

Julie Roscoe
Director of Planning
Building Control & Licensing
Manchester City Council
PO Box 532 Town Hall
Manchester M60 2LA

Our Ref: 34290
9th July 2021

Dear Julie,

Planning Application 126476/JO/2020: 11 York Street, Manchester, M2 2AW. Discharge of conditions 3, 9, 11, 12 and 22

Please see attached information in the appendices to discharge the following planning conditions associated with the 11 York Street project:

- Condition 3 – Details of sustainable drainage scheme
- Condition 9 – A3 acoustics and noise breakout
- Condition 11 – Externally mounted equipment acoustic insulation
- Condition 12 – Acoustic insulation of rooftop amenity space
- Condition 22 – Details of car park traffic management

Condition 3

In order to discharge condition 3 regarding the sustainable drainage scheme, Kier Property's civil engineer, Tier Consult, have provided in Appendix A:

- Flood Risk Assessment (pages 1-26)
- Surface Water Maintenance Plan (pages 27-30)
- Verification Report for the Sustainable Drainage Installation (pages 31-43)
- Current as built drainage layout (page 44)

Conditions 9, 11 and 12

Kier Property's acoustic consultant, AEC, has provided a verification report to discharge these conditions. The report provides information about the following elements:

- Noise breakout from A3 units
- Atmospheric noise from mechanical plant and ancillary equipment
- Noise break out from rooftop amenity space

The report can be found in Appendix B to this letter.

Condition 22

Appendix D contains details of the car park traffic management plan and access summary.

We trust that this is sufficient to discharge the conditions but if you have any questions or require further information then please contact myself.

Yours sincerely



Mark Munnelly
Partner
for Gardiner & Theobald LLP

11 YORK STREET, MANCHESTER

PLANNING APPLICATION 126476/JO/2020
APPENDIX A
DISCHARGE OF PLANNING CONDITION 3

9th July 2021

11 York Street, Manchester

FLOOD RISK ASSESSMENT

Introduction

This Flood Risk Assessment (FRA) has been prepared by Tier Consult Ltd to demonstrate compliance with the requirements of the Building Research Establishment & Sustainability Standard (BREEAM) in terms of Pol 3: Surface Water Run Off for the development at 11 York Street, Manchester.

This FRA has been carried out in accordance with guidance contained in BREEAM, National Planning Policy Framework (NPPF)¹ and associated Planning Practice Guidance². This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

BREEAM

POL 3 – Surface Water Run Off

BREEAM requires an assessment of flood risk for new buildings. The aim is to ensure developments will minimise the risk of flooding and to promote development in low flood risk areas, or to take measures to reduce the impact of flooding in areas with a medium or high risk of flooding.

To encourage development in low flood risk areas or to take measures to reduce the impact of flooding on buildings in areas with a medium or high risk of flooding.
Two credits Criterion 1: Where the assessed development is situated in a flood zone that is defined by the relevant planning, policy and technical guidance documents, as having a low annual probability of flooding. A site-specific Flood Risk Assessment (FRA) confirms that - the ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600mm above the design flood level of the flood zone in which the assessed development is located (see CN3.5); OR - The final design of the building and the wider site reflects the recommendations made by an appropriate consultant in accordance with the hierarchy approach outlined in section 5 of BS 8533:2011.
One credit Criteria 4-7: An appropriate consultant is appointed to carry out, demonstrate and/or confirm the following criteria:

¹ Department for Communities and Local Government (2012) National Planning Policy Framework.

² Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change.

Where drainage measures are specified to ensure that the peak rate of run-off from the site to the watercourses (natural or municipal) is no greater for the developed site than it was for the pre-development site. This should comply at the 1 year and 100 year return period events. Calculations include an allowance for climate change; this should be made in accordance with current best practice planning guidance.

One credit

Criteria 9-14: Where flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance) AND The post development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. Any additional predicted volume of run-off for the 100 year 6 hour event must be prevented from leaving the site by using infiltration or other SuDS techniques.

To demonstrate compliance a FRA is required and should include:

- Confirm the flood zone of the development and if appropriate demonstrate that the development is flood resilient and resistant with safe access and escape routes and that residual risk can be safely managed.
- Confirm the risk of flooding from all sources of flooding.
- These issues are considered in this report.

