



PHASE 2 NEW VICTORIA: OFFICE DEVELOPMENT, MANCHESTER

DRAINAGE STRATEGY REPORT



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Phase 2 New Victoria: Office Development
Drainage Strategy Report

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PREPARED BY JOHN SPEERS



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MORGAN CAPITAL - PHASE 2 NEW VICTORIA: OFFICE DEVELOPMENT



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Alan Johnston Partnership Ltd.

Company No. 13204766

Phase 2 New Victoria: Office Development, Manchester

Drainage Strategy Report

1.0 INTRODUCTION

This drainage strategy report has been prepared on behalf of Morgan Capital in connection with the construction of a 10 storey office building. The proposed site is located adjacent to Manchester Victoria Station, Manchester.

The purpose of this report is to present the surface water and foul water outline drainage strategies for the site which have been developed by the Alan Johnston Partnership. To demonstrate how the specific drainage requirements are to be met, the report should be read in conjunction with the relevant drawings and supporting information, included within the appendices.

The drainage strategies outlined within this report, have been prepared in accordance with BS EN 752:2017 (Drain and sewer systems outside buildings), Sewers for Adoption, Building Regulations Approved Document H (Drainage and waste disposal), the Planning Practice Guidance and the National Planning Policy Framework document (Department for Communities and Local Government, March 2014).

The site is located within Flood Zone 1, with a total site area under 1.0ha. Therefore, in accordance with DEFRA guidance, a Flood Risk Assessment (FRA) is not required. A review of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) identifies that the site is located within the Conurbation Core Critical Drainage Area (CDA).

However, based on guidance within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide, only sites with an area greater than 0.5ha within a Critical Drainage Area require a Flood Risk Assessment. As the total site area is less than 0.5ha it has been deemed that an FRA is not required to support the planning application for this development.



2.0 SITE DESCRIPTION

The existing site is situated adjacent to the south-east corner of Manchester Victoria Station and is located at National Grid reference SJ 84080 98975. The site location is illustrated in Appendix A and the extent of the area to which the application relates is shown on the enclosed existing site plan, attached in Appendix B.

The existing site covers a total area of 0.201ha and is a brownfield site. The site primarily comprises of hardstanding, with a small number of temporary cabins present on the site,

supporting Phase 1 of the New Victoria development. The site is currently located within the boundary of the construction compound for the New Victoria Phase 1: residential development and currently accommodates site access, parking and storage facilities.

The site is bounded by Manchester Victoria Train Station to the east, the Metrolink tramlines to the south west, Corporation Street to the west and the Phase 1 New Victoria: residential development to the north.

The site generally falls from east to west, with levels falling from approximately 35.00mAOD in the east to 33.10mAOD in the west. An existing site plan is included in Appendix B to illustrate the site at the present day and the topographic survey is included in Appendix C.

The site benefits from a fully implemented, extant planning consent comprising a wider regeneration project adjacent to Victoria Station, known as 'New Victoria' (the 'Extant Consent'). The office element benefits from the extant implemented consent, which remains in perpetuity. This was approved 29 September 2016 (LPA Ref: 111777/FO/2016/C1) and covers the site bounded by Manchester Victoria Train Station, Corporation Street and Cheetham Hill Road (A665).

Phase 1 of this development is currently under construction, and comprises two residential buildings, along with ground floor commercial space, parking and other associated works. Phase 2 covers this site, and the consented proposals comprise an 8 storey commercial office development.

The office building originally proposed as part of the New Victoria development will now be delivered under this separate application, reflecting changes to the design of the office building in order to better address current market requirements.



3.0 PROPOSED DEVELOPMENT

The proposed development consists of a new 10 storey office building plus basement, with associated ground floor commercial units, roof terrace, plant, cycle parking and hard and soft landscaping.

To enable a viable scheme, the proposed site levels are constrained by the existing developments and highways surrounding the site. Therefore, site levels are likely to remain similar to the existing. The proposed site plans indicating the proposed basement level, ground floor level and roof levels are attached in Appendix D.



4.0 ASSESSMENT OF FLOOD RISK

Even though a Flood Risk Assessment is not required under the Technical Guidance to the National Planning Policy Framework, a small site-specific flood risk assessment has been completed below.

4.1 Flooding from Rivers

The Flood Risk map is included as Appendix E. As can be seen from the Flood Risk map, the entire site is located within Flood Zone 1 and therefore, the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

The nearest watercourse is the culverted River Irk, which is located to the north of the site, within the Phase 1 New Victoria: residential development. Despite this, the risk of flooding to the new development from rivers is considered to be low.

4.2 Flooding from the Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 33.10mAOD, i.e. well above tidal flood levels.

4.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The Surface Water Flooding map is included in Appendix E. It can be seen from the map that the majority of the site is classified as having a very low or low risk of surface water flooding with only small areas having a medium risk.

As a suitably designed surface water drainage network is to be constructed as part of the proposed development and the surrounding external grounds levels are to fall away from the proposed building, towards the surrounding highway and car parking areas, the risk of flooding from overland flows due to surface water flooding is considered to be low.

Therefore, the overall site is considered to be at low risk of flooding from surface water/surrounding land.

4.4 Flooding from Groundwater

To date an intrusive site investigation is yet to be completed for the proposed development but a site investigation for the adjacent Phase 1 New Victoria: residential development has previously been completed by Bridgeway.

The window sample borehole records presented in the Bridgeway Manchester Victoria Ground Investigation Report J10782 dated March 2012, indicate that the groundwater is at a level around 8.5mbgl and therefore it is envisaged that the groundwater flood risk to the proposed development is low.

This is supported by the information provided by the Groundwater Flooding Map contained within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) Report, which indicates that the site lies within an area that is not at risk of groundwater flooding.

Therefore, due to the information provided above, the site is considered to be at low risk of flooding from groundwater.

4.5 Flooding from Sewers

A record of the historic public sewers surrounding and serving the development site has been obtained and this is included in Appendix F. Also included within Appendix F are the Section 185 and Section 116 drawings which indicate the existing United Utilities sewers that have or will be abandoned and/or diverted as part of both the Phase 1 New Victoria: residential development and Phase 2 New Victoria: Office Development.

As can be seen from the existing drainage drawings attached in Appendix F, there were a number of existing public sewers located within the site boundary and also within the Phase 1 New Victoria: residential development site boundary.

The existing drainage drawings indicate that the existing public sewers within the Phase 1 New Victoria: residential development have been abandoned as part of the Phase 1 works and the public sewers within the Phase 2 New Victoria: Office Development are to be abandoned as part of the proposed works for this site.

The required Section 116 and Section 185 agreements have been completed with United Utilities and therefore it is envisaged that the remaining public sewers within the Phase 2 New Victoria: Office Development are to be abandoned as per the agreements with United Utilities.

Therefore, it is envisaged that there will be no public sewers located within the proposed development site, with the only nearby public sewers located within the surrounding highways. Therefore, should any flooding from sewers occur this should be contained within the existing highways and should not encroach upon the proposed site.

Therefore, as a result of the only remaining public sewers being located within the adjacent highways, the site itself is considered to be at low risk of flooding from sewers.

4.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Reservoir Flood Risk map is included in Appendix E. It can be seen from the map that the site is at risk of flooding from reservoirs. However, due to the introduction of the Reservoirs Act 1975 in England, the reservoir owner must ensure that all large reservoirs are supervised by reservoir panel engineers and that the reservoirs are inspected regularly and essential safety work is carried out.

Therefore, despite the flood maps indicating that the site is located within an area at risk of reservoir flooding, the likelihood of reservoir flooding occurring is low and as such, the

site is considered to be at low risk of flooding from reservoirs, canals and other artificial sources.

5.0 PROPOSED DEVELOPMENT

5.1 Effect of Proposed Development

As previously outlined in Section 2.0, the existing site covers a total area of 0.201ha and is a brownfield site. The site currently comprises of hardstanding, with a small number of temporary cabins present on the site, supporting Phase 1 of the New Victoria development.

The site is currently located within the boundary of the construction compound for the New Victoria Phase 1: residential development and currently accommodates site access, parking and storage facilities.

As outlined within Section 2.0, Phase 1 of this development is currently under construction, and comprises two residential buildings, along with ground floor commercial space, parking and other associated works. Phase 2 covers this site, and the consented proposals comprise an 8 storey commercial office development.

The office building originally proposed as part of the New Victoria development will now be delivered under this separate application, reflecting changes to the design of the office building in order to better address current market requirements.

Therefore, the effect of the proposed development has already been considered within the original approved planning application and as outlined later within Section 5.2 the Phase 1 surface water drainage has accounted for the proposed Phase 2 development.

Therefore, even though the changes to the existing site will increase the volume of impermeable areas and as such will lead to an increase in the;

- ◆ Volume of surface water ponding on the site
- ◆ Volume of surface water runoff leaving the site or discharging into surrounding areas
- ◆ Peak discharge rate from the site.

This has been considered within the original approved planning application and as outlined later within Section 5.2 the Phase 1 surface water drainage has accounted for the proposed Phase 2 development.

Despite this, site-wide drainage systems are still required to drain the foul and surface water flows arising from the proposed development. Appropriate design and construction of these systems as set out in Section 5.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

5.2 Existing Drainage Systems

As can be seen from the existing drainage information attached in Appendix F, there are a number of existing public sewers, TfGM drainage and also the Phase 1 New Victoria: residential development located within and surrounding the proposed development site.

It is envisaged that CCTV surveys of the existing TfGM drainage and other surrounding drainage is required to confirm the location, levels and details of the existing drainage which is to be abandoned and/or diverted as part of the proposed development.

Further discussions should also be undertaken with United Utilities, TfGM and the LLFA, to confirm that the proposed drainage abandonments, diversions and also the proposed drainage strategy and discharge rates are acceptable to all parties.

5.2.1 Existing Public Drainage

As discussed previously in Section 4.5, a record of the historic public sewers surrounding and serving the development site has been obtained and this is included in Appendix F. Also included within Appendix F are the Section 185 and Section 116 drawings which indicate the existing United Utilities sewers that have or will be abandoned and/or diverted as part of both the Phase 1 New Victoria: residential development and Phase 2 New Victoria: Office Development.

As can be seen from the existing drainage drawings attached in Appendix F, there were a number of existing public sewers located within the site boundary and also within the Phase 1 New Victoria: residential development site boundary.

The existing drainage drawings indicate that the existing public sewers within the Phase 1 New Victoria: residential development have been abandoned as part of the Phase 1 works and the public sewers within the Phase 2 New Victoria: Office Development are to be abandoned as part of the proposed works for this site.

The required Section 116 and Section 185 agreements have been completed with United Utilities and therefore it is envisaged that the remaining public sewers within the Phase 2 New Victoria: Office Development are to be abandoned as per the agreements with United Utilities.

It should be noted that as part of the Section 116 abandonment works an existing Combined Sewer Overflow (CSO) pipeline which currently discharges into the River Irk culvert will be abandoned and removed. This is deemed as a water quality benefit associated with the proposed development as it prevents the existing public combined water sewer from discharging into the watercourse.

It is envisaged that the remaining public sewers within the Phase 2 New Victoria: Office Development will be abandoned and/or diverted as per the Section 116 and Section 185 agreements with United Utilities and as such, there will be no public sewers located within the proposed development site, with the only nearby public sewers located within the surrounding highways.

5.2.2 Existing TfGM Drainage

As per the existing drainage information attached in Appendix F, there is an existing Transport for Greater Manchester (TfGM) track drainage network which currently discharges into the United Utilities combined sewer network within the proposed development site.

As such, it is proposed to divert this existing track drainage into the culverted watercourse. Discussions with TfGM are currently ongoing but it is likely that the proposed diversion will direct the track drainage into the basement area of the proposed development prior to discharging into the watercourse via the new outfall which has been constructed as part of the Phase 1 New Victoria: residential development.

As can be seen from the TfGM as-built drawing, attached in Appendix F, the existing TfGM track drainage is restricted to a maximum discharge of 5.0 L/s via an existing hydrobrake located immediately upstream of the pipeline which discharges into the existing public combined water sewer located within the proposed development site. As such, this discharge restriction should be taken into account when completing the detailed design of the proposed TfGM diversion.

It should be noted that this also provides a water quality benefit to the wider area as the surface water runoff from the TfGM track drainage will be separated from the United Utilities combined water network therefore ensuring the surface water runoff load on the public sewer network is reduced.

5.2.3 Phase 1 New Victoria: Residential Development Drainage

As previously outlined in Section 2.0, the site benefits from a fully implemented, extant planning consent comprising a wider regeneration project adjacent to Victoria Station, known as 'New Victoria' (the 'Extant Consent').

The office element benefits from the extant implemented consent, which remains in perpetuity. This was approved 29 September 2016 (LPA Ref: 111777/FO/2016/C1) and covers the site bounded by Manchester Victoria Train Station, Corporation Street and Cheetham Hill Road (A665).

Phase 1 of this development is currently under construction, and comprises two residential buildings, along with ground floor commercial space, parking and other associated works. Phase 2 covers this site, and the consented proposals comprise an 8 storey commercial office development.

The office building originally proposed as part of the New Victoria development will now be delivered under this separate application, reflecting changes to the design of the office building in order to better address current market requirements.

As such, the proposed Phase 1 drainage networks which are currently under construction have made an allowance for the proposed Phase 2 works. As can be seen from the Phase 1 drainage information, attached in Appendix G, the proposed Phase 2 area has been included within the Phase 1 development drainage.

Correspondence with the LLFA is included also included within Appendix G and as can be seen the LLFA have agreed that the proposed discharge rates can hold an average betterment of 50%, with the 2 year discharge rate having around a 30% betterment and the 30 year and 100 year +20% climate change discharge rates having around a 60% betterment.

Therefore, the 50% average betterment on the proposed discharge rates has been maintained within the proposed Phase 1 surface water drainage design which includes an allowance for the Phase 2 New Victoria: Office Development and it is anticipated that this will not change due to the Phase 2 New Victoria: Office Development.

5.3 Proposed Drainage Strategy

As outlined above in Section 5.1, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

5.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2015) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- ◆ Discharge via infiltration
- ◆ Discharge to watercourse
- ◆ Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed site should infiltrate where possible. To date an intrusive site investigation is yet to be completed for the proposed development but a site investigation for the adjacent Phase 1 New Victoria: residential development has previously been completed by Bridgeway.

The window sample borehole records presented in the Bridgeway Manchester Victoria Ground Investigation Report J10782 dated March 2012 supports the BGS information by indicating no superficial deposits, with only made ground down to depths of around 7.0mbgl. Underlying the made ground, down to approximately 15.0mbgl is sandstone bedrock which supports the BGS information stating that Chester Formation.

An intrusive site investigation for the proposed development should be undertaken to confirm the underlying strata is as per the adjacent Phase 1 New Victoria: residential development and BGS information.

Due to the large depths of made ground encountered across the site, the use of infiltration could result in inundation settlement. This coupled with the fact that the Phase 1 New Victoria: residential development discharges into the culverted watercourse leads to the conclusion that infiltration drainage is not considered to be a viable option for the discharge of surface water.

As the possibility of infiltration has been ruled out by the site investigation, the intention for the development would be to discharge to watercourse. The nearest watercourse is the River Irk culverted watercourse which is located to the north of the site, within the Phase 1 New Victoria: residential development.

As such, it is envisaged that the proposed surface water drainage from the Phase 2 New Victoria: Office Development will discharge into this culverted watercourse via the Phase 1 New Victoria: residential development surface water drainage network.

While every effort to utilise any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Sewers for Adoption (7th Edition), the requirements for the design of a new surface water drainage systems are as follows:

- ◆ Below ground piped drainage to be sized to accommodate the 1 in 2 year (50% AEP) design storm without surcharge.
- ◆ System to be designed not to flood any part of the site in a 1 in 30 year (3% AEP) design storm.
- ◆ For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100 year design storm, a 20% increase in the peak rainfall intensity is applied to allow for climate change.

While current Environment Agency guidance states that a 40% increase to account for climate change is applicable, the 20% increase is in accordance with the drainage strategy, attached in Appendix G, for the previously approved planning application, as outlined in Section 2.0.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30 year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100 year (+20%) event, will be retained on-site in safe storage areas.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

To comply with Section 3.4.1 of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide a minimum 50% betterment on the existing surface water brownfield runoff rates should be applied.

However, as outlined within the correspondence and drainage strategy drawing, attached in Appendix G, previous discussions with the LLFA have been undertaken which indicate that due to site constraints an overall average 50% betterment is acceptable, with the 2 year discharge rate having around a 30% betterment and the 30 year and 100 year +20% climate change discharge rates having around a 60% betterment.

Therefore, the 50% average betterment on the proposed discharge rates has been maintained within the proposed Phase 1 surface water drainage design which includes an allowance for the Phase 2 New Victoria: Office Development and it is anticipated that this approach will not change due to the Phase 2 New Victoria: Office Development.

However, further discussions should be undertaken with the LLFA to confirm that the proposed surface water discharge rates and overall drainage strategy is still acceptable.

As previously outlined within Section 5.2.3, an allowance for the Phase 2 New Victoria: Office Development has been included within the Phase 1 New Victoria: residential development surface water drainage. The proposed detailed drainage design drawing for the Phase 1 New Victoria: residential development is attached in Appendix H.

As can be seen from the detailed drainage design drawing 2no. spurs, one for the Phase 2 New Victoria: Office Development surface water drainage and one for the Phase 2 New Victoria: Office Development foul water drainage have been incorporated within the Phase 1 New Victoria: residential development.

The surface water drainage calculations for the Phase 1 New Victoria: residential development are also included within Appendix H. As can be seen from the calculations an allowance for the Phase 2 New Victoria: Office Development has been included within the calculations, with an impermeable area of 0.185ha added into manhole SW35 within the model.

The entire 0.201ha site has not been added to the model as the surface water drainage for the Phase 1 New Victoria: residential development already collects an area of 0.016ha to the south-east of corner of the Phase 2 New Victoria: Office Development.

As can be seen from the surface water drainage calculations the attenuation tank currently being constructed as part of the Phase 1 New Victoria: residential development has been suitably sized to accommodate not only the Phase 1 development but also the Phase 2 development, without any flooding.

It should also be noted that even though the previously approved planning application states that a 20% increase for climate change is acceptable, the proposed detailed drainage design also includes a 40% increase for climate change during the 1 in 100 year rainfall event.

It can be seen from the Phase 1 New Victoria: residential development detailed drainage design that a suitable attenuation allowance for the Phase 2 New Victoria: Office Development has been included within the Phase 1 below ground cellular attenuation tank.

Therefore, it is concluded that no further attenuation is required for the Phase 2 New Victoria: Office Development.

The detailed drainage design calculations also indicate that the proposed surface water discharge rates comply with the overall average 50% betterment as per the previously approved planning application. The discharge rates are summarised within the table below and as can be seen the overall average betterment is 52%.

Rainfall Return Period (years)	Outfall 1 Discharge Rate (L/s)	Outfall 2 Discharge Rate (L/s)	Total Discharge Rate (L/s)	Existing Brownfield Runoff Rate (L/s)	Proposed Overall Betterment (%)
2 year	4.9	41.6	46.5	65.0	29%
30 year	4.9	41.5	46.4	123.0	62%
100 year + 40%	5.5	50.1	55.6	157.0	65%

As seen in the Phase 2 Drainage Strategy Drawing, attached in Appendix I, it is anticipated that no attenuation storage will be provided as this is already included within the Phase 1 development, with a suitable allowance for the Phase 2 development having been incorporated within the Phase 1 surface water drainage design.

As previously discussed, a spur for the connection of the Phase 2 New Victoria: Office Development surface water drainage has been incorporated within the Phase 1 New Victoria: residential development. However, as the proposed basement area is a new addition to the proposed development, the invert level of the surface water spur is too high to connect via gravity.

However, as there is no requirement for any surface water drainage in the basement of the proposed development, it is proposed that the surface water drainage will be slung under the ground floor slab and will therefore be able to connect via gravity into the surface water drainage spur, constructed as part of the Phase 1 works.

It is also envisaged that green roofs and rainwater harvesting will be incorporated within the proposed development, with a rainwater harvesting tanks and plant rooms incorporated within the proposed basement area. These SuDS features will be incorporated where possible across the proposed development, with the rainwater harvesting being used to flush toilets etc...

Other SuDS features have also been considered across the proposed development but there are a number of site constraints, such as available space, which limit the use of suitable SuDS elements to green roofs and rainwater harvesting.

As outlined below, all other SuDS techniques have been considered for this development;

SuDS Technique	Suitable for This Development?	Reasoning
Green Roof	✓	Suitable and incorporated, where possible.
Rainwater Harvesting	✓	Suitable and incorporated, where possible.
Basins & Ponds	✗	Unsuitable due to lack of available space across site.
Filter Strips & Swales	✗	Unsuitable due to infiltration being unsuitable and also a lack of available space across site.
Infiltration Techniques	✗	Unsuitable due to underlying strata and lack of available space to incorporate infiltration.
Permeable Surfaces	✗	Unsuitable due to underlying strata and minimal available areas.
Tanked Systems	✓	Suitable and incorporated within the Phase 1 development.

The surface water drainage strategy and discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

It is also envisaged that discussions with the Environment Agency regarding gaining a permit to work within 8m of the culverted watercourse will be required. However, it should be noted that initial discussions with the EA have been undertaken and there is a possibility of utilising the existing permit gained for the Phase 1 works but this is to be confirmed via more detailed discussions.

5.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank
3. Cesspool

The foul water system shall be designed in accordance with;

- ◆ BS EN 752:2017 (Drain and sewer systems outside buildings)
- ◆ Sewers for Adoption (7th Edition)
- ◆ National Planning Policy Framework document (Department for Communities and Local Government, March 2014) and associated Planning Practice Guidance.
- ◆ BS EN 12056-2:2000 (Drainage systems inside buildings)
- ◆ Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2015).

As with the surface water runoff, a spur for the connection of the Phase 2 New Victoria: Office Development foul water drainage has been incorporated within the Phase 1 New Victoria: residential development. However, as the proposed basement area is a new

addition to the proposed development, the invert level of the foul water spur is too high to connect via gravity.

Therefore, it is envisaged that where possible, the foul water runoff from the above floors will be collected and conveyed via foul drainage slung under the ground floor slab, to the spur provided within the Phase 1 works.

Where this is not possible it is envisaged that the foul drainage will be dropped into the basement area where it will be collected and conveyed into 2no. proposed package pump stations that will pump the foul discharge into the foul spur provided during the Phase 1 works. There are a number of areas within the basement that require foul drainage and as such it is envisaged that these will also be collected and conveyed into the same package pump stations.

There are a number of showers and changing rooms in the basement area of the proposed development. As such, it is anticipated that the foul drainage from these areas will be collected and conveyed to a separate greywater pump station that will pump the foul drainage into the greywater plant room where it will be utilised to also flush toilets etc... as a greywater re-use system.

This can be seen within the Phase 2 Drainage Strategy Drawing, attached in Appendix I, with the proposed foul package pump stations and proposed greywater pump station all indicated. The foul drainage slung under the ground floor slab is not indicated on the drawing as this is classified as above ground drainage and will therefore be developed during the detailed design stage.

It is envisaged that the foul water discharge from the proposed development will be unrestricted and therefore the 300mm diameter foul spur provided within the Phase 1 works will be suitably sized to accommodate the unrestricted foul water discharge from the proposed development. This is to be confirmed at detailed design stage.

