
Subject New Victoria – Surface and Foul Water Drainage Strategy

Date 17 February 2016

Job No/Ref 218128

New Victoria Drainage Strategy – Surface and Foul Water

1 Introduction

Arup have been appointed by Muse Developments Limited to carry out Engineering Design Services for the New Victoria project.

This design note summarises the existing drainage regime on the site and proposes the future design for the forthcoming project. The scheme has been designed in accordance with National Planning Policy (NPPF) Guidance, the Building Regulations Document H and Sewers for Adoption. The design incorporates the use of Sustainable Drainage Systems (SuDS) where practical.

This note covers all aspects of external drainage serving buildings, car parks, landscaping and road surfacing. This includes associated underground drainage infrastructure, such as storm water attenuation tanks, infiltration, pollution interceptors, outfall connection locations and design flow rates.

The document has been produced to support consultation with Manchester City Council (MCC), United Utilities (UU) and the Environment Agency (EA) for inclusion within Planning Application documentation.

1.1 Development Proposals

The proposed development is split into three distinct plots as shown in **Figure 1**.

Plots 1 and 2 will accommodate the proposed residential buildings, and Plot 3 the proposed office building. Plot 1 will accommodate a 25 storey residential building with c.287 apartments and Plot 2 a twenty storey residential building with c.227 apartments. Plot 3 will accommodate an eight storey office building comprising approximately 13,053m² gross internal area.

Each of the three buildings will include ground floor active uses and be set within an area of landscaped public realm. The development will also include cycle and car parking for both the residential and office uses.

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Figure 1 - Development Proposals

1.2 General requirements

Proposals for the design and specification of surface water and foul water drainage systems are summarised below and indicated on the following Arup drawings attached to this document:

- **218128-C-SK013** – Existing Surface Water Drainage and catchments
- **VSM-ARP-SW-LA-CD-200**– Proposed Surface Water Drainage Layout
- **218128-C-SK021** – Proposed Foul Water Drainage Proposals Rev B

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Indicative “below ground” drainage connections below finished floor level are assumed, but drainage at and above finished floor level has not been considered at this stage. All proposals are based on the following Sheppard Robson layout drawings dated 29/10/2015 and the Planit landscape masterplan drawings including:

- 5219-SR-SI-00-100 Rev F– Lower Ground Masterplan
- 5219-SR-SI-00-101 Rev E– Ground Floor Masterplan
- PL1487.105.10 – Lower Ground Floor Level
- PL1487.106.08 – Ground Floor Level

1.3 General drainage requirements

The drainage system has been designed to consist of independent surface water and foul networks to convey the anticipated flows and to sustain the physical loads imposed, including any external temporary loading applied during construction. Furthermore, the drainage networks for each building will be independent where practicable for facilities management purposes.

The drainage scheme will be designed and constructed in accordance with the relevant British/European Standards, recognised best practice guidance and Building Regulations approved documents. The general drainage philosophy will be to optimise design to self-cleansing velocities as a minimum, ensuring capacities are such that the network can convey the flows determined in accordance with the design philosophies below.

It is not envisaged that the proposed drainage will be put forward for adoption by UU, and as such, the new drainage will not necessarily be designed to full adoptable standards. However, where practical adoptable standards will be considered to maintain a consistency across the site with the standards necessary for any public sewer diversions required (with only depth of construction, easement widths and polypropylene chamber use seen as likely departures).

The two key factors that restrict the drainage scheme and are likely to lead to departures are the lack of external space along the southern façade of the office building and the need to avoid construction in the external areas above the culvert. These necessitate the proposed drainage infrastructure being located within the basement footprint beneath undercroft areas.

1.4 Consultation

Consultation has taken place with the Environment Agency, United Utilities, Manchester City Council, Network Rail and TfGM in relation to flood risk and drainage and these organisations are in general agreement with proposals put forward. Copies of correspondence are given in **Appendix B** and a summary of discussions are recorded below in **Table 1**.

Date	Consultee	Key Issues
02 October 2015	Environment Agency Helen Telfer (EA Planning Advisor) and Sylvia Whittington	<i>The EA have no objection in principle to the proximity of works above the River Irk Culvert. The EA shall refer to Manchester Council for agreeing surface water discharge flows.</i>

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Date	Consultee	Key Issues
02 November 2015	Environment Agency Helen Telfer (Via the Scoping Opinion ref: SO/2015/115547/01_LO1)	Water Resources including Flood Risk and Drainage We support the scope of work identified to consider flood risk impacts. The Water Framework Directive (2000/60/EC) applies to all surface waters and Groundwaters. It requires member states to prevent deterioration of water bodies and to improve or maintain them with the aim to meet 'good status' or 'good ecological potential' in all water bodies. The North West River Basin Management Plan (RBMP) identifies measures to achieve WFD requirements in its catchment. Regulation 17 of the Water Environment (WFD)(E&W) Regulations 2003 places a duty on each public body including local planning authorities to 'have regard to' RBMPs The scoping report makes <u>no reference</u> to the need to consider the Water Framework Directive in relation to the proposed development. It is identified that the proposed development site will be above the River Irk which flows in culvert. This waterbody (Ref: GB112069061070) is classified as heavily modified. The Environmental Impact Assessment should consider the impacts of the proposals on this waterbody and its ability to meet good ecological potential. In addition Policy EN17 (Water Quality) of the Council's Core Strategy requires developments wherever possible to enhance water quality (both chemical and ecological). <i>These comments have been addressed as part of the Water Resources Assessment Chapter in the ES.</i>
14 October 2015	United Utilities Neil O'Brien (Developer Services Planning Liaison Team) and Danny McDermott	<i>UU are in agreement with abandoning the Long Millgate sewers and to the abandonment of the CSO (south) from Long Millgate. UU are also in agreement to retaining a short section of the CSO for use by the scheme to discharge site surface water flows via the River Irk Culvert.</i>
22 October 2015	Manchester City Council Zorica Todorovic (Flood Risk & Drainage Officer)	<i>MCC are in agreement with scheme proposals and requested the development target of a 50% reduction in runoff (compared to the existing drainage regime, 1:100 year return period event).</i>
23 September 2015	Network Rail Andy Hughes (Asset Manager) and John Tym (Property Services)	<i>To agree working and stand-off distances required between existing River Irk Culvert and proposed buildings.</i>
10 November 2015	TfGM	<i>To agree the principle of diverting the track drainage into the CSO and the River Irk such that the sewers on Long Millgate can be abandoned.</i>

Table 1- Consultation summary

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2 Surface water drainage

2.1 Existing site drainage

Public sewer records received previously from United Utilities (UU) in January 2014 for this area indicate public combined sewers along Corporation St (1850 Brick, 640x500 Vitreous clay and 900x600 Vitreous clay) and Long Millgate (400x300 CO and 300 VC) to the South-East boundary. There is also a public combined sewer overflow (CSO) currently indicated in Long Millgate with a large sleeved overflow (1220x864 sleeve with sliplined 450 VC) discharging into the River Irk culvert towards and within the South-West boundary.

The River Irk culvert itself is a large brickwork arched section that traverses beneath the site from North-East to South-West. The precise construction details of the River Irk are being investigated via trail hole surveys to determine construction dimensions (in particular to confirm culvert thickness and buttress locations), structural integrity and precise location. An internal 3D digital dimensional survey has been carried out to confirm the route of the River Irk culvert.

UU has indicated that its public sewer records in this area are likely to be inaccurate with respect to pipe sizes, depths and connectivity. UU believes that the ‘combined’ sewers in Long Millgate are probably only serving highway storm drainage picking up gully connections. UU is unsure if the known CSO is actually functional, and Arup is aware from a previous inspection of the culvert that a further two outfall pipes are present within the Irk culvert structure at the North-East end of the site (adjacent to Cheetham Hill Rd), suggesting the potential for a further two CSO structures not recorded on the public sewer records. These could possibly be two former CSO chambers on Corporation Street / Miller Street but again UU is not clear if they still function and will require investigation to confirm.

A CCTV and connectivity drainage survey is planned to determine location, levels and condition of existing drainage in and around the boundary of the site (particularly in Corporation St) to determine the extent of drainage to be abandoned and better understand the site drainage regime.

The former use of the site was as car parking and more recently, it has been used as a temporary site compound for the Victoria Station Roof project.

The site is predominantly hard-standing with the main central area (Catchments B and C in **Figure 2**) drainage directly to the River Irk via a historic network of buried (un-attenuated) drainage. There are also two areas of car parking to the east of Long Millgate (Catchment A) next to Corporation Street which are also surfaced and understood to drain directly to the highway drainage in Long Millgate. Refer to **Figure 2**.

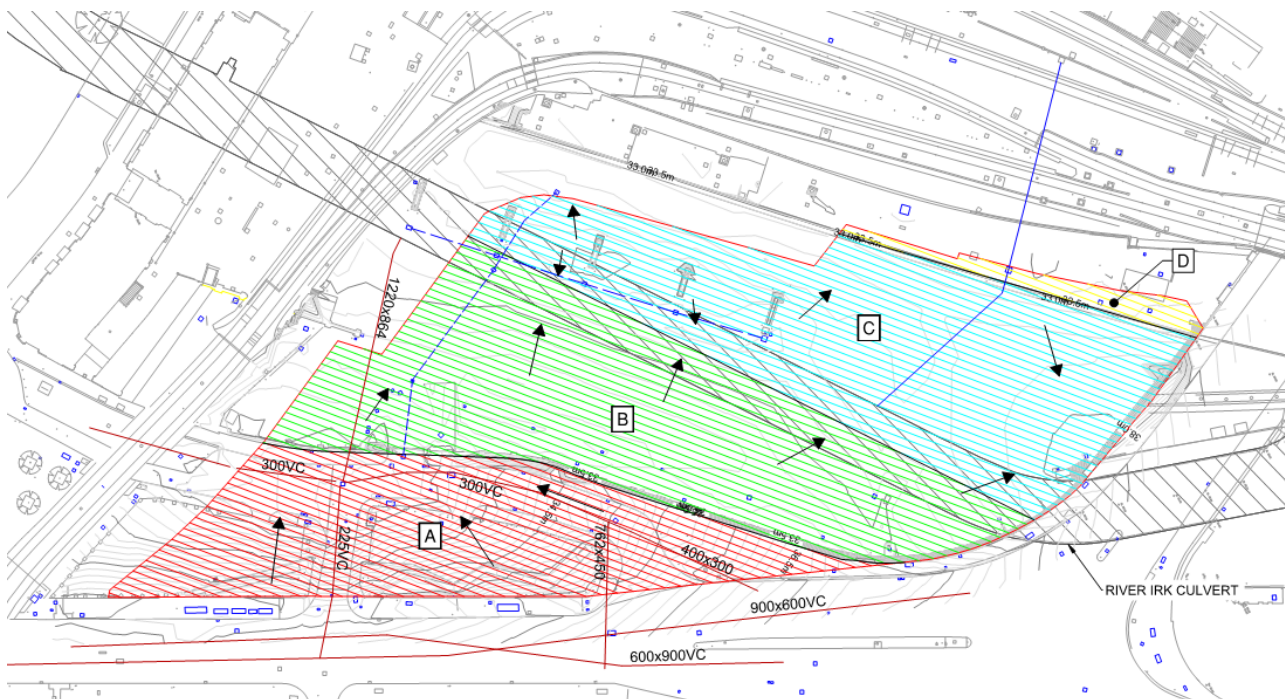


Figure 2 - Site catchments (with arrows showing directions of existing overland flow)

To the west (adjacent to the station), there is a small area of previously developed land that formed railway sidings (Catchment D). This has been assumed to infiltrate and therefore a Greenfield runoff rate has been assumed.