FLOOD RISK

Sources of Flooding

All sources of flooding have been considered, these are; Fluvial (river) Flooding, Tidal (coastal) Flooding, Groundwater Flooding, Surface Water (pluvial) Flooding, Sewer Flooding and Flooding from Artificial Drainage Systems/Infrastructure Failure. The key consequences of flooding are death/personal injury, extensive damage to property, properties uninhabitable for long periods, properties cannot be sold, insurance unavailable or too expensive, expense of installing flood resilience measures and business interruptions.

Fluvial (river) Flooding

There are no watercourses evident either on, or within the vicinity of the site. A review of the Environment Agency flood map indicates that the site is located within Flood Zone 1 and therefore has a 'low probability' of fluvial flooding, with less than a 1 in 1000 annual probability of river flooding in any year (<0.1%).

The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development.

The site is not located within the vicinity of fluvial flooding sources and the risk of fluvial flooding is considered to be not significant. Therefore, flooding from this source has not been considered further within this FRA.

Tidal (coastal) Flooding

The site is not located within the vicinity of tidal flooding sources and the risk of tidal flooding is considered to be not significant. Therefore, flooding from this source has not been considered further within this FRA.

Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded. Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

Site conditions suggest a low probability of groundwater flooding due to the substantial depth of Made Ground. The site has a low risk of groundwater flooding this will be mitigated by the adoption of the Surface Water Management Strategy (SWMS) for the site and provided the finished floor levels are set above the adjacent ground levels, the risk of flooding from groundwater flooding is considered to be not significant. Therefore, flooding from this source has not been considered further within this FRA.

Surface Water (pluvial) Flooding

The soil condition at the site and within the vicinity of the site and the topography of the site suggest that the site is relatively well drained and surface water flooding would not be expected to accumulate to any significant depths. Surface water flooding tends to occur sporadically in both location and time such surface water would tend to be confined to the streets around the development. The Environment Agency Surface Water flood map shows that the site has a very low risk of surface water flooding with a chance of flooding of less than 1 in 1000 (<0.1%) years.

The site has a low risk of surface water flooding this will be further mitigated by the adoption of the SWMS for the site and provided the finished floor levels are set above the adjacent ground levels, the risk of flooding from surface water flooding is considered to be not significant. Therefore, flooding from this source has not been considered further within this FRA.

Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

There are existing public sewers within roads adjacent to the site; these will inevitably have a limited capacity so in extreme conditions there would be surcharges, which may in turn cause flooding. Flood flows could also be generated by burst water mains but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes of this assessment. Given the design parameters normally used for drainage design in recent times and allowing for some deterioration in the performance of the installed systems, which are likely to have been in place for many years, an appropriate flood risk probability from this source could be assumed to have a return period in the order of 1 in 10 to 1 in 30 years. The provision of adequate level difference between the ground floors and adjacent ground level would reduce the annual probability of damage to property from this source to 1 in 100 years or less.

This risk will be mitigated by the adoption of the SWMS and foul water drainage strategy for the site and provided the finished floor levels are set above the adjacent ground levels, the risk of flooding from sewer flooding is considered to be not significant. Therefore, flooding from this source has not been considered further within this FRA.

Flooding from Artificial Drainage Systems/Infrastructure Failure

There are no other nearby reservoirs, artificial water bodies, water channels and artificial drainage systems that could be considered a flood risk to the site. The Environment Agency Reservoir flood map shows that the site is not at risk of reservoir flooding.

The risk of flooding from artificial drainage systems/infrastructure failure is considered to be not significant. Therefore, flooding from these sources has not been considered further within this FRA.

Historic Flooding

There are no records of anecdotal information of flooding at the site. The British Hydrological Society "Chronology of British Hydrological Event" has no information on flooding within the vicinity of the site. No other historical records of flooding for the site have been recorded. Therefore, it has been assumed that the site has not flooded within the recent past (i.e. the last thousand years).

Existing and Planned Flood Defence Measures

A review of the Environment Agency flood map confirms that the site is not protected by any formal or informal flood defence measures.

Summary of BREEAM POL 3 – Flood Risk

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 1.

Table 1 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial (river) Flooding	No	None Reported	Not significant
Tidal (coastal) Flooding	No	None Reported	Not significant
Groundwater Flooding	No	None Reported	Not significant
Surface Water (pluvial) Flooding	Yes	Poor Permeability	Not significant
Sewer Flooding	Yes	Local Sewers	Not significant
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	Not significant

The risk of flooding from all sources is considered to be not significant this will be further mitigated by the adoption of the SWMS for site and provided the finished floor levels are set above the adjacent ground levels. The site and surrounding area is located within Flood Zone 1 therefore a permanently safe and dry access can be maintained.

