

Drainage Strategy Report

For

Buckley Wells, East Lancashire Railway

By

Booth King Partnership Limited.

Dated: 04/04/23

Ref:

Prepared By: _____ Aaron Wragg MEng

Approved By: _____ Barry Jefcoate PhD MEng
(Hons)

Address: 9c Tollgate House, Bridge Street, Ramsbottom, BL0 9AB
Telephone: 01706 822022

Email: office@booth-king.co.uk
Website: www.booth-king.co.uk



PROJECT: Buckley Wells Drainage Strategy

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1. BRIEF

Booth King Partnership have been appointed by East Lancashire Railway Trust to assess the drainage requirements for the Buckley Wells site where a new carriage shed is to be constructed.

As a new development, SUDS (sustainable urban drainage systems), surface and foul drainage are to be considered. This report gives an overview of the strategy to utilize parts of the existing drainage systems in combination with new systems to provide the required drainage to the new development.

This strategy will be used to support a detailed planning applications.

2. SITE

The site is an existing brownfield site located to the south of central Bury. The site access is located on Baron Street.

2.1. EXISTING SITE

The site currently consists of a large brownfield site. The site is bounded by residential areas and Bury CE High School to the east, St Gabriels Roman Catholic High School and it's associated sports pitches to the West and Baron Street to the North.

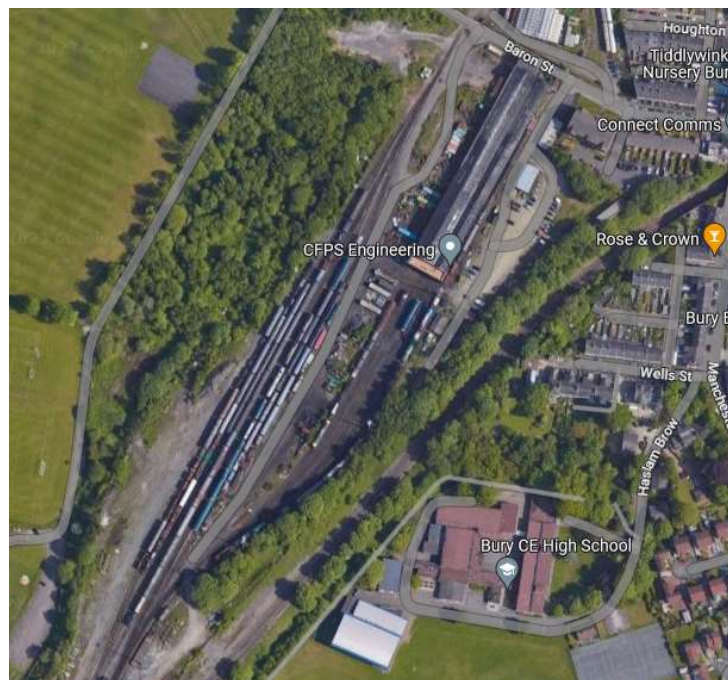


Figure 1 - Site location showing current site access from Baron Street



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Existing site levels include a significant overall fall in site levels from north-east to south-west of the site, as indicated in the topographical information in Appendix C

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

The existing surface water drainage enters the site from the level railway crossing on Baron Street. It runs North-South adjacent to the Westernmost set of tracks currently on the site and exists the site at the South-West across the high-school sports pitches.

See Appendix B for an existing sewer plan provided as part of the drainage report carried out in August 2022.

2.2. DESIGN CODES

The project has been designed in accordance with the following design codes and guidance:

Element	Design Code
Drainage:	BS EN 752-4:2008 Drain and sewer systems outside buildings SuDS Manual (CIRIA C753)
	Building Regs Approved Document H – Drainage and waste disposal
	HR Wallingford Greenfield Runoff Estimation
	HR Wallingford Surface Water Storage Estimation
	Sewers for Adoption (7 th Edition)
	British Water; Flows and Loads 4 – Sizing Criteria, Treatment Capacity for Sewage Treatment Storage

Table 1 - Design Codes, Standards & Guidance Documents

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3. 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.

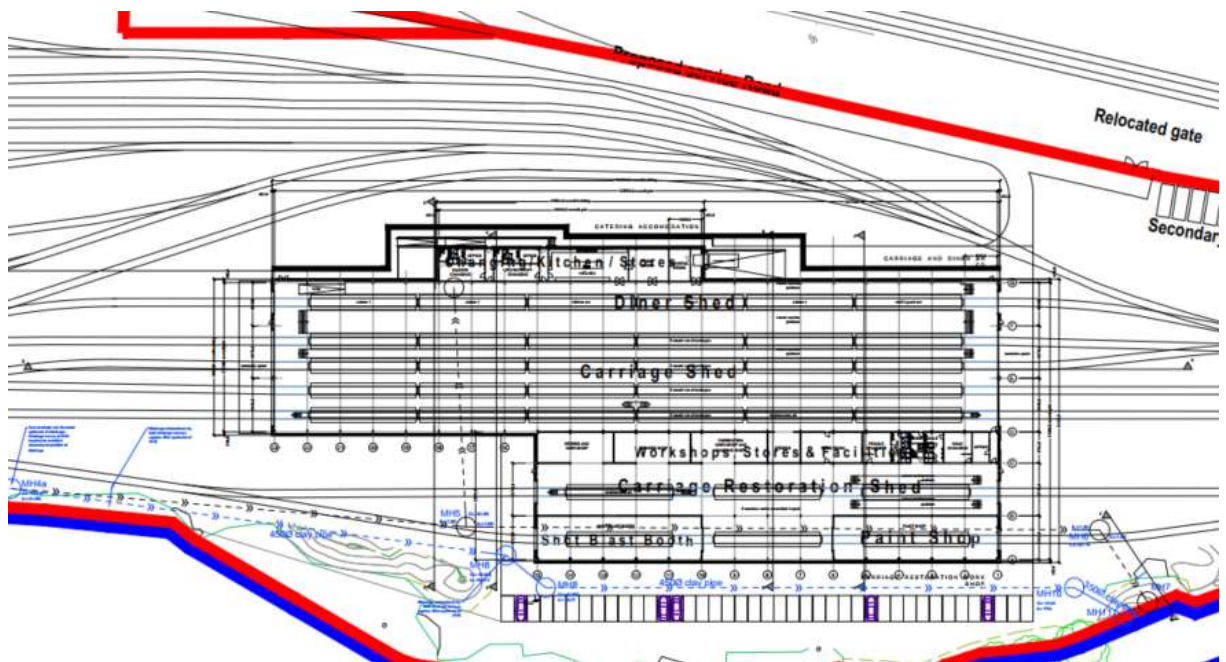


Figure 2 - Current Proposed Location Plan showing some drainage overlay

The proposed new access road from enters the site from the east on Baron Street. It runs south along the eastern face of the existing carriage shed. It then runs along the Eastern edge of the site boundary and turns West along the Southern edge of the new shed.

The yard becomes a large open space to the south of the existing carriage shed where multiple groups of tracks run south-west. It is at the south-west of the site where the new carriage shed, shown in Figure 2, is to be located.

A new line of car parking spaces is to be located to the south of the new shed.

See drawing 0030 in Appendix A which shows all new hardstanding areas.

Drawing 0010 in Appendix A shows the existing drainage line. DrainAlert CCTV surveys have found that part of this existing drainage route is a 300mm clay pipe which has collapsed. Drain survey information indicates that the collapse ends 66m upstream from MH5. However, we do not know at what distance downstream from MH4 the collapse begins. This position will be verified on site.