The existing site catchments have been assessed and split by catchment area and surface type as shown in **Figure 2**. An assessment of the total runoff has been made by reviewing surface type and the presence of any historic sewer network (if actively drained). Varying coefficients of runoff have been applied to determine an overall assessment of the 1:2 year runoff rate which represents the pre-development case. Catchments and flows are summarised in **Tables 2 & 3** below.

Catchment	Area (ha)	Basis	Run-Off Coefficient	1:2 Year Runoff Q2 (l/s)	Notes
A	0.22	Impermeable	0.85	17.3	Majority hardstanding surfaced car park area. Run-off collected by United Utilities network in Long Millgate.
B	0.31	Impermeable	0.85	24	Surfaced car park with gullies and drainage network. Condition of drainage network unknown.
C	0.30	Impermeable	0.85	23.3	Surfaced car park with gullies and drainage network. Condition of drainage network unknown.
D	0.02	Greenfield	-	0.10	Unsurfaced - assumed to infiltrate
Totals	0.84			64.7	

Table 2 - Estimated 1:2 year site flows

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The modified rational method have also been used to derive flows for the 1in30 and 1in 100 year storm return periods to allow comparison with the proposed drainage system to be made, and used to set discharge limits for the future development as discussed in **Section 2.3**.

Storm return period (year)	Site Runoff (l/s)
2	65
30	123
100	157

Table 3 - Existing site runoff for varying return periods

2.2 Assumptions

For the purpose of this initial drainage strategy the following assumptions have been made:

- For existing drainage assets, runoff coefficients of 0.85 have been applied to reflect the hardstanding areas.
- There are no constraints to drainage discharge in terms of network capacity – this has been confirmed in discussion with UU.
- It is envisaged infiltration drainage cannot be achieved due to a combination of ground conditions (awaited) and proximity to proposed buildings
- Surface water discharges will be reduced to at least 50% of existing runoff rates in order to meet the aims of Manchester's Strategic Flood Risk Assessment (SFRA) User Guide and National Planning Policy Framework. This has been agreed in consultation with MCC.
- Site drainage will remain private so design / construction does not need to be to adoptable standard, although adoptable standards will be incorporated where practical.

2.3 Proposed surface water drainage

In accordance with Building Regulations, a hierarchy of drainage discharge options has been considered for surface water discharge. These options are discussed in the following sections with justifications of the options chosen and reasons why others were discounted.

- **Disposal of surface water via infiltration:**

A soakaway test to BRE365 will be undertaken to determine if the ground may be able to accommodate infiltration. However, due to the close proximity of the buildings and the River Irk culvert, areas suitable for infiltration are limited while maintaining sufficient distance from the structures. Therefore, infiltration will not provide the only means of surface water discharge for the scale of the site. Other discharge options will provide the main means of discharge but infiltration will continue to be considered as a means of discharging a proportion of the surface water from the site subject to infiltration, contamination testing and assessment.

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- **Discharge to watercourse:**

The closest body of water to the site is the River Irk, which lies beneath the site. This is a viable solution which is consistent with the drainage outfall solution recently installed for the Victoria Station new roof works and with the former drainage regime of the site.

- **Discharge to surface water sewer:**

Drainage records obtained from United Utilities (see **Figure 3**) show a CSO through the site is classified as a surface water sewer. The scheme proposes to re-use the downstream length of this connection to drain a proportion the new scheme at location A (**Figure 3**) as shown on drawing **VSM-ARP-SW-LA-CD-200** which then discharges to the River Irk. This principle has been agreed with UU and negates the need to make a new outfall connection to the River Irk Culvert from the southern side by re-using the existing connection.

- **Discharge to combined sewer:**

This is viable due to the presence of UU combined sewers in Corporation Street and Long Millgate. However, it has been dismissed in preference of the options described above.

The hierarchy for disposal of surface water as described in Requirement H3 of the Building Regulations (2000) will therefore be followed. Consequently, it is proposed that the River Irk culvert will be the accepted point of discharge for the management of surface water runoff from the development. CCTV investigations are ongoing (as of Feb 2015) to confirm the precise points of discharge to the River Irk and their condition to determine whether they can be reused by the new system.

The proposed drainage layout for New Victoria is given on Arup drawing **VSM-ARP-SW-LA-CD-200**. This has been developed and hydraulically modelled using WinDES Microdrainage software in order to size the network, derive initial pipe sizes and drainage depths and confirm the discharge limits can be achieved. Outputs are given in **Appendix A**. This design shall be further refined prior to construction.

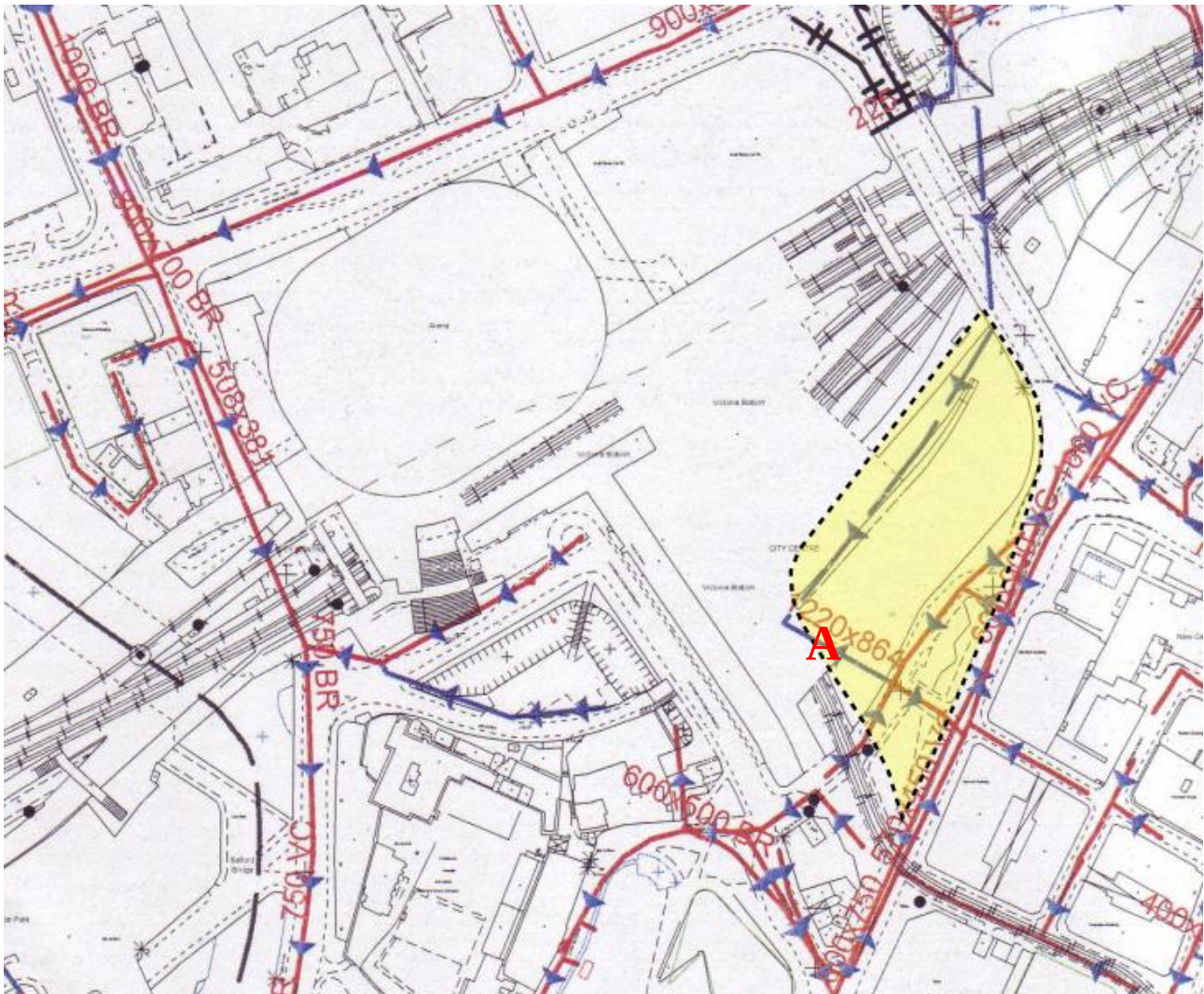


Figure 3 - Extract of UU Sewer Records

The surface water drainage systems have been designed as traditional gravity systems for each building (and associated external hardstandings) to convey the flows occurring during a 1 in 2 year return period rainfall event without surcharge in the pipework and without flooding during a 1 in 30 year return period rainfall event. Drainage systems and site levels are designed such that buildings do not flood during a 1 in 100 year return period plus 20% climate change rainfall event in accordance with NPPF requirements.

Siphonic roof drainage systems are not anticipated – initial proposals are based on surface water runoff from rainwater pipes (RWPs) and channel drainage. It has been assumed that main surface water drain runs can be routed between proposed pilecaps at lower ground level, and that RWPs / public realm deck channel drain outlets can be routed down to these lower ground level networks adjacent to column locations; minimising deck construction thickness above to maintain headroom clearances below.

As the site is located in a 'Critical Drainage Area', the discharge rate permitted to the River Irk will be limited to 50% of the pre-development discharge rates as a maximum utilising, where practical, the existing connection points.