In conclusion, the development will be situated in Flood Zone 1, with a low annual probability of flooding and from all sources. The chance of flooding from all sources each year is less than 0.1% (1 in 1000 years).

Two credits can therefore be awarded under BREEAM POL 3 – Flood Risk.

SURFACE WATER DRAINAGE

Proposed Surface Water Management Strategy (SWMS)

The objective of this SWMS is to ensure that a sustainable drainage solution can be achieved which reduces the peak discharge rate to manage and reduce the flood risk posed by the surface water runoff from the site.

The site has existing connection to the United Utilities public combined sewer via a free discharge and it is considered sustainable to retain and reuse this connection. The pre-application site is constructed entirely from impermeable surfaces with no permeable surfaces located on the site. The post-application site will not increase the impermeable surfaces on the site. As there is no history of surface water flooding at the site it is likely that the current drainage system is sufficient for the current and proposed site use.

Therefore, the amount of impermeable surfaces will not increase post-application compared to pre-application. A derivation of the Lloyd-Davies Rational Method has been used to assess the pre- and post-application surface water runoff rate from the site. This derivation includes for a fixed rainfall rate of 50mm/hr and a dimensionless coefficient of 1.00 with the conversion factor of 2.78 using the existing impermeable area of 0.11 hectares (ha) to give the equation:

$$Q \text{ (l/s)} = 2.78 \times 50 \times A \text{ (ha)}$$

This gives an existing and proposed discharge rate of 15.30 litres a second (l/s) for the impermeable areas of the site. Greenfield runoff rates from the total site area of 0.11ha has been calculated using the Institute of Hydrology Report 124 method (I0H124), QBAR (rural) has been calculated to be 0.65l/s.

The proposed runoff rate will be restricted to 50% of the pre-development flow rates with an allowance of 40% climate change for the proposed 100 year event. The restriction of 50% pre-development runoff rates is based on the recommendations within the Manchester Strategic Flood Risk Assessment for brownfield sites within 'Critical Drainage Areas'. Therefore, the proposed runoff rate is 7.65l/s for all events up to and including the 1 in 100 year (+40%) event.

Table 2 shows the volume of attenuation required for the proposed development for the 1 in 100 year event with a 40% allowance for climate change assuming the proposed impermeable area (see Appendix 1).

Table 2 - Attenuation Storage Volume

Return Period (years)	Limiting Discharge Rate (l/s)	Volume (m ³)
1 + 40%	7.65	6.90
30 + 40%		21.90
100 + 40%		33.40

The attenuation storage will be located in: street planters, porous/permeable paving, cellular storage, storage tanks, oversized drainage networks and surface storage. It would not be practical to include a pond, or lagoon within the site. Made ground deposits are likely to be present to a significant depth and there is a lack of space which makes soakaways impractical. Additional attenuation storage will be located within the pipework and manholes located on the site to provide betterment over and above the 1 in 100 year (+40%) event.

The surface water runoff will not increase post-application compared to pre-application and there will be no increase in surface water flood risk to the site and off-site locations. Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the building and through contouring of the hardstanding areas.

The adoption of a surface water management strategy for the site represents an enhancement from the current conditions as the current surface water runoff from the site is uncontrolled, untreated, unmanaged and unmitigated. In adopting these principles, it has been demonstrated that a scheme can be developed that does not increase the risk of flooding to adjacent properties and development further downstream.

Designing for Local Drainage System Failure

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system. The SWMS applies a safe and sustainable approach to discharging rainfall runoff from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk. This section of the FRA is therefore associated with the way the residual risk is managed.

As part of the SWMS it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure and/or design exceedance. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground³.

The design of the site layout provides an opportunity to manage this local drainage system failure/exceedance flow and ensure that indiscriminate flooding of property does not occur.

There will not be an extensive sewerage network on the proposed development site and therefore any potential exceedance flooding would be from the sewers. It is very unlikely that a catastrophic failure would occur. An exceedance or blockage event of the sewers would not affect the proposed buildings because the finished floor level will be raised above surrounding ground levels, ensuring any exceedance flooding would not affect the buildings.

Exceedance flows would be contained within the highways within the site and adjacent to the site and would flow to the lower ground levels. Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas. It is not considered that there is an increased risk to the properties on the site or located adjacent to the site.

There is additional capacity with the system to accommodate this. If this freeboard was to be exceeded the consequences would be similar, if not less than for the local drainage system failure. Drainage gullies, manholes and pipework will provide additional water storage and provide betterment. Consequently, the impact of an exceedance event is not considered to represent any significant flood hazard.