The foul water drainage strategy and unrestricted discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

6.0 FUTURE MANAGEMENT & MAINTENANCE

The proposed drainage solution uses SUDS techniques in accordance with the CIRIA SUDS Manual C753. The surface water run-off from the proposed development is restricted using a vortex flow control device and the attenuated run-off is stored using a below ground cellular attenuation tank.

It is envisaged that the following components have been or will be included within the drainage strategy for the proposed development:

- ◆ Inspection chambers, manholes and catchpits.
- ◆ Pipes.
- ◆ Drainage channels and gullies.
- ◆ Vortex flow control device (Phase 1).
- ◆ Cellular attenuation tank (Phase 1).
- ◆ Green roof.
- ◆ Rainwater harvesting.

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented. It is assumed that the proposed drainage will remain private and therefore maintenance of the surface and foul water drainage systems will be the responsibility of The English Cities Fund or an on-site facilities management team and therefore a copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.

As such, the maintenance of the specified SuDS should be included within the developments Operation and Maintenance Manual and should be detailed in accordance with the CIRIA SuDS Manual C753, as per the operation and maintenance guidance outlined below.

6.1 General Maintenance & Inspection Requirements

- ◆ No work shall be carried out on the drainage system without permission from a nominated person, who has access to information/a working knowledge of the system.
- ◆ Maintenance/inspection work shall be carried out in a safe/planned manner.
- ◆ All work is to be carried out by competent persons suitably trained and equipped in accordance with current statutory safe working policies.
- ◆ Entry into confined spaces shall be kept to a minimum and be restricted to suitably qualified/equipped persons working in accordance with current statutory safe working policies.
- ◆ Drainage systems shall be inspected on a regular basis or should any problems be suspected. Any debris/defects discovered shall be recorded and a programme of cleaning/ repair initiated. Urgent repairs/cleaning shall be actioned as soon as practicable.
- ◆ It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- ◆ Clearing of the drainage system can be achieved by a number of methods depending on the nature of the work;
 - o Rodding - Manual/Mechanical with flexible rods.
 - o Jetting - High pressure water jetting.
 - o Plunging.

6.2 Inspection Chambers, Manholes and Catchpits

The appropriate health and safety equipment must be used when accessing manholes/catchpits. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access. The following operations should be carried out annually.

- ◆ Covers of inspection chambers and manholes shall be removed and the sides, benchings and channels cleared.
- ◆ Accumulated deposits of silt in inspection chambers, catchpits and manholes shall be removed. Any traps shall then be plunged and thoroughly flushed out with clean water. This should be completed in Autumn, after leaf fall.
- ◆ Main and branch drains shall be cleared as required and afterwards be flushed with clean water. Any obstructions found shall be removed and not flushed down the system.
- ◆ Covers of inspection chambers, manholes and catchpits shall be replaced, bedded in suitable grease or other sealing material as required and bolted/locked down as appropriate. Missing bolts and broken items shall be replaced in accordance with the manufacturer's details.

6.3 Pipes

Regular inspection and maintenance are important to identify areas which may have become obstructed/clogged and may not be draining correctly, as failure to do so would expose the development to a greater level of flood risk.

Pipes are proprietary products and therefore the materials used can vary across the site. As such, where used the manufacturer's recommendations should be followed. Access for maintenance of the pipes is provided through inspection chambers and manholes. The below table sets out the maintenance schedule for the pipe components of the proposed drainage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for evidence of poor operation via water levels. If required take remedial action.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection should be provided as post construction CCTV survey.	N/A
	Inspect/check all inlets, outlets and overflows to ensure they are in good condition and operating as designed.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

6.4 Drainage Channels and Gullies

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating. The below table sets out the maintenance schedule for the drainage channel and gullies components of the proposed drainage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Litter and debris removal.	Monthly or as required.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
Remedial Actions	Inspect access/outlet boxes and rod through poorly performing channels and outlets as initial remediation.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection including channel outlet boxes and gully sumps.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

6.5 Vortex Flow Control Device (Phase 1)

Regular inspection and maintenance is important to identify if the vortex flow control device has become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

Vortex flow control devices are proprietary products and therefore can vary from manufacturer to manufacturer. As such, where used the manufacturer's recommendations should be followed.

- ◆ Normally, little maintenance is required as there are generally a vortex flow control device has no moving parts.
- ◆ If blockages occur they tend to do so at the intake of the vortex flow control device.
- ◆ Vortex flow control devices are generally fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.
- ◆ The smaller type conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard.

- Following installation of the vortex flow control device it is vitally important that any extraneous material i.e. Building materials are removed from the unit and the chamber.
- After the system is made live, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. Units should also be inspected within 48 hours after large storms.

6.6 Cellular Attenuation Tank (Phase 1)

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

The maintenance requirements for cellular attenuation tanks are outlined within Table 21.3 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenance schedule for the cellular attenuation tank component of the proposed drainage systems.

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

6.7 Green Roof

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk. The maintenance requirements for green roofs are outlined within Table 12.5 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenance schedule for the green roof components of the proposed drainage systems.

TABLE 12.5 Operation and maintenance requirements for green roofs		
Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

6.8 Rainwater Harvesting

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk. The maintenance requirements for green roofs are outlined within Table 12.5 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenance schedule for the green roof components of the proposed drainage systems.

TABLE 11.6 Operation and maintenance requirements for RWH systems		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional maintenance	Cleaning and/or replacement of any filters	Three monthly (or as required)
Remedial actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

It should be noted that the Main Contractor should provide a Verification Report, including photographic evidence, to demonstrate that the drainage has been constructed as per the design drawings. As-built drawings should as be supplied by the Main Contractor, where the construction of the drainage varies from the design construction status drawings.

7.0 CONCLUSIONS & RECOMMENDATIONS

- ◆ The site is located within Flood Zone 1 and is less than 0.5ha in area, therefore no Flood Risk Assessment is required to support the planning application.
- ◆ The site benefits from a fully implemented, extant planning consent comprising a wider regeneration project adjacent to Victoria Station, known as 'New Victoria' (the 'Extant Consent'). The office element benefits from the extant implemented consent, which remains in perpetuity. This was approved 29 September 2016 (LPA Ref: 111777/FO/2016/C1) and covers the site bounded by Manchester Victoria Train Station, Corporation Street and Cheetham Hill Road (A665).
- ◆ Phase 1 of this development is currently under construction, and comprises two residential buildings, along with ground floor commercial space, parking and other associated works. Phase 2 covers this site, and the consented proposals comprise an 8 storey commercial office development.

- ◆ The office building originally proposed as part of the New Victoria development will now be delivered under this separate application, reflecting changes to the design of the office building in order to better address current market requirements.
- ◆ The proposed development consists of a new 10 storey office building plus basement, with associated ground floor commercial units, roof terrace, plant, cycle parking and hard and soft landscaping.
- ◆ The existing public sewers within the Phase 1 New Victoria: residential development have been abandoned as part of the Phase 1 works and the public sewers within the Phase 2 New Victoria: Office Development are to be abandoned as part of the proposed works for this site.
- ◆ The required Section 116 and Section 185 agreements have been completed with United Utilities and therefore it is envisaged that the remaining public sewers within the Phase 2 New Victoria: Office Development are to be abandoned as per the agreements with United Utilities.
- ◆ It is proposed to divert the existing TfGM track drainage into the culverted watercourse. Discussions with TfGM are currently ongoing but it is likely that the proposed diversion will direct the track drainage into the basement area of the proposed development prior to discharging into the watercourse via the new outfall which has been constructed as part of the Phase 1 New Victoria: residential development.
- ◆ The Phase 1 drainage networks which are currently under construction have made an allowance for the proposed Phase 2 works with the Phase 1 cellular attenuation tank and vortex flow control device suitably sized to accommodate an unrestricted discharge from the Phase 2 surface water drainage. Therefore, it is envisaged that no additional attenuation or flow controls are required within the Phase 2 development.
- ◆ As part of the overall 'New Victoria' planning application the LLFA have agreed that the proposed discharge rates can hold an average betterment of 50%, with the 2 year discharge rate having around a 30% betterment and the 30 year and 100 year +20% climate change discharge rates having around a 60% betterment.
- ◆ Therefore, it is proposed to maintain the 50% average betterment on the proposed surface water discharge rates and as such this will not change due to the Phase 2 New Victoria: Office Development.
- ◆ It is envisaged that CCTV surveys of the existing TfGM drainage and other surrounding drainage is required to confirm the location, levels and details of the existing drainage which is to be abandoned and/or diverted as part of the proposed development.
- ◆ Further discussions should also be undertaken with United Utilities, TfGM and the LLFA, to confirm that the proposed drainage abandonments, diversions and also the proposed drainage strategy and discharge rates are acceptable to all parties.

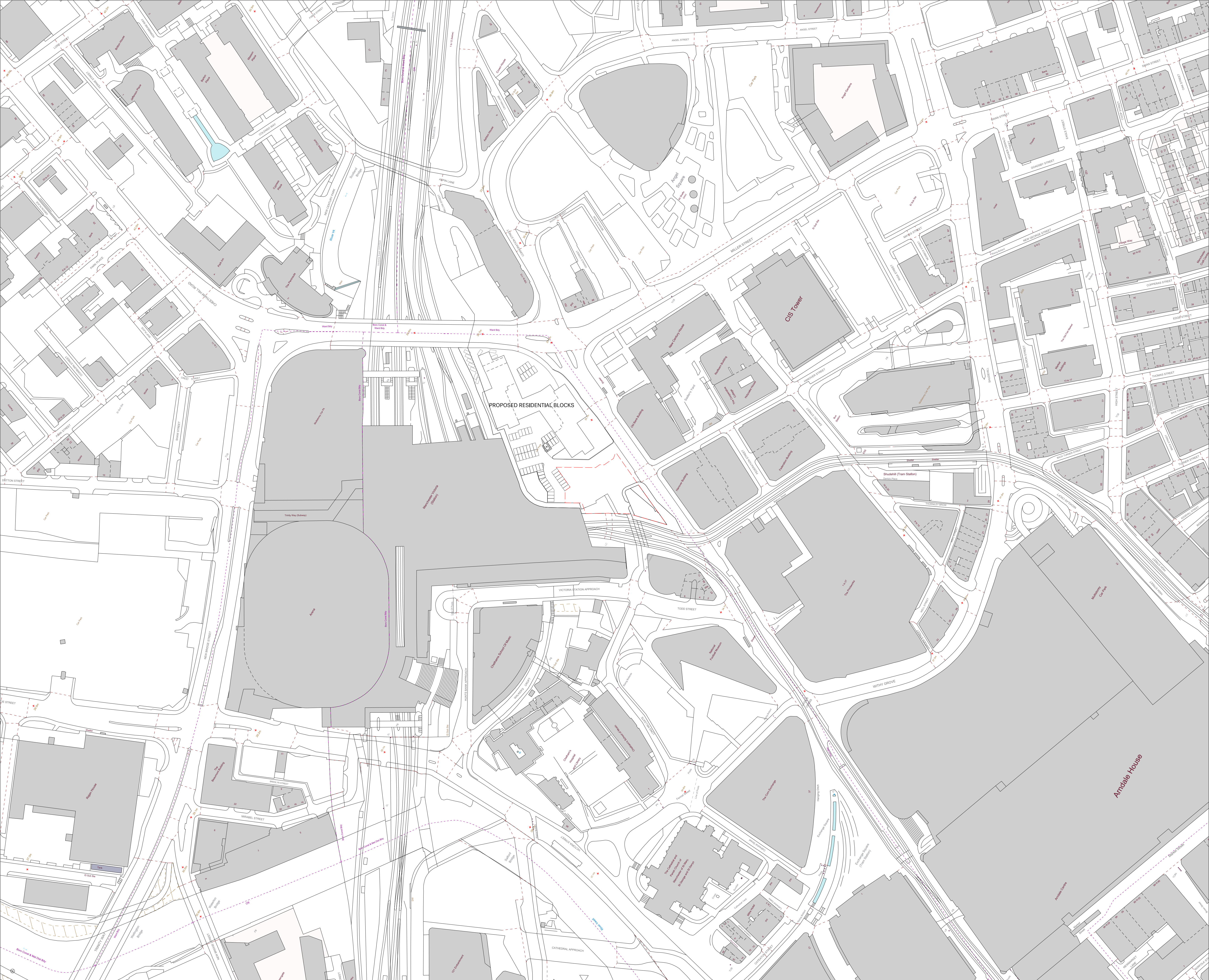
- ◆ To date an intrusive site investigation is yet to be completed for the proposed development but a site investigation for the adjacent Phase 1 New Victoria: residential development has previously been completed by Bridgeway.
- ◆ The Bridgeway Manchester Victoria Ground Investigation Report J10782 dated March 2012 indicates large depths of made ground encountered across the site and therefore the use of infiltration could result in inundation settlement. This coupled with the fact that the Phase 1 New Victoria: residential development discharges into the culverted watercourse leads to the conclusion that infiltration drainage is not considered to be a viable option for the discharge of surface water.
- ◆ An intrusive site investigation for the proposed development should be undertaken to confirm the underlying strata is as per the adjacent Phase 1 New Victoria: residential development and BGS information.
- ◆ As the possibility of infiltration has been ruled out, the intention for the development would be to discharge to watercourse. The nearest watercourse is the River Irk culverted watercourse which is located to the north of the site, within the Phase 1 New Victoria: residential development.
- ◆ As such, it is envisaged that the proposed surface water drainage from the Phase 2 New Victoria: Office Development will discharge into this culverted watercourse via the Phase 1 New Victoria: residential development surface water drainage network.
- ◆ A spur for the connection of the Phase 2 New Victoria: Office Development surface water drainage has been incorporated within the Phase 1 New Victoria: residential development but as the proposed basement area is a new addition, the invert level of the surface water spur is too high to connect via gravity.
- ◆ However, as there is no requirement for any surface water drainage in the basement of the proposed development, it is proposed that the surface water drainage will be slung under the ground floor slab and will therefore be able to connect via gravity into the surface water drainage spur, constructed as part of the Phase 1 works.
- ◆ It is also envisaged that green roofs and rainwater harvesting will be incorporated within the proposed development, with a rainwater harvesting tanks and plant rooms incorporated within the proposed basement area. These SuDS features will be incorporated where possible across the proposed development, with the rainwater harvesting being used to flush toilets etc...
- ◆ Other SuDS features have also been considered across the proposed development but there are a number of site constraints, such as available space, which limit the use of suitable SuDS elements to green roofs and rainwater harvesting.
- ◆ It can be seen from the Phase 1 New Victoria: residential development detailed drainage design that a suitable attenuation allowance for the Phase 2 New Victoria: Office Development has been included within the Phase 1 below ground cellular attenuation tank and flow control device. Therefore, it is concluded that no further

attenuation or flow control devices are required for the Phase 2 New Victoria: Office Development.

- ◆ The detailed drainage design calculations indicate that the proposed surface water discharge rates comply with the overall average 50% betterment as per the previously approved planning application. The discharge rates indicate that the overall average betterment is 52%.
- ◆ Further detailed discussions with the Lead Local Flood Authority and United Utilities should be completed to ensure agreement of the surface water discharge rate and the overall approach.
- ◆ It is also envisaged that discussions with the Environment Agency regarding gaining a permit to work within 8m of the culverted watercourse will be required. However, it should be noted that initial discussions with the EA have been undertaken and there is a possibility of utilising the existing permit gained for the Phase 1 works but this is to be confirmed via more detailed discussions.
- ◆ A spur for the connection of the Phase 2 New Victoria: Office Development foul water drainage has been incorporated within the Phase 1 New Victoria: residential development. However, as the proposed basement area is a new addition, the invert level of the foul water spur is too high to connect via gravity.
- ◆ Therefore, it is envisaged that where possible, the foul water runoff from the above floors will be collected and conveyed via foul drainage slung under the ground floor slab, to the spur provided within the Phase 1 works.
- ◆ Where this is not possible it is envisaged that the foul drainage will be dropped into the basement area where it will be collected and conveyed into 2no. proposed package pump stations that will pump the foul discharge into the foul spur provided during the Phase 1 works.
- ◆ There are also a number of areas within the basement that require foul drainage and as such it is envisaged that these will also be collected and conveyed into the same package pump stations.
- ◆ There are a number of showers and changing rooms in the basement area of the proposed development. As such, it is anticipated that the foul drainage from these areas will be collected and conveyed to a separate greywater pump station that will pump the foul drainage into the greywater plant room where it will be utilised to also flush toilets etc... as a greywater re-use system.
- ◆ Further discussions with the Lead Local Flood Authority and United Utilities should be completed to ensure agreement of the foul water discharge rate and the overall approach.



Appendix A – Site Location Plan



Notes

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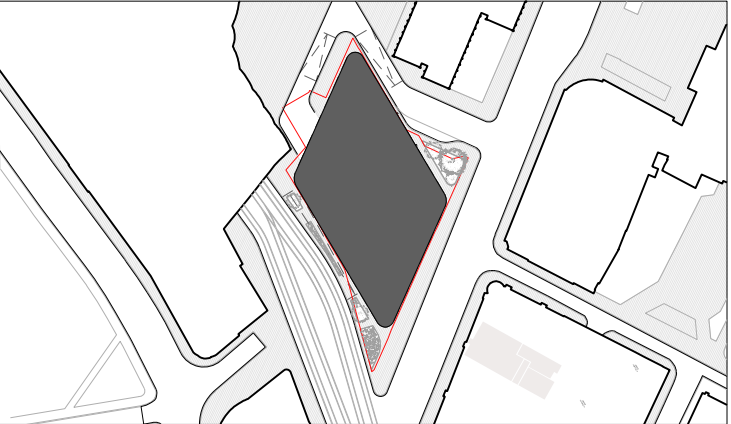
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Planning Boundary



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Rev	Date	Description



Key Plan

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New Victoria, Manchester	
Client	
Torriview Ltd	
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Drawing Title	
Existing site location plan	

Drawn	Checked	Approved
BE	NH	NH

Drawing Status					
Planning					
Project	Discipline	Level	Series	Dwg No	Rev
13701	A	SL	P00	000	P1

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Appendix B – Existing Site Plan



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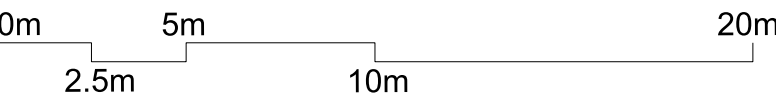
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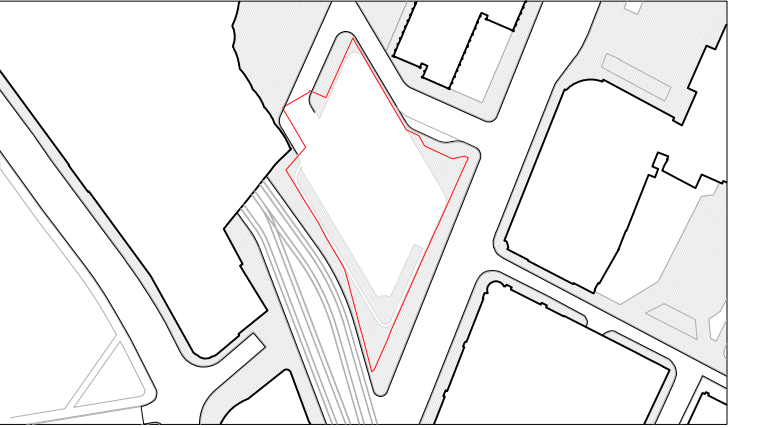
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Key Plan

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Existing Site Plan
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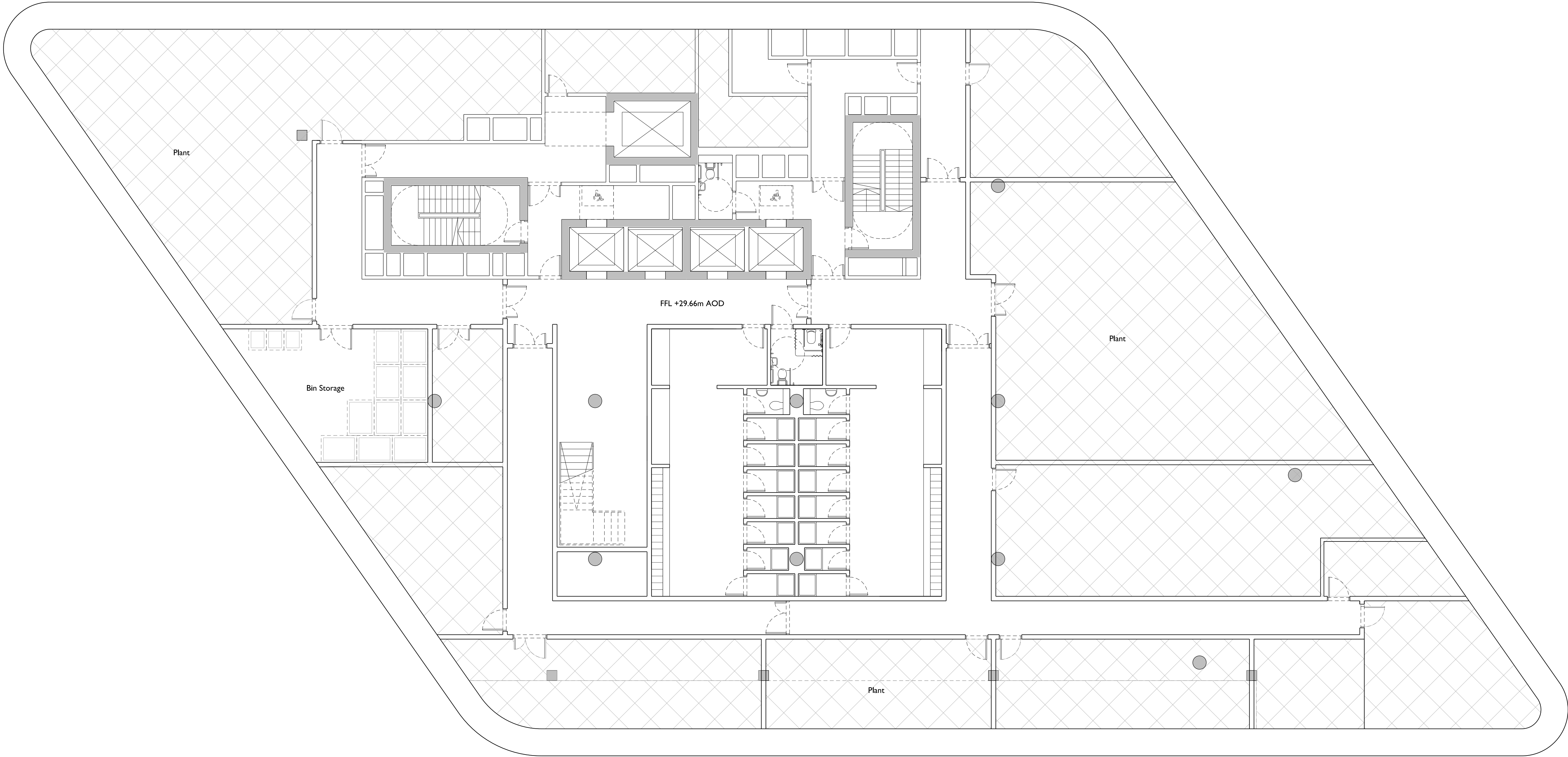
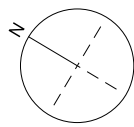
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Appendix C – Topographic Survey