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This surface water management strategy will require the provision of independent on-site attenuation structures and outflow control devices (e.g. Hydrobrakes) to achieve agreed discharge rates. The attenuation is likely to be provided in the form of underground tanks, geo-cellular structures or oversized pipes, supplemented with SuDs in above ground landscaping and hardstanding areas with the above hydraulic performance and flood resistance criteria, i.e.:

- The underground tanks will be sized to ensure the 1 in 30 year event can be stored as a minimum without flooding anywhere in the network and without exceeding the agreed permissible discharge rates.
- In addition to the above, NPPF requires that the surface water runoff for all events up to the 1 in 100 year plus climate change (20% in this case) storm be retained on site and attenuated to the same discharge rates. An additional storage volume will be necessary to comply with this and can be achieved by incorporating guidance on designing for exceedance such as CIRIA C635 Report. This further storage could be provided through a combination of increased underground storage (if necessary) and controlled local and temporary exceedance flooding of external landscaped and hardstanding areas ensuring building floor levels are not compromised by this flooding.

The design will incorporate oil separators in accordance with Environment Agency, Pollution Prevention Guidelines PPG3 – Use and design of oil separators in surface water drainage systems (April 2006).

2.3.1 Drainage Abandonments

The scheme proposes to abandon the following public sewers (shown in **Figure 3**) that are present adjacent to and within the site as part of a Section 116 agreement:-

- Existing UU 300VC and 225VC combined sewers within long Millgate (and from below the TfGM tramline), which drain into the Corporation Street combined sewer.
- A combined sewer overflow (CSO) chamber within the Long Millgate overflowing via a 450mm diameter pipe (within a 1220 x 864mm pipe) to the River Irk culvert.

2.3.2 Proposed SW Flows

The proposed surface water system shall provide a 50% reduction in flow compared to the former use if the site as summarised in **Table 4** below. The basis for this has been discussed with Manchester City Council.

Storm return period (year)	Pre-development discharge rate (l/s)	Discharge limit (l/s) to provide a 50% reduction beyond existing	WinDES Modelled discharge rate (l/s)	% site reduction from existing
2	65	32	29	55%
30	123	61	47	62%
100	157	-	-	
100 + 20% CC	-	79	64	59%

Table 4 – Proposed Peak Discharge Rates

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2.3.3 Climate Change Allowances

The scheme has been designed such that if the 1in100 year storm intensity increased by 20%, then peak discharge rates would be below the existing 1in100 year rates (without climate change allowances). This allowance has based on a design life of 60 years, in accordance with NPPF and PPS25 methodology as per **Table 5** from the NPPF Technical Guidance document extracted below.

Table 5: Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

Table 5 - Climate change recommended allowances from NPPF

2.3.4 Proposed SW Attenuation Requirements

The estimated attenuation volumes necessary to comply with the above design are estimated in **Table 6** below:

Block (inc. associated external hardstanding areas)	Estimated 100 year annual probability plus 20% climate change return period volume (m ³)
1	40
2	60
Office	80

Table 6 - Estimated development attenuation volumes based on anticipated permissible discharges to the River Irk

The 100 year attenuation volume has been used in the Development Appraisal but further refinement of external landscaping areas and localised use of SuDs will be explored during detailed design such that some of this exceedance volume can be stored above ground within the site in external areas away from building footprints. See **Section 2.4** below for details.

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In areas where there is a risk of oil contaminating the drainage from the site, Class 1 bypass oil separators have been specified in order to reduce potential contaminants.

2.4 SuDs and Multifunctional Green Infrastructure

The surface water drainage scheme will incorporate green infrastructure where practical to further reduce runoff rates. Proposed potential solutions for the inclusion of sustainable drainage systems (SuDs) include above ground storage within soft landscaping, profiling of levels within public realm areas to fall into French Drain gravel strips and bio-retention tree pit drainage; these would overflow to the main drainage system when full. These would be used in addition to traditional attenuation provided within the drainage network through construction of buried attenuation tanks and oversizing of main pipe runs.

Development proposals do not support the use of rainwater harvesting as relative roof footprints are small in comparison to the height of buildings. Green roofs were considered but found not to be viable. The residential blocks have roof terrace gardens which provide amenity provision for the residents and, hence, would not be suitable for the storage of rainwater; the office roof space is utilised for plant.

The areas identified as having potential for SuDs are shown in green on **Figure 4** (areas identified above the culvert location would only be suitable for shallow landscaping).



Figure 4 - Landscape masterplan (Planit)

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The ability to use wide scale SuDs techniques across the entire site is limited by the following factors:-

- a) The need to provide car/cycle parking and circulation space which limits the extent of soft landscaping that is possible on the site;
- b) Ground Issues - Desk study and historical ground investigation data indicates contamination to be present on the site. This includes heavy metals, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Extents are not known but it is anticipated likely to be 'hotspots'. Further ground investigation is planned to allow further assessment of contamination risks present at the site within the existing ground. The presence of historic obstructions and former foundations may also compound this;
- c) The River Irk flows in culvert beneath the site and is a controlled water. A soakaway would introduce a potential contaminant pathway and needs further assessment (and discussion with regulator) following completion of planned ground investigation to determine if use is acceptable.
- d) Close proximity of buildings and the presence of the River Irk Culvert and supporting culvert structure. Site investigation has shown the top of this structure is relatively shallow beneath ground level (typically 1.5m bgl) which limits the ability to introduce SuDs or soft landscaping due to cover depth in vicinity of the culvert.

Soakaway tests will be carried out to BRE Digest 365 to determine the viability of the ground to infiltrate in discrete areas away from buildings and where contamination is not an issue. Overall, SuDs will be used in specific areas where they can be delivered to further reduce post development runoff and provide environmental enhancements within public realm areas.

A summary of the proposals with respect to sustainable drainage is:-

1. Below ground drainage infrastructure sized to provide a 50% reduction compared to the existing 1:100 year run-off flow rates (with an allowance for climate change).
2. Localised planting will be promoted to increase interception and transpiration.
3. Bio-retention tree pits, French drains and soft landscaping will be promoted (see **Figure 5**). These will be connected to the drainage network so they can overflow into the River Irk. These can be used where slot drainage channels are in close proximity to trees and will lead to a reduction in overall contributing catchment area drained to the River Irk.
4. In areas where there is a risk of oil contaminating the drainage from the site, Class 1 bypass oil separators have been specified in order to reduce potential contaminants which could otherwise reach the River Irk. This can be also viewed as a positive contribution towards the Water Framework Directive (2000/60/EC) to prevent deterioration of water bodies and improve or maintain their water quality as the previous car park is believed to discharge surface water unattenuated and without oil interception.
5. A former United Utilities Combined Sewer Overflow from the combined sewer on Corporations Street will be abandoned. This reduces the risk of unacceptable intermittent discharges (UID) from this CSO.



Figure 5 - Example Bio-retention tree pits

Refer to landscape Architects proposals for additional green infrastructure proposals.

3 Proposed foul water drainage

The most economically advantageous and sustainable means of disposing of foul water is to discharge to the nearby public combined sewers in Corporation St. Unfortunately, the proposed ground floor levels and construction depths (for utilities and channel drainage) for the public realm walkways do not permit traditional gravity foul networks at ground floor level.

There is the potential that the existing combined sewer in Corporation St is deep enough to still permit gravity connections to be performed from a new foul sewer network installed at lower ground level, necessitating coring through of the Long Millgate wall retaining structure and deep highway excavations across Corporation St. CCTV survey investigations will need to be completed before this option can be fully evaluated. However, at this stage, our proposals assume pumping will be required.

On this basis, internal foul water sewer connections will be routed internally where necessary via suspension within ground floor ceiling voids to suitable plant risers / columns before connecting to the lower ground floor gravity foul sewer network. Internal drain connections at high level will be maintained internally by rodding eyes that are installed at the head of each suspended drain run and at all changes of direction (in conjunction with the requirements BS EN 12056 AD H). These gravity foul sewer networks will then discharge to the associated proprietary foul pumping station serving each 'block' (subject to space availability and hazard zoning requirements).

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Rising mains will then lift flows to ground floor level and will be routed within ground floor public realm walkway service zones before connecting to discharge break chamber manholes within Corporation St, prior to final gravity discharge into the public combined sewers in Corporation St.

The Discharge Unit (DU) method described in BS EN 752 / BS EN 12056 will be used to evaluate the peak design flow in each pipe. At this stage the number of foul appliances is unknown so estimates on foul flow rates have been made based on gross floor areas and anticipated occupancy rates for the purpose of the initial design proposals.

Soil vent pipes will need to be provided at the head of each foul network (location to be agreed with the architect).

A preliminary foul drainage layout for New Victoria is given on Arup drawing **218128-C-SK021**.

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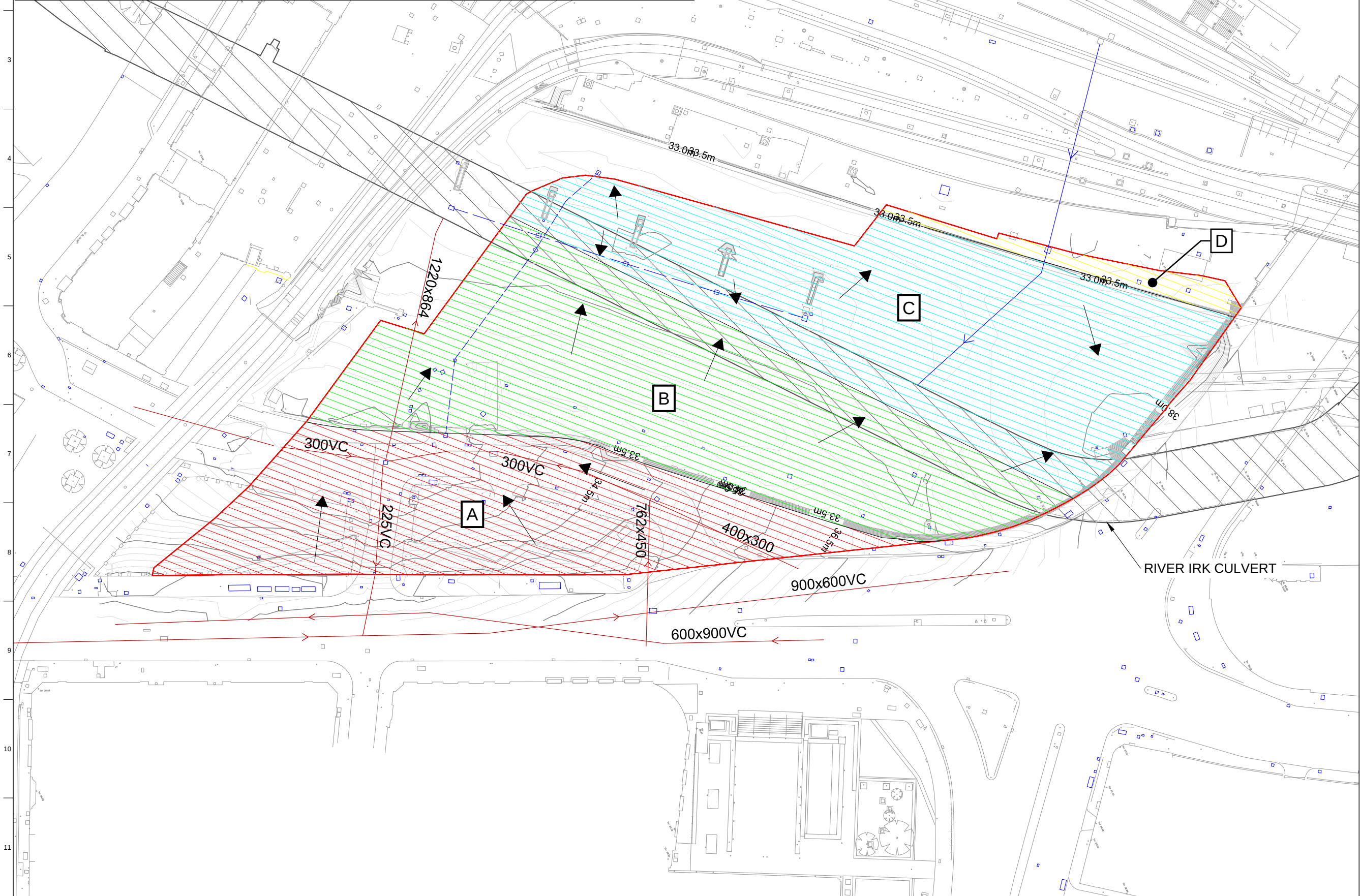
Date 17 February 2016

