	1	74.044	0.000	87.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH19	5.008	SMH20	226.0	3.443	0.441	3.1997	
15 minute winter	SMH20a	8.000	SMH20	65.1	2.411	0.323	0.4138	
15 minute winter	SMH20	5.009	SMH21	288.0	2.329	0.280	3.8933	
15 minute winter	SMH21	5.010	SMH22	332.3	2.097	1.788	1.4249	
15 minute winter	SMH22	5.011	Attenuation Tank	319.8	2.253	1.003	8.1451	
30 minute summer	Attenuation Tank	5.012	SMH23	90.8	0.722	0.325	10.9538	
120 minute winter	SMH23	Hydro-Brake®	Outfall	89.7				1083.6

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH1	11	84.854	0.334	72.4	1.1981	0.0000	SURCHARGED
15 minute winter	SMH2	11	84.729	0.479	135.2	1.7552	0.0000	SURCHARGED
15 minute winter	SMH3	11	84.263	0.743	70.6	3.0950	0.0000	FLOOD RISK
15 minute winter	SMH4	11	84.221	0.891	130.2	2.9262	0.0000	SURCHARGED
15 minute winter	SMH5	11	84.048	1.048	328.7	3.8176	0.0000	SURCHARGED
60 minute winter	SMH5a	46	83.625	0.665	275.5	228.9804	0.0000	SURCHARGED
60 minute winter	SMH6	46	83.493	0.718	99.8	1.2679	0.0000	SURCHARGED
60 minute winter	SMH6a	48	82.955	0.231	99.7	0.4076	0.0000	OK
60 minute winter	SMH7	50	82.833	0.188	99.7	0.3331	0.0000	OK
30 minute winter	SMH8	21	82.093	0.224	127.0	0.6042	0.0000	OK
30 minute winter	SMH9	21	81.104	0.195	141.8	0.4277	0.0000	OK
15 minute winter	SMH10	10	80.964	0.094	15.3	0.1548	0.0000	OK
30 minute winter	SMH11	20	79.792	0.228	167.0	0.4537	0.0000	OK
15 minute winter	SMH11a	10	81.523	0.173	73.6	0.5165	0.0000	OK
30 minute summer	SMH11b	19	79.369	0.235	305.4	0.6607	0.0000	OK
15 minute winter	SMH12a	10	84.937	0.117	26.5	0.2375	0.0000	OK
15 minute winter	SMH12b	10	84.877	0.137	26.5	0.2792	0.0000	OK
15 minute winter	SMH12c	10	84.848	0.223	78.9	0.5969	0.0000	OK
15 minute winter	SMH12	10	84.735	0.160	78.1	0.2820	0.0000	OK
15 minute winter	SMH13	10	84.763	0.193	59.5	0.5061	0.0000	OK
15 minute winter	SMH14	10	84.424	0.212	195.4	0.7910	0.0000	OK
15 minute winter	SMH15	11	83.485	0.458	254.0	1.2562	0.0000	SURCHARGED
15 minute winter	SMH16	11	82.824	0.527	314.2	1.4190	0.0000	SURCHARGED
15 minute winter	SMH17	12	82.285	0.395	309.2	0.6982	0.0000	SURCHARGED
15 minute winter	SMH18	12	81.107	0.423	307.3	0.7483	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH1	1.000	SMH2	67.0	1.104	0.601	1.8889	
15 minute winter	SMH2	1.001	SMH5	133.4	1.895	1.193	1.8374	
15 minute winter	SMH3	2.000	SMH4	63.5	0.876	0.421	3.6679	
15 minute winter	SMH4	2.001	SMH5	127.1	1.152	0.842	3.6680	
15 minute winter	SMH5	1.002	SMH5a	323.7	2.976	3.649	2.1999	
60 minute winter	SMH5a	1.003	SMH6	99.8	0.905	1.005	4.8434	
60 minute winter	SMH6	Hydro-Brake®	SMH6a	99.7				
60 minute winter	SMH6a	1.005	SMH7	99.7	1.583	0.611	0.7502	
60 minute winter	SMH7	1.006	SMH8	99.6	1.746	0.498	4.6851	
30 minute winter	SMH8	1.007	SMH9	126.7	2.004	0.635	6.1119	
30 minute winter	SMH9	1.008	SMH11	141.5	2.230	0.539	5.0286	
15 minute winter	SMH10	3.000	SMH11	14.8	0.975	0.345	0.4903	
30 minute winter	SMH11	1.009	SMH11b	167.3	2.525	0.575	1.4370	
15 minute winter	SMH11a	4.000	SMH11b	71.3	2.249	0.890	1.7684	
30 minute summer	SMH11b	1.010	Attenuation Tank	304.9	4.326	0.679	5.2776	
15 minute winter	SMH12a	5.000	SMH12c	26.2	1.215	0.385	0.1709	
15 minute winter	SMH12b	6.000	SMH12c	26.2	0.883	0.289	0.1962	
15 minute winter	SMH12c	5.001	SMH12	78.1	1.645	0.862	0.3560	
15 minute winter	SMH12	5.002	SMH14	77.4	2.227	0.439	0.4019	
15 minute winter	SMH13	7.000	SMH14	58.6	1.298	0.652	0.7561	
15 minute winter	SMH14	5.003	SMH15	194.6	2.389	0.613	4.0862	
15 minute winter	SMH15	5.004	SMH16	239.5	2.237	0.845	4.0290	
15 minute winter	SMH16	5.005	SMH17	309.2	2.814	0.975	1.7974	
15 minute summer	SMH17	5.006	SMH18	307.4	2.946	0.969	5.0476	
15 minute winter	SMH18	5.007	SMH19	301.0	3.143	0.949	3.0320	

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SMH19	11	80.126	0.276	301.0	0.7033	0.0000	OK
15 minute winter	SMH20a	10	82.662	0.162	95.4	0.6771	0.0000	OK
15 minute winter	SMH20	11	78.829	0.190	393.6	0.4838	0.0000	OK
15 minute winter	SMH21	12	76.329	1.414	463.4	4.0533	0.0000	SURCHARGED
15 minute winter	SMH22	12	75.963	1.078	442.9	3.7349	0.0000	SURCHARGED
180 minute winter	Attenuation Tank	176	75.490	1.200	340.1	1068.3330	0.0000	SURCHARGED
180 minute winter	SMH23	176	75.474	1.374	91.9	5.3403	0.0000	SURCHARGED
15 minute summer	Outfall	1	74.044	0.000	89.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SMH19	5.008	SMH20	302.8	3.780	0.591	4.0132	
15 minute winter	SMH20a	8.000	SMH20	94.5	2.621	0.469	0.5518	
15 minute winter	SMH20	5.009	SMH21	394.1	3.044	0.384	4.1351	
15 minute winter	SMH21	5.010	SMH22	442.9	2.796	2.384	1.4254	
15 minute winter	SMH22	5.011	Attenuation Tank	443.5	2.800	1.391	8.3844	
15 minute summer	Attenuation Tank	5.012	SMH23	93.4	0.722	0.334	11.3722	
60 minute winter	SMH23	Hydro-Brake®	Outfall	89.7				1225.0

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