Appendix D – Proposed Site Plans



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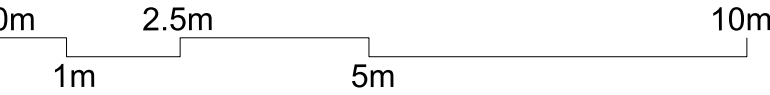
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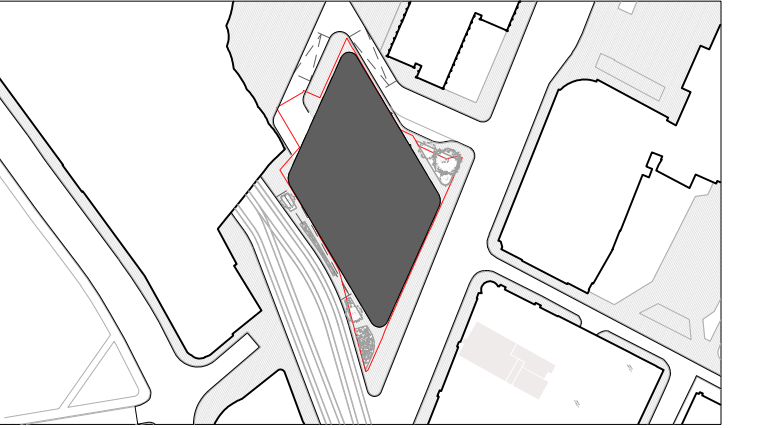
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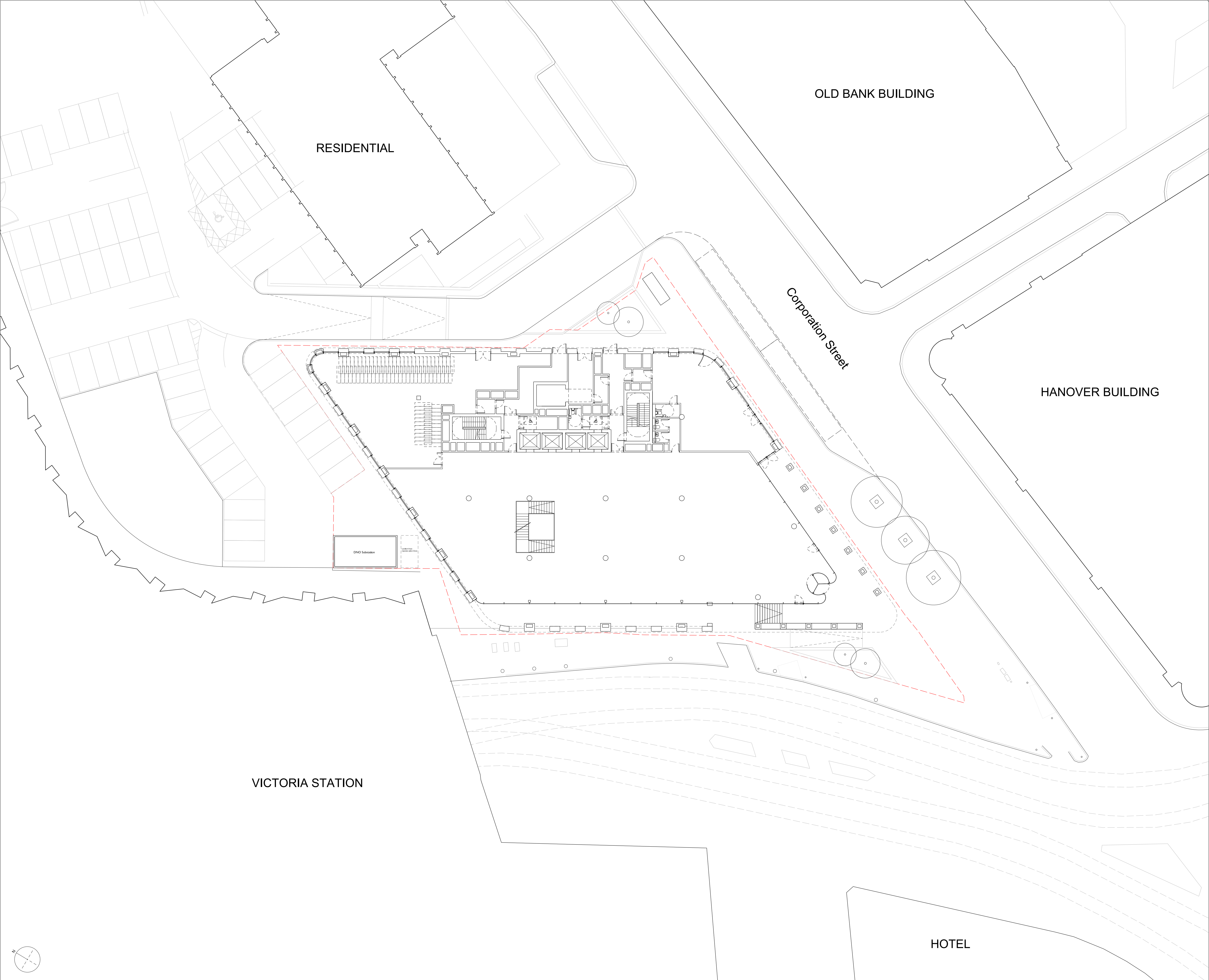
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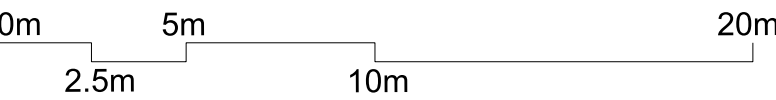
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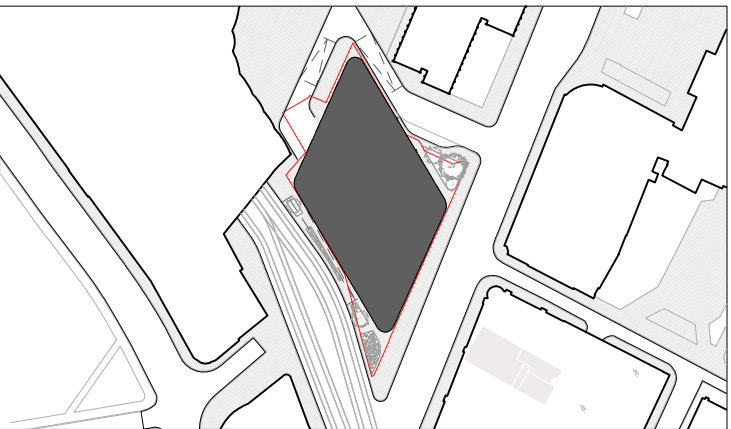
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Project
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Date
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Proposed Site Plan

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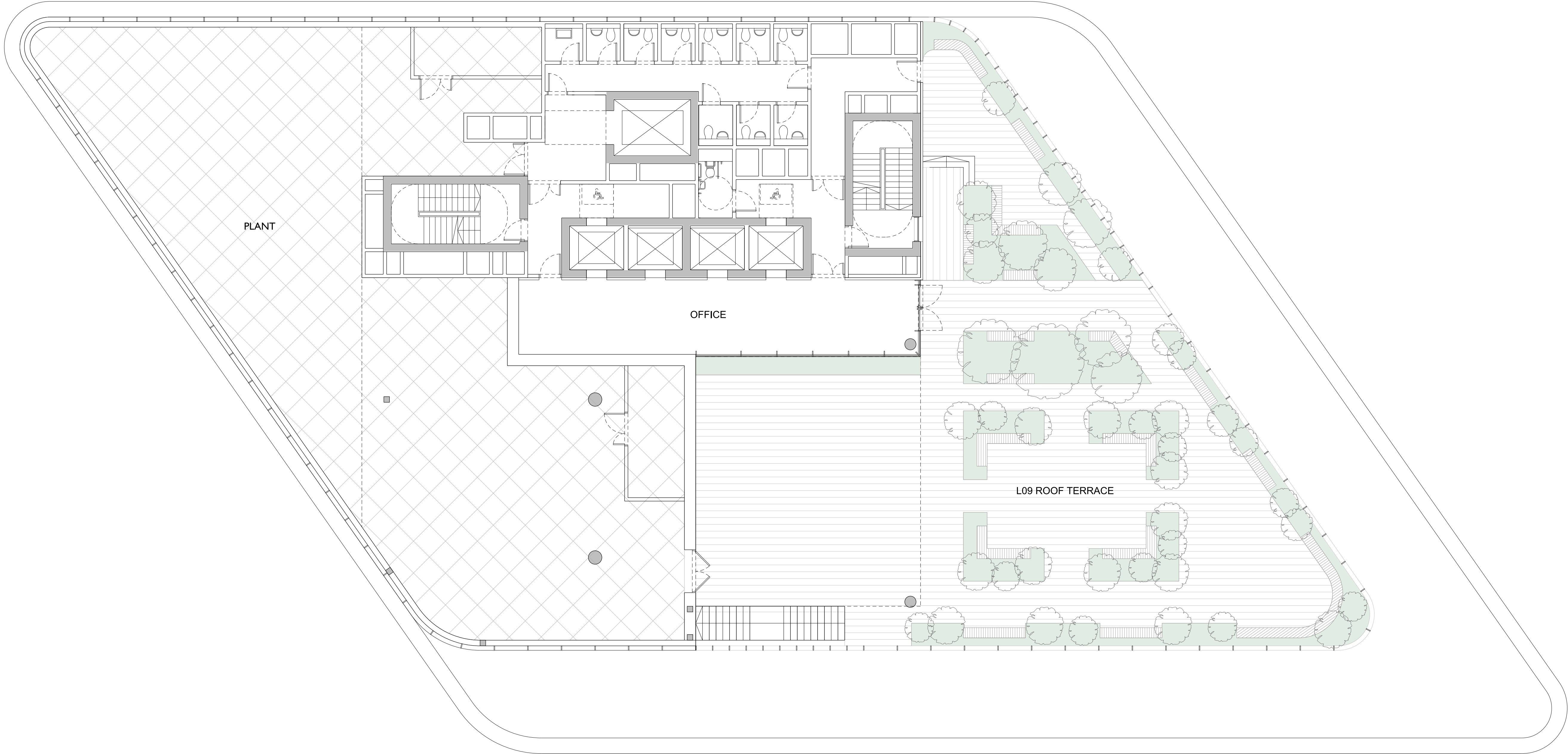
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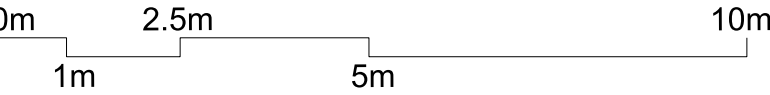
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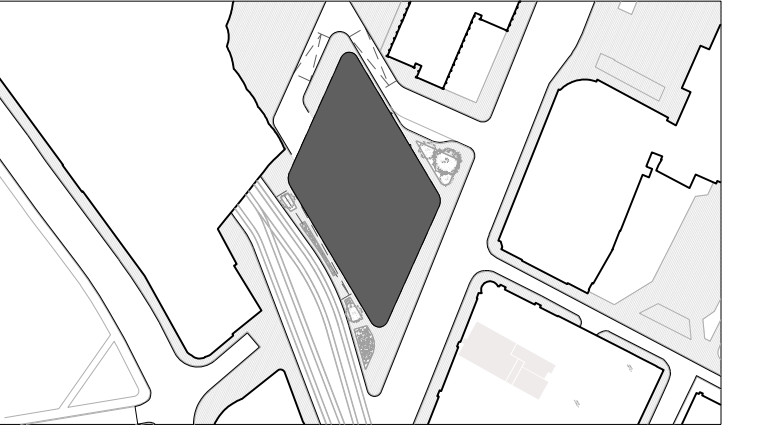
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Indicative Landscape Layout



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Rev	Date	Description



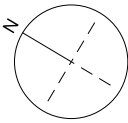
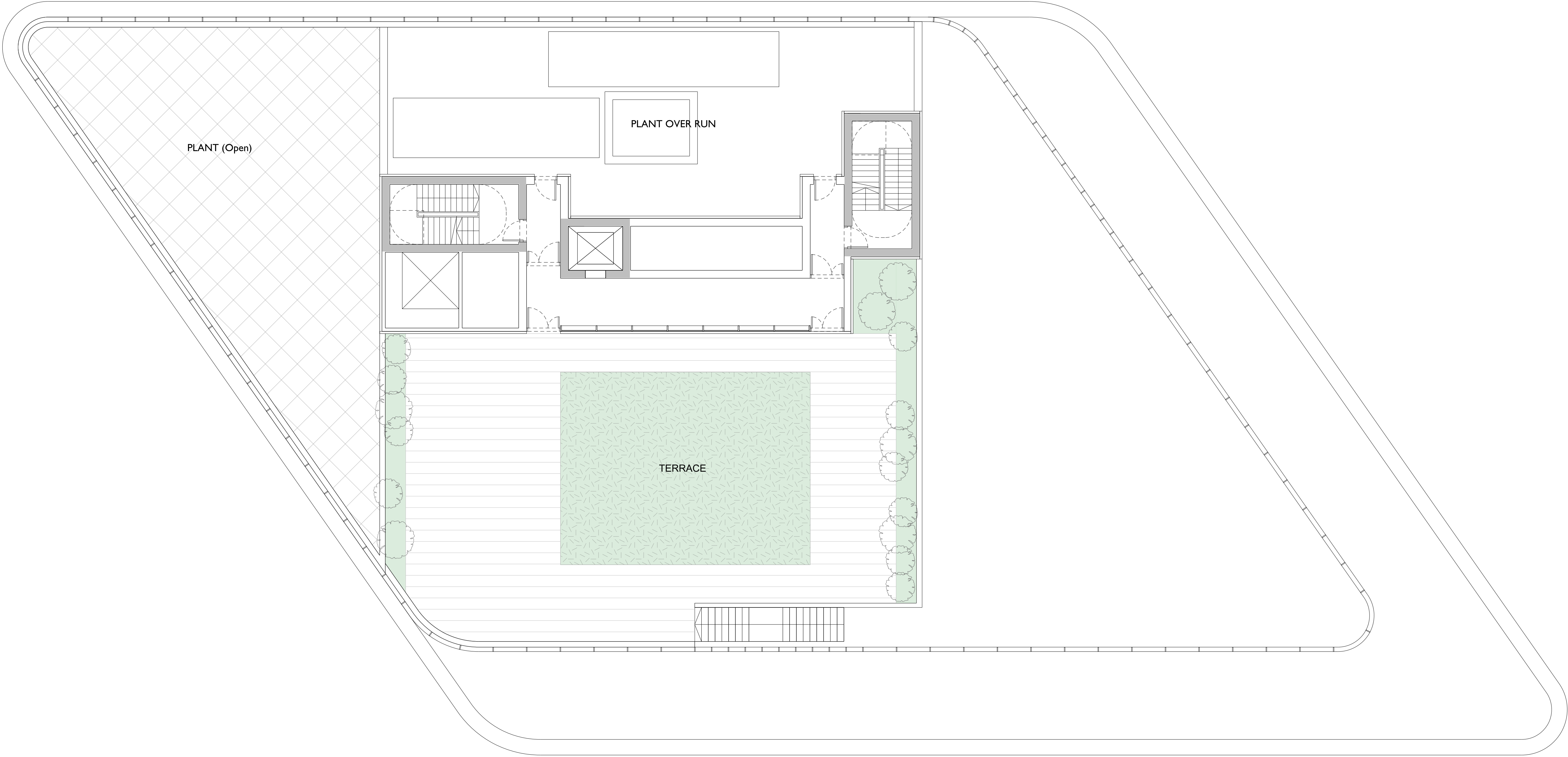
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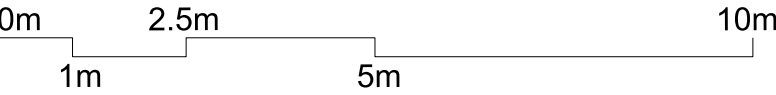
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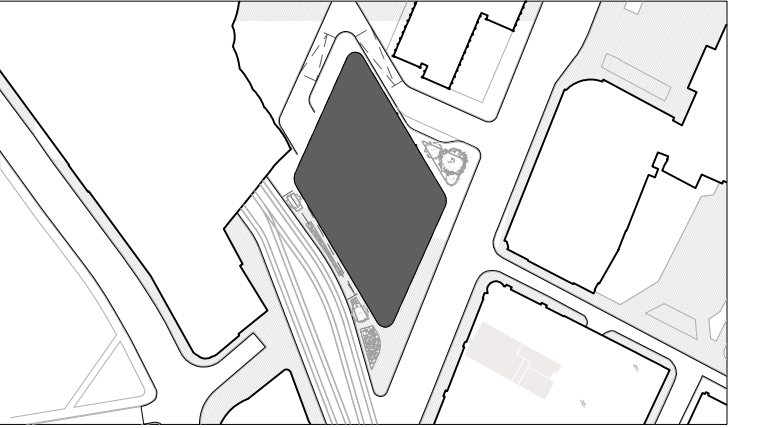
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Indicative Landscape Layout



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31.05.2022

Drawing Scale

1:100 @ A1 / 1:200 @ A3

Drawing Title

General Arrangement

Level 10

Drawn

EZ

Checked

NH

Approved

NH

Drawing Status

Planning

Project	Discipline	Level	Series	Dwg No	Rev
13701	A	10	P03	110	P1

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Piercy&Company

Appendix E – Flood Risk Maps

Flood map for planning

Your reference
221-132

Location (easting/northing)
384086/398956

Created
27 May 2022 14:45

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

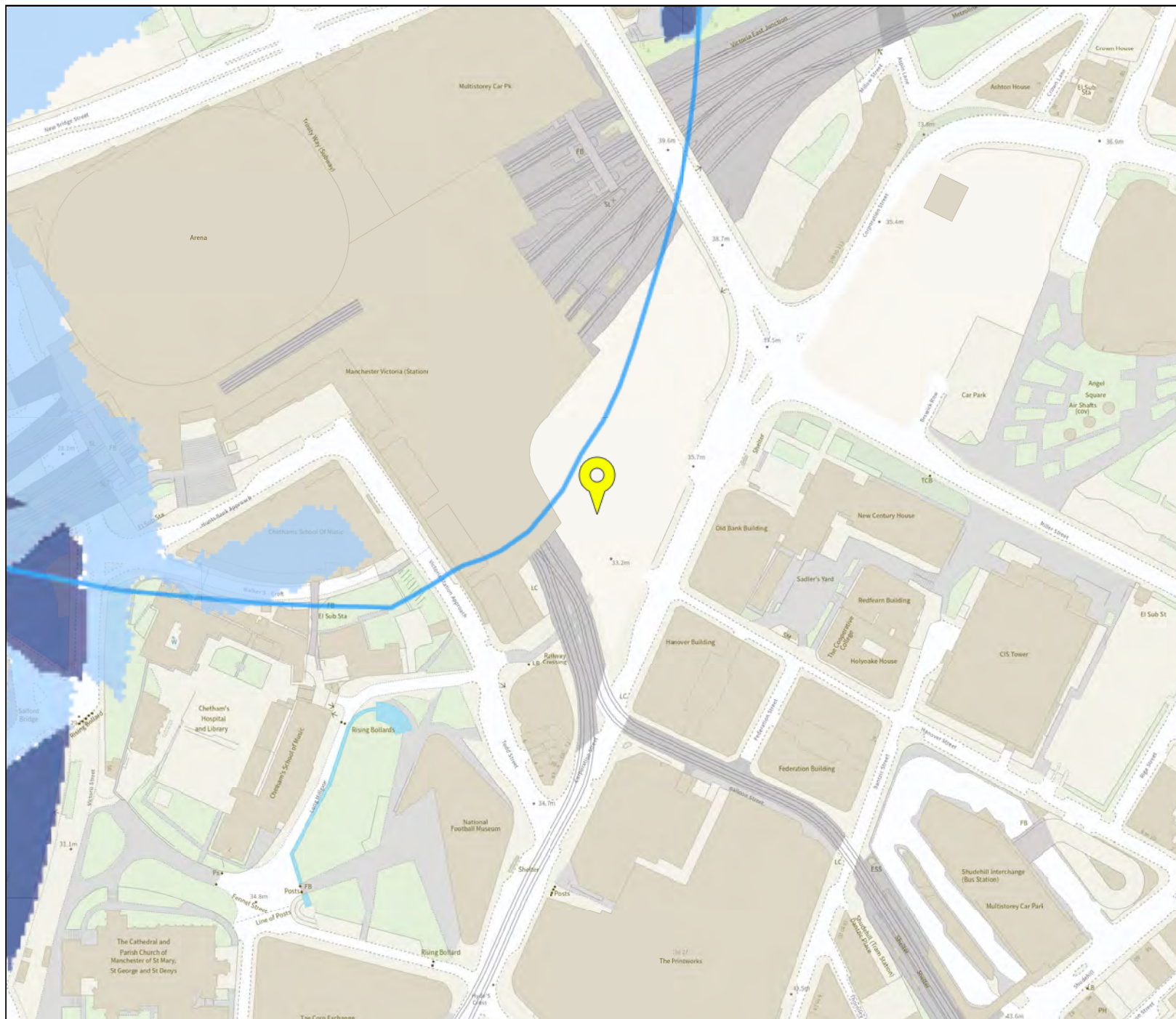
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

221-132

Location (easting/northing)