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Drawings

Catchment	Area (ha)	Basis	Run-Off Coefficient	1:2 Year Runoff Q2 (l/s)	Notes
A	0.22	Impermeable	0.85	17.3	Majority hardstanding surfaced car park area. Run-off collected by United Utilities network in Long Millgate.
B	0.31	Impermeable	0.85	24	Surfaced car park with gullys and drainage network. Condition of drainage network unknown.
C	0.30	Impermeable	0.85	23.3	Surfaced car park with gullys and drainage network. Condition of drainage network unknown.
D	0.02	Greenfield	-	0.10	Unsurfaced - assumed to infiltrate
0.84				64.7	

Runoff (l/s)	Return period
65	Q2
123	Q30
157	Q100
205	Q100+30%



- Notes:
- Topographic Survey provided by Survey Systems Limited, 2008.
 - The purpose of this drawing is to define the existing surface water drainage catchments and overland flow directions of the New Victoria site.

- Key:
- Site Boundary
 - Contours
 - United Utilities Drainage
 - Network Rail Outfall
 - Historic Car Park Drainage
 - Gully
 - Flow Arrow

A	13/10/15	ST	TS	TS
Issue	Date	By	Chkd	Appd

ARUP

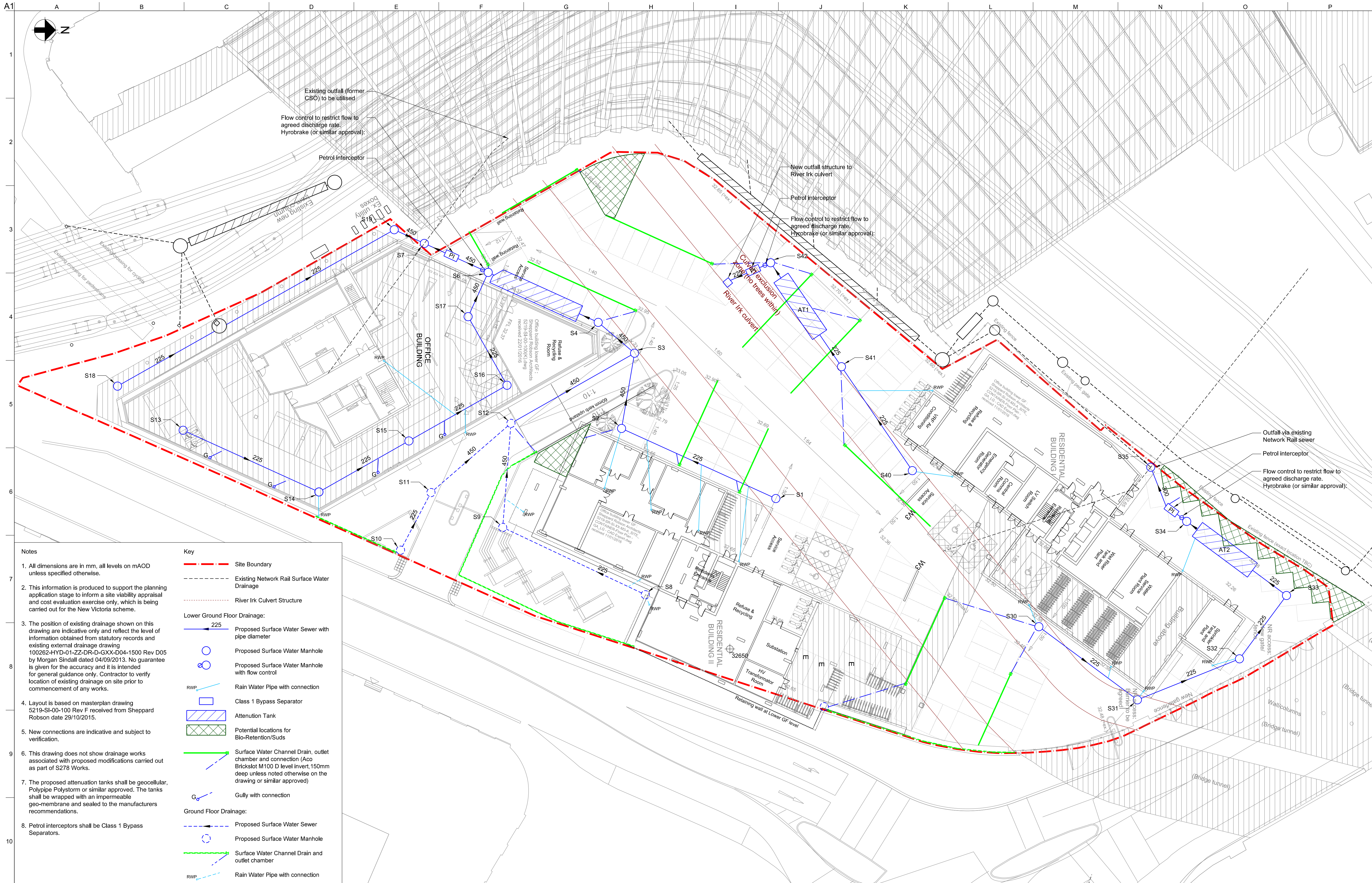
Client
Muse Developments

Job Title
New Victoria

Drawing Title
Existing Surface Water
Drainage and Catchments

Scale at A1
Not to scale
Discipline
Civil
Drawing Status
Planning

Job No 218128	Drawing No 218128-C-SK013	Issue A
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Notes

- All dimensions are in mm, all levels on mAOD unless specified otherwise.
- This information is produced to support the planning application stage to inform a site viability appraisal and cost evaluation exercise only, which is being carried out for the New Victoria scheme.
- The position of existing drainage shown on this drawing are indicative only and reflect the level of information obtained from statutory records and existing external drainage drawing 100262-HYD-01-ZZ-DR-D-GXX-D04-1500 Rev D05 by Morgan Sindall dated 04/09/2013. No guarantee is given for the accuracy and it is intended for general guidance only. Contractor to verify location of existing drainage on site prior to commencement of any works.
- Layout is based on masterplan drawing 5219-SI-00-100 Rev F received from Sheppard Robson date 29/10/2015.
- New connections are indicative and subject to verification.
- This drawing does not show drainage works associated with proposed modifications carried out as part of S278 Works.
- The proposed attenuation tanks shall be geocellular, Polypipe Polystorm or similar approved. The tanks shall be wrapped with an impermeable geo-membrane and sealed to the manufacturers recommendations.
- Petrol interceptors shall be Class 1 Bypass Separators.

Key

Site Boundary

Existing Network Rail Surface Water Drainage

River Irk Culvert Structure

Lower Ground Floor Drainage:

Proposed Surface Water Sewer with pipe diameter

Proposed Surface Water Manhole

Proposed Surface Water Manhole with flow control

Rain Water Pipe with connection

Class 1 Bypass Separator

Attenuation Tank

Potential locations for Bio-Retention/Suds

Surface Water Channel Drain, outlet chamber and connection (Aco Brickslot M100 D level invert, 150mm deep unless noted otherwise on the drawing or similar approved)

Gully with connection

Ground Floor Drainage:

Proposed Surface Water Sewer

Proposed Surface Water Manhole

Surface Water Channel Drain and outlet chamber

Rain Water Pipe with connection

02	10/02/16	AS	ST	AJ
Updated Following New Masterplan				
01	06/11/15	AS	AJ	TS
First Issue				
Issue	Date	By	Chkd	Appd