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The existing drainage route would also clash with the proposed location of the new carriage shed.

We propose that a diversion be installed to avoid this collapse between MH4 and MH5. A new manhole, MH4a will be installed, with a 450mm clay pipe leading the diversion along the new route, shown in drawing 0010. The proposed pipe size is to match the largest pipe along the existing drainage route, according to DrainAlert survey information.

This diversion will run parallel to the western face of the proposed new building and reconnect to the existing drainage route downstream of existing manhole MH7, making use of the existing drain which runs beneath the sports fields to the west and outfalls into the River Irwell.



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4. SUDS METHODOLOGY

The following steps were used to produce a SuDS methodology for the site:-

- Calculate pre-development Greenfield runoff rate, utilising the HR Wallingford greenfield runoff rate estimation tool
- Calculate the required post development attenuation required for the critical storm with a return period of 30 years in line with the CIRIA SuDS Manual.
- Calculate the storage requirements for the critical storm with a return period of 100 years in line with the CIRIA SuDS Manual.
- Control the flow into the connection being made from the proposed surface water drainage diversion back into the existing drainage system, so that this downstream system is not overloaded.

Surface water attenuation provided is to ensure that surface water flows from a storm of up to a 30-year return period can flow without causing any flooding on the development. The below ground drainage network will be designed to have the storage capacity to accommodate this event.

The design will consider the event of a 1 in 100-year return storm (with a 40% allowance made for climate change). Guidance states that this event must be considered when sizing attenuation systems, but that it can cause flooding at the nodes in the drainage network (typically manholes). However, this flooding can not affect highways, infrastructure, and other key parts of any development. A detailed post-planning drainage design will consider this storm event and highlight any areas of potential flooding to ensure that appropriate measures are taken.

According to SuDS guidance the methods of discharge in order of preference are:-

- Discharge by infiltration
- Discharge to watercourse
- Discharge to surface water sewer
- Discharge to combined sewer

A site investigation was carried out by Leyden Kirby Associates Ltd.

This investigation showed that made ground was encountered across the majority of the site down to 11m below ground level at it's deepest on the eastern part of the site. Below this made ground the natural ground is a layer of stiff boulder clay overlaid.



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4 ASSESSMENT OF RESULTS

For a design soakaway rate the lowest infiltration rate results from each pit should be adopted. Therefore this is 1.44E-05 m/s in S1 test 2. This equates to 8.64E-04m/min and 0.052m/hour.

However the strata was not sufficiently free draining to allow triplicate tests in each location and groundwater was encountered at the base of the first excavation of S3 at 1.1mbgl.

Location S2 was the only pit excavated in granular material only, however it was not possible to complete one infiltration test at this location and only 46% head was achieved after 300 minutes.

Figure 3 - Excerpt from Leyden Kirby Associates Ltd. Soil Infiltration Test Results

Figure 3 shows that the site is not suitable for discharge via infiltration. See Appendix F

To the west of the site is the River Irwell. Closed circuit television surveys (CCTV) of the existing surface water drainage shows suggests that the surface water is currently discharging into this watercourse. Therefore our surface water drainage system will connect into this existing system within our site boundary and then into a watercourse satisfying the SuDS hierarchy.

Surface water flow will be restricted to a flow rate to ensure there will be no additional flooding to the surrounding area due to the development. At the time of writing this report the LLFA have been contacted and an enquiry into the information that they require has been made.

A wastewater pre-development enquiry has also been made to United Utilities (UU).

4.1. ASSESSMENT OF SURFACE WATER CONTROLS

The below ground surface water network collects water from all hard-standing and roof areas on site.

The surface water flows have been analysed for the proposed development roof and all hardstanding areas.

The on-site network has been sized using the Causeway Flow with the following design criteria:

- No surcharging within the system for storm with a return period of 1:1 years;
- No surface water flooding for storms with a return period of 1:30 years;
- No surface water flooding for storms with a return period of 1:100 years;



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- Controlled water flooding for storms with a return period of 1:100-year + 40% increase for climatic change.
- Qbar of the developed area is 6.8 l/s. The site outflow will be restricted as described in Section 5.2 of this report.

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5. SURFACE WATER DRAINAGE STRATEGY

5.1. OVERVIEW

The proposed surface water drainage system will serve the roof of the new shed, it's surrounding hardstanding areas, and the access road. The sum of these areas is 0.87Ha, with the entirety to be treated as impermeable requiring positive drainage.

The greenfield runoff rate for the area has been calculated using the IH24 input method, carried out using the HR Wallingford online tool. This is shown in Figure 3 – the full calculation is available in Appendix D

Greenfield runoff rates	Default	Edited
Q _{BAR} (l/s):	6.8	6.8
1 in 1 year (l/s):	5.92	5.92
1 in 30 years (l/s):	11.56	11.56
1 in 100 year (l/s):	14.15	14.15
1 in 200 years (l/s):	16.12	16.12

Figure 4 - HR Wallingford Greenfield Runoff calculation

The calculated greenfield runoff rates are as follows:-

Qbar	:	6.8 l/s
1 in 1 year	:	5.92 l/s
1 in 30 year	:	11.56 l/s
1 in 100 year	:	14.15 l/s

For a new development, the surface water discharge for a previously undeveloped site would normally be expected to be restricted to the QBar greenfield runoff rate. To achieve a restricted flow rate to match the QBar greenfield runoff rate it is proposed to limit the surface water discharge to 6.8 l/s.

The HR Wallingford online tool has also been used to calculate the surface water attenuation volume required for a 1 in 100-year return storm event.



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5.2. DIVERSION

There is an existing culvert which enters the site from the north, travelling south parallel to the existing tracks which enter the site from the Baron Street rail level crossing.

This is shown to be a 400x300mm stone culvert by the point it reached manhole MH3 (refer to drawing 0010 in Appendix A). It is not known what the catchment area for this drain is. The outfall flow rate from the site from the diversion to the culvert will be limited to $Q_1 + Q_{bar}$, where:-

- Q_1 is the full bore flow rate upstream of the proposed diversion
- Q_{bar} is the outflow from the attenuation tank, limited to the equivalent greenfield runoff rate.

This strategy is illustrated in Figure 4.

It is proposed to drain hardstanding areas of the site via gullies and linear drainage. The levels and falls across the site will be designed to direct surface water away from buildings.

During extreme storm events in excess of a 1 in 30-year return period event, exceedance flows will be retained in the below ground network. Once the peak of a storm subsides the flow will drain from the network and discharge at the controlled flow rate. This will ensure that all buildings are protected from flooding and that any exceedance flows are managed within the site boundary.

5.3. PERMEABLE PAVING

The proposed car park spaces along the western edge of the new building will be situated directly over the proposed attenuation tank.

The surface water from these spaces will infiltrate down into the tank through the granular buildup over the tank extending to ground level.