384086/398956

Scale

1:2500

Created

27 May 2022 14:45



Selected point



Flood zone 3



Flood zone 3: areas benefitting from flood defences



Flood zone 2



Flood zone 1



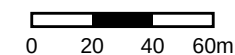
Flood defence



Main river



Water storage area



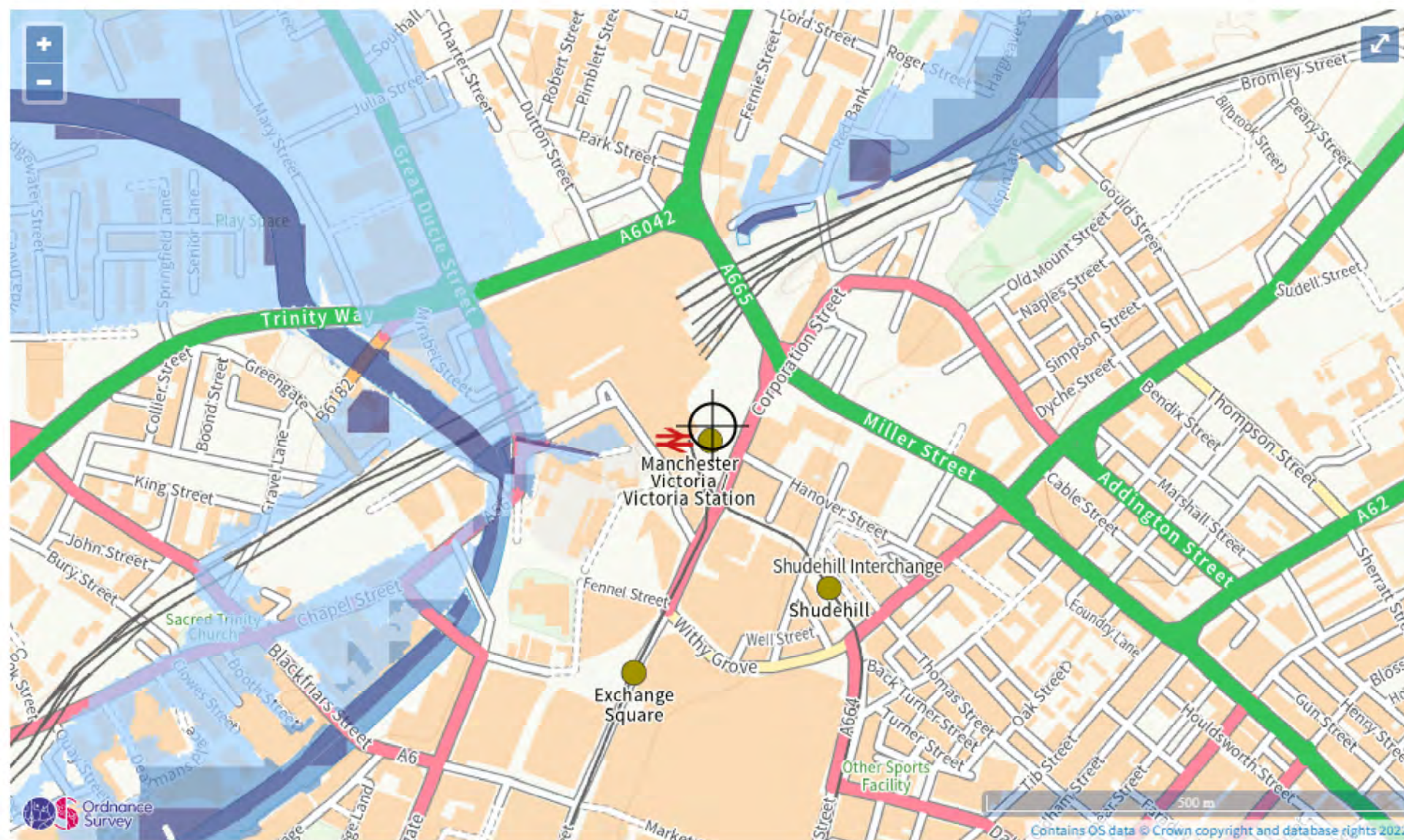
Flood risk

Extent of flooding



Location

Enter a place or postcode



Extent of flooding from rivers or the sea

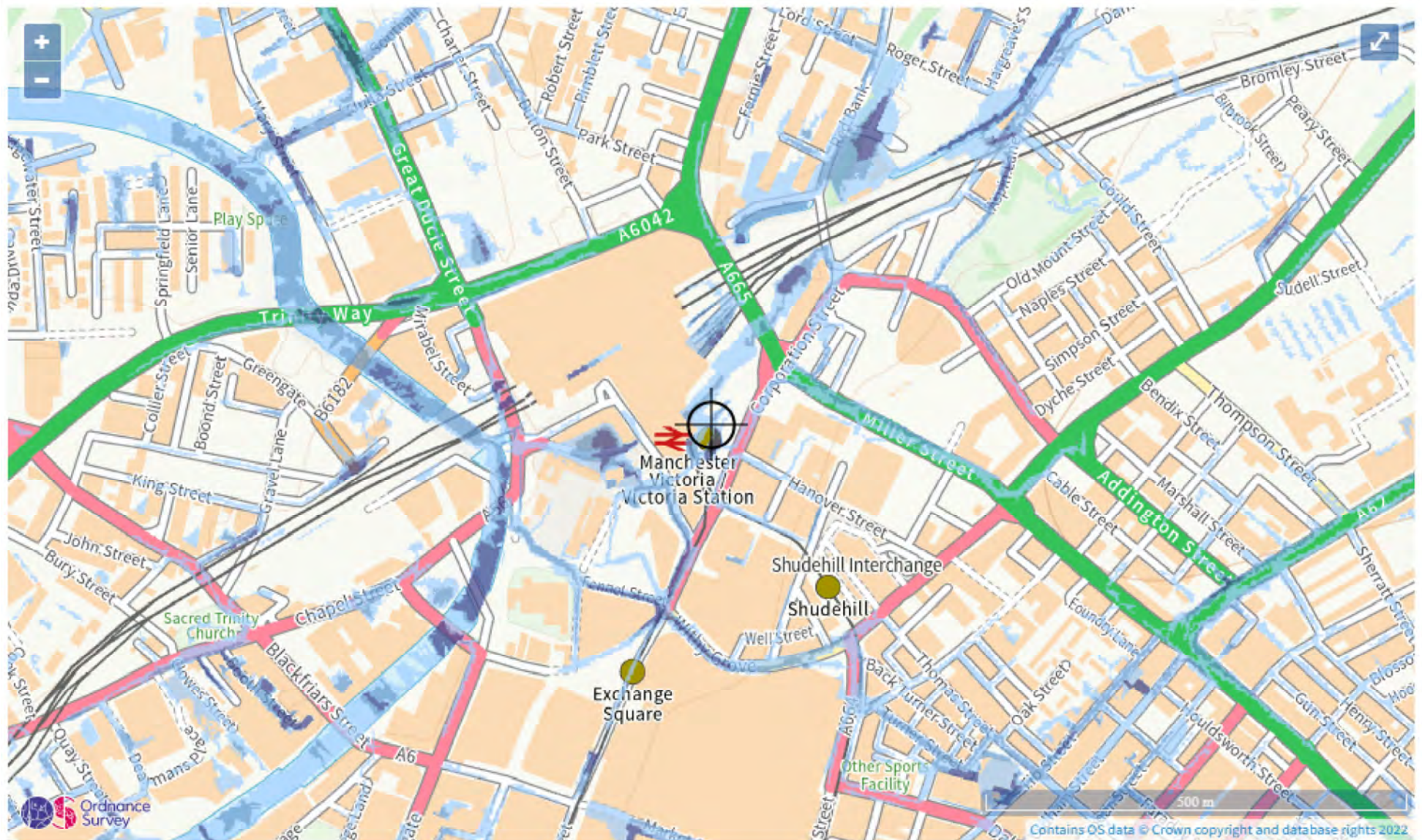
High Medium Low Very low Location you selected

Flood risk

Extent of flooding

Location

Enter a place or postcode



Extent of flooding from surface water

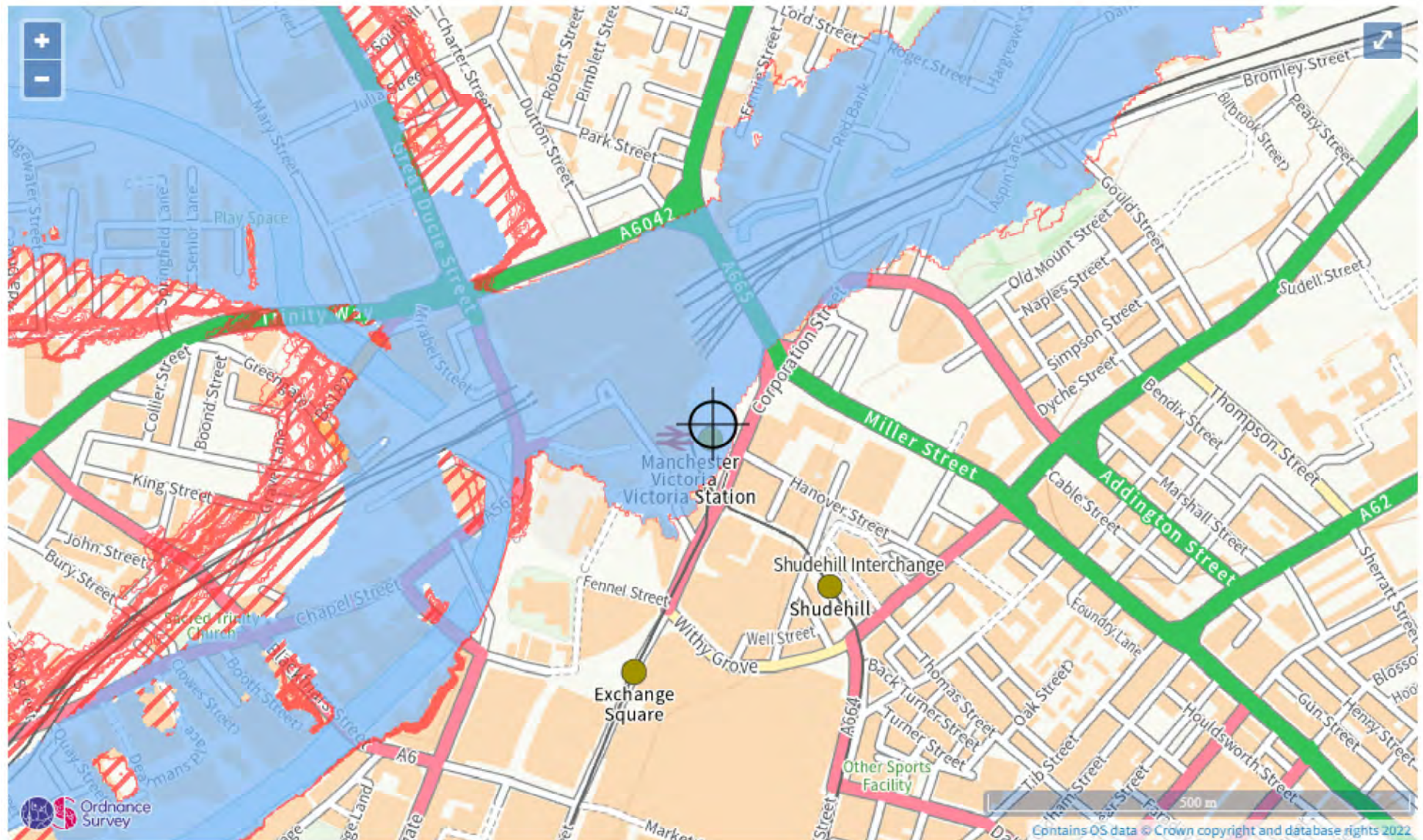
High Medium Low Very low Location you selected

Flood risk

Extent of flooding

Location

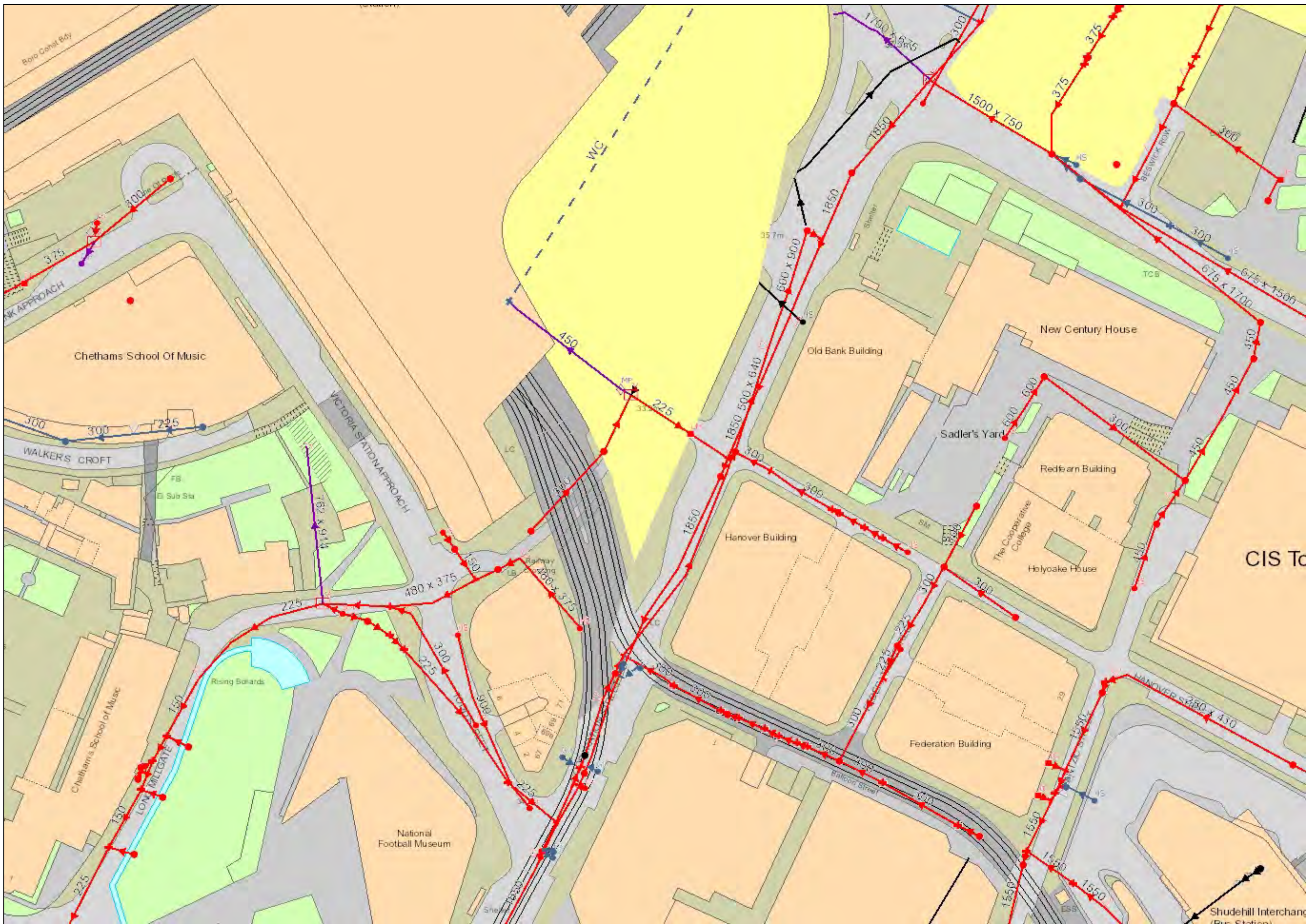
Enter a place or postcode



Maximum extent of flooding from reservoirs:

when river levels are normal when there is also flooding from rivers Location you selected

Appendix F – Existing Drainage Information



United Utilities Maps
for SafeDig

Date :	30/05/2022 10:42:27
Centre X:	384097
Centre Y:	398918
Scale :	1000
UserName:	4MY37

Extract from maps of United Utilities'
Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

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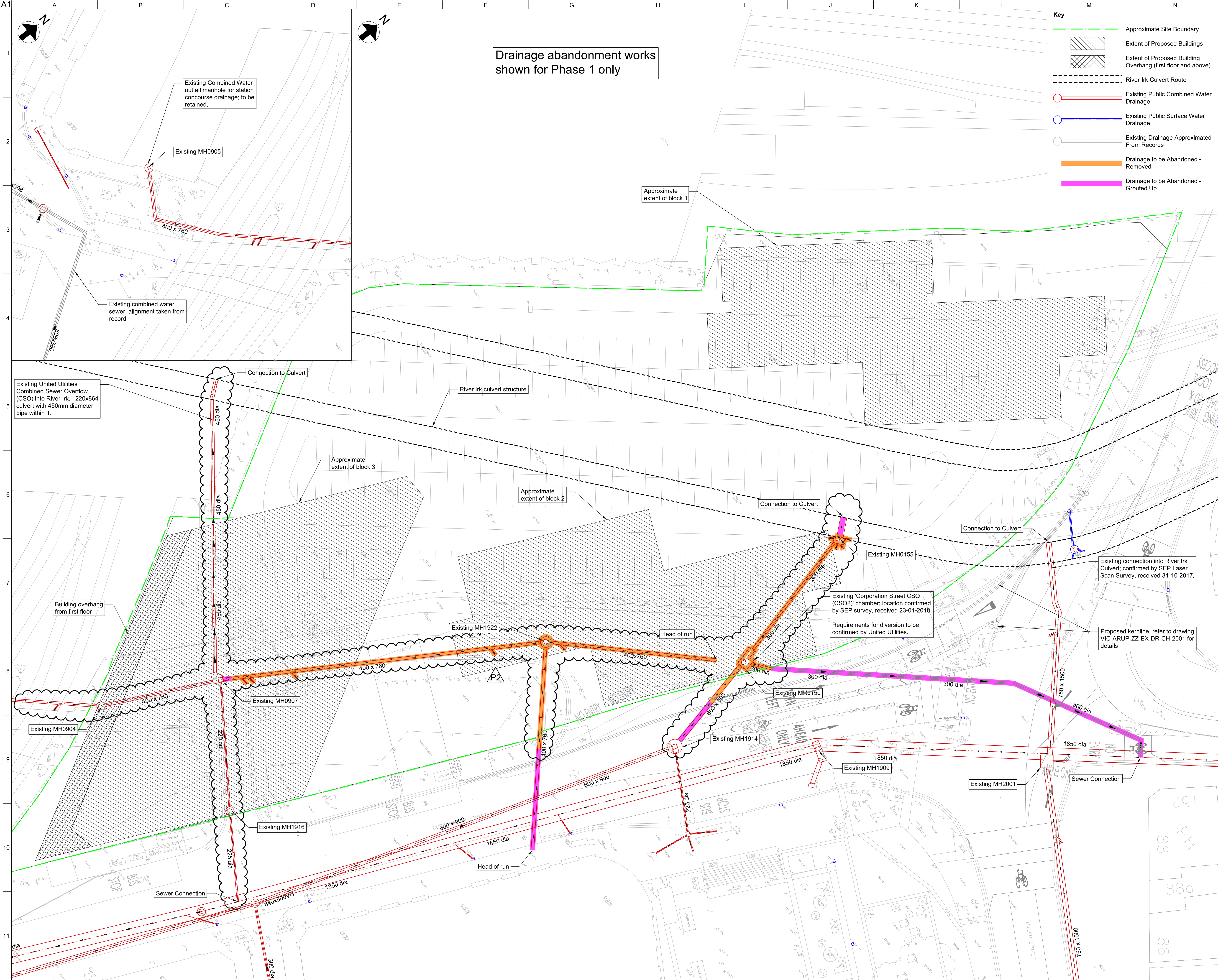
United Utilities SafeDig Website

Wastewater Symbolology

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	



Drainage abandonment works
shown for Phase 1 only

Key

- Approximate Site Boundary
- Extent of Proposed Buildings
- Extent of Proposed Building Overhang (first floor and above)
- River Irk Culvert Route
- Existing Public Combined Water Drainage
- Existing Public Surface Water Drainage
- Existing Drainage Approximated From Records
- Drainage to be Abandoned - Removed
- Drainage to be Abandoned - Grouted Up

- Notes**
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 - Layout is based on Topographical Survey drawing 'S11982-T_revA', undertaken by SEP Ltd; supplied 24/03/2016.
 - River Irk Culvert Route is based on Laser Scan survey undertaken by SEP Ltd, provided on drawing 'S14976-FP_revA'; supplied on 31/10/2017.
 - Existing drainage information is based on the following information:
 - Drainage CCTV Surveys undertaken by SEP Ltd, provided on drawing 'LS043-CCTV_revE'; supplied on 18/04/218
 - Existing Network Rail drainage based on Morgan Sindall External Drainage drawing '100262-HYD-00-ZZ-DR-D-GXX-1508_revAFC1'; dated 01/04/2014.
 - Layout is based on the following Planit-IE Landscape Masterplan drawings:
 - Phase 1 Lower Ground Floor - 'PL1487-VW-114_rev08'; supplied on 10/12/2019
 - Phase 1 Ground Floor - 'PL1487-VW-115_rev09'; supplied on 10/12/2019
 - Phase 2 Lower Ground Floor - DWG File; supplied on 06/12/2019
 - Proposed building outlines are based on Sheppard Robson Plan 'S219-SI-00-100_revT'; supplied on 16/10/2017.
 - Approximate Site Boundary is based on Sheppard Robson drawing 'S219-SI-00-502_revB'; supplied on 29/11/2019.
 - This drawing shall be read in conjunction with all other Engineer's drawings, reports and specifications.
 - Services may exist at various depths and their routes may deviate within the vicinity of the routes shown. No guarantee is given for the accuracy of existing services or constraints info, it is meant for information only. It is the Contractor's responsibility to satisfy themselves of the location and depth of existing services prior to any intrusive works.
 - Where connections to existing infrastructure are shown, the Contractor shall be responsible for undertaking an intrusive survey to confirm the suitability of this, prior to commencement of works and ordering of any materials.
 - Refer to the Ameen's Utility and Drainage Diversion Tracker Schedule for further details and proposals for each of the annotated utilities.
 - Extents of abandonments/diversions to be agreed with individual Utility Providers. Extents on this drawing are indicative only.
 - Refer to Arup drawing VIC-ARUP-ZZ-EX-DR-CU-2025 for diversion of pass forward flows through MH1914 and MH0150.