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Client
Muse Developments

Job Title
New Victoria Station

Scale at A1
1:250

Discipline
Civils

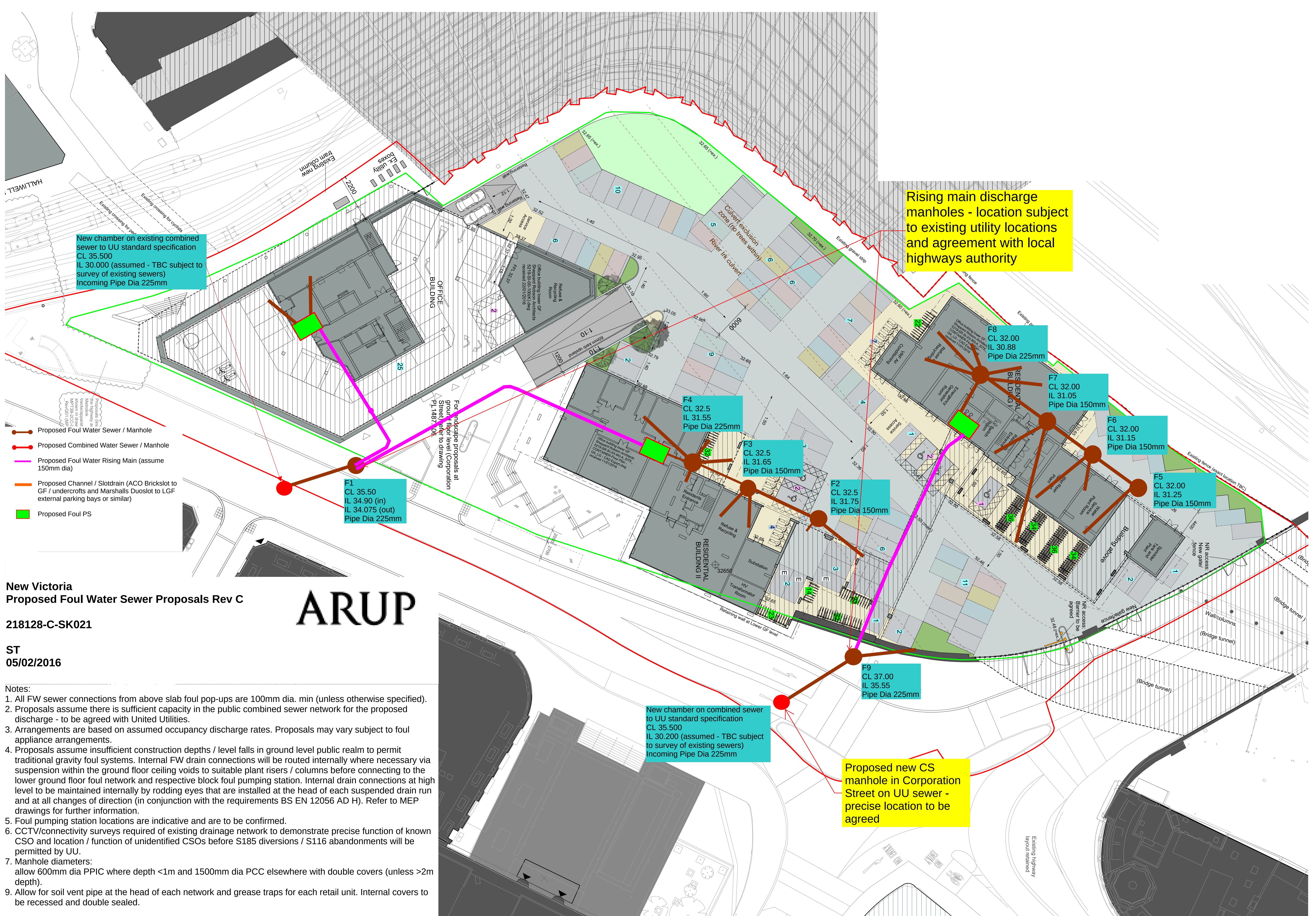
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218128-00

Drawing Status
Draft

Drawing No
VSM-ARP-SW-LA-CD-200

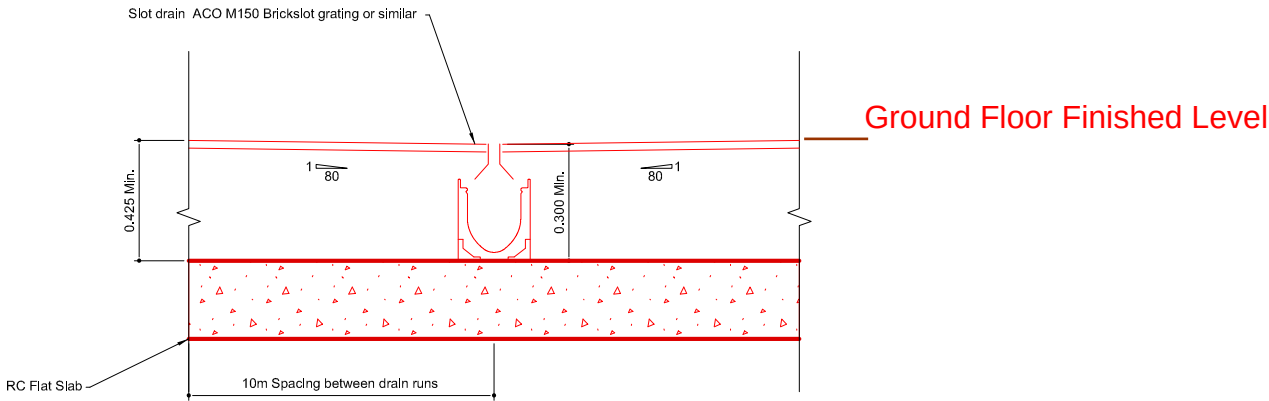
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02

Proposed Drainage Layout

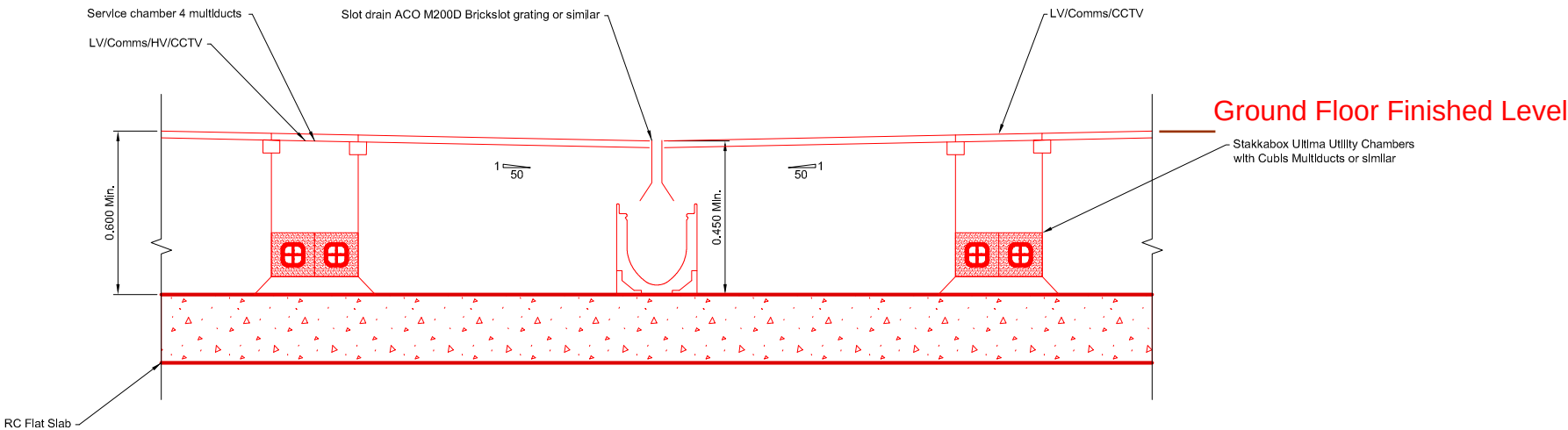


Drawing provided for initial costing and site appraisal purposes only. Not to be used for tender or construction

- Notes
1. Dimensions shown are minimum requirements for feasibility purposes only. Actual slab depth will depend on public realm finishes, structural and utility requirements.
 2. Proposals assume only foul rising mains will be routed through the ground floor level public realm deck / walkway structures with all gravity drainage either at lower ground level or beyond the public realm deck.



Section Above Public Realm Deck (No Utilities)
Scale 1:10



Section Above Public Realm Deck (With Utilities)
Scale 1:10

ARUP

New Victoria
Drainage Channel
Section Proposals
Rev A

218128-C-SK022

WJW
02/04/2015

Subject New Victoria – Surface and Foul Water Drainage Strategy

Date 17 February 2016

Job No/Ref 218128

Appendix A – WinDes Microdrainage Model Outputs

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The Arup Campus Blyth Gate Solihull B90 8AE		
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm 1S

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.358	Maximum Backdrop Height (m)	3.000
Maximum Rainfall (mm/hr)	75	Min Design Depth for Optimisation (m)	0.600
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Storm 1S

- Indicates pipe length does not match coordinates

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S8.000	27.020	0.270	100.0	0.055	5.00	0.0	0.600	o	225	
S8.001	13.131	0.089	147.5	0.032	0.00	0.0	0.600	o	450	
S9.000	11.806	0.118	100.0	0.012	5.00	0.0	0.600	o	225	
S9.001	15.347	0.153	100.0	0.011	0.00	0.0	0.600	o	450	
S10.000	23.002	0.230	100.0	0.038	5.00	0.0	0.600	o	225	
S10.001	15.148	0.151	100.0	0.038	0.00	0.0	0.600	o	225	
S9.002	20.715	2.893	7.2	0.000	0.00	0.0	0.600	o	300	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.000	58.10	5.34	31.500	0.055	0.0	0.0	0.0	1.31	52.0	8.7
S8.001	59.09	5.13	31.005	0.000	17.0	0.0	0.0	1.67	265.9	17.0
S9.000	59.00	5.15	33.800	0.012	0.0	0.0	0.0	1.31	52.0	1.9
S9.001	58.41	5.28	33.457	0.023	0.0	0.0	0.0	2.03	323.4	3.7
S10.000	58.34	5.29	34.000	0.038	0.0	0.0	0.0	1.31	52.0	6.0
S10.001	57.46	5.49	33.770	0.076	0.0	0.0	0.0	1.31	52.0	11.8
S9.002	57.21	5.54	33.303	0.099	0.0	0.0	0.0	5.91	417.8	15.4

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Network Design Table for Storm 1S

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S8.002	6.846	0.046	150.0	0.018	0.00	0.0	0.600	o	450	
S8.003	8.012	0.053	150.0	0.028	0.00	0.0	0.600	o	450	
S8.004	9.520	0.063	151.1	0.000	0.00	0.0	0.600	o	450	
S11.000	21.703	0.145	150.0	0.012	5.00	0.0	0.600	o	225	
S11.001	15.053	0.100	150.0	0.042	0.00	0.0	0.600	o	225	
S11.002	16.438	0.110	150.0	0.090	0.00	0.0	0.600	o	225	
S11.003	11.387	0.076	150.0	0.000	0.00	0.0	0.600	o	225	
S11.004	7.122	0.041	175.7	0.000	0.00	0.0	0.600	o	450	
S8.005	10.321	0.069	150.0	0.008	0.00	0.0	0.600	o	450	
S12.000	46.312	0.370	125.2	0.023	5.00	0.0	0.600	o	225	
S12.001	3.910	0.039	100.3	0.004	0.00	0.0	0.600	o	450	
S8.006	10.000#	0.013	769.2	0.000	0.00	0.0	0.600	o	450	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.002	56.91	5.61	30.260	0.118	17.0	0.0	0.0	1.66	263.6	35.1
S8.003	56.56	5.69	30.215	0.146	17.0	0.0	0.0	1.66	263.6	39.4
S8.004	56.15	5.79	28.600	0.146	17.0	0.0	0.0	1.65	262.7	39.4
S11.000	58.12	5.34	30.800	0.012	0.0	0.0	0.0	1.07	42.4	1.9
S11.001	57.07	5.58	30.655	0.054	0.0	0.0	0.0	1.07	42.4	8.3
S11.002	55.98	5.83	30.555	0.144	0.0	0.0	0.0	1.07	42.4	21.8
S11.003	55.25	6.01	30.445	0.144	0.0	0.0	0.0	1.07	42.4	21.8
S11.004	54.94	6.09	30.144	0.144	0.0	0.0	0.0	1.53	243.4	21.8
S8.005	54.53	6.19	28.537	0.298	17.0	0.0	0.0	1.66	263.6	61.0
S12.000	56.70	5.66	30.800	0.023	0.0	0.0	0.0	1.17	46.4	3.6
S12.001	56.56	5.69	30.205	0.027	0.0	0.0	0.0	2.03	322.9	4.2
S8.006	53.64	6.42	28.468	0.325	17.0	0.0	0.0	0.73	115.3	64.3