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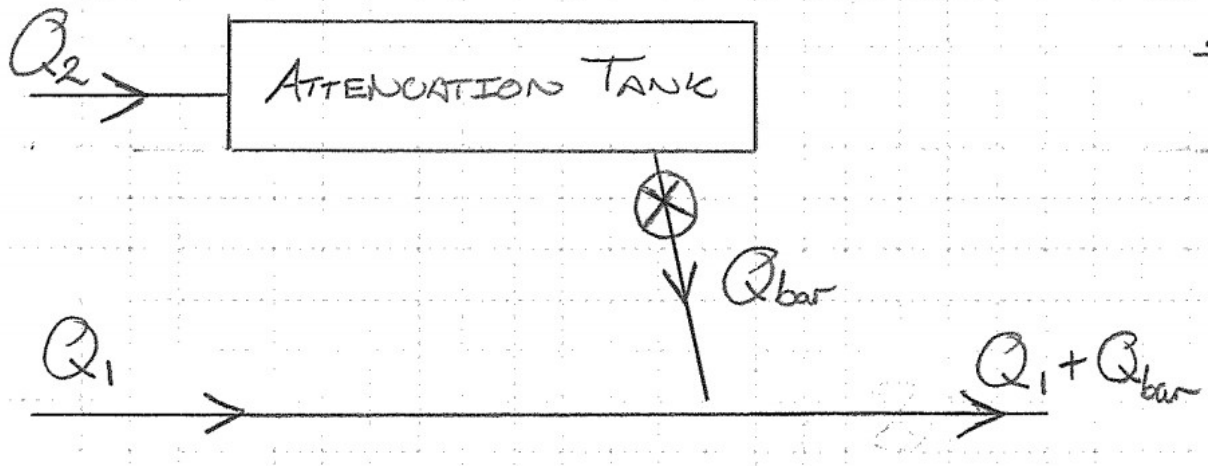


Figure 5 - Diversion strategy

From drain survey information:-

Inlet Level MH4 = 80.73m

Inlet Level MH5 = 75.95m

Pipe length = 136.23m

$$\text{Pipe gradient} = \text{Pipe gradient} = \frac{80.73 - 75.95}{136.23} = 1:28.5$$

Interpolated from HR Wallingford pipe data for 375mm diameter pipe:-

Discharge $Q_1 = 504$ l/s @ 4.57 m/s

5.4. SOURCE CONTROL

Due to the site being composed of impermeable ground, source control by infiltration is not possible by infiltration. Source control, as indicated in Figure 4, is to be provided on this development from the use of attenuation tanks and flow controls.

The attenuation tank, as previously mentioned, has been designed and sized using the HR Wallingford Surface Water Storage requirements calculation. The full calculations for the attenuation tank sizing is available in Appendix D.

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Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	5.9	5.9	Attenuation storage 1/100 years (m³):	866	866
1 in 30 years (l/s):	6.8	6.8	Long term storage 1/100 years (m³):	0	0
1 in 100 year (l/s):	6.8	6.8	Total storage 1/100 years (m³):	866	866

Figure 6 - Attenuation Tank Sizing

The tank will be situated beneath the parking spaces on the western edge of the new carriage shed. The total available area here is approximately 600m², and therefore the preliminary tank size will be 1.5m deep.

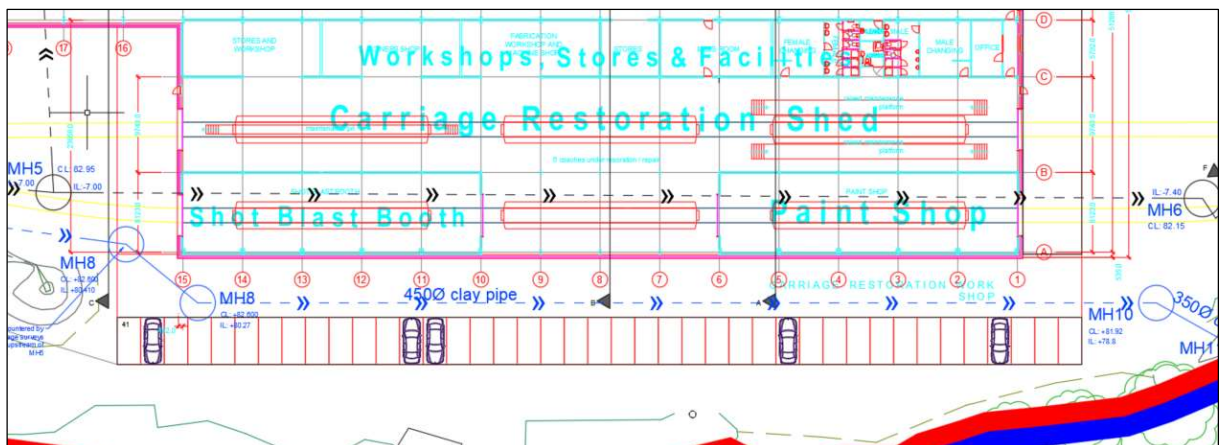


Figure 7 - Attenuation Tank Location

The surface water runoff from the roof of the carriage shed and other newly developed areas will flow uncontrolled into the tank, whilst the surface water directly above it in the parking spaces will filter down through permeable paving directly into the tank.

5.5. CALCULATIONS

A full set of the greenfield runoff and surface water storage calculations can be found in Appendix D.



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5.6. MAINTENANCE

The drainage network and inherent SuDS have 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.

Maintenance of the works will fall under the site operator's responsibility.

5.6.1. Manholes

Manholes are typically sized in accordance with Sewers for Adoption, which relates to the incoming and outgoing pipe diameters. However, as the system is not Adopted, PPICs have been used where manufacturer's limitations permit.

Manholes have been located outside the building in all cases which will allow much greater freedom with future maintenance access.

Maintenance Schedule	Required Action	Frequency
Occasional Maintenance and Monitoring	Covers should be lifted and inspected for litter and debris to ensure that the runs are free-flowing.	3 Monthly (or as required).

Table 2 - Manhole maintenance

5.6.2. SDS GEOlight Storage

SDS GEOlight Storage is proposed to be used for stormwater storage for the application of stormwater attenuation.



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Lightweight materials combined with robust design make it easy to transport, quick to install and extremely durable, even beneath high-traffic areas such as roads, car parks and warehouse yards.

Access shafts can be easily constructed during installation of the SDS GEOlight storage system to enable inspection and maintenance.

The channels between the vertical struts allow access for CCTV inspection, maintenance and cleaning and ensures that the storage volume of the system isn't compromised by the build-up of silts.

5.6.3. Hydro-Brake Flow Control device

The Hydro-Brake Flow Control is a versatile, self-activating device with a unique geometry designed to harness the energy of vortex flow.

The Hydro-Brake is used to maximize savings on new construction projects by minimizing stormwater detention volumes. The Hydro-Brake can be installed in downstream manholes to restrict the outflow without requiring the construction of additional detention volumes.

Not only will a Hydro-Brake allow more water to go downstream in the build-up of a storm event, but it will drain down quicker than alternatives leaving the tank volume ready to accept a following storm event. Some advantages include;

- Reduced stormwater storage volumes by up to 40%
- Up to 50% savings in project storage costs
- Self-activating with no moving parts or power requirements
- Available in wall-mounted or floor-mounted geometries
- Virtually maintenance free

5.6.4. Permeable Paving

Permeable paving is a type of paving surface that allows water to pass through it into the base beneath. In our case the attenuation tank is beneath

It's proposed to install 300 mm. layer of MOT Type 3 as storage base beneath Grasscrete plates. Beneath this the tank is planned to be plastic crates wrapped, to the sides and base and with a permeable cover, in impermeable membrane which then discharges to the proposed network.