P2	13/12/19	TH	AJ	AJ
Scope of abandonments reduced to Phase 1				
P1	29/11/18	TH	AJ	AJ
Issued for Information				
Rev	Date	By	Chkd	Appd

ARUP

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Client
Muse Developments Ltd

Project Title
New Victoria

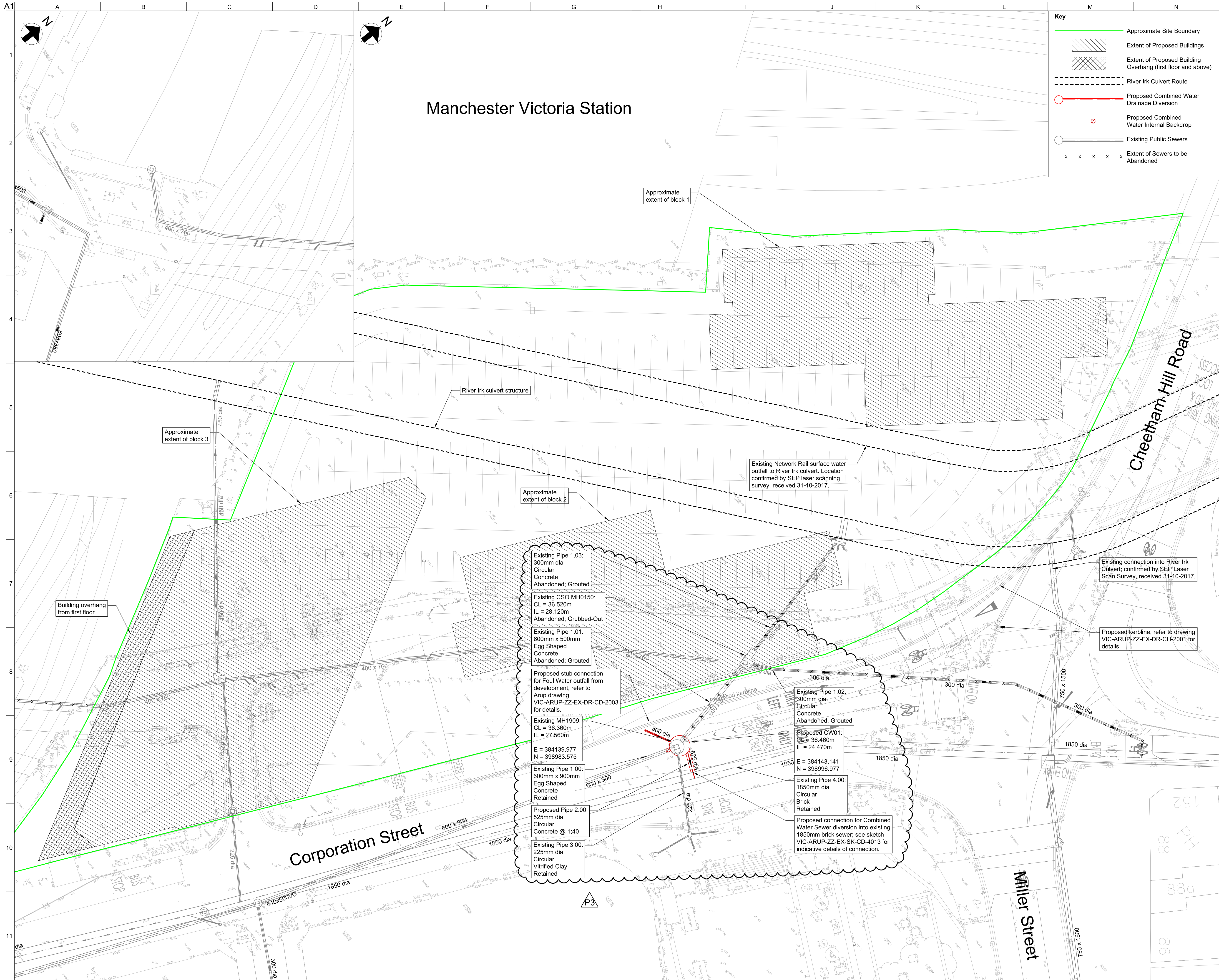
Drawing Title
**Existing Utilities
S116 Sewer Abandonments Plan
Existing Drainage Abandonments
Drainage (Public) - United Utilities**

Scale at A1
1:250

Role
Civils

Suitability
S2 - Issued for Information

Arup Job No 255644-00	Rev P2
Name VIC-ARUP-ZZ-EX-DR-CU-2024	



Key

- Approximate Site Boundary
- Extent of Proposed Buildings
- Extent of Proposed Building Overhang (first floor and above)
- River Irk Culvert Route
- Proposed Combined Water Drainage Diversion
- Proposed Combined Water Internal Backdrop
- Existing Public Sewers
- Extent of Sewers to be Abandoned

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 - Existing Network Rail drainage based on Morgan Sindall External Drainage drawing '100262-HYD-00-ZZ-DR-D-GXX-1508_revAFC1'; dated 01/04/2014.
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 - Phase 1 Ground Floor - 'PL1487-VW-115_rev09'; supplied on 10/12/2019
 - Phase 2 Lower Ground Floor - DWG File; supplied on 06/12/2019
 - Proposed building outlines are based on Sheppard Robson Plan '5219-SI-00-100_revT'; supplied on 16/10/2017.
 - Approximate Site Boundary is based on Sheppard Robson drawing '5219-SI-00-502_revB'; supplied on 29/11/2019.
 - This drawing shall be read in conjunction with all other Engineer's drawings, reports and specifications.
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 - Where connections to existing infrastructure are shown, the Contractor shall be responsible for undertaking an intrusive survey to confirm the suitability of this, prior to commencement of works and ordering of any materials.
 - Refer to the Ameon's Utility and Drainage Diversion Tracker Schedule for further details and proposals for each of the annotated utilities.
 - Extents of abandonments/diversions to be agreed with individual Utility Providers. Extents on this drawing are indicative only.
 - A S116 Application is being progressed in parallel to this S185 Application. Refer to Arup drawing VIC-ARUP-ZZ-EX-DR-CU-2024 for S116 Drainage Abandonments.

P3	13/12/19	TH	AJ	AJ
Updated for WS3+				
P2	22/02/19	TH	AJ	AJ
Annotation Updated				
Rev	Date	By	Chkd	Appd

ARUP

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Client
Muse Developments Ltd

Project Title
New Victoria

Drawing Title
**Existing Utilities
S185 Sewer Diversion Plan
Corporation Street CSO Diversion
Drainage (Public) - United Utilities**

Scale at A1
1:250

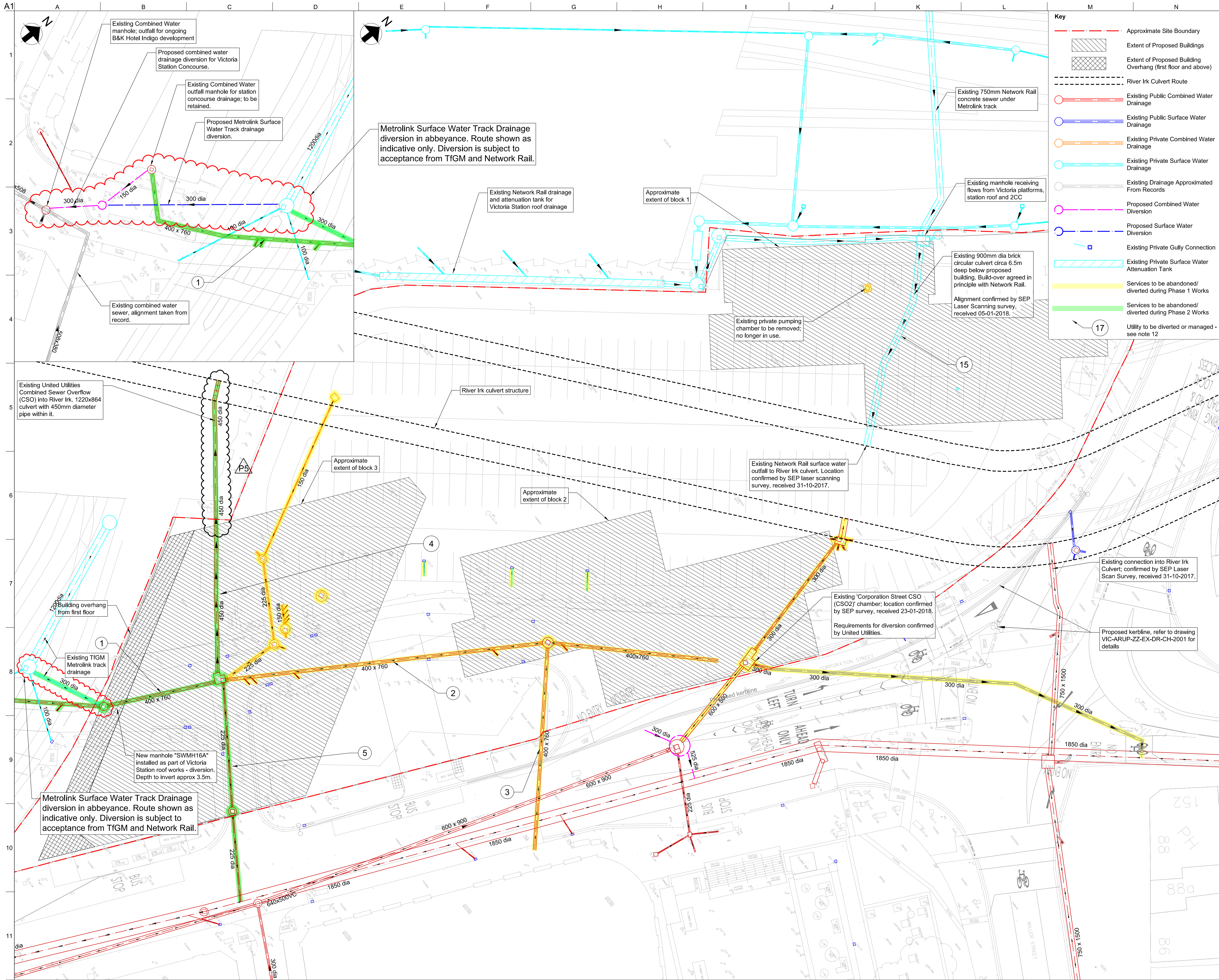
Role
Civils

Suitability
S2 - Issued for Information

Arup Job No
255644-00

Rev
P3

Name
VIC-ARUP-ZZ-EX-DR-CU-2025



Notes

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- River Irk Culvert Route is based on Laser Scan survey undertaken by SEP Ltd, provided on drawing 'S14976-FP_revA'; supplied on 31/10/2017.
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 - Existing Network Rail drainage based on Morgan Sindall External Drainage drawing '100262-HYD-00-ZZ-DR-D-GXX-1508_revAFC1'; dated 01/04/2014.
- Layout is based on the following Planit-IE Landscape Masterplan drawings:
 - Phase 1 Lower Ground Floor - 'PL1487-VW-114_rev08'; supplied on 10/12/2019
 - Phase 1 Ground Floor - 'PL1487-VW-115_rev09'; supplied on 10/12/2019
 - Phase 2 Lower Ground Floor - DWG File; supplied on 06/12/2019
- Proposed building outlines are based on Sheppard Robson Plan '5219-SI-00-100_revT'; supplied on 16/10/2017.
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- Where connections to existing infrastructure are shown, the Contractor shall be responsible for undertaking an intrusive survey to confirm the suitability of this, prior to commencement of works and ordering of any materials.
- Refer to the Ameon's Utility and Drainage Diversion Tracker Schedule for further details and proposals for each of the annotated utilities.
- Extents of abandonments/diversions to be agreed with individual Utility Providers. Extents on this drawing are indicative only.

P5	13/12/19	TH	AJ	AJ
Updated for WS3+				
P4	08/08/18	TH	AJ	SIL
Updated to reflect latest drainage survey information				
P3	16/02/18	TH	AJ	SIL
Updated for Masterplan and Client Comments				
Rev	Date	By	Chkd	Appd

ARUP

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Client
Muse Developments Ltd

Project Title
New Victoria

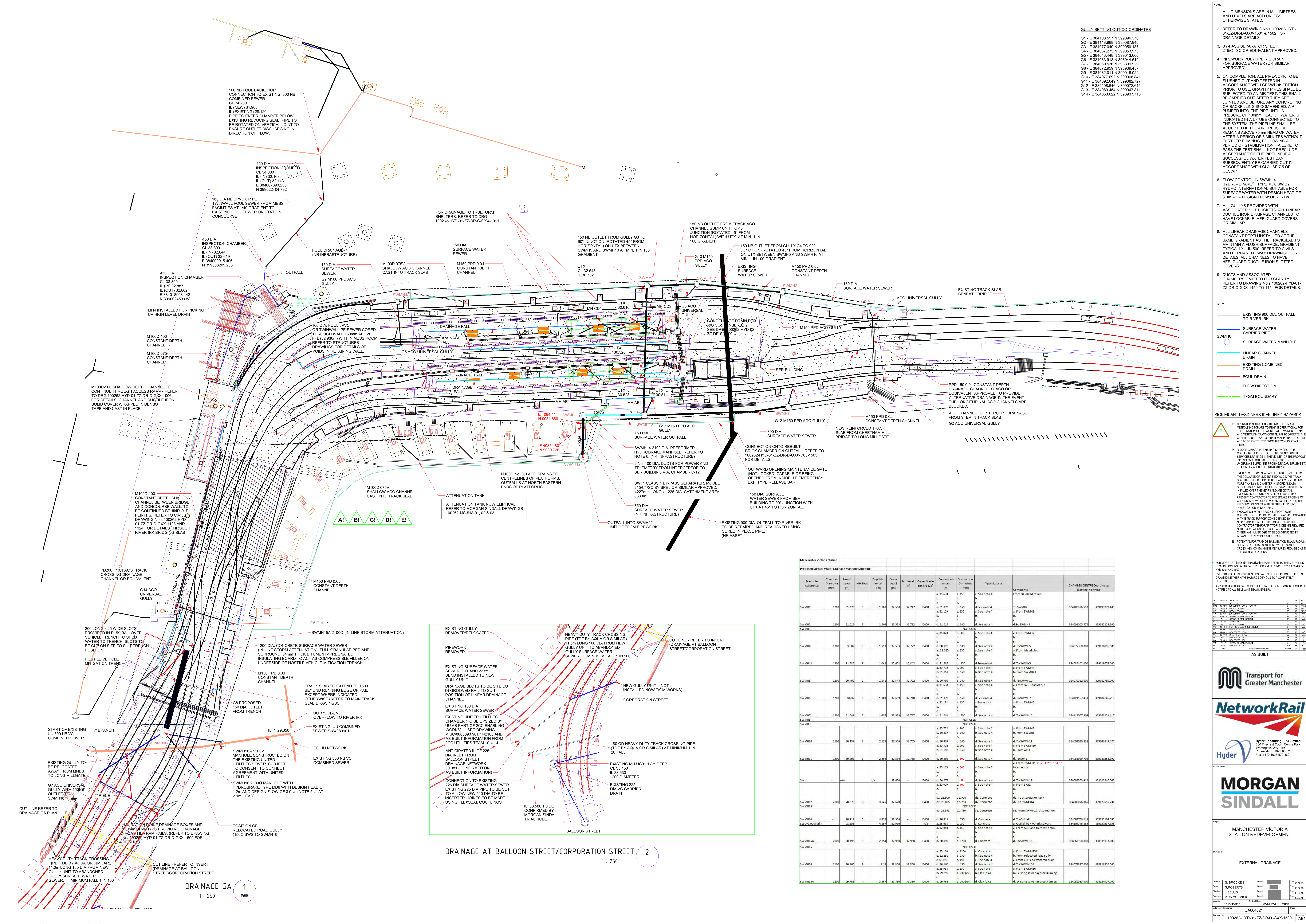
Drawing Title
**Existing Utilities
Abandonments and Diversions
Drainage - Various**

Scale at A1
1:250

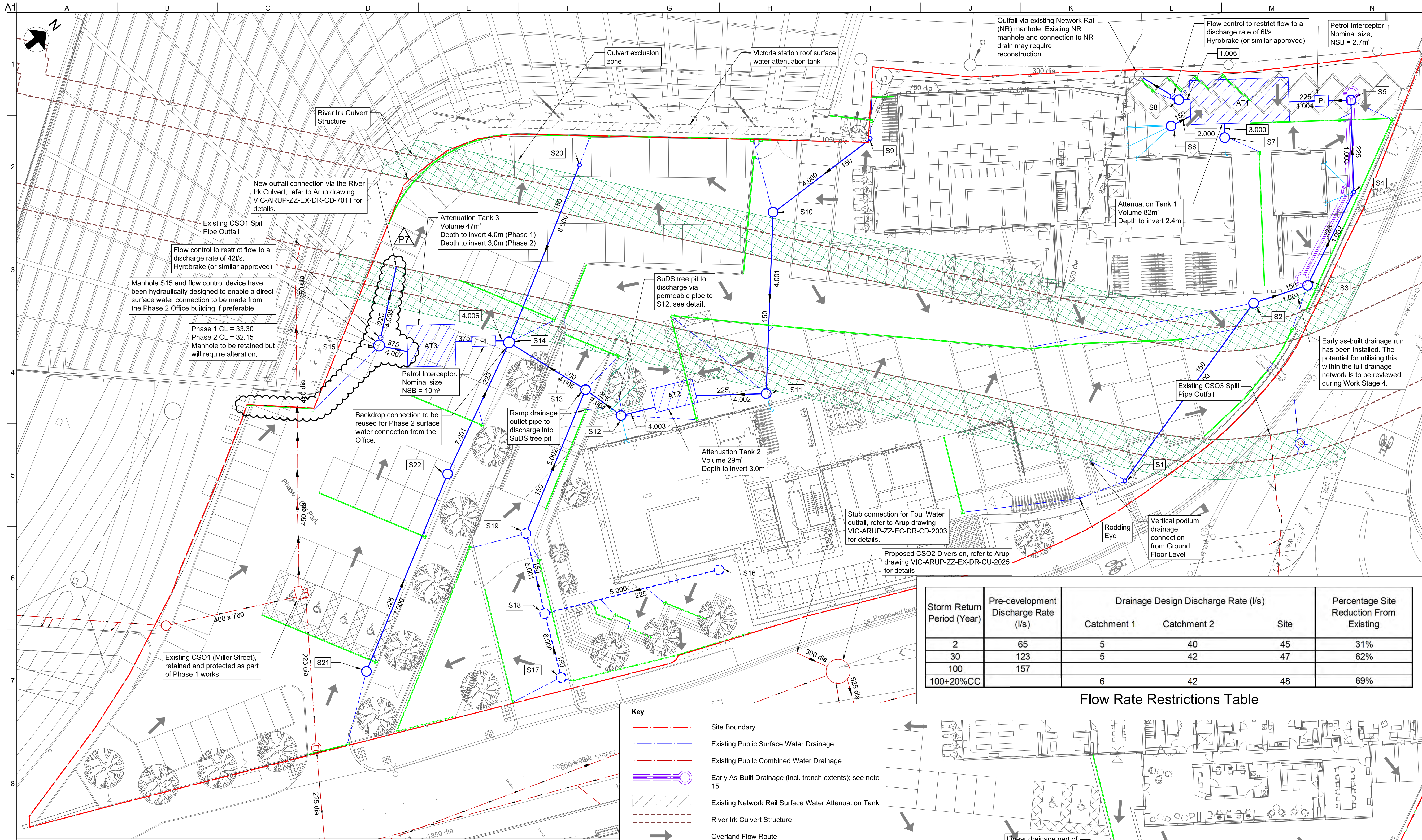
Role
Civils

Suitability
S2 - Issued for Information

Arup Job No 255644-00	Rev P5
Name VIC-ARUP-ZZ-EX-DR-CU-2005	



Appendix G – Phase 1 Drainage Information



- Notes:**

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 - Existing drainage information is based on the following information:
 - Drainage CCTV Surveys undertaken by SEP Ltd, provided on drawing 'LS043-CCTV_revE', supplied on 18/04/2018
 - Existing Network Rail drainage is based on Morgan Sindall External Drainage drawing '100262-HYD-00-ZZ-DR-D-GXX-1508_revAFC1', dated 01/04/2014
 - Layout is based on the following Planit-IE Landscape Masterplan drawing:
 - Phase 1 Lower Ground Floor - 'PL1487-VW-114_rev08', supplied on 10/12/2019
 - Phase 1 Ground Floor - 'PL1487-VW-115_rev09', supplied on 10/12/2019
 - Phase 2 Lower Ground Floor - DWG File; supplied on 06/12/2019
 - Approximate Site Boundary is based on Sheppard Robson drawing 'S219-SI-00-502_revB', supplied on 29/11/2019.
 - This drawing shall be read in conjunction with all other Engineer's drawings, reports and specifications.
 - Services may exist at various depths and their routes may deviate within the vicinity of the routes shown. No guarantee is given for the accuracy of existing services and constraints information. It is the Contractor's responsibility to satisfy themselves of the location and depth of existing services prior to any intrusive works.
 - New connections are indicative and subject to verification and acceptance from Statutory Undertakers.
 - This drawing does not show drainage works associated with proposed modifications carried out as part of S278 Works.
 - The proposed geocellular attenuation tanks shall be Hydro-International Stormbloc or similar approved. The tanks shall be wrapped with an impermeable geo-membrane and sealed to the manufacturers recommendations. Refer to Arup Attenuation Tank Performance Specification, document reference 'VIC-ARUP-ZZ-EX-SP-CD-0001'.
 - Petrol interceptors shall be Class 1 Bypass Separators. An allowance for vent pipes, alarms and access points shall be made. Connectivity and location TBC at detailed design stage by others.
 - Refer to Arup drawing 'VIC-ARUP-ZZ-EX-DR-CD-2004' for the Proposed Drainage Manhole Schedule.
 - Early as-built drainage run has been installed between MH S3 and S5 inclusive. The potential for utilising this within the full drainage network is to be reviewed during Work Stage 4.
- Key**

 - Site Boundary
 - Existing Public Surface Water Drainage
 - Existing Public Combined Water Drainage
 - Early As-Built Drainage (incl. trench extents); see note 15
 - Existing Network Rail Surface Water Attenuation Tank
 - River Irk Culvert Structure
 - Overland Flow Route

Lower Ground Floor Drainage:

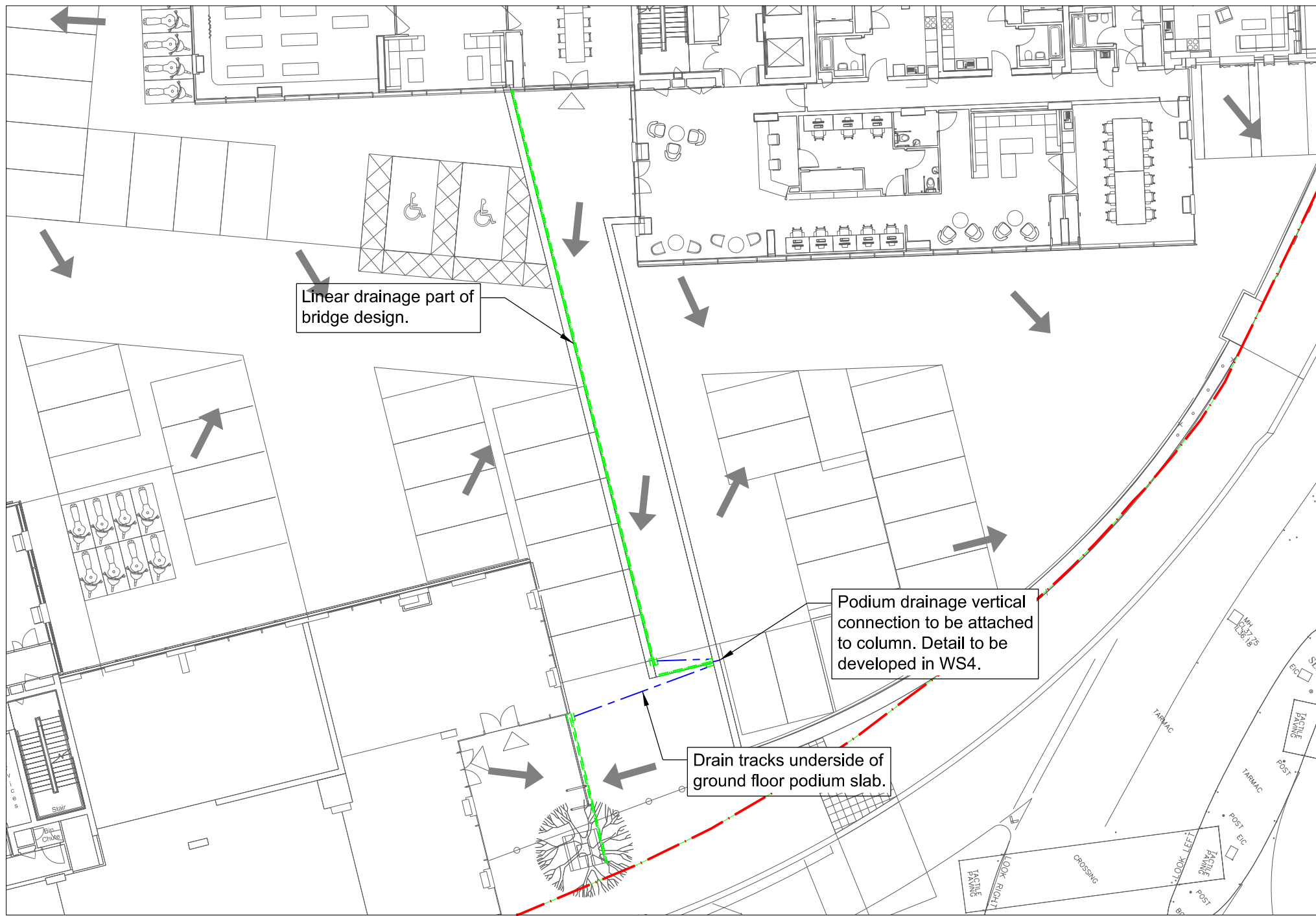
 - Proposed Surface Water Sewer with pipe diameter and pipe reference
 - Proposed Surface Water Manhole with reference No.
 - Proposed Surface Water Manhole with flow control
 - Surface Water Connection from building
 - Class 1 Bypass Separator
 - Attenuation Tank
 - SuDS Tree Pit
 - Surface Water Channel Drain, outlet chamber and connection (Marshalls Birco 150 and 0/0 channel unit or similar approved)
 - Gully with connection

Ground Floor Drainage:

 - Proposed Surface Water Sewer
 - Proposed Surface Water Manhole
 - Surface Water Slot Drain, outlet chamber and connection (Marshalls Drexus Slot Drain and 20/0 channel unit or similar approved).
 - Surface Water Connection

Storm Return Period (Year)	Pre-development Discharge Rate (l/s)	Drainage Design Discharge Rate (l/s)			Percentage Site Reduction From Existing
		Catchment 1	Catchment 2	Site	
2	65	5	40	45	31%
30	123	5	42	47	62%
100	157				
100+20%CC		6	42	48	69%

Flow Rate Restrictions Table



Ground Floor Level - Footbridge Drainage

Scale 1:250

P7	13/12/19	TH	AJ	AJ
Updated for WS3+				
P6	04/10/19	TH	AJ	SL
Updated to Incorporate Early As-Built				
P5	12/07/19	EC	AJ	SL
Updated to Incorporate MCC Comments				
P4	17/05/19	JS	AJ	SL
Updated for Planning Condition 31				
P3	16/02/18	EC	AJ	SL
Updated for Masterplan & Client Comments				
P2	16/10/17	AS	AJ	SL
Workstage 3 Issue				
P1	16/06/17	AS	AJ	SL
Workstage 2 Issue				
Rev	Date	By	Chkd	Appd

ARUP

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Client
Muse Developments Ltd

Project Title
New Victoria

Drawing Title
Proposed Surface Water Drainage Layout General Arrangement Phase 1

Scale at A1

1:250

Role

Civils

Suitability
S2 - Issued for Information

Arup Job No

255644-00

Name

VIC-ARUP-P1-EX-DR-CD-2001

Rev

P7

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Project title	New Victoria	Job number
		255644
cc	MCC	File reference
		4-05-02
Prepared by	Emma Cecil	Date
		16 May 2019
Subject	2019 Update on Surface Water Drainage Strategy	

1 Introduction

This should be read in conjunction with the original Arup Drainage Strategy (2016), which formed part of the planning submission, for full details of the existing site drainage regime and the agreed design criteria for the surface water and foul networks.