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Manhole Schedules for Storm 1S

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	32.700	1.200	Open Manhole	1200	S8.000	31.500	225				
S2	32.000	0.995	Open Manhole	1350	S8.001	31.005	450	S8.000	31.230	225	
S10	35.000	1.200	Open Manhole	1200	S9.000	33.800	225				
S11	35.000	1.543	Open Manhole	1350	S9.001	33.457	450	S9.000	33.682	225	
S8	35.500	1.500	Open Manhole	1200	S10.000	34.000	225				
S9	35.000	1.230	Open Manhole	1200	S10.001	33.770	225	S10.000	33.770	225	
S12	35.000	1.697	Open Manhole	1350	S9.002	33.303	300	S9.001	33.303	450	
								S10.001	33.619	225	240
S3	33.000	2.740	Open Manhole	1350	S8.002	30.260	450	S8.001	30.916	450	655
								S9.002	30.410	300	
S4	33.000	2.785	Open Manhole	1350	S8.003	30.215	450	S8.002	30.215	450	
SAT3	32.750	4.150	Open Manhole	1350	S8.004	28.600	450	S8.003	30.161	450	1561
S13	32.000	1.200	Open Manhole	1200	S11.000	30.800	225				
S14	32.000	1.345	Open Manhole	1200	S11.001	30.655	225	S11.000	30.655	225	
S15	32.000	1.445	Open Manhole	1200	S11.002	30.555	225	S11.001	30.555	225	
S16	32.000	1.555	Open Manhole	1200	S11.003	30.445	225	S11.002	30.445	225	
S17	32.000	1.856	Open Manhole	1350	S11.004	30.144	450	S11.003	30.369	225	
S6	32.000	3.463	Open Manhole	1350	S8.005	28.537	450	S8.004	28.537	450	
								S11.004	30.104	450	1567
S18	32.000	1.200	Open Manhole	1200	S12.000	30.800	225				
S19	32.000	1.795	Open Manhole	1350	S12.001	30.205	450	S12.000	30.430	225	
S7	32.000	3.532	Open Manhole	1350	S8.006	28.468	450	S8.005	28.468	450	
								S12.001	30.166	450	1698
S	32.000	3.545	Open Manhole	0		OUTFALL		S8.006	28.455	450	

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Area Summary for Storm 1S

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
8.000	User	-	100	0.055	0.055	0.055
8.001	User	-	100	0.032	0.032	0.032
9.000	User	-	100	0.012	0.012	0.012
9.001	User	-	100	0.011	0.011	0.011
10.000	User	-	100	0.027	0.027	0.027
	User	-	100	0.011	0.011	0.038
10.001	User	-	100	0.038	0.038	0.038
9.002	-	-	100	0.000	0.000	0.000
8.002	User	-	100	0.018	0.018	0.018
8.003	User	-	100	0.028	0.028	0.028
8.004	-	-	100	0.000	0.000	0.000
11.000	User	-	100	0.012	0.012	0.012
11.001	User	-	100	0.042	0.042	0.042
11.002	User	-	100	0.090	0.090	0.090
11.003	-	-	100	0.000	0.000	0.000
11.004	-	-	100	0.000	0.000	0.000
8.005	User	-	100	0.008	0.008	0.008
12.000	User	-	100	0.023	0.023	0.023
12.001	User	-	100	0.004	0.004	0.004
8.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.412	0.412	0.412

Simulation Criteria for Storm 1S

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

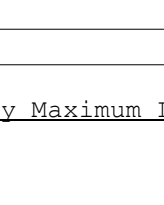
Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm 1S

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S8.000	S1	-0.161	0.000	0.18		8.5	OK	
S8.001	S2	-0.368	0.000	0.08		12.8	OK	
S9.000	S10	-0.196	0.000	0.04		1.8	OK	
S9.001	S11	-0.417	0.000	0.02		3.3	OK	
S10.000	S8	-0.172	0.000	0.12		5.8	OK	
S10.001	S9	-0.150	0.000	0.24		10.9	OK	
S9.002	S12	-0.262	0.000	0.04		14.3	OK	
S8.002	S3	-0.322	0.000	0.18		29.6	OK	
S8.003	S4	-0.316	0.000	0.20		33.2	OK	
S8.004	SAT3	-0.015	0.000	0.08		13.4	OK	
S11.000	S13	-0.193	0.000	0.05		1.9	OK	
S11.001	S14	-0.157	0.000	0.20		7.4	OK	
S11.002	S15	-0.110	0.000	0.51		19.2	OK	
S11.003	S16	-0.108	0.000	0.53		19.1	OK	
S11.004	S17	-0.345	0.000	0.12		19.0	OK	
S8.005	S6	0.035	0.000	0.10		16.4	SURCHARGED	
S12.000	S18	-0.182	0.000	0.08		3.6	OK	
S12.001	S19	-0.403	0.000	0.02		4.1	OK	
S8.006	S7	-0.301	0.000	0.24		18.6	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm 1S

Simulation Criteria

Areal Reduction Factor 1.000	Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0	MADD Factor * 10m ³ /ha Storage 2.000
Hot Start Level (mm) 0	Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500	Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000	

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R 0.360
Region England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000 Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep 2.5 Second Increment (Extended)	
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440	
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S8.000	S1	15 Winter	30	+0%					31.591
S8.001	S2	15 Winter	30	+0%					31.124
S9.000	S10	15 Winter	30	+0%					33.842
S9.001	S11	15 Winter	30	+0%					33.509
S10.000	S8	15 Winter	30	+0%					34.074
S10.001	S9	15 Winter	30	+0%					33.884
S9.002	S12	15 Winter	30	+0%					33.361
S8.002	S3	15 Winter	30	+0%					30.452
S8.003	S4	15 Winter	30	+0%	100/60 Winter				30.417
S8.004	SAT3	60 Winter	30	+0%	30/15 Summer				29.759
S11.000	S13	15 Winter	30	+0%	100/15 Summer				30.853
S11.001	S14	15 Winter	30	+0%	100/15 Summer				30.830
S11.002	S15	15 Winter	30	+0%	30/15 Summer				30.805
S11.003	S16	15 Winter	30	+0%	30/15 Summer				30.678
S11.004	S17	15 Winter	30	+0%	100/60 Winter				30.299
S8.005	S6	60 Winter	30	+0%	2/30 Winter				29.770
S12.000	S18	15 Winter	30	+0%					30.859
S12.001	S19	15 Winter	30	+0%					30.269
S8.006	S7	15 Winter	30	+0%					28.642

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm 1S

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S8.000	S1	-0.134	0.000	0.33		16.1	OK	
S8.001	S2	-0.331	0.000	0.15		25.9	OK	
S9.000	S10	-0.183	0.000	0.08		3.4	OK	
S9.001	S11	-0.398	0.000	0.03		7.0	OK	
S10.000	S8	-0.151	0.000	0.23		11.0	OK	
S10.001	S9	-0.111	0.000	0.50		22.8	OK	
S9.002	S12	-0.242	0.000	0.08		29.6	OK	
S8.002	S3	-0.258	0.000	0.37		60.7	OK	
S8.003	S4	-0.248	0.000	0.41		69.2	OK	
S8.004	SAT3	0.709	0.000	0.10		16.6	SURCHARGED	
S11.000	S13	-0.172	0.000	0.09		3.4	OK	
S11.001	S14	-0.050	0.000	0.42		15.6	OK	
S11.002	S15	0.025	0.000	1.06		39.9	SURCHARGED	
S11.003	S16	0.008	0.000	1.11		39.9	SURCHARGED	
S11.004	S17	-0.295	0.000	0.26		39.6	OK	
S8.005	S6	0.783	0.000	0.10		16.8	SURCHARGED	
S12.000	S18	-0.166	0.000	0.16		6.9	OK	
S12.001	S19	-0.387	0.000	0.05		8.0	OK	
S8.006	S7	-0.276	0.000	0.32		24.5	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm 1S

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S8.000	S1	-0.108	0.000	0.52		24.9	OK	
S8.001	S2	-0.300	0.000	0.24		40.1	OK	
S9.000	S10	-0.173	0.000	0.12		5.3	OK	
S9.001	S11	-0.386	0.000	0.05		10.9	OK	
S10.000	S8	-0.131	0.000	0.36		17.1	OK	
S10.001	S9	-0.074	0.000	0.77		35.3	OK	
S9.002	S12	-0.229	0.000	0.13		45.9	OK	
S8.002	S3	-0.031	0.000	0.31		51.1	OK	
S8.003	S4	0.008	0.000	0.34		58.2	SURCHARGED	
S8.004	SAT3	1.621	0.000	0.10		16.7	SURCHARGED	
S11.000	S13	0.123	0.000	0.16		6.4	SURCHARGED	
S11.001	S14	0.256	0.000	0.61		22.6	SURCHARGED	
S11.002	S15	0.292	0.000	1.58		59.4	SURCHARGED	
S11.003	S16	0.120	0.000	1.64		59.2	SURCHARGED	
S11.004	S17	0.078	0.000	0.23		35.9	SURCHARGED	
S8.005	S6	1.685	0.000	0.10		17.1	SURCHARGED	
S12.000	S18	-0.150	0.000	0.24		10.6	OK	
S12.001	S19	-0.369	0.000	0.07		12.4	OK	
S8.006	S7	-0.259	0.000	0.38		29.1	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm 2S