Some advantages are:



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- Control of surface water run-off preventing floods and puddles.
- These surfaces absorb heat, which increases the temperature and causes a heat island effect
- Natural and sustainable materials

Permeable paving needs to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. A brush and suction cleaner should be used for regular sweeping.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 3 - Permeable pavements operation & maintenance

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6. FOUL WATER DRAINAGE STRATEGY

Foul water from the new carriage shed and carriage wash will be discharged 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.

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.

6.1. PUMP REQUIREMENTS

The foul water will outfall into a manhole which forms an existing connection into a UU sewer. This outfall manhole is at a higher level than the proposed development, and therefore the foul water will need to be pumped through a rising main.

The cover level to the first proposed foul manhole has been taken from TriCAD Solutions Ltd. Tite Survey drawing TRI-2313-04.

Cover and inlet levels for the existing foul manhole FW1 have been obtained from measurements taken from site.

The levels of the proposed beginning and end of the foul drainage network is as follows:-

- Start: FMH3 Cover level +83.330 Inlet level TBC
- End: FW1 Cover level +85.670 Inlet level +84.470

The proposed foul drainage route is shown on drawing 0040 in Appendix A. This was provided to two pump suppliers for them to provide a preliminary design for the proposed scheme. A preliminary pump specification can be found in Appendix C

Due to the requirement for a carriage wash facility, the foul drain serving this area will be fitted with a detergent interceptor before combining with the rest of the foul water drainage network.

Appendix C shows our calculations for the peak flow rate of the foul water from the building, and a preliminary pipe sizing into the pump chamber. These calculations have been carried out by tallying the discharge units from all foul appliances shown on the architectural plans of the building.

Appendix C also contains the calculations which determine our maximum peak foul flow value into the existing foul drains on site. A pre-development enquiry by UU states that the flow into the sewer can be unrestricted, but we are restricted by the size of the existing foul drain pipes (225mm diameter). We have allocated for the existing foul flow into this drain and have calculated a restricted value for the peak foul flow of the new development so as to not overload this pipe.



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6.2. CARRIAGE WASH

A new facility to wash the train carriages will be included in the development. An allowance has been made within the foul water flow rate for this and a detergent interceptor will be fitted before the discharge from here combined with the foul water from the main shed.

There will be a provision for an alarm which will alert staff to when / if the pump is not functioning. In this circumstance the carriage wash will not be permitted to be used, as it's use could overload the storage capacity within the foul drainage network upstream of the pump.

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Telephone: 01706 822022

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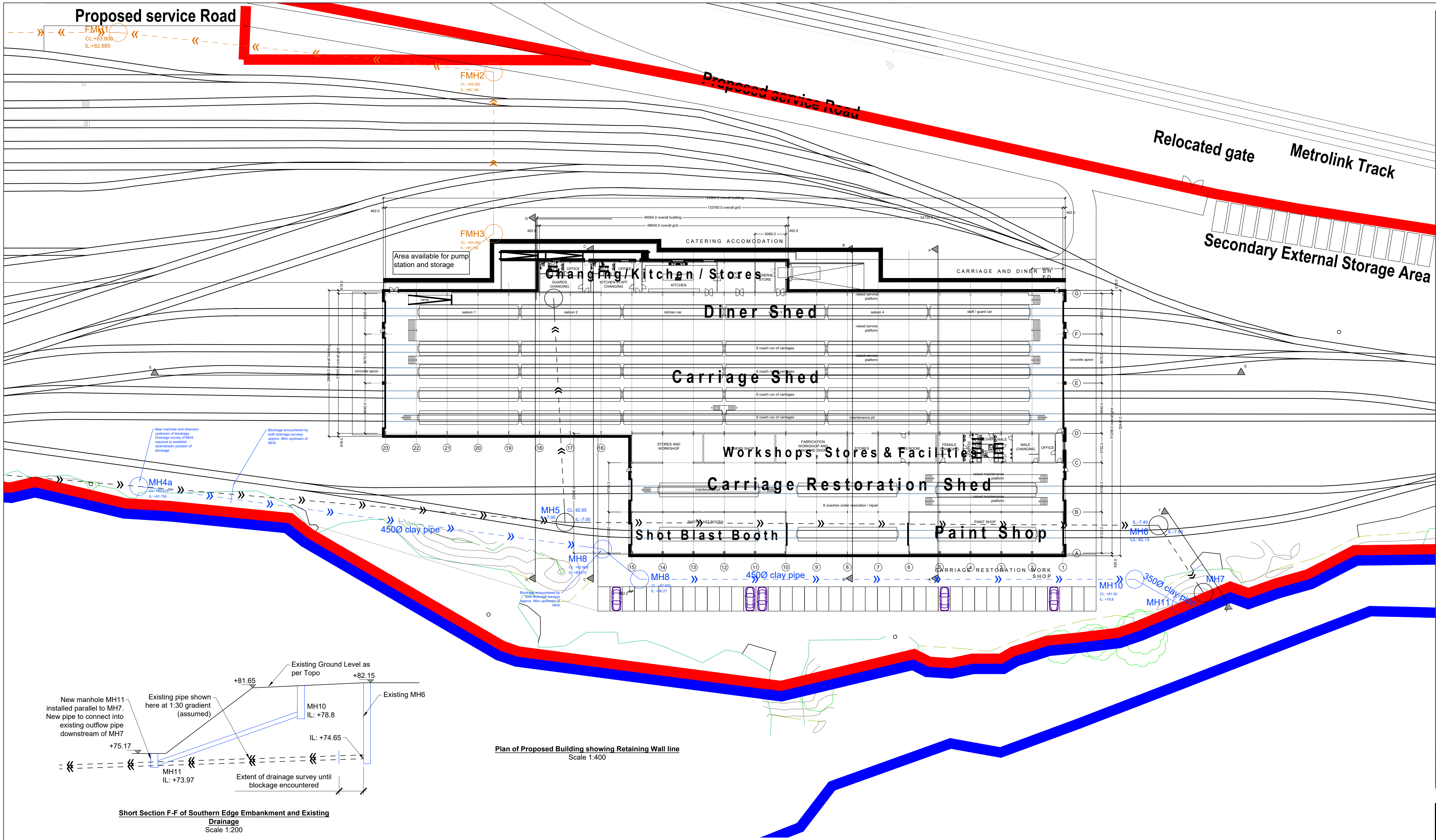
Appendix A
BKP Drainage Scheme Drawings

By

Booth King Partnership Limited.