As the design for New Victoria has progressed some of this Strategy has been developed further. This Note sets out the updated information for the Surface Water Drainage Strategy.

The surface water drainage network layout for the New Victoria site is provided on the drawing VIC-ARUP-P1-EX-DR-CD-2001 for Phase 1 of the scheme.

2 Design Updates

2.1 Catchments

At the time that the original drainage strategy was produced, the proposed surface water drainage scheme had three catchments, each with their own network, petrol interceptor and attenuation storage tank. During WS3 these have been rationalised to two in order to negate a new connection into the culvert for the proposed surface water (as indicated on the accompanying drawing VIC-ARUP-P1-EX-DR-DC-2001 RevP4). The two proposed surface water catchments (see Figure 1) are:

- Catchment 1: Residential Block 1 and northern car park areas - drain to the River Irk culvert via Network Rail's outfall pipe
- Catchment 2: Residential Block 2, the Phase 2 Office Block and remaining southern car park areas - drain the River Irk culvert via the existing UU CSO – further details of UU consultation and proposed ownership is described below.

File Note

255644

16 May 2019



Figure 1 - Surface Water Drainage Catchments

2.2 Phase 2 Allowance

Phase 2 development involves the construction of an office building adjacent to the Metrolink and Corporation Street. This is not presently being progressed by the developer.

The Phase 1 drainage scheme has been designed to account for Phase 2 with regard to network sizing, levels and layout. The basement of the Phase 2 office is approximately 1m lower than the Phase 1 of the carpark, making these the critical ground levels in terms of flooding, and so the network has been designed to accommodate Phase 2. Connection stubs in two locations constructed during Phase 1 will retain flexibility for the office block connection, depending on the final pile foundations design. As Phase 1 is hardstanding car park and Phase 2 is impermeable office building, the run off rates and therefore attenuation requirements remain the same for both.

2.3 Surface Water Drainage Hierarchy

Infiltration

Arup's Ground Investigation Report concluded that the Made Ground across the site has elevated concentrations of contaminants, with a potential risk to future site users arising from exposure to soils in soft landscaping areas. Therefore, infiltration will not be used to discharge the surface water from this Site.

Planning conditions 28 and 32 restrict infiltration without the written consent of MCC due to the ground contamination. The drainage of the few soft landscaped areas has been discussed and agreed with MCC as acceptable via infiltration and, therefore, these areas do not require active drainage.

Surface Water Body

It is proposed that New Victoria discharges via existing sewers to the River Irk which passes through a culvert beneath the site.

File Note

255644

16 May 2019

Agreement in principles have been obtained from Network Rail and UU to discharge our site into their existing sewers, the formalised approvals are in progress.

A Bespoke Permit has been granted from the EA for the development of New Victoria as it is within 8m of a Main River. However, we are utilising existing outfalls to the culvert and so will not be discharging directly to the river nor working on the structure to construct new outfalls.

2.4 SuDS

New Victoria is heavily constrained by the River Irk culvert which passes beneath the site (see drawing VIC-ARUP-P1-EX-DR-CD-2001). This has minimal cover (1-1.2m) and so eliminates the potential for swales etc in this area. There is also the requirement to not cause additional loading on this structure.

To avoid the structural pile caps, and act as wind mitigation, the trees within the site are in raised planters. Therefore, generally, it is not possible to utilise these as bioretention tree pits within the drainage network.

We have been able to get one of the tree pits to be able to operate as a bioretention tree pit – this is at the base of the ramp where levels allow this to work. The design has now been modified to discharge the ramp gullies into a raised tree pit, which has the potential to overflow back into the network rather than infiltrate into the ground. This is illustrated on drawing VIC-ARUP-P1-EX-DR-CD-2001. The investigation of potential SuDS locations and the constraints on the site have been discussed with MCC.

2.5 Flow Rates

The New Victoria site is very congested due to the River Irk culvert beneath. Between the culvert and the building foundations, there is little remaining space in which attenuation storage can be provided. We have maximised Catchment 1 where there is more available space to provide attenuation, in order to minimise the volume of tanks required for Catchment 2 where space is most limited. The contractor involved to date previously expressed concerns as to the health and safety implications associated with the buildability of these tanks in such a constrained space (currently 4m deep). Reducing the surface water runoff rates would reduce the required attenuation tank volumes, reducing excavation depths and the proximity to culvert/piles.

It has therefore been agreed with MCC to reduce the runoff rate restriction to 30%. Whilst there is a 30% reduction in the 1 in 2 year storm event, there is still a >60% reduction for the larger storm events, and so on average a >50% betterment would still be achieved.

Storm return period (year)	Pre-development rate (l/s)	Discharge limit (l/s) to provide a 30% reduction beyond existing	MicroDrainage modelled site discharge rate (l/s)	Percentage site reduction from existing
2	65	46	45	31%
30	123	86	47	62%
100	157			
100 + 20% CC	-	110	48	69%

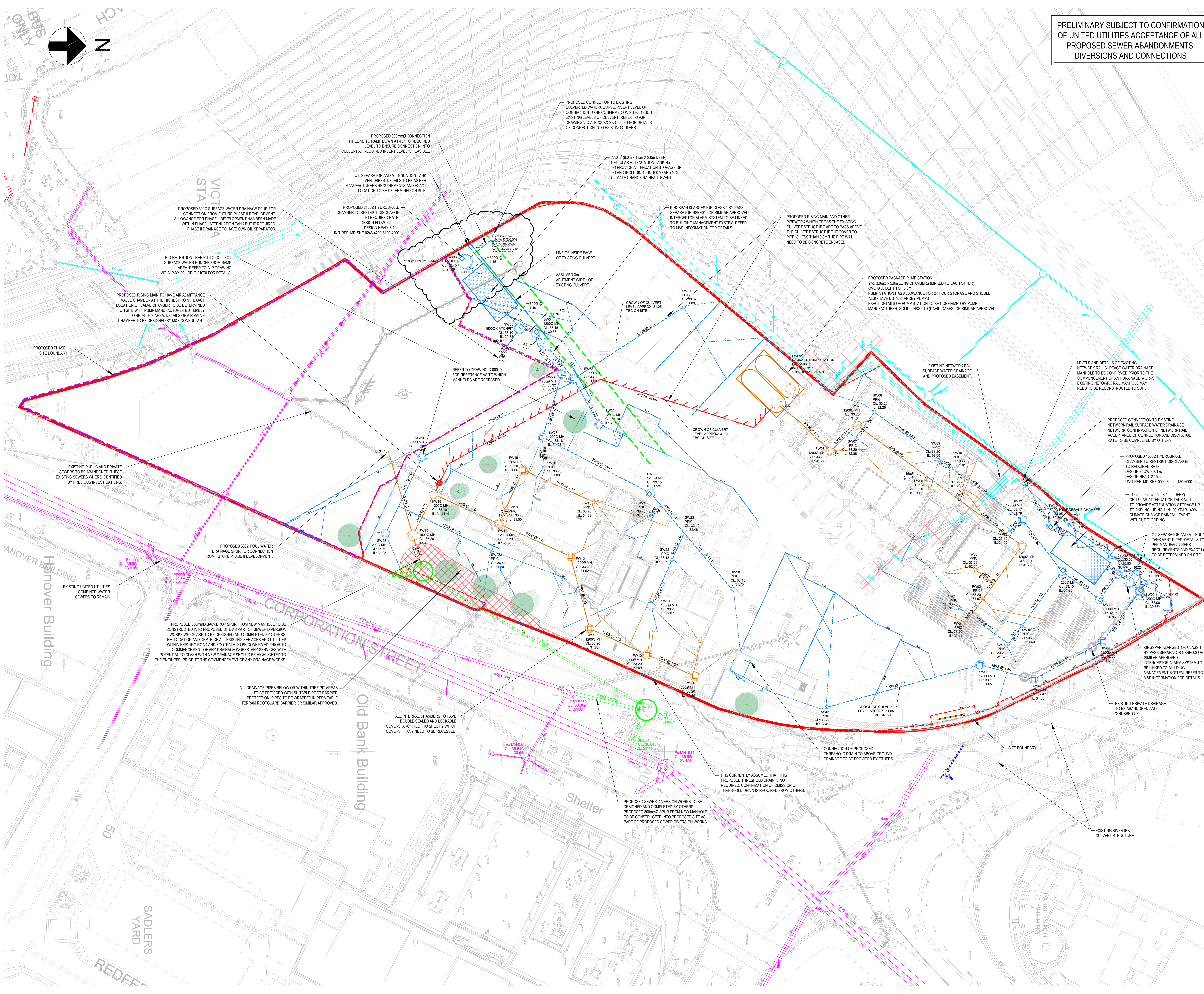
File Note

255644

16 May 2019

DOCUMENT CHECKING (not mandatory for File Note)			
	Prepared by	Checked by	Approved by
Name	Emma Cecil	Andrew Jackson	
Signature	EC	AJ	

Appendix H – Phase 1 Detailed Drainage Design



PRELIMINARY SUBJECT TO CONFIRMATION
OF UNITED UTILITIES ACCEPTANCE OF ALL
PROPOSED SEWER ABANDONMENTS,
DIVERSIONS AND CONNECTIONS

IMPORTANT NOTES

- SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES NOT BE SCALED FROM THIS DRAWING.
- ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
- THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm.
- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE RATES SHALL INCLUDE FOR HANDING AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADVISE TO THE CONVEYANCE AT ALL TIMES.
- THE OUTLETS OF ALL SEWERS SHALL BE A MINIMUM OF 1.0m FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 1.0m FROM KERB LINES.
- EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES.
- ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES.
- ALL MATERIALS TO BEAR THE RELEVANT B.S. ITEM MARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT UNLESS THE SITE INVESTIGATION REPORT PROVIDES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHIN A CLASS.
- ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY A J.A. INVC OR THE NETWORK OPERATOR AS APPLICABLE.
- WHERE 'ULTRA REP' UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND Laid IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
- A CLASS 8 REIN. AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1M OF HIGHWAY SHALL AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUBTLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL 4.3.4.
- SUB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE.
- DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS. APPROVED DOCUMENT H. 110mm UP V.C. PIPES Laid TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.
FOUL: 1 IN 40
RAIN: 1 IN 60
HEAD RUN ELSEWHERE: 1 IN 30
- ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE.
- ALL INTERNAL MANHOLE COVERS TO BE RECESSED TO ACCEPT FINISH AS DETAILLED BY ARCHITECT.
- THE LOCATION AND ORIENTATION OF ALL RECESSED COVERS IN BLOCK PAVING AREAS TO BE COORDINATED WITH BLOCK LAYING PATTERN.
- SLOW REST BENDS TO BE USED IN ALL LOCATIONS MADE UP FROM 20m 24.45 DEG BENDS (800mm TO INVERT FROM FFL).
- MANHOLE POSITIONS AND ACCESS COVERS TO BE ACCURATELY SET OUT BY LANDSCAPE ARCHITECT TO SUIT EXTERNAL FINISHES.
- ALL DRAINS CAST THROUGH FOUNDATIONS TO HAVE ROOFER PIPES ON BOTH SIDES OF FOUNDATION.
- ALL POP UP POSITIONS TO BE CONFIRMED SET OUT DIMENSIONS TO BE AGREED & PROVIDED BY OTHERS.
- ALL DISCHARGE RATES TO BE CONFIRMED BY M&E DESIGNER.
- ALL SURFACE WATER COLLECTION FEATURES TO BE CONFIRMED BY THE LANDSCAPE ARCHITECT.
- STORAGE HAS BEEN PROVIDED IN A CELLULAR STORAGE TANK AND UP-SIZED MANHOLES AND PIPES.
- EXISTING SEWER DEPTHS HAVE BEEN APPROXIMATED FROM LIMITED INFORMATION. NEW CONNECTIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION OF ANY DRAINAGE WORKS.
- LANDSCAPE ARCHITECT TO CONFIRM GULLY AND DRAINAGE CHANNEL LOCATIONS TO LANDSCAPED AREAS.
- FOUL NETWORK TO BE CONFIRMED FOLLOWING CONFIRMATION OF BRANCH CONNECTION POINTS FROM BUILDING M&E DESIGNER.

NOTE 1

Manhole covers to be related to match/suit the landscape architects finishes. Recessed manhole covers to suit landscape architects details and finishes. Drainage covers within paving to be recessed.

LEGEND

- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL WATER MANHOLE
- PROPOSED FOUL WATER PPC
- PROPOSED SURFACE WATER PPC
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED UNITS UTILITIES COMBINED SEWER DIVERSIONS TO BE COMPLETED BY OTHERS
- PROPOSED ACID DRAIN
- PROPOSED THRESHOLD DRAIN
- EXISTING NETWORK RAIL SURFACE WATER DRAINAGE EASEMENTS
- EXISTING UNITS UTILITIES COMBINED SEWERS TO REMAIN
- EXISTING UNITS UTILITIES SURFACE WATER SEWERS TO REMAIN
- EXISTING NETWORK RAIL SEWERS TO REMAIN
- EXISTING PUBLIC AND PRIVATE SEWERS TO BE ABANDONED
- EXISTING RIVER RIK CULVERT STRUCTURE

REV	DATE	DESCRIPTION	BY	CHK	APP
C16	01.03.2022	CONSTRUCTION ISSUE - UPDATED TO LATEST SITE REVISIONS	JAR	JRS	DJS
C15	01.03.2022	CONSTRUCTION ISSUE - UPDATED TO LATEST SITE COMMENTS	JAR	JRS	DJS
C14	17.01.2022	CONSTRUCTION ISSUE - REB OUTFALL MANHOLE UPDATED TO SUIT FULCRUM	JAR	JRS	DJS
C13	10.01.2022	CONSTRUCTION ISSUE - UPDATED TO SUIT LATEST SITE LAYOUT	JAR	JRS	DJS
C12	05.12.2021	CONSTRUCTION ISSUE - BLOCK 2 PLANT ROOM DRAINAGE AMENDED TO SUIT WATER TANK	JRS	DJS	DJS
C11	28.12.2021	CONSTRUCTION ISSUE - BLOCK 2 PLANT ROOM DRAINAGE AMENDED TO SUIT WATER TANK	JRS	DJS	DJS
C10	26.08.2021	CONSTRUCTION ISSUE - THRESHOLD DRAINING ADDED AND OTHER MANOR AMENDMENTS	JRS	DJS	DJS
C09	05.08.2021	CONSTRUCTION ISSUE - YELLOW STRUCTURE EASEMENT HATCHING REMOVED	JRS	DJS	DJS
C08	29.05.2021	CONSTRUCTION ISSUE - UPDATED TO SUIT ADDITIONAL BLOCK LIPS UP	JRS	DJS	DJS
C07	18.02.2021	CONSTRUCTION ISSUE - UPDATED TO SUIT LATEST POP-UP LOCATIONS & VARIOUS UPDATES	JRS	DJS	DJS
C06	22.01.2021	CONSTRUCTION ISSUE - TANK LOCATION REVISED TO SUIT CONTRACTOR REQUIREMENTS	JRS	DJS	DJS
C05	11.01.2021	CONSTRUCTION ISSUE - FIVE LOCATION REVISED TO SUIT PLANT LOCATION	JRS	DJS	DJS
C04	07.12.2020	CONSTRUCTION ISSUE - UPDATED TO SUIT REVERSED BLOCK POP-UPS	JRS	DJS	DJS
C03	24.11.2020	CONSTRUCTION ISSUE - UPDATED TO SUIT CONTRACTOR COMMENTS	JRS	DJS	DJS
C02	16.11.2020	CONSTRUCTION ISSUE - UPDATED TO SUIT LATEST LAYOUT & POP-UP LOCATIONS	JRS	DJS	DJS
C01	20.09.2020	CONSTRUCTION ISSUE	JRS	DJS	DJS
PA4	17.04.2020	SECTION 18 WORKS ON CORPORATION STREET - UPDATED TO SUIT LATEST INFORMATION	JRS	DJS	DJS
PD3	27.03.2020	DRAINAGE WITHIN PHASE 2 FOOTPRINT AMENDED TO SUIT LATEST PROPOSALS	JRS	DJS	DJS
PD2	11.02.2020	LEGAL EASEMENTS ADDED - DRAINAGE WITHIN PHASE 1 FOOTPRINT IDENTIFIED & AMENDED	JRS	DJS	DJS
PD1	09.01.2020	STAGE 4 ISSUE - TECHNICAL DESIGN	JRS	DJS	DJS

DRAWING STATUS:

CONSTRUCTION

CLIENT: VINCI CONSTRUCTION

ARCHITECT: SHEPPARD ROBSON

PROJECT: NEW VICTORIA MANCHESTER

TITLE: BELOW GROUND DRAINAGE STRATEGY

STATUS	PROJECT No.	PROJECT	ORIGINATOR	VOL/ISSUE	TYPE	ROLE	DRAWING No.	REV
A5	218-209	VIC - AJP - XX - 00L-DR - C - 00001	C16					

SCALE: 1:200
DATE: JAN 2020

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CONSULTING STRUCTURAL & CIVIL ENGINEERS
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall (pipe 1.008)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.158	4-8	0.056

Total Area Contributing (ha) = 0.215

Total Pipe Volume (m³) = 4.488

Time Area Diagram at outfall (pipe 6.009)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.446	4-8	0.119

Total Area Contributing (ha) = 0.565

Total Pipe Volume (m³) = 7.730

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	26.376	0.799	33.0	0.076	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	9.185	0.195	47.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	13.105	0.269	48.7	0.006	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	10.364	0.330	31.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.25	32.450	0.076	0.0	0.0	0.0	1.76	31.1	10.3
1.001	50.00	5.35	31.650	0.090	0.0	0.0	0.0	1.47	26.0	12.2
1.002	50.00	5.47	31.380	0.096	0.0	0.0	0.0	1.88	74.7	13.1
1.003	50.00	5.54	31.110	0.096	0.0	0.0	0.0	2.34	93.2	13.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	16.032	0.160	100.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	1.914	0.020	97.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	2.560	0.080	32.0	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	1.998	0.070	28.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	5.285	0.070	75.0	0.022	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	13.469	0.210	64.2	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	2.299	0.040	57.0	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	14.698	0.230	64.0	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	2.746	0.140	19.6	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.004	10.688	0.529	20.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	9.992	0.130	77.0	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	3.702	0.070	53.0	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.002	11.209	0.350	32.0	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.005	7.794	0.390	20.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.006	5.178	0.255	20.3	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	6.687	0.110	61.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	6.963	0.120	58.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	8.726	0.090	97.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	5.27	31.900	0.000	0.0	0.0	0.0	1.00	17.7	0.0
2.001	50.00	5.30	31.740	0.000	0.0	0.0	0.0	1.02	18.0	0.0
1.004	50.00	5.56	30.780	0.104	0.0	0.0	0.0	2.32	92.3	14.1
1.005	50.00	5.58	30.600	0.104	0.0	0.0	0.0	2.46	97.8	14.1
3.000	50.00	5.08	32.380	0.022	0.0	0.0	0.0	1.16	20.5	3.0
3.001	50.00	5.25	32.260	0.028	0.0	0.0	0.0	1.26	22.2	3.7
3.002	50.00	5.28	32.050	0.031	0.0	0.0	0.0	1.33	23.6	4.2
3.003	50.00	5.48	32.010	0.053	0.0	0.0	0.0	1.26	22.3	7.1
4.000	50.00	5.02	31.920	0.019	0.0	0.0	0.0	2.28	40.4	2.5
3.004	50.00	5.56	31.780	0.071	0.0	0.0	0.0	2.25	39.8	9.7
5.000	50.00	5.15	31.850	0.011	0.0	0.0	0.0	1.15	20.3	1.5
5.001	50.00	5.19	31.670	0.014	0.0	0.0	0.0	1.38	24.5	1.9
5.002	50.00	5.29	31.600	0.035	0.0	0.0	0.0	1.79	31.6	4.8
3.005	50.00	5.61	31.250	0.107	0.0	0.0	0.0	2.26	40.0	14.5
3.006	50.00	5.65	30.860	0.110	0.0	0.0	0.0	2.25	39.7	14.9
1.006	50.00	5.72	30.530	0.215	0.0	0.0	0.0	1.68	66.7	29.1
1.007	50.00	5.79	30.420	0.215	0.0	0.0	0.0	1.72	68.4	29.1
1.008	50.00	5.90	30.300	0.215	0.0	0.0	0.0	1.33	52.8	29.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
6.000	11.939	0.439	27.2	0.003	5.00	0.0	0.600	o	225	Pipe/Conduit	
7.000	8.370	0.450	18.6	0.052	5.00	0.0	0.600	o	225	Pipe/Conduit	
7.001	4.780	0.160	29.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	6.148	0.162	38.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
8.000	2.667	0.107	25.0	0.020	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.002	2.702	0.068	40.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.003	20.181	0.201	100.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.000	4.939	0.050	98.0	0.014	5.00	0.0	0.600	o	225	Pipe/Conduit	
6.004	10.970	0.060	183.0	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.005	8.031	0.065	124.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
10.000	5.055	0.200	25.3	0.046	5.00	0.0	0.600	o	150	Pipe/Conduit	
11.000	17.077	0.850	20.1	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
10.001	9.066	0.360	25.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
10.002	28.239	1.351	20.9	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
12.000	8.603	0.524	16.4	0.098	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.000	50.00	5.08	31.900	0.003	0.0	0.0	0.0	2.52	100.1	0.5
7.000	50.00	5.05	32.070	0.052	0.0	0.0	0.0	3.05	121.2	7.0
7.001	50.00	5.08	31.620	0.052	0.0	0.0	0.0	2.41	95.6	7.0
6.001	50.00	5.13	31.460	0.055	0.0	0.0	0.0	2.13	84.7	7.4
8.000	50.00	5.02	31.480	0.020	0.0	0.0	0.0	2.02	35.7	2.7
6.002	50.00	5.15	31.298	0.075	0.0	0.0	0.0	2.07	82.5	10.1
6.003	50.00	5.41	31.230	0.075	0.0	0.0	0.0	1.30	51.9	10.1
9.000	50.00	5.06	31.080	0.014	0.0	0.0	0.0	1.32	52.5	1.8
6.004	50.00	5.60	31.030	0.105	0.0	0.0	0.0	0.96	38.3	14.2
6.005	50.00	5.71	30.970	0.105	0.0	0.0	0.0	1.17	46.6	14.2
10.000	50.00	5.04	34.050	0.046	0.0	0.0	0.0	2.01	35.5	6.2
11.000	50.00	5.13	34.700	0.000	0.0	0.0	0.0	2.26	39.9	0.0
10.001	50.00	5.20	33.850	0.046	0.0	0.0	0.0	2.01	35.6	6.2
10.002	50.00	5.41	33.490	0.068	0.0	0.0	0.0	2.21	39.1	9.2
12.000	50.00	5.04	31.790	0.098	0.0	0.0	0.0	3.25	129.0	13.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
13.000	21.852	0.625	35.0	0.108	5.00	0.0	0.600	o	225	Pipe/Conduit	
10.003	7.817	0.320	24.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
10.004	2.221	0.040	55.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.006	2.764	0.040	69.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.007	7.656	0.080	95.7	0.185	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.008	6.662	0.050	133.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.009	5.669	0.171	33.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
13.000	50.00	5.16	31.890	0.108	0.0	0.0	0.0	2.22	88.3	14.6
10.003	50.00	5.45	31.190	0.275	0.0	0.0	0.0	3.20	225.9	37.2
10.004	50.00	5.47	30.870	0.275	0.0	0.0	0.0	2.12	150.2	37.2
6.006	50.00	5.73	30.830	0.380	0.0	0.0	0.0	1.89	133.9	51.4
6.007	50.00	5.81	29.530	0.565	0.0	0.0	0.0	1.61	113.6	76.4
6.008	50.00	5.90	29.450	0.565	0.0	0.0	0.0	1.36	96.2	76.4
6.009	50.00	5.93	27.684	0.565	0.0	0.0	0.0	2.74	193.8	76.4