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	18.312	0.122	150.0	0.040	5.00	0.0	0.600	o	225	
S1.001	9.250	0.061	151.6	0.080	0.00	0.0	0.600	o	225	
S1.002	9.053	0.061	148.4	0.059	0.00	0.0	0.600	o	225	
S1.003	7.006	0.047	150.0	0.067	0.00	0.0	0.600	o	225	
S2.000	17.744	0.118	150.0	0.105	5.00	0.0	0.600	o	225	
S2.001	15.937	0.106	150.0	0.019	0.00	0.0	0.600	o	225	
S2.002	11.450	0.076	150.0	0.011	0.00	0.0	0.600	o	225	
S2.003	11.270	0.075	150.0	0.040	0.00	0.0	0.600	o	225	
S2.004	10.579	0.071	149.0	0.014	0.00	0.0	0.600	o	300	
S2.005	6.079	0.041	150.0	0.000	0.00	0.0	0.600	o	300	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	58.53	5.29	30.800	0.040	0.0	0.0	0.0	1.07	42.4	6.4
S1.001	57.87	5.43	30.678	0.121	0.0	0.0	0.0	1.06	42.1	18.9
S1.002	57.24	5.57	30.300	0.180	0.0	0.0	0.0	1.07	42.6	27.8
S1.003	56.77	5.68	30.239	0.246	0.0	0.0	0.0	1.07	42.4	37.9
S2.000	58.57	5.28	31.300	0.105	0.0	0.0	0.0	1.07	42.4	16.6
S2.001	57.44	5.53	31.182	0.123	0.0	0.0	0.0	1.07	42.4	19.2
S2.002	56.67	5.71	31.075	0.134	0.0	0.0	0.0	1.07	42.4	20.6
S2.003	55.92	5.88	30.999	0.174	0.0	0.0	0.0	1.07	42.4	26.4
S2.004	55.36	6.02	29.800	0.189	0.0	0.0	0.0	1.29	90.9	28.3
S2.005	55.04	6.10	29.689	0.189	0.0	0.0	0.0	1.28	90.6	28.3

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File New Victoria Concept Dr...	Checked by	
XP Solutions		Network 2015.1

Manhole Schedules for Storm 2S

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S40	32.000	1.200	Open Manhole	1200	S1.000	30.800	225				
S41	33.000	2.322	Open Manhole	1200	S1.001	30.678	225	S1.000	30.678	225	
SAT1	32.700	2.400	Open Manhole	1200	S1.002	30.300	225	S1.001	30.617	225	317
S42	32.700	2.461	Open Manhole	1200	S1.003	30.239	225	S1.002	30.239	225	
S43	32.500	2.308	Open Manhole	0		OUTFALL		S1.003	30.192	225	
S30	32.500	1.200	Open Manhole	1200	S2.000	31.300	225				
S31	32.500	1.318	Open Manhole	1200	S2.001	31.182	225	S2.000	31.182	225	
S32	32.500	1.425	Open Manhole	1200	S2.002	31.075	225	S2.001	31.075	225	
S33	32.400	1.401	Open Manhole	1200	S2.003	30.999	225	S2.002	30.999	225	
SAT2	32.200	2.400	Open Manhole	1200	S2.004	29.800	300	S2.003	30.924	225	1049
S34	32.500	2.811	Open Manhole	1200	S2.005	29.689	300	S2.004	29.729	300	40
S35	32.500	2.852	Open Manhole	0		OUTFALL		S2.005	29.648	300	

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Area Summary for Storm 2S

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.040	0.040	0.040
1.001	User	-	100	0.080	0.080	0.080
1.002	User	-	100	0.059	0.059	0.059
1.003	User	-	100	0.067	0.067	0.067
2.000	User	-	100	0.105	0.105	0.105
2.001	User	-	100	0.019	0.019	0.019
2.002	User	-	100	0.011	0.011	0.011
2.003	User	-	100	0.040	0.040	0.040
2.004	User	-	100	0.014	0.014	0.014
2.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.435	0.435	0.435

Simulation Criteria for Storm 2S

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm 2S

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
S1.003	S42	0.073	0.000	0.23		6.9	SURCHARGED	
S2.000	S30	-0.121	0.000	0.42		16.1	OK	
S2.001	S31	-0.112	0.000	0.50		18.6	OK	
S2.002	S32	-0.105	0.000	0.55		19.9	OK	
S2.003	S33	-0.085	0.000	0.69		24.8	OK	
S2.004	SAT2	-0.023	0.000	0.09		5.7	OK	
S2.005	S34	0.083	0.000	0.08		4.9	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm 2S

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S1.003	S42	0.433	0.000	0.23		6.9	SURCHARGED	
S2.000	S30	-0.013	0.000	0.76		28.9	OK	
S2.001	S31	0.032	0.000	0.87		32.5	SURCHARGED	
S2.002	S32	0.049	0.000	0.97		35.1	SURCHARGED	
S2.003	S33	0.038	0.000	1.25		44.9	SURCHARGED	
S2.004	SAT2	0.437	0.000	0.09		6.3	SURCHARGED	
S2.005	S34	0.559	0.000	0.08		4.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm 2S

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
S1.003	S42	0.943	0.000	0.23		6.9	SURCHARGED	
S2.000	S30	0.394	0.000	1.11		42.0	SURCHARGED	
S2.001	S31	0.360	0.000	1.31		49.2	SURCHARGED	
S2.002	S32	0.281	0.000	1.48		53.4	SURCHARGED	
S2.003	S33	0.191	0.000	1.87		67.2	SURCHARGED	
S2.004	SAT2	1.282	0.000	0.10		6.7	SURCHARGED	
S2.005	S34	1.389	0.000	0.09		5.8	SURCHARGED	

Subject New Victoria – Surface and Foul Water Drainage Strategy

Date 17 February 2016

Job No/Ref 218128

Appendix B - Consultation

Arup
3 Piccadilly Place
MANCHESTER
M1 3BN

Our ref: SO/2015/115334/01-L01
Your ref: Simon Tomizzi
Date: 02 October 2015

Dear Sir/Madam

PRELIMINARY PLANNING ADVICE NEW VICTORIA SITE

Thank you for your recent enquiry regarding the above proposed development, which was received 12 September 2015. Having reviewed the submitted information, we would wish to make the following comments.

With reference to the proposed development adjacent to Victoria Station, the developer should carefully consider how repairs or reconstruction of the culvert could take place with the proposed building adjacent to it. The collapse of a relative small structure in comparison on the 'Mancunian Way' is a good example of the disruption and cost involved in repair of an underground structure.

We would also reiterate the importance of ensuring that the exact line and size of the culvert is determined prior construction works and a full structural survey is undertaken.

We would have no objection in principle to the proposed tower blocks either side of the culvert as long as no additional loading is imposed on the culvert and sufficient room is allowed should the culvert require reconstruction during the lifetime of the proposed buildings.

Flood Defence Consents

Under the terms of the Water Resources Act 1991, and the Land Drainage Byelaws, the prior written consent of the Environment Agency is required for any proposed works or structures, in, under, over or within 8 metres of the culvert as the River Irk is designated 'main river'.

The Environment Agency has discretionary powers to carry out maintenance works on the channels of "main river" watercourses to remove blockages and ensure the free flow of water. The responsibility for the repair and condition of the River Irk, its channel, banks and adjacent structures, lies ultimately with the riparian owner.

Please note that this information is based on the information you have provided at this time and if this changes in the future we would need to consider our position again.

I trust you find this comments helpful.

Yours faithfully

Mrs SYLVIA WHITTINGHAM
Planning Advisor

Direct dial 01925 542529

Direct fax 01925 415961

Direct e-mail sylvia.whittingham@environment-agency.gov.uk

Tom Saville

From: Telfer, Helen <helen.telfer@environment-agency.gov.uk>
Sent: 09 October 2015 14:38
To: Simon Tomizzi
Cc: Whittingham, Sylvia
Subject: RE: PRELIMINARY PLANNING ADVICE NEW VICTORIA SITE

Hi Simon

In response to the query regarding surface water drainage, I can confirm that we would refer this to Manchester Council as they are now the responsible body for agreeing surface water discharges.

Please do not hesitate to get in touch should you have further queries.

Kind regards

Helen

Helen Telfer
Planning Advisor
(Manchester, Salford, Trafford and Wigan)

Environment Agency
Sustainable Places Team
Richard Fairclough House
Knutsford Road
Warrington
WA4 1HT

Tel: 01925 542525
Email: helen.telfer@environment-agency.gov.uk
Team Email: SPPlanning.RFH@environment-agency.gov.uk

We are now

Greater Manchester, Merseyside and Cheshire Area

From 1 April 2014 North West South Area has a new name. Covering the same geography, we will continue to work with our partners and customers to help protect and improve the environment.



From: Whittingham, Sylvia
Sent: 09 October 2015 12:21
To: 'simon.tomizzi@arup.com'
Cc: Telfer, Helen
Subject: FW: PRELIMINARY PLANNING ADVICE NEW VICTORIA SITE

Simon, thank you for your email.

For your information my colleague Helen Telfer is the officer covering the Manchester area.

I have copied Helen in on this email and she will be in touch. Helen can be contacted on 01925 542525 or email helen.telfer@environment-agency.gov.uk

Many thanks
Sylvia

Sylvia Whittingham
Sustainable Places Advisor
(Greater Manchester, Merseyside and Cheshire Area)

Telephone: 01925 542529
Email: sylvia.whittingham@environment-agency.gov.uk
Team Email: SPPLANNING.RFH@environment-agency.gov.uk

Environment Agency
Environment, Planning and Engagement
Sustainable Places Team
Richard Fairclough House
Knutsford Road
Warrington
WA4 1HT

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From: Simon Tomizzi [<mailto:Simon.Tomizzi@arup.com>]
Sent: 08 October 2015 16:40
To: Whittingham, Sylvia
Subject: RE: PRELIMINARY PLANNING ADVICE NEW VICTORIA SITE

Hi Sylvia,

Thanks for your response. This is useful advice.

Regarding constructing foundations near to the culvert, we have already specified site investigation works to identify the location of the back of culvert wall on site and are in receipt of a 3d internal survey which has located the internal faces of the irk Culvert along its length.

With respect to demonstrating 'no additional loading' is imposed on the culvert and that sufficient room is allowed should the culvert require reconstruction during the lifetime of the proposed buildings and we would aim to demonstrate these points as part of our planning submission once foundation design are identified – currently envisaged to be a piled solution, extending beyond the bed level of the river into rock. Network Rail as asset owner have also asked for this.