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Telephone: 01706 822022

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www.booth-king.co.uk office@booth-king.co.uk

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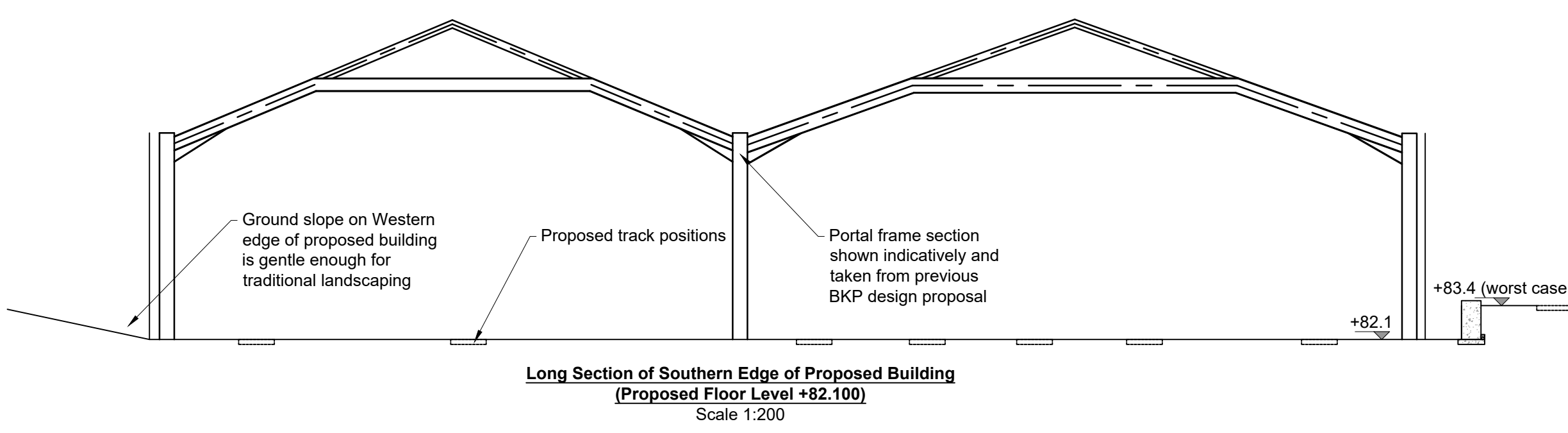
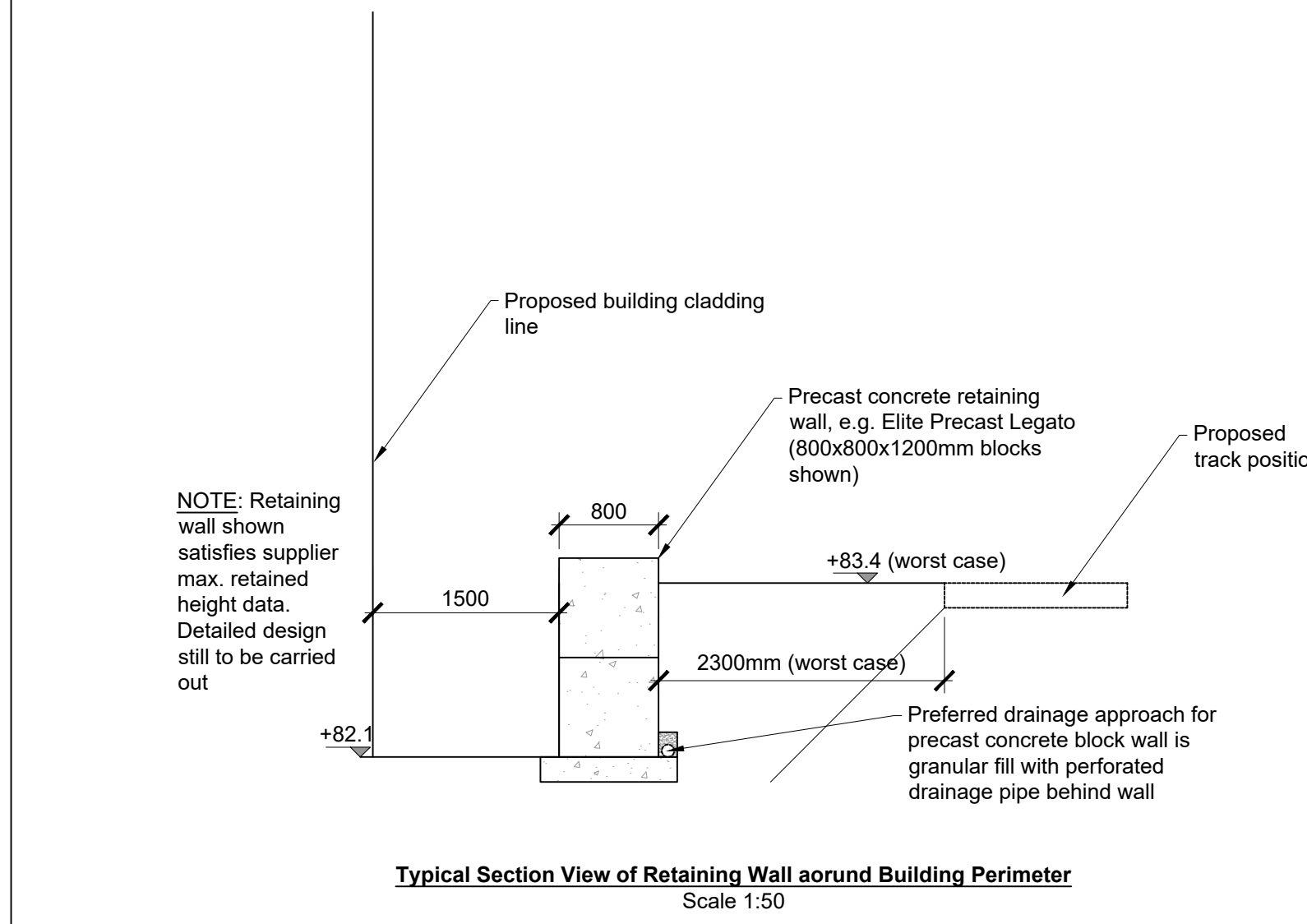
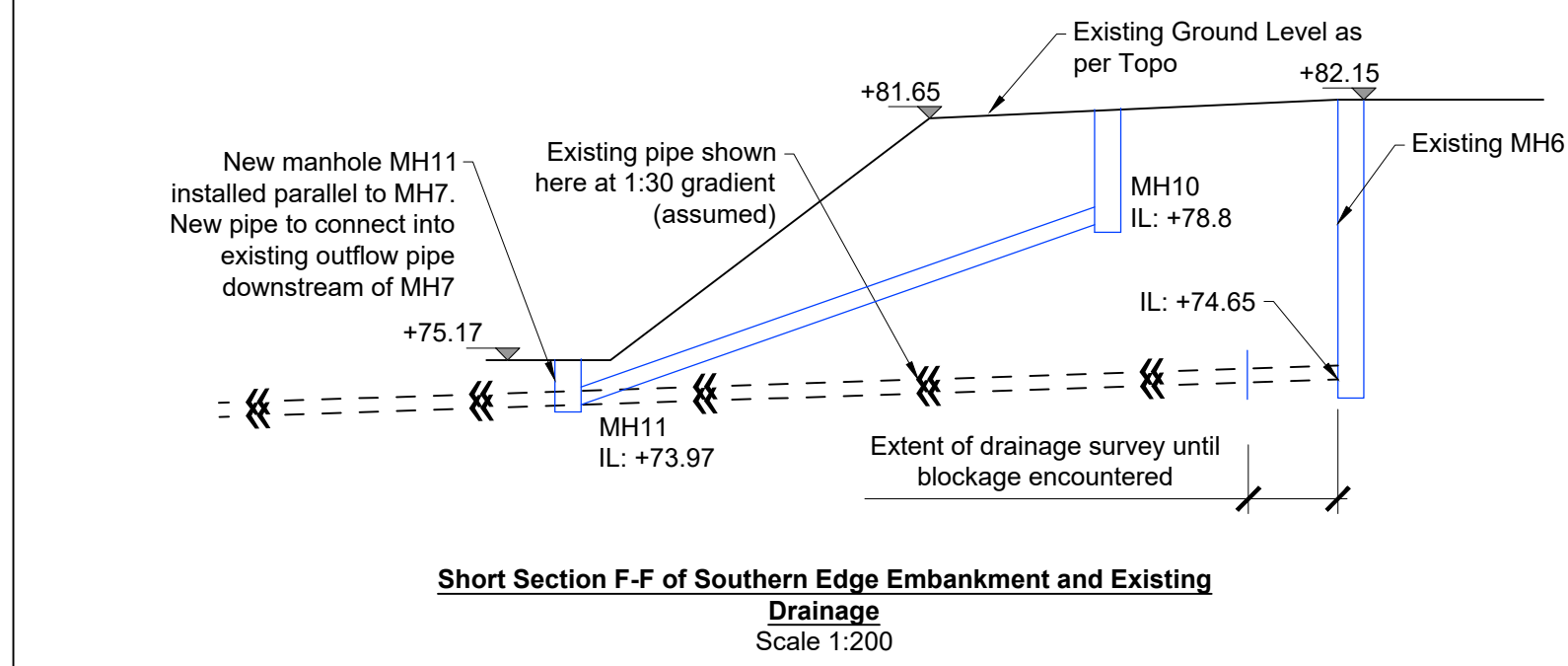
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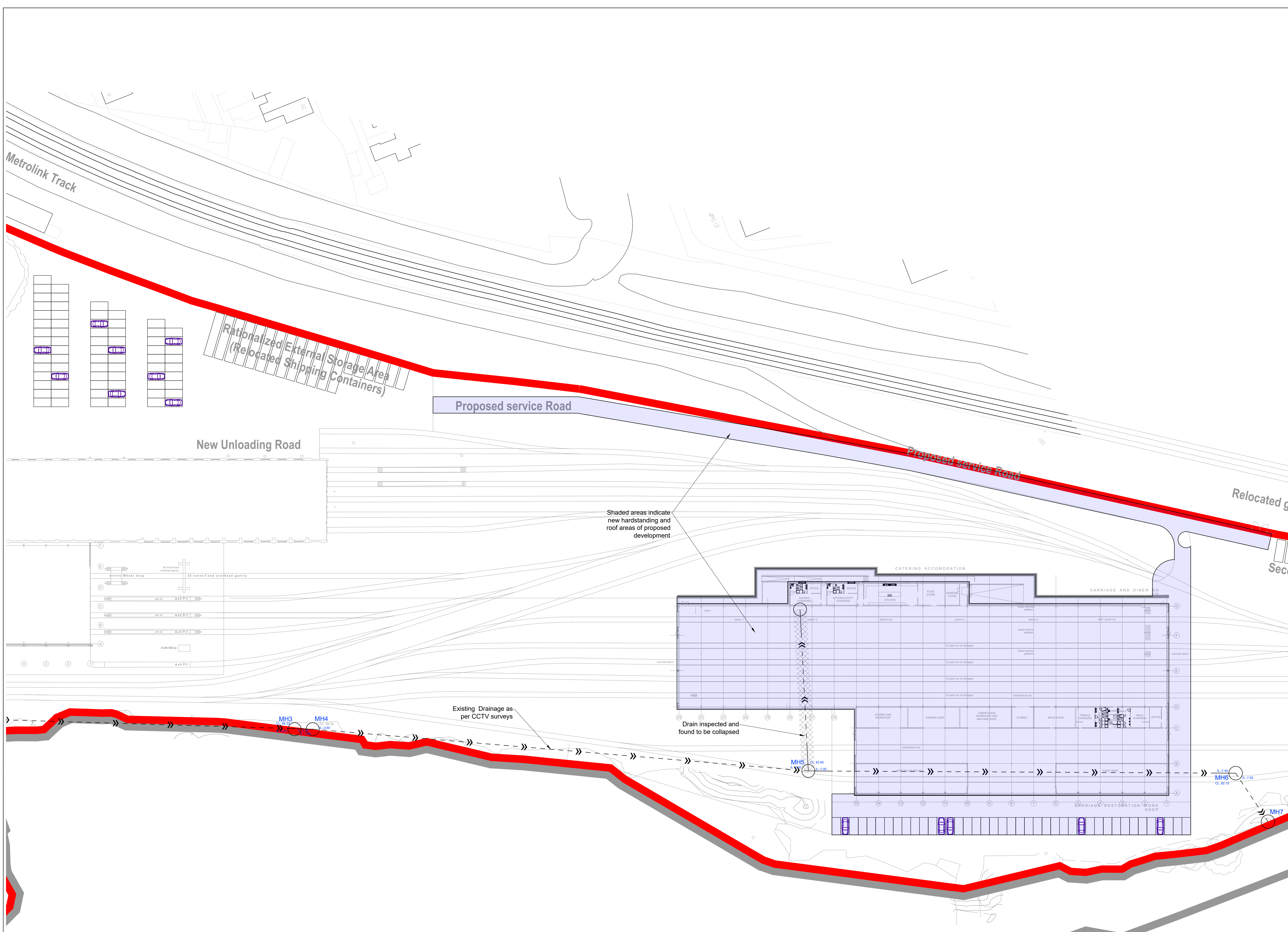
**Proposed Building Section
& Drainage Strategy**