218-209
New Victoria



Designed by JJR

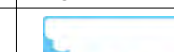
Checked by JRS

Network 2019.1

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)	
SW01	33.220	0.770	Open Manhole	600	1.000	32.450	150					
SW02	33.100	1.450	Open Manhole	1200	1.001	31.650	150	1.000	31.651	150	1	
SW03	32.470	1.090	Open Manhole	1200	1.002	31.380	225	1.001	31.455	150		
SW04	32.550	1.440	Open Manhole	1200	1.003	31.110	225	1.002	31.110	225		
SW05	33.000	1.100	Open Manhole	600	2.000	31.900	150					
SW05A	33.000	1.260	Open Manhole	600	2.001	31.740	150	2.000	31.740	150		
SW06	32.900	2.120	Open Manhole	1200	1.004	30.780	225	1.003	30.780	225		
Separator 1	32.900	2.300	Open Manhole	1200	1.005	30.600	225	2.001	31.720	150	865	
	SW07	33.200	0.820	Open Manhole	600	3.000	32.380	150	1.004	30.700	225	100
	SW08	33.200	0.940	Open Manhole	600	3.001	32.260	150				
	SW09	33.200	1.150	Open Manhole	600	3.002	32.050	150	3.000	32.310	150	50
	SW10	33.200	1.190	Open Manhole	600	3.003	32.010	150	3.001	32.050	150	
	SW11	33.100	1.180	Open Manhole	600	4.000	31.920	150	3.002	32.010	150	
	SW12	33.170	1.390	Open Manhole	1200	3.004	31.780	150	4.000	31.780	150	
SW13	33.200	1.350	Open Manhole	600	5.000	31.850	150					
SW14	33.200	1.530	Open Manhole	600	5.001	31.670	150	5.000	31.720	150	50	
SW15	33.200	1.600	Open Manhole	600	5.002	31.600	150	5.001	31.600	150		
SW16	33.100	1.850	Open Manhole	1200	3.005	31.250	150	3.004	31.251	150	1	
								5.002	31.250	150		
SW17	32.950	2.090	Open Manhole	1200	3.006	30.860	150	3.005	30.860	150		
SW18	33.000	2.470	Open Manhole	1200	1.006	30.530	225	1.005	30.530	225		
								3.006	30.605	150		
Tank 1	32.970	2.550	Open Manhole	1200	1.007	30.420	225	1.006	30.420	225		
SW19	33.050	2.750	Open Manhole	1500	1.008	30.300	225	1.007	30.300	225		
	32.750	2.540	Open Manhole	0		OUTFALL		1.008	30.210	225		
SW20	33.180	1.280	Open Manhole	600	6.000	31.900	225					
SW21	33.200	1.130	Open Manhole	600	7.000	32.070	225					
SW22	33.180	1.560	Open Manhole	600	7.001	31.620	225	7.000	31.620	225		
SW23	33.180	1.720	Open Manhole	600	6.001	31.460	225	6.000	31.461	225	1	
								7.001	31.460	225		
SW24	33.200	1.720	Open Manhole	600	8.000	31.480	150					
Junction	33.180	1.882	Junction		6.002	31.298	225	6.001	31.298	225		
								8.000	31.373	150		
SW25	33.150	1.920	Open Manhole	1200	6.003	31.230	225	6.002	31.230	225		
SW26	33.200	2.120	Open Manhole	1200	9.000	31.080	225					
SW27	33.180	2.150	Open Manhole	1200	6.004	31.030	225	6.003	31.030	225		
								9.000	31.030	225		
SW27A	33.320	2.350	Open Manhole	1200	6.005	30.970	225	6.004	30.970	225		
SW28	35.330	1.280	Open Manhole	1200	10.000	34.050	150					
SW28A	36.480	1.780	Open Manhole	600	11.000	34.700	150					
Junction	35.200	1.350	Junction		10.001	33.850	150	10.000	33.850	150		
								11.000	33.850	150		

Manhole Schedules for Storm											
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)
SW29	35.100	1.610	Open Manhole	1200	10.002	33.490	150	10.001	33.490	150	
SW30	33.250	1.460	Open Manhole	1200	12.000	31.790	225				
SW31	33.070	1.180	Open Manhole	600	13.000	31.890	225				
SW32	33.320	2.130	Open Manhole	1200	10.003	31.190	300	10.002	32.139	150	799
								12.000	31.266	225	1
								13.000	31.265	225	
Separator 2	33.300	2.430	Open Manhole	1200	10.004	30.870	300	10.003	30.870	300	
SW34	33.150	2.320	Open Manhole	1200	6.006	30.830	300	6.005	30.905	225	1
								10.004	30.830	300	
SW35	33.100	3.570	Open Manhole	1500	6.007	29.530	300	6.006	30.790	300	1260
Tank 2	32.470	3.020	Open Manhole	1200	6.008	29.450	300	6.007	29.450	300	
SW36	32.450	4.766	Open Manhole	2100	6.009	27.684	300	6.008	29.400	300	1716
	33.020	5.507	Open Manhole	0		OUTFALL		6.009	27.513	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW01	384142.661	399026.954	384142.661	399026.954	Required	
SW02	384135.584	399052.364	384135.584	399052.364	Required	
SW03	384138.065	399061.207	384138.065	399061.207	Required	
SW04	384131.747	399072.689	384131.747	399072.689	Required	
SW05	384112.352	399067.066	384112.352	399067.066	Required	
SW05A	384121.863	399079.972	384121.863	399079.972	Required	
SW06	384123.404	399078.837	384123.404	399078.837	Required	
Separator 1	384121.757	399076.877	384121.757	399076.877	Required	
SW07	384097.934	399031.713	384097.934	399031.713	Required	
SW08	384093.676	399034.818	384093.676	399034.818	Required	
SW09	384101.611	399045.701	384101.611	399045.701	Required	

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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW10	384102.966	399047.559	384102.966	399047.559	Required	
SW11	384113.324	399057.279	384113.324	399057.279	Required	
SW12	384111.625	399059.435	384111.625	399059.435	Required	
SW13	384126.239	399049.005	384126.239	399049.005	Required	
SW14	384132.126	399057.079	384132.126	399057.079	Required	
SW15	384129.145	399059.273	384129.145	399059.273	Required	
SW16	384120.120	399065.920	384120.120	399065.920	Required	
SW17	384124.741	399072.196	384124.741	399072.196	Required	
SW18	384120.593	399075.254	384120.593	399075.254	Required	
Tank 1	384116.653	399069.852	384116.653	399069.852	Required	
SW19	384112.475	399064.281	384112.475	399064.281	Required	
	384105.144	399059.548			No Entry	
SW20	384123.011	399011.114	384123.011	399011.114	Required	
SW21	384125.794	398997.793	384125.794	398997.793	Required	
SW22	384118.173	399001.254	384118.173	399001.254	Required	
SW23	384113.901	399003.398	384113.901	399003.398	Required	
SW24	384110.934	398997.389	384110.934	398997.389	Required	
Junction	384109.210	398999.424			No Entry	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW25	384107.149	398997.677	384107.149	398997.677	Required	
SW26	384102.791	398980.031	384102.791	398980.031	Required	
SW27	384097.859	398979.761	384097.859	398979.761	Required	
SW27A	384087.362	398982.949	384087.362	398982.949	Required	
SW28	384113.862	398953.715	384113.862	398953.715	Required	
SW28A	384116.656	398971.305	384116.656	398971.305	Required	
Junction	384109.300	398955.893			No Entry	
SW29	384101.118	398959.798	384101.118	398959.798	Required	
SW30	384095.690	398989.144	384095.690	398989.144	Required	
SW31	384076.266	399003.186	384076.266	399003.186	Required	
SW32	384088.182	398984.909	384088.182	398984.909	Required	
Separator 2	384082.116	398979.979	384082.116	398979.979	Required	
SW34	384080.600	398978.617	384080.600	398978.617	Required	
SW35	384079.804	398975.965	384079.804	398975.965	Required	
Tank 2	384073.884	398971.111	384073.884	398971.111	Required	
SW36	384068.726	398966.895	384068.726	398966.895	Required	
	384065.160	398971.168			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	SW01	33.220	32.450	0.620	Open Manhole	600
1.001	o	150	SW02	33.100	31.650	1.300	Open Manhole	1200
1.002	o	225	SW03	32.470	31.380	0.865	Open Manhole	1200
1.003	o	225	SW04	32.550	31.110	1.215	Open Manhole	1200
2.000	o	150	SW05	33.000	31.900	0.950	Open Manhole	600
2.001	o	150	SW05A	33.000	31.740	1.110	Open Manhole	600
1.004	o	225	SW06	32.900	30.780	1.895	Open Manhole	1200
1.005	o	225	Separator 1	32.900	30.600	2.075	Open Manhole	1200
3.000	o	150	SW07	33.200	32.380	0.670	Open Manhole	600
3.001	o	150	SW08	33.200	32.260	0.790	Open Manhole	600
3.002	o	150	SW09	33.200	32.050	1.000	Open Manhole	600
3.003	o	150	SW10	33.200	32.010	1.040	Open Manhole	600
4.000	o	150	SW11	33.100	31.920	1.030	Open Manhole	600
3.004	o	150	SW12	33.170	31.780	1.240	Open Manhole	1200
5.000	o	150	SW13	33.200	31.850	1.200	Open Manhole	600
5.001	o	150	SW14	33.200	31.670	1.380	Open Manhole	600
5.002	o	150	SW15	33.200	31.600	1.450	Open Manhole	600
3.005	o	150	SW16	33.100	31.250	1.700	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	26.376	33.0	SW02	33.100	31.651	1.299	Open Manhole	1200
1.001	9.185	47.0	SW03	32.470	31.455	0.865	Open Manhole	1200
1.002	13.105	48.7	SW04	32.550	31.110	1.215	Open Manhole	1200
1.003	10.364	31.4	SW06	32.900	30.780	1.895	Open Manhole	1200
2.000	16.032	100.2	SW05A	33.000	31.740	1.110	Open Manhole	600
2.001	1.914	97.0	SW06	32.900	31.720	1.030	Open Manhole	1200
1.004	2.560	32.0	Separator 1	32.900	30.700	1.975	Open Manhole	1200
1.005	1.998	28.5	SW18	33.000	30.530	2.245	Open Manhole	1200
3.000	5.285	75.0	SW08	33.200	32.310	0.740	Open Manhole	600
3.001	13.469	64.2	SW09	33.200	32.050	1.000	Open Manhole	600
3.002	2.299	57.0	SW10	33.200	32.010	1.040	Open Manhole	600
3.003	14.698	64.0	SW12	33.170	31.780	1.240	Open Manhole	1200
4.000	2.746	19.6	SW12	33.170	31.780	1.240	Open Manhole	1200
3.004	10.688	20.2	SW16	33.100	31.251	1.699	Open Manhole	1200
5.000	9.992	77.0	SW14	33.200	31.720	1.330	Open Manhole	600
5.001	3.702	53.0	SW15	33.200	31.600	1.450	Open Manhole	600
5.002	11.209	32.0	SW16	33.100	31.250	1.700	Open Manhole	1200
3.005	7.794	20.0	SW17	32.950	30.860	1.940	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
3.006	o	150	SW17	32.950	30.860	1.940	Open Manhole	1200
1.006	o	225	SW18	33.000	30.530	2.245	Open Manhole	1200
1.007	o	225	Tank 1	32.970	30.420	2.325	Open Manhole	1200
1.008	o	225	SW19	33.050	30.300	2.525	Open Manhole	1500
6.000	o	225	SW20	33.180	31.900	1.055	Open Manhole	600
7.000	o	225	SW21	33.200	32.070	0.905	Open Manhole	600
7.001	o	225	SW22	33.180	31.620	1.335	Open Manhole	600
6.001	o	225	SW23	33.180	31.460	1.495	Open Manhole	600
8.000	o	150	SW24	33.200	31.480	1.570	Open Manhole	600
6.002	o	225	Junction	33.180	31.298	1.657	Junction	
6.003	o	225	SW25	33.150	31.230	1.695	Open Manhole	1200
9.000	o	225	SW26	33.200	31.080	1.895	Open Manhole	1200
6.004	o	225	SW27	33.180	31.030	1.925	Open Manhole	1200
6.005	o	225	SW27A	33.320	30.970	2.125	Open Manhole	1200
10.000	o	150	SW28	35.330	34.050	1.130	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
3.006	5.178	20.3	SW18	33.000	30.605	2.245	Open Manhole	1200
1.006	6.687	61.0	Tank 1	32.970	30.420	2.325	Open Manhole	1200
1.007	6.963	58.0	SW19	33.050	30.300	2.525	Open Manhole	1500
1.008	8.726	97.0		32.750	30.210	2.315	Open Manhole	0
6.000	11.939	27.2	SW23	33.180	31.461	1.494	Open Manhole	600
7.000	8.370	18.6	SW22	33.180	31.620	1.335	Open Manhole	600
7.001	4.780	29.8	SW23	33.180	31.460	1.495	Open Manhole	600
6.001	6.148	38.0	Junction	33.180	31.298	1.657	Junction	
8.000	2.667	25.0	Junction	33.180	31.373	1.657	Junction	
6.002	2.702	40.0	SW25	33.150	31.230	1.695	Open Manhole	1200
6.003	20.181	100.5	SW27	33.180	31.030	1.925	Open Manhole	1200
9.000	4.939	98.0	SW27	33.180	31.030	1.925	Open Manhole	1200
6.004	10.970	183.0	SW27A	33.320	30.970	2.125	Open Manhole	1200
6.005	8.031	124.0	SW34	33.150	30.905	2.020	Open Manhole	1200
10.000	5.055	25.3	Junction	35.200	33.850	1.200	Junction	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
11.000	o	150	SW28A	36.480	34.700	1.630	Open Manhole	600
10.001	o	150	Junction	35.200	33.850	1.200	Junction	
10.002	o	150	SW29	35.100	33.490	1.460	Open Manhole	1200
12.000	o	225	SW30	33.250	31.790	1.235	Open Manhole	1200
13.000	o	225	SW31	33.070	31.890	0.955	Open Manhole	600
10.003	o	300	SW32	33.320	31.190	1.830	Open Manhole	1200
10.004	o	300	Separator 2	33.300	30.870	2.130	Open Manhole	1200
6.006	o	300	SW34	33.150	30.830	2.020	Open Manhole	1200
6.007	o	300	SW35	33.100	29.530	3.270	Open Manhole	1500
6.008	o	300	Tank 2	32.470	29.450	2.720	Open Manhole	1200
6.009	o	300	SW36	32.450	27.684	4.466	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
11.000	17.077	20.1	Junction	35.200	33.850	1.200	Junction	
10.001	9.066	25.2	SW29	35.100	33.490	1.460	Open Manhole	1200
10.002	28.239	20.9	SW32	33.320	32.139	1.031	Open Manhole	1200
12.000	8.603	16.4	SW32	33.320	31.266	1.829	Open Manhole	1200
13.000	21.852	35.0	SW32	33.320	31.265	1.830	Open Manhole	1200
10.003	7.817	24.4	Separator 2	33.300	30.870	2.130	Open Manhole	1200
10.004	2.221	55.0	SW34	33.150	30.830	2.020	Open Manhole	1200
6.006	2.764	69.1	SW35	33.100	30.790	2.010	Open Manhole	1500
6.007	7.656	95.7	Tank 2	32.470	29.450	2.720	Open Manhole	1200
6.008	6.662	133.2	SW36	32.450	29.400	2.750	Open Manhole	2100
6.009	5.669	33.1		33.020	27.513	5.207	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.008		32.750	30.210	26.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
6.009		33.020	27.513	27.500	0	0

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Simulation Criteria for Storm

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 Offline Controls	0
Number of Online Controls	2	Number of Storage Structures	2
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	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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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW19, DS/PN: 1.008, Volume (m³): 5.1

Unit Reference	MD-SHE-0099-6000-2150-6000
Design Head (m)	2.150
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	30.300
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.150	6.0	Kick-Flo®	0.881	4.0
Flush-Flo™	0.433	5.0	Mean Flow over Head Range	-	4.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	0.800	4.4	2.000	5.8	4.000	8.0	7.000	10.5
0.200	4.5	1.000	4.2	2.200	6.1	4.500	8.5	7.500	10.8
0.300	4.8	1.200	4.6	2.400	6.3	5.000	8.9	8.000	11.1
0.400	5.0	1.400	4.9	2.600	6.5	5.500	9.3	8.500	11.5
0.500	4.9	1.600	5.2	3.000	7.0	6.000	9.7	9.000	11.8
0.600	4.9	1.800	5.5	3.500	7.5	6.500	10.1	9.500	12.1

Hydro-Brake® Optimum Manhole: SW36, DS/PN: 6.009, Volume (m³): 16.9

Unit Reference	MD-SHE-0243-4200-3100-4200
Design Head (m)	3.100
Design Flow (l/s)	42.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	243
Invert Level (m)	27.684
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.100	42.0	Kick-Flo®	1.873	32.9
Flush-Flo™	0.896	42.0	Mean Flow over Head Range	-	36.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	0.400	37.7	0.800	41.9	1.400	40.1	2.000	34.0
0.200	24.8	0.500	39.6	1.000	41.9	1.600	38.1	2.200	35.6
0.300	34.8	0.600	40.8	1.200	41.3	1.800	34.7	2.400	37.1

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Hydro-Brake® Optimum Manhole: SW36, DS/PN: 6.009, Volume (m³): 16.9

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
2.600	38.5	4.000	47.4	5.500	55.3	7.000	62.2	8.500	68.3
3.000	41.3	4.500	50.2	6.000	57.7	7.500	64.3	9.000	70.3
3.500	44.5	5.000	52.8	6.500	60.0	8.000	66.4	9.500	72.1

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Storage Structures for Storm

Cellular Storage Manhole: Tank 1, DS/PN: 1.007

Invert Level (m) 30.420 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	40.5	0.0	1.600	40.5	0.0	1.601	0.0	0.0

Cellular Storage Manhole: Tank 2, DS/PN: 6.008

Invert Level (m) 29.450 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	40.5	0.0	2.000	40.5	0.0	2.001	0.0	0.0

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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

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

Profile(s)

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW01	15 Winter	2	+0%	100/15 Summer				32.516	-0.084
1.001	SW02	15 Winter	2	+0%	30/15 Summer				31.735	-0.065
1.002	SW03	15 Winter	2	+0%	100/15 Winter				31.452	-0.152
1.003	SW04	15 Winter	2	+0%	100/15 Summer				31.176	-0.159
2.000	SW05	60 Winter	2	+0%	100/120 Winter				31.900	-0.150
2.001	SW05A	60 Winter	2	+0%	100/60 Winter				31.740	-0.150
1.004	SW06	15 Winter	2	+0%	30/30 Summer				30.877	-0.128
1.005	Separator 1	60 Winter	2	+0%	30/15 Summer				30.742	-0.083
3.000	SW07	15 Winter	2	+0%	100/15 Summer				32.427	-0.103
3.001	SW08	15 Winter	2	+0%	100/15 Summer				32.306	-0.104
3.002	SW09	15 Winter	2	+0%	100/15 Summer				32.114	-0.086
3.003	SW10	15 Winter	2	+0%	100/15 Summer				32.073	-0.087
4.000	SW11	15 Winter	2	+0%	100/15 Summer				31.955	-0.115
3.004	SW12	15 Winter	2	+0%	100/15 Summer				31.835	-0.095
5.000	SW13	15 Winter	2	+0%	100/15 Summer				31.881	-0.119
5.001	SW14	15 Winter	2	+0%	100/15 Summer				31.705	-0.115
5.002	SW15	15 Winter	2	+0%	100/15 Summer				31.642	-0.108
3.005	SW16	15 Winter	2	+0%	30/15 Winter				31.320	-0.080
3.006	SW17	15 Winter	2	+0%	30/15 Summer				30.935	-0.075
1.006	SW18	60 Winter	2	+0%	30/15 Summer				30.741	-0.013
1.007	Tank 1	60 Winter	2	+0%	2/15 Summer				30.737	0.091
1.008	SW19	60 Winter	2	+0%	2/15 Summer				30.732	0.206
6.000	SW20	15 Winter	2	+0%	100/30 Winter				31.907	-0.218
7.000	SW21	15 Winter	2	+0%					32.114	-0.181
7.001	SW22	15 Winter	2	+0%	100/15 Summer				31.677	-0.168
6.001	SW23	15 Winter	2	+0%	100/15 Summer				31.519	-0.166
8.000	SW24	15 Winter	2	+0%	100/15 Summer				31.519	-0.111
6.002	Junction	15 Winter	2	+0%					31.386	-0.137
6.003	SW25	15 Winter	2	+0%	100/15 Summer				31.306	-0.149
9.000	SW26	15 Winter	2	+0%	30/15 Summer				31.143	-0.162
6.004	SW27	15 Winter	2	+0%	30/15 Summer				31.141	-0.114