With respect to surface water drainage, would the Agency like to be consulted with respect to agreeing discharge limits for the new site or are you happy to leave this to Manchester City Council? Our general principle is to provide a 50% reduction beyond the former car park surface water discharge rates to account

for the site's location within a CDA. The former car park drained via a piped system into the culvert un-attenuated so we have undertaken calculations to estimate these flows. For the proposed scheme, we may need to relocate the points of discharge into the Irk Culvert to suit the new building locations but these principles would remain as per previous site use but with attenuation/infiltration and flow control to provide this reduction beyond the former peak flow rates. As part of the SI, we are also investigating the viability of infiltration drainage by undertaking site soakaway testing to confirm permeability rates, and incorporate this if technically viable.

We would appreciate the Agency's view on this and whether you would be a consultee on this matter, in which case we could liaise with you now in more detail regarding our drainage proposals?

I look forward to hearing from you.

Kind Regards,

Simon Tomizzi
Engineer | Civil Engineering

Arup
6th Floor 3 Piccadilly Place Manchester M1 3BN United Kingdom
t: +44 161 228 2331
www.arup.com

From: Whittingham, Sylvia [<mailto:sylvia.whittingham@environment-agency.gov.uk>]
Sent: 02 October 2015 16:07
To: Simon Tomizzi
Subject: FW: PRELIMINARY PLANNING ADVICE NEW VICTORIA SITE [Filed 05 Oct 2015 10:19]

Sylvia Whittingham
Sustainable Places Advisor
(Greater Manchester, Merseyside and Cheshire Area)

Telephone: 01925 542529
Email: sylvia.whittingham@environment-agency.gov.uk
Team Email: SPPLANNING.RFH@environment-agency.gov.uk

Environment Agency
Environment, Planning and Engagement
Sustainable Places Team
Richard Fairclough House
Knutsford Road
Warrington
WA4 1HT



NEW: Charging for Planning Advice

As of 3rd March 2014 we have been charging for some of our planning advice. For more information please see our web pages at <http://www.environment-agency.gov.uk/research/planning/33580.aspx> or speak to your local Sustainable Places team.

Follow us on Twitter @EnvAgencyNW

Visit the website - <https://www.gov.uk/environment-agency>

From: Whittingham, Sylvia
Sent: 02 October 2015 15:57
To: 'simon.tomizz@arup.com'
Cc: Telfer, Helen
Subject: PRELIMINARY PLANNING ADVICE NEW VICTORIA SITE

Simon, please find attached our preliminary comments relating to the above site.

Should you have any further queries please don not hesitate to contact me.

Many thanks
Sylvia

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Project title	New Victoria	Job number 218128
Meeting name and number	Initial meeting with United Utilities 001/15	File reference 9 02 04
Location	Sankey House – Warrington North Wastewater Treatment Works	Time and date 2.30 14 October 2015
Purpose of meeting	Discuss modifications to United Utilities assets to accommodate the New Victoria Development	
Present	Simon Tomizzi Danny McDermott	Tom Saville Neil O'Brien
Apologies		
Circulation	Those present	

Action

1. Scheme Overview

TS provided history of the site and overview of proposed development.

Development comprises of two new residential towers and an 8-storey office block. Site constraints include the River Irk culvert running through the site and the adjacent Victoria Station.

2. Stopping up Long Millgate

Arup proposed that all Long Millgate drainage be abandoned in order to accommodate the proposed development.

Manchester City Council have been consulted in regards to the stopping up of Long Millgate and are in agreement with the principle in order to bring forward the project.

NO'B and DM stated abandoning the Long Millgate sewers would be acceptable as long as it is demonstrated that no other flows are entering this network. Survey will be required to confirm possible connections.

UU stated that their knowledge gained from the recent TfGM and station works indicates the sewers do not currently take any foul

Arup (CCTV)

Prepared by Simon Tomizzi

Date of circulation

Date of next meeting If required

Minutes

Project title	Job number	Date of Meeting
New Victoria	218128	14 October 2015

Action

flows and they are likely to only serve the TfGM track drainage and a portion of the (old) railway station roof.

3. Combined Sewer Overflows to River Irk Culvert South CSO

The scheme proposes to abandon the existing Combined Sewer Overflow from Long Millgate to the River Irk culvert.

NO'B noted that a lot of survey work was done as part of the Metrolink works and provided Arup with drawings showing the connectivity of CSO's to the River Irk.

NO'B noted that the pipe is documented as a surface water pipe on UU's records and not an Overflow pipe, meaning different agreements regarding discharge are in place with the EA.

NO'B and DM noted that the "overflow" pipe was only linked with the Long Millgate drainage assets and was not an overflow for the combined sewer in Corporation Street, hence it can be abandoned along with the Long Millgate drainage assets.

In principal UU were generally supportive regarding abandoning the "CSO" from Long Millgate as long as all other flows are diverted away from the network, and of abandoning assets that were no longer needed.

NO'B suggested retaining the downstream section of the "CSO" pipe for use by the scheme as part of a future drainage strategy, which could also be used as a new connection for the Metrolink track drainage via a new connection (see Section 4).

DM stated that if a section of "CSO" is to be maintained and used as part of the proposed drainage strategy, Arup should submit a Pre Development Enquiry, stating the proposed flow rates.

UU stated they would apply the same criteria as per current MCC guidance regarding offsite flows (i.e. a 50% reduction in site run-off as the site is in a Critical Drainage Area). Arup discussed the methodology of using a conservative run-off coefficients for the car parked area to account for the condition of the old drainage network (unknown).

Central CSO

This is understood to be part of the Long Millgate sewers system so can be abandoned. Arup drainage survey to confirm if there is any small areas of highway around the top of Corporation Street that would need re-routing.

Minutes

Project title	Job number	Date of Meeting
New Victoria	218128	14 October 2015

Action

North CSO

This is part of the Corporation Street sewer system and is required as part of the sewer network. *No anticipated impact on scheme.*

4. **Diverting Metrolink Track Drainage (and small highway catchment and existing Victoria Station Roof drainage) away from site**

The scheme proposes a “pipe-jacking” solution to send incoming Metrolink track drainage away from the site into the UU network on the south side of the tram lines.

NO'B stated that UU would not be obliged to take the track drainage and that their preference was to send this through our site via a new connection to the existing “CSO” pipe. Examples were noted where pipes such as these had been “anchored to the sides of buildings or squeezed in between walls”.

It was noted that this proposed pipe connection would be a TfGM asset (not UU) and private pipe, hence UU easements and access requirements would not apply.

Arup to investigate viability of this option and discuss with TfGM. An agreement for access would be required between Muse/TfGM.

Arup

NO'B stated that if it was unviable to connect the track drainage to the “CSO” then UU would consider the pipe jacking option and take track drainage into their network as they are already doing so elsewhere.

5. **Other Notes**

N'OB stated that Ian Wylie (UU) had a very good understanding of Long Millgates' drainage and Arup should contact Ian to see if he holds additional site information.

Arup

Minutes

ARUP

Project title	New Victoria	Job number	218128
Meeting name and number	Drainage Meeting Arup/MCC	File reference	9-02-04
Location	Town Hall Extension	Time and date	1.30 22 October 2015
Purpose of meeting	To discuss basis for surface water drainage strategy		
Present	Zorica Todorovic - MCC Flood Risk & Drainage Officer Tom Saville - Arup		
Apologies			
Circulation	Those present,+ Planit (Landscape Architect)		

Action

1. Introductions

TS summarised the development proposals of two new residential blocks and an office tower adjacent to Corporation Street and tabled plans. TS have project background and explained the scheme proposals were to stop up Long Millgate, and for buildings to avoid building over the River Irk which runs beneath the site in a culvert.

2. Previous liaison

TS explained that Arup have met with United Utilities who are in agreement with proposals to abandon the existing CSO that runs through the site and drainage associated with Long Millgate. Arup also noted that consultation with EA/Network rail was underway regarding the River Irk Culvert and that the EA had confirmed that they would be happy to leave negotiations on SW drainage strategy to be carried out directly with MCC.

Note

3. Site Investigation

TS noted that a CCTV drainage survey, SI, trial pits to confirm the location of the Irk culvert walls and a utilities tracing survey had been planned and were due to start imminently.

Note

Prepared by Tom Saville
Date of circulation 04 Nov 2015
Date of next meeting TBA

Minutes

Project title	Job number	Date of Meeting
New Victoria	218128	22 October 2015

Action

4. SW Drainage Strategy

4.1 TS summarised the anticipated drainage strategy that is being developed which follows the SuDs hierarchy and proposes to discharge surface water to the River Irk and is assessing the viability of use of SuDs to control and reduce discharge rates. The process Arup are following was outlined as:-

- Calculate site runoff pre-scheme using Modified runoff method based on the pre-development car park use, with some small areas acting as greenfield (near Metrolink where not formerly positively drained).
- Check resulting runoff rates are within those of typical brownfield rates of 140l/s/ha and within the capacity of the pipe that discharged them to the Irk historically.
- Provide a min 50% reduction against the 1:100 year proposed scheme flow when compared to pre-developed case. This reflects the requirements of the SFRA since the site sits within Manchester's Critical Drainage Area.

Arup

4.2 ZT noted that using a 0.85 runoff coefficient for a typical car park was acceptable for pre-scheme calculations.

4.3 ZT requested that the scheme should incorporate the use of SuDs in areas of the masterplan where they can be readily used (or alternatively the scheme design should demonstrate why it is not technically able to do so). ZT noted that new guidance requires SuDs should be used where possible and MCC were keen to see them prompted on city centre schemes to help raise quality of the City's public realm as they are being taken forward in other cities such as Bristol and Cardiff. Examples discussed were French drains, green tree pits for landscape drainage, bio-retention tree pits, perhaps with an overflow into the main drainage network etc.

Arup/Planit(Landscape Architect)

4.4 TS noted the potential for these (away from the culvert which is relatively shallow) and that soakaway tests were planned as part of the forthcoming SI. However, it is envisaged soakaway drainage a solution on its own is unlikely to work site wide and that an outfall to the Irk would still be required, along with considering other SuDs approaches.

4.5 ZT had no objection to the scheme's SW drainage discharging via the existing CSO on the site if the downstream stub of it were retained on site and used for TfGM's drainage connection to the River Irk (as per UU's preference). This connects directly to the

Minutes

Project title	Job number	Date of Meeting
New Victoria	218128	22 October 2015

	Irk and would negate the need for a new connection into the Irk Culvert wall.	Action
4.6	ZT suggested the scheme drainage design should be checked against DEFRA's principles set out in the Non-Statutory Technical Standards for Sustainable Drainage.	Arup
4.7	ZT suggested that the use of bio retention drainage could be offset against savings made by omitting some petrol interceptors	Arup/Planit(Landscape Architect)
5.	FW Drainage Strategy TS noted foul water would be discharged un-attenuated to local sewer and United Utilities have already stated there is sufficient capacity in local sewers to do this.	