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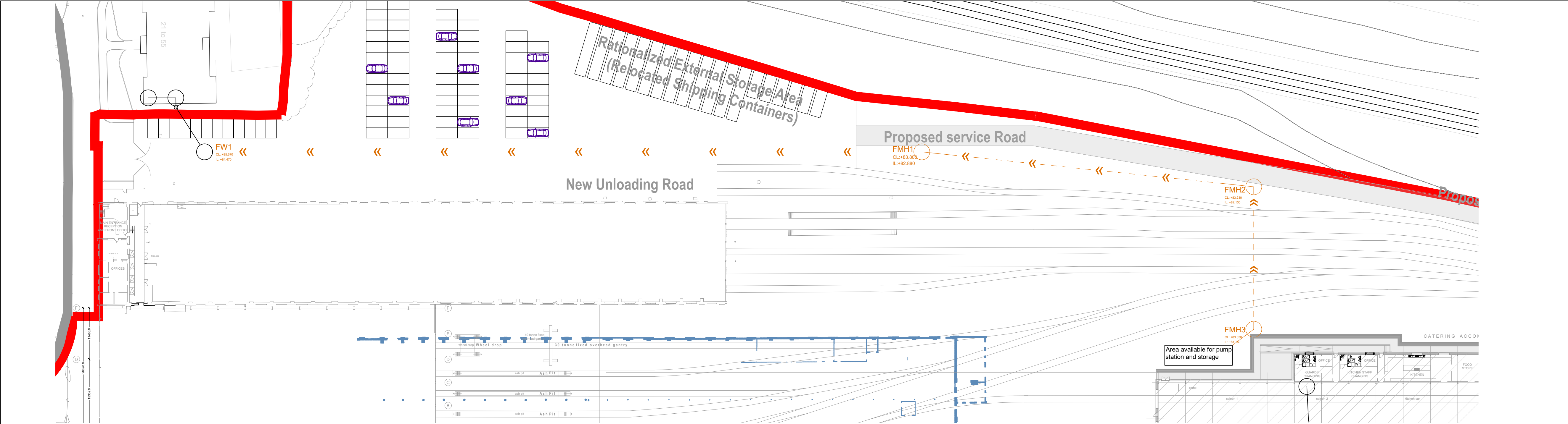
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Site Plan showing
New Roof & Hardstanding Areas