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.000	0.40		11.8	OK	
1.001	SW02	0.000	0.59		13.5	OK	
1.002	SW03	0.000	0.22		14.5	OK	
1.003	SW04	0.000	0.19		14.6	OK	
2.000	SW05	0.000	0.00		0.0	OK	
2.001	SW05A	0.000	0.00		0.0	OK	
1.004	SW06	0.000	0.39		15.6	OK	
1.005	Separator 1	0.000	0.23		8.6	OK	
3.000	SW07	0.000	0.21		3.5	OK	
3.001	SW08	0.000	0.20		4.2	OK	
3.002	SW09	0.000	0.37		4.6	OK	
3.003	SW10	0.000	0.37		7.5	OK	
4.000	SW11	0.000	0.12		2.9	OK	
3.004	SW12	0.000	0.29		10.4	OK	
5.000	SW13	0.000	0.10		1.7	OK	
5.001	SW14	0.000	0.12		2.1	OK	
5.002	SW15	0.000	0.17		4.9	OK	
3.005	SW16	0.000	0.44		15.4	OK	
3.006	SW17	0.000	0.50		15.8	OK	
1.006	SW18	0.000	0.38		17.6	OK	
1.007	Tank 1	0.000	0.11		5.6	SURCHARGED	
1.008	SW19	0.000	0.12		4.9	SURCHARGED	
6.000	SW20	0.000	0.01		0.5	OK	
7.000	SW21	0.000	0.08		8.0	OK	
7.001	SW22	0.000	0.14		8.0	OK	
6.001	SW23	0.000	0.15		8.5	OK	
8.000	SW24	0.000	0.15		3.1	OK	
6.002	Junction	0.000	0.32		11.6	OK*	
6.003	SW25	0.000	0.25		11.7	OK	
9.000	SW26	0.000	0.06		2.0	OK	
6.004	SW27	0.000	0.49		15.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
6.005	SW27A	15 Winter	2	+0%	30/15 Summer				31.080	-0.115
10.000	SW28	15 Winter	2	+0%					34.101	-0.099
11.000	SW28A	60 Winter	2	+0%					34.700	-0.150
10.001	Junction	15 Winter	2	+0%					33.896	-0.104
10.002	SW29	15 Winter	2	+0%					33.544	-0.097
12.000	SW30	15 Winter	2	+0%	100/15 Summer				31.848	-0.167
13.000	SW31	15 Winter	2	+0%	100/15 Summer				31.960	-0.155
10.003	SW32	15 Winter	2	+0%	100/15 Summer				31.302	-0.188
10.004	Separator 2	15 Winter	2	+0%	30/15 Summer				31.069	-0.101
6.006	SW34	15 Winter	2	+0%	30/15 Summer				31.057	-0.073
6.007	SW35	15 Winter	2	+0%	2/15 Summer				29.841	0.011
6.008	Tank 2	15 Winter	2	+0%	30/15 Summer				29.740	-0.010
6.009	SW36	15 Winter	2	+0%	2/15 Summer				29.714	1.730

PN	US/MH Name	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.005	SW27A	0.000	0.44	15.9	OK	
10.000	SW28	0.000	0.25	7.1	OK	
11.000	SW28A	0.000	0.00	0.0	OK	
10.001	Junction	0.000	0.20	7.0	OK*	
10.002	SW29	0.000	0.27	10.1	OK	
12.000	SW30	0.000	0.15	15.3	OK	
13.000	SW31	0.000	0.21	16.8	OK	
10.003	SW32	0.000	0.29	41.6	OK	
10.004	Separator 2	0.000	0.68	41.9	OK	
6.006	SW34	0.000	0.93	57.1	OK	
6.007	SW35	0.000	1.14	80.7	SURCHARGED	
6.008	Tank 2	0.000	1.00	61.4	OK	
6.009	SW36	0.000	0.40	41.6	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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

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

Profile(s)

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW01	15 Winter	30	+0%	100/15 Summer				32.549	-0.051
1.001	SW02	15 Winter	30	+0%	30/15 Summer				31.861	0.061
1.002	SW03	15 Winter	30	+0%	100/15 Winter				31.484	-0.121
1.003	SW04	60 Winter	30	+0%	100/15 Summer				31.212	-0.124
2.000	SW05	60 Winter	30	+0%	100/120 Winter				31.900	-0.150
2.001	SW05A	60 Winter	30	+0%	100/60 Winter				31.740	-0.150
1.004	SW06	60 Winter	30	+0%	30/30 Summer				31.209	0.204
1.005	Separator 1	60 Winter	30	+0%	30/15 Summer				31.208	0.383
3.000	SW07	15 Winter	30	+0%	100/15 Summer				32.446	-0.084
3.001	SW08	15 Winter	30	+0%	100/15 Summer				32.327	-0.083
3.002	SW09	15 Winter	30	+0%	100/15 Summer				32.148	-0.052
3.003	SW10	15 Winter	30	+0%	100/15 Summer				32.111	-0.049
4.000	SW11	15 Winter	30	+0%	100/15 Summer				31.969	-0.101
3.004	SW12	15 Winter	30	+0%	100/15 Summer				31.865	-0.065
5.000	SW13	15 Winter	30	+0%	100/15 Summer				31.893	-0.107
5.001	SW14	15 Winter	30	+0%	100/15 Summer				31.721	-0.099
5.002	SW15	15 Winter	30	+0%	100/15 Summer				31.665	-0.085
3.005	SW16	15 Winter	30	+0%	30/15 Winter				31.401	0.001
3.006	SW17	60 Winter	30	+0%	30/15 Summer				31.212	0.202
1.006	SW18	60 Winter	30	+0%	30/15 Summer				31.207	0.452
1.007	Tank 1	60 Winter	30	+0%	2/15 Summer				31.203	0.558
1.008	SW19	120 Winter	30	+0%	2/15 Summer				31.234	0.709
6.000	SW20	15 Winter	30	+0%	100/30 Winter				31.913	-0.212
7.000	SW21	15 Winter	30	+0%					32.130	-0.165
7.001	SW22	15 Winter	30	+0%	100/15 Summer				31.700	-0.145
6.001	SW23	15 Winter	30	+0%	100/15 Summer				31.542	-0.143
8.000	SW24	15 Winter	30	+0%	100/15 Summer				31.535	-0.095
6.002	Junction	15 Winter	30	+0%					31.425	-0.098
6.003	SW25	15 Winter	30	+0%	100/15 Summer				31.381	-0.074
9.000	SW26	15 Winter	30	+0%	30/15 Summer				31.341	0.036
6.004	SW27	15 Winter	30	+0%	30/15 Summer				31.338	0.084

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.000	0.75		22.3	OK	
1.001	SW02	0.000	1.15		26.3	SURCHARGED	
1.002	SW03	0.000	0.44		28.1	OK	
1.003	SW04	0.000	0.20		15.3	OK	
2.000	SW05	0.000	0.00		0.0	OK	
2.001	SW05A	0.000	0.00		0.0	OK	
1.004	SW06	0.000	0.41		16.3	SURCHARGED	
1.005	Separator 1	0.000	0.42		15.5	SURCHARGED	
3.000	SW07	0.000	0.40		6.6	OK	
3.001	SW08	0.000	0.40		8.2	OK	
3.002	SW09	0.000	0.73		9.2	OK	
3.003	SW10	0.000	0.78		15.9	OK	
4.000	SW11	0.000	0.24		5.5	OK	
3.004	SW12	0.000	0.60		21.2	OK	
5.000	SW13	0.000	0.18		3.2	OK	
5.001	SW14	0.000	0.25		4.1	OK	
5.002	SW15	0.000	0.38		10.9	OK	
3.005	SW16	0.000	0.90		31.3	SURCHARGED	
3.006	SW17	0.000	0.55		17.4	SURCHARGED	
1.006	SW18	0.000	0.69		32.0	SURCHARGED	
1.007	Tank 1	0.000	0.12		6.1	SURCHARGED	
1.008	SW19	0.000	0.12		4.9	SURCHARGED	
6.000	SW20	0.000	0.01		1.0	OK	
7.000	SW21	0.000	0.16		15.2	OK	
7.001	SW22	0.000	0.27		15.1	OK	
6.001	SW23	0.000	0.28		16.0	OK	
8.000	SW24	0.000	0.28		5.8	OK	
6.002	Junction	0.000	0.60		21.9	OK*	
6.003	SW25	0.000	0.45		21.2	OK	
9.000	SW26	0.000	0.11		3.5	SURCHARGED	
6.004	SW27	0.000	0.88		28.5	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
6.005	SW27A	15 Winter	30	+0%	30/15 Summer				31.290	0.095
10.000	SW28	15 Winter	30	+0%					34.124	-0.076
11.000	SW28A	60 Winter	30	+0%					34.700	-0.150
10.001	Junction	15 Winter	30	+0%					33.914	-0.086
10.002	SW29	15 Winter	30	+0%					33.570	-0.070
12.000	SW30	15 Winter	30	+0%	100/15 Summer				31.872	-0.143
13.000	SW31	15 Winter	30	+0%	100/15 Summer				31.989	-0.126
10.003	SW32	15 Winter	30	+0%	100/15 Summer				31.447	-0.043
10.004	Separator 2	15 Winter	30	+0%	30/15 Summer				31.348	0.178
6.006	SW34	15 Winter	30	+0%	30/15 Summer				31.253	0.123
6.007	SW35	30 Winter	30	+0%	2/15 Summer				30.511	0.681
6.008	Tank 2	30 Winter	30	+0%	30/15 Summer				30.474	0.724
6.009	SW36	30 Winter	30	+0%	2/15 Summer				30.455	2.471

PN	US/MH Name	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.005	SW27A	0.000	0.83	29.7	SURCHARGED	
10.000	SW28	0.000	0.48	13.4	OK	
11.000	SW28A	0.000	0.00	0.0	OK	
10.001	Junction	0.000	0.37	13.3	OK*	
10.002	SW29	0.000	0.54	20.3	OK	
12.000	SW30	0.000	0.28	29.0	OK	
13.000	SW31	0.000	0.40	31.8	OK	
10.003	SW32	0.000	0.56	79.1	OK	
10.004	Separator 2	0.000	1.29	79.0	SURCHARGED	
6.006	SW34	0.000	1.71	104.8	SURCHARGED	
6.007	SW35	0.000	1.71	121.2	SURCHARGED	
6.008	Tank 2	0.000	1.37	83.9	SURCHARGED	
6.009	SW36	0.000	0.40	41.5	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 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, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW01	15 Winter	100	+40%	100/15 Summer				33.214	0.614
1.001	SW02	15 Winter	100	+40%	30/15 Summer				32.170	0.370
1.002	SW03	120 Winter	100	+40%	100/15 Winter				32.122	0.518
1.003	SW04	120 Winter	100	+40%	100/15 Summer				32.118	0.782
2.000	SW05	120 Winter	100	+40%	100/120 Winter				32.114	0.064
2.001	SW05A	120 Winter	100	+40%	100/60 Winter				32.115	0.225
1.004	SW06	120 Winter	100	+40%	30/30 Summer				32.115	1.109
1.005	Separator 1	120 Winter	100	+40%	30/15 Summer				32.113	1.288
3.000	SW07	15 Winter	100	+40%	100/15 Summer				32.715	0.185
3.001	SW08	15 Winter	100	+40%	100/15 Summer				32.694	0.284
3.002	SW09	15 Winter	100	+40%	100/15 Summer				32.634	0.433
3.003	SW10	15 Winter	100	+40%	100/15 Summer				32.596	0.436
4.000	SW11	15 Winter	100	+40%	100/15 Summer				32.395	0.325
3.004	SW12	15 Winter	100	+40%	100/15 Summer				32.386	0.456
5.000	SW13	15 Winter	100	+40%	100/15 Summer				32.179	0.179
5.001	SW14	15 Winter	100	+40%	100/15 Summer				32.164	0.344
5.002	SW15	15 Winter	100	+40%	100/15 Summer				32.157	0.407
3.005	SW16	120 Winter	100	+40%	30/15 Winter				32.126	0.726
3.006	SW17	120 Winter	100	+40%	30/15 Summer				32.118	1.108
1.006	SW18	120 Winter	100	+40%	30/15 Summer				32.112	1.357
1.007	Tank 1	120 Winter	100	+40%	2/15 Summer				32.107	1.462
1.008	SW19	120 Winter	100	+40%	2/15 Summer				32.102	1.576
6.000	SW20	60 Winter	100	+40%	100/30 Winter				32.282	0.157
7.000	SW21	60 Winter	100	+40%					32.290	-0.005
7.001	SW22	60 Winter	100	+40%	100/15 Summer				32.285	0.440
6.001	SW23	60 Winter	100	+40%	100/15 Summer				32.281	0.596
8.000	SW24	60 Winter	100	+40%	100/15 Summer				32.279	0.649
6.002	Junction	60 Winter	100	+40%					31.523	0.000
6.003	SW25	60 Winter	100	+40%	100/15 Summer				32.275	0.819
9.000	SW26	60 Winter	100	+40%	30/15 Summer				32.262	0.957
6.004	SW27	60 Winter	100	+40%	30/15 Summer				32.261	1.006

The Alan Johnston Partnership		Page 23
1 Dale Street Liverpool L2 2ET	218-209 New Victoria	
Date 31/05/2022 09:25 File 2022.05.27 - SW NETWORK WITH	Designed by JJR Checked by JRS	
XP Solutions	Network 2019.1	

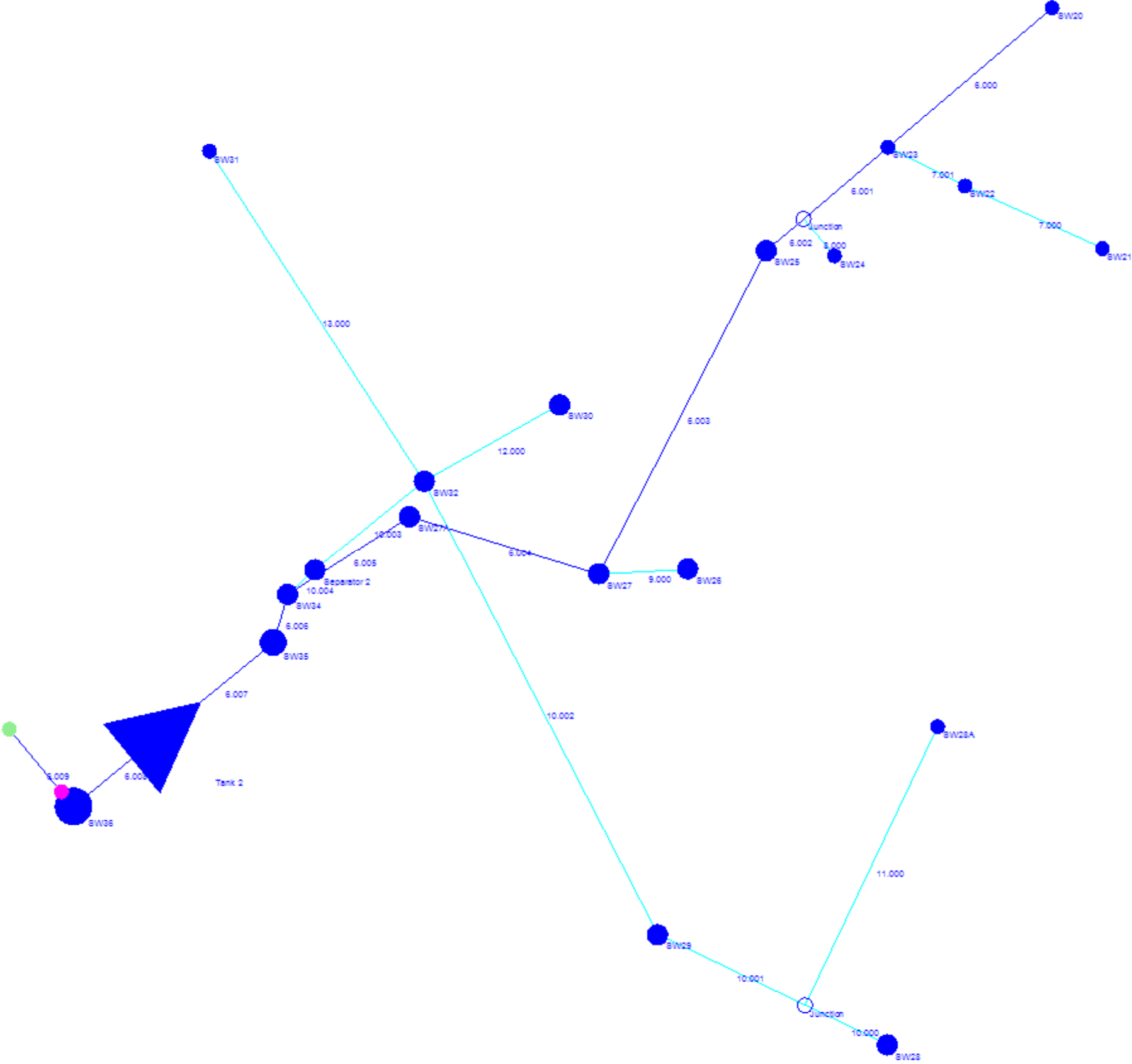
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.000	1.14		33.7	FLOOD RISK	
1.001	SW02	0.000	1.70		39.1	SURCHARGED	
1.002	SW03	0.000	0.27		17.7	SURCHARGED	
1.003	SW04	0.000	0.21		16.1	SURCHARGED	
2.000	SW05	0.000	0.00		0.1	SURCHARGED	
2.001	SW05A	0.000	0.03		0.3	SURCHARGED	
1.004	SW06	0.000	0.41		16.4	SURCHARGED	
1.005	Separator 1	0.000	0.42		15.6	SURCHARGED	
3.000	SW07	0.000	0.66		11.0	SURCHARGED	
3.001	SW08	0.000	0.62		12.7	SURCHARGED	
3.002	SW09	0.000	0.99		12.5	SURCHARGED	
3.003	SW10	0.000	1.11		22.8	SURCHARGED	
4.000	SW11	0.000	0.38		8.8	SURCHARGED	
3.004	SW12	0.000	0.76		27.0	SURCHARGED	
5.000	SW13	0.000	0.30		5.4	SURCHARGED	
5.001	SW14	0.000	0.33		5.4	SURCHARGED	
5.002	SW15	0.000	0.55		15.6	SURCHARGED	
3.005	SW16	0.000	0.53		18.3	SURCHARGED	
3.006	SW17	0.000	0.57		18.1	SURCHARGED	
1.006	SW18	0.000	0.70		32.8	SURCHARGED	
1.007	Tank 1	0.000	0.12		5.8	SURCHARGED	
1.008	SW19	0.000	0.13		5.5	SURCHARGED	
6.000	SW20	0.000	0.01		1.0	SURCHARGED	
7.000	SW21	0.000	0.16		15.0	OK	
7.001	SW22	0.000	0.27		15.0	SURCHARGED	
6.001	SW23	0.000	0.28		16.0	SURCHARGED	
8.000	SW24	0.000	0.28		5.7	SURCHARGED	
6.002	Junction	0.000	0.59		21.7	SURCHARGED*	
6.003	SW25	0.000	0.45		21.2	SURCHARGED	
9.000	SW26	0.000	0.11		3.5	SURCHARGED	
6.004	SW27	0.000	0.88		28.6	SURCHARGED	

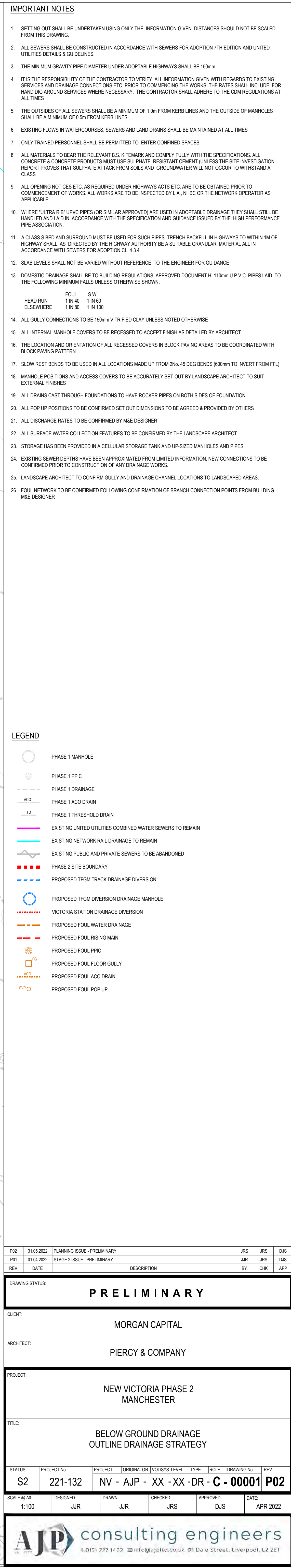
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
6.005	SW27A	60 Winter	100	+40%	30/15 Summer				32.248	1.053
10.000	SW28	15 Winter	100	+40%					34.159	-0.041
11.000	SW28A	60 Winter	100	+40%					34.700	-0.150
10.001	Junction	15 Winter	100	+40%					33.942	-0.058
10.002	SW29	15 Winter	100	+40%					33.613	-0.027
12.000	SW30	15 Winter	100	+40%	100/15 Summer				32.311	0.296
13.000	SW31	15 Winter	100	+40%	100/15 Summer				32.445	0.330
10.003	SW32	60 Winter	100	+40%	100/15 Summer				32.257	0.767
10.004	Separator 2	60 Winter	100	+40%	30/15 Summer				32.243	1.073
6.006	SW34	60 Winter	100	+40%	30/15 Summer				32.237	1.108
6.007	SW35	60 Winter	100	+40%	2/15 Summer				32.228	2.398
6.008	Tank 2	60 Winter	100	+40%	30/15 Summer				32.200	2.450
6.009	SW36	60 Winter	100	+40%	2/15 Summer				32.174	4.190

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.005	SW27A	0.000	0.78		28.1	SURCHARGED	
10.000	SW28	0.000	0.87		24.3	OK	
11.000	SW28A	0.000	0.00		0.0	OK	
10.001	Junction	0.000	0.68		24.0	OK*	
10.002	SW29	0.000	0.98		36.6	OK	
12.000	SW30	0.000	0.44		45.2	SURCHARGED	
13.000	SW31	0.000	0.62		49.9	SURCHARGED	
10.003	SW32	0.000	0.56		79.0	SURCHARGED	
10.004	Separator 2	0.000	1.28		78.4	SURCHARGED	
6.006	SW34	0.000	1.73		106.1	SURCHARGED	
6.007	SW35	0.000	2.14		151.3	SURCHARGED	
6.008	Tank 2	0.000	1.14		69.9	FLOOD RISK	
6.009	SW36	0.000	0.48		50.1	FLOOD RISK	



Appendix I – Phase 2 Outline Drainage Strategy Drawing



AJP consulting engineers
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