The above manages and mitigates the flood risk from surface water runoff to the proposed properties from surface water runoff generated by the site development and to offsite locations as well the risk from surface water runoff generated offsite.

³ CIRIA (2006) Designing for exceedance in urban drainage – good practice.

Summary of BREEAM POL 3 – Surface Water Run Off

The peak rate of runoff from the site will be no greater for the developed site than it was the pre-development site. Flooding of property will not occur in the event of local drainage system failure and the post development runoff volume, over the lifetime of the development, will be no greater than it would have been prior to the assessed site's development.

Two credits can therefore be awarded under BREEAM POL 3 – Surface Water Run Off.

APPENDIX 1 – Attenuation Storage Volumes



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 1		
Date 09/05/17		
By	Checked	Reviewed

Project **11 York Street**
Title **1 in 1 Year (+40%) Attenuation Storage Volume**

Data:-

Location = MANCHESTER (CENTRAL) Grid reference = SJ8397
M5-60 (mm) = 17.8 r = 0.36
Soil index = 0.45 SAAR (mm/yr) = 900
Return period = 1 WRAP = 4
UCWI = 96.2 Climate change = 40%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Pipeline storage = 0.0 m³ Available MH storage = 0.0 m³
Offline storage = 0.0 m³

Percentage runoff = 100.0% (manual setting)

Imperv. area = 1100 m² Pervious area = 0 m²
Total area = 1100 m² Equiv area = 1100 m² (Tot. area x % runoff).
Total runoff = 12.1 m³ Discharge rate = 7.650 l/s
Storage (m³) = 6.9 m³ (Sum of all balance quantities)
Total rainfall depth = 11.0 mm

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.002	20.0	8.8	0.024	0.069	0.000	0.000
0.005	20.0	8.8	0.024	0.069	0.000	0.000
0.007	21.0	9.3	0.026	0.069	0.000	0.000
0.010	21.0	9.3	0.026	0.069	0.000	0.000
0.013	22.0	9.7	0.027	0.069	0.000	0.000
0.015	23.0	10.2	0.028	0.069	0.000	0.000
0.018	24.0	10.6	0.029	0.069	0.000	0.000
0.020	26.0	11.5	0.032	0.069	0.000	0.000
0.023	27.0	11.9	0.033	0.069	0.000	0.000
0.025	29.0	12.8	0.035	0.069	0.000	0.000
0.027	31.0	13.7	0.038	0.069	0.000	0.000
0.030	32.0	14.1	0.039	0.069	0.000	0.000
0.032	33.0	14.6	0.040	0.069	0.000	0.000
0.035	34.0	15.0	0.041	0.069	0.000	0.000
0.038	36.0	15.9	0.044	0.069	0.000	0.000
0.040	38.0	16.8	0.046	0.069	0.000	0.000
0.043	39.0	17.2	0.047	0.069	0.000	0.000
0.045	40.0	17.7	0.049	0.069	0.000	0.000
0.047	42.0	18.6	0.051	0.069	0.000	0.000
0.050	45.0	19.9	0.055	0.069	0.000	0.000
0.052	49.0	21.6	0.060	0.069	0.000	0.000
0.055	53.0	23.4	0.064	0.069	0.000	0.000
0.058	57.0	25.2	0.069	0.069	0.000	0.000
0.060	62.0	27.4	0.075	0.069	0.006	0.007
0.062	66.0	29.2	0.080	0.069	0.011	0.018
0.065	71.0	31.4	0.086	0.069	0.017	0.036
0.068	77.0	34.0	0.094	0.069	0.025	0.060
0.070	84.0	37.1	0.102	0.069	0.033	0.093
0.072	91.0	40.2	0.111	0.069	0.042	0.135
0.075	98.0	43.3	0.119	0.069	0.050	0.185
0.078	105.0	46.4	0.128	0.069	0.059	0.244
0.080	114.0	50.4	0.138	0.069	0.070	0.314
0.083	125.0	55.2	0.152	0.069	0.083	0.397
0.085	135.0	59.6	0.164	0.069	0.095	0.492
0.087	143.0	63.2	0.174	0.069	0.105	0.597
0.090	154.0	68.0	0.187	0.069	0.118	0.715
0.093	164.0	72.4	0.199	0.069	0.130	0.845
0.095	173.0	76.4	0.210	0.069	0.141	0.987
0.097	183.0	80.8	0.222	0.069	0.153	1.140
0.100	194.0	85.7	0.236	0.069	0.167	1.307