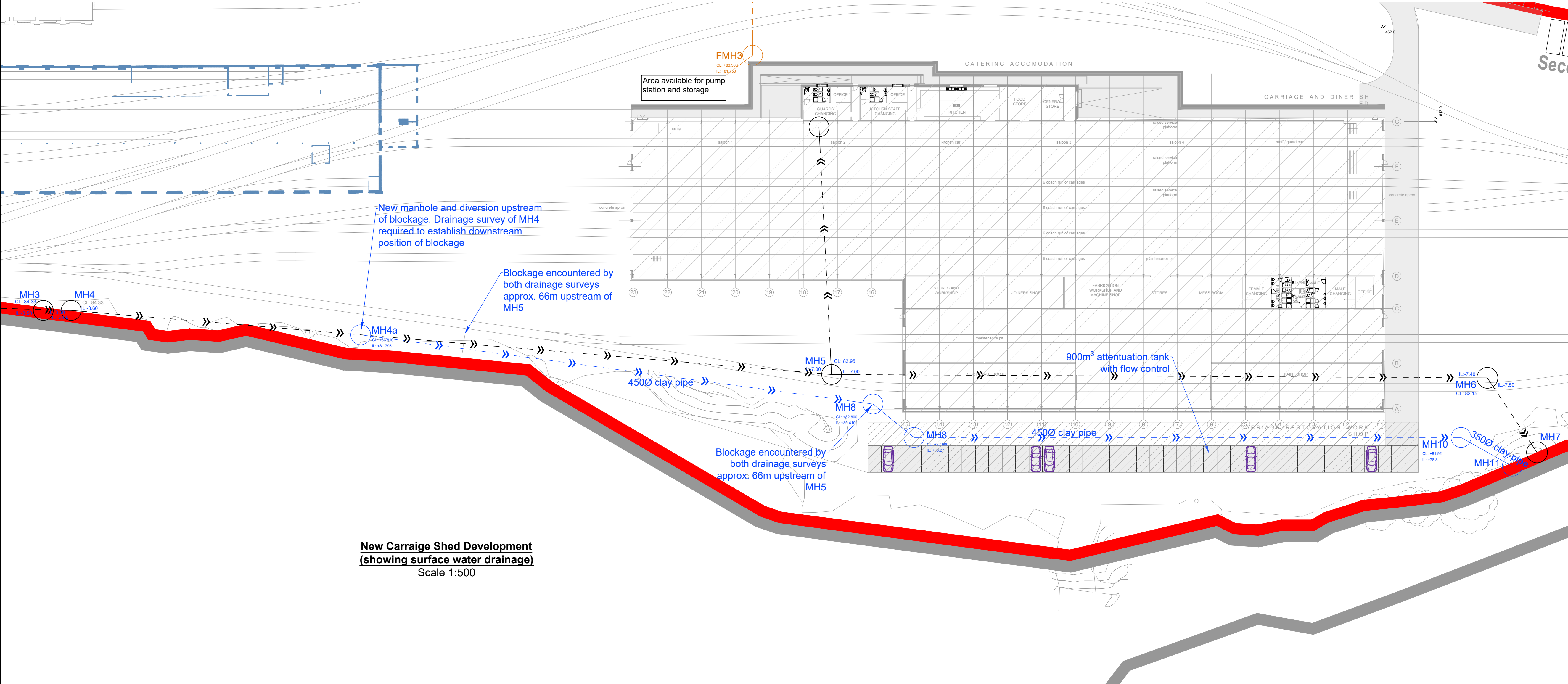
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Foul Drain Proposed Route
Scale 1:500



New Carriage Shed Development
(showing surface water drainage)
Scale 1:500

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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.

x	x	x	x
REV.	DATE	REVISION DETAILS	INITIALS

bk

boothking

PARTNERSHIP LIMITED

CONSULTING CIVIL & STRUCTURAL ENGINEERS

www.booth-king.co.uk

office@booth-king.co.uk

MANCHESTER

RAMSBOTTOM

EDINBURGH

Tel: 0161 694 7087

Tel: 01706 822 022

Tel: 0131 229 1547

PROJECT:

Buckley Wells
Drainage Strategy

TITLE:

Surface & Foul
Drainage Routes

SCALE @ A1:	DRAWN:	DATE:	REVISION:	STATUS:
As shown	AW	15.02.23		

DRAWING No:

14550-BKP-V1-00-DR-S-0040

Buckley Wells, East Lancashire Railway

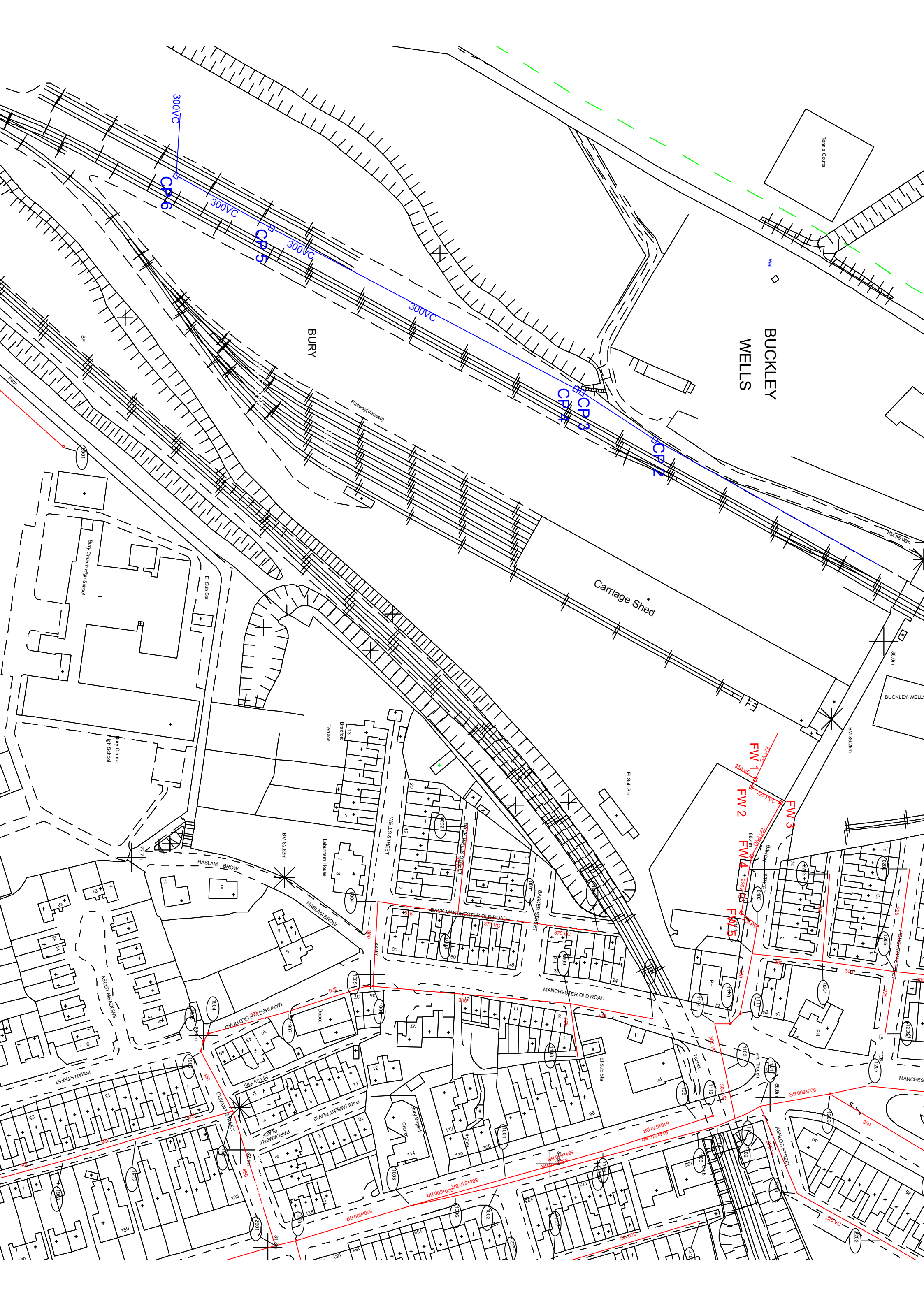
Appendix B
Existing Drainage Plan
(DrainAlert survey information)

By

Booth King Partnership Limited.

Address: 9c Tollgate House, Bridge Street, Ramsbottom, BL0 9AB
Telephone: 01706 822022

Email: office@booth-king.co.uk
Website: www.booth-king.co.uk



Buckley Wells, East Lancashire Railway

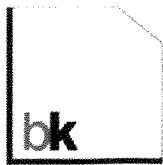
Appendix C
Foul Water Discharge Calculations
& Preliminary Pump Specs

By

Booth King Partnership Limited.

Address: 9c Tollgate House, Bridge Street, Ramsbottom, BL0 9AB
Telephone: 01706 822022

Email: office@booth-king.co.uk
Website: www.booth-king.co.uk



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PARTNERSHIP LIMITED

INCORPORATED IN THE UNITED KINGDOM

PROJECT No: 14550

PAGE No: 1

DATE: 23/03/23

ENGINEER: AN

CHECKED:

PROJECT: BUCKLEY DELLS DRAINAGE STRATEGY

Foul RISING MAIN SCREEN

UC: 12

Sinks: 14

Shower: 7

Kitchen sink: 2

$$12 \times 1.800 = 21.6$$

$$14 \times 0.300 = 4.2$$

$$7 \times 0.400 = 2.8$$

$$2 \times 1.300 = 2.6$$

$$Z = 31.200$$

$$k = 0.7 (\text{Cheteb})$$

$$Q = 0.7 \times \sqrt{31.2}$$

$$= 3.91 \text{ l/s peak}$$

$$L = 270.9 \text{ m}$$

$$\text{Gradient} \approx 1 \text{ in } 100$$

at this gradient: 150mm clay pipe; 0.87 m/s; 15.46 l/s

$$\frac{3.91}{15.46} = 0.253 \Rightarrow 0.835 \text{ proportional velocity @ } 0.34 \text{ proportional discharge}$$

$$0.87 \text{ m/s} \times 0.835 = 0.73 \text{ m/s} > 0.7 \text{ m/s} \therefore \text{OK}$$



PROJECT: BOCKLEY LELLS DRAINAGE STRATEGY

Allowable Flow into Existing Foul Drain

OO Pe-Dev Enquiry allows for unrestricted flow into sewer.
However, flow limited to existing pipe capacity.
Existing pipe also serves existing carriage shed.

From equilibrium survey drainage of existing carriage shed:-

<u>APPLIANCE</u>	<u>DU</u>
Sink x 4	0.3 x 4
Urinal x 2	0.4 x 2
WC x 4	2 x 4
	<u>$\Sigma DU = 10$</u>

$$k = 0.7$$

$$Q = 0.7 \sqrt{10} = 2.2 \text{ lps}$$

Double this to allow for on site odours $\Rightarrow 4.4 \text{ lps}$

Flow in existing drains limited by Ø225 drain pipe

From RainAlert CCTV; gradient = 1 in 65

$$\text{Full bore flow} = 55.91 \text{ lps at } 1.41 \text{ m/s}$$

$\therefore$ flow from development into existing foul drains
limited to 51.51 lps

Pump Station 1 (Foul Pump Station)

Key Selection Criteria: (Scheme Drainage Plans ref. 13511 - BKP - V1 - 00 - DR - S - 0040)

Effluent Type	: Sewage	Final Outfall Level	: 84.470
Cover Level	: 83.330	Top Water Level	: 82.210
Lowest Inlet Level	: 81.750 (1.580 m below CL)	Rising Main Length	: 271m
Maximum ground water level	: 82.030	Distance from Pump Chamber to Control Panel	: <10m

Scope of supply:

- Vortech GRP horizontal underground chamber pre-fitted with twin pump auto-coupling system, guiderails, internal pipework, check valves, isolation valve and float switch bracket, c/w inlet and vent/duct connections to suit site requirements
- 2no submersible sewage pumps c/w lifting chains and D shackles
- 400v DOL Twin Pump Control Panel with metal enclosure, adjustable overloads, VFC's, klixons, hand/off/auto selectors, run and trip lamps and high level alarm
- 4no Single Acting Float Switches
- Galvanized Steel Solid Top Access Cover 800x1200 clear opening, Facta AAA (2.5T SMWL) Load Rating, Standard Seal
- Delivery to site of all the above (offloading by others)

Specification:

Civils Data:

System Type	: HG15.600.2P.80G.GR02	
Chamber Size	: 1.5m Ø x 6m long chamber with 1.2Ø x 0.7m deep sump, 1m high turrets	
Access Size	: 800x1200 (Pump Access), 750Ø (Secondary Access)	
Cover Depth	: 100mm (depth from cover level to top of turret)	Inlet Connections Included:
Total Storage Volume	: 10160 Litres	110mm: : 0
Design Storage Volume	: 10130 Litres (below TWL of 82.21)	160mm : 1
Rising Main Required (by others)	: 90mm SDR17 PE100 Pipe	200mm : 0
Discharge Connection	: 90mm Connector to suit PE pipe	300mm : 0
		450mm : 0
		600mm : 0

M&E Data:

Pump Model	: 80AFU21.5L 1.5kW 3" 3ph	Impeller Type	: Vortex (76mm solids handling)
Design Flow Rate	: 4 l/sec	Design Total Head	: 6.9 m
No of pumps	: Two	Configuration	: Duty / Standby
Motor Rating	: 1.5 kW	Full Load Current	: 3.5 Amps per pump
Motor Speed	: 2820 RPM	Internal Pipework	: 80mm Galvanised Steel
Cable Length	: 10 m	Level Control Type	: Floatswitch
Control Panel	: CK19T/2.5-4	Method of Starting	: Direct Online
Supply Voltage	: 400/3/50		

Total Package Price	: £13,889.00
Commissioning Price	: £960.00
Estimated Lead Time	: 5 Weeks*

Buckley Wells, East Lancashire Railway

Appendix D
Surface Water Drainage Calculations

By

Booth King Partnership Limited.

Address: 9c Tollgate House, Bridge Street, Ramsbottom, BL0 9AB
Telephone: 01706 822022

Email: office@booth-king.co.uk
Website: www.booth-king.co.uk

Greenfield runoff rate estimation for sites

www.uknuts.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

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:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

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):	1057	1057
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 $SPR/SPRHOST \leq 0.3$?

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):	6.8	6.8
1 in 1 year (l/s):	5.92	5.92
1 in 30 years (l/s):	11.56	11.56
1 in 100 year (l/s):	14.15	14.15
1 in 200 years (l/s):	16.12	16.12