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 2		
Date 09/05/17		
By	Checked	Reviewed

Project **11 York Street**
Title **1 in 1 Year (+40%) Attenuation Storage Volume**

Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.102	204.0	90.1	0.248	0.069	0.179	1.486
0.105	212.0	93.6	0.258	0.069	0.189	1.674
0.108	219.0	96.7	0.266	0.069	0.197	1.872
0.110	226.0	99.8	0.275	0.069	0.206	2.077
0.112	233.0	102.9	0.283	0.069	0.214	2.292
0.115	239.0	105.6	0.290	0.069	0.221	2.513
0.117	244.0	107.8	0.296	0.069	0.228	2.741
0.120	248.0	109.5	0.301	0.069	0.232	2.973
0.123	249.0	110.0	0.302	0.069	0.234	3.207
0.125	250.0	110.4	0.304	0.069	0.235	3.441
0.127	250.0	110.4	0.304	0.069	0.235	3.676
0.130	249.0	110.0	0.302	0.069	0.234	3.910
0.132	248.0	109.5	0.301	0.069	0.232	4.142
0.135	244.0	107.8	0.296	0.069	0.228	4.370
0.138	239.0	105.6	0.290	0.069	0.221	4.591
0.140	233.0	102.9	0.283	0.069	0.214	4.806
0.142	226.0	99.8	0.275	0.069	0.206	5.011
0.145	219.0	96.7	0.266	0.069	0.197	5.208
0.147	212.0	93.6	0.258	0.069	0.189	5.397
0.150	204.0	90.1	0.248	0.069	0.179	5.576
0.153	194.0	85.7	0.236	0.069	0.167	5.743
0.155	183.0	80.8	0.222	0.069	0.153	5.896
0.157	173.0	76.4	0.210	0.069	0.141	6.038
0.160	164.0	72.4	0.199	0.069	0.130	6.168
0.162	154.0	68.0	0.187	0.069	0.118	6.286
0.165	143.0	63.2	0.174	0.069	0.105	6.391
0.168	135.0	59.6	0.164	0.069	0.095	6.486
0.170	125.0	55.2	0.152	0.069	0.083	6.569
0.172	114.0	50.4	0.138	0.069	0.070	6.639
0.175	105.0	46.4	0.128	0.069	0.059	6.698
0.177	98.0	43.3	0.119	0.069	0.050	6.748
0.180	91.0	40.2	0.111	0.069	0.042	6.789
0.183	84.0	37.1	0.102	0.069	0.033	6.823
0.185	77.0	34.0	0.094	0.069	0.025	6.847
0.188	71.0	31.4	0.086	0.069	0.017	6.865
0.190	66.0	29.2	0.080	0.069	0.011	6.876
0.192	62.0	27.4	0.075	0.069	0.006	6.883
0.195	57.0	25.2	0.069	0.069	0.000	6.883
0.198	53.0	23.4	0.064	0.069	0.000	6.878
0.200	49.0	21.6	0.060	0.069	0.000	6.869
0.203	45.0	19.9	0.055	0.069	0.000	6.855
0.205	42.0	18.6	0.051	0.069	0.000	6.837
0.207	40.0	17.7	0.049	0.069	0.000	6.817
0.210	39.0	17.2	0.047	0.069	0.000	6.795
0.213	38.0	16.8	0.046	0.069	0.000	6.773
0.215	36.0	15.9	0.044	0.069	0.000	6.748
0.218	34.0	15.0	0.041	0.069	0.000	6.720
0.220	33.0	14.6	0.040	0.069	0.000	6.691
0.222	32.0	14.1	0.039	0.069	0.000	6.661
0.225	31.0	13.7	0.038	0.069	0.000	6.630
0.228	29.0	12.8	0.035	0.069	0.000	6.596
0.230	27.0	11.9	0.033	0.069	0.000	6.560
0.233	26.0	11.5	0.032	0.069	0.000	6.523
0.235	24.0	10.6	0.029	0.069	0.000	6.483
0.237	23.0	10.2	0.028	0.069	0.000	6.443
0.240	22.0	9.7	0.027	0.069	0.000	6.400
0.243	21.0	9.3	0.026	0.069	0.000	6.357
0.245	21.0	9.3	0.026	0.069	0.000	6.314
0.248	20.0	8.8	0.024	0.069	0.000	6.269
0.250	20.0	8.8	0.024	0.069	0.000	6.225

Storage volume (m³) = 6.9 m³ (Sum of all balance quantities)



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.

Sheet no.

3

Date

09/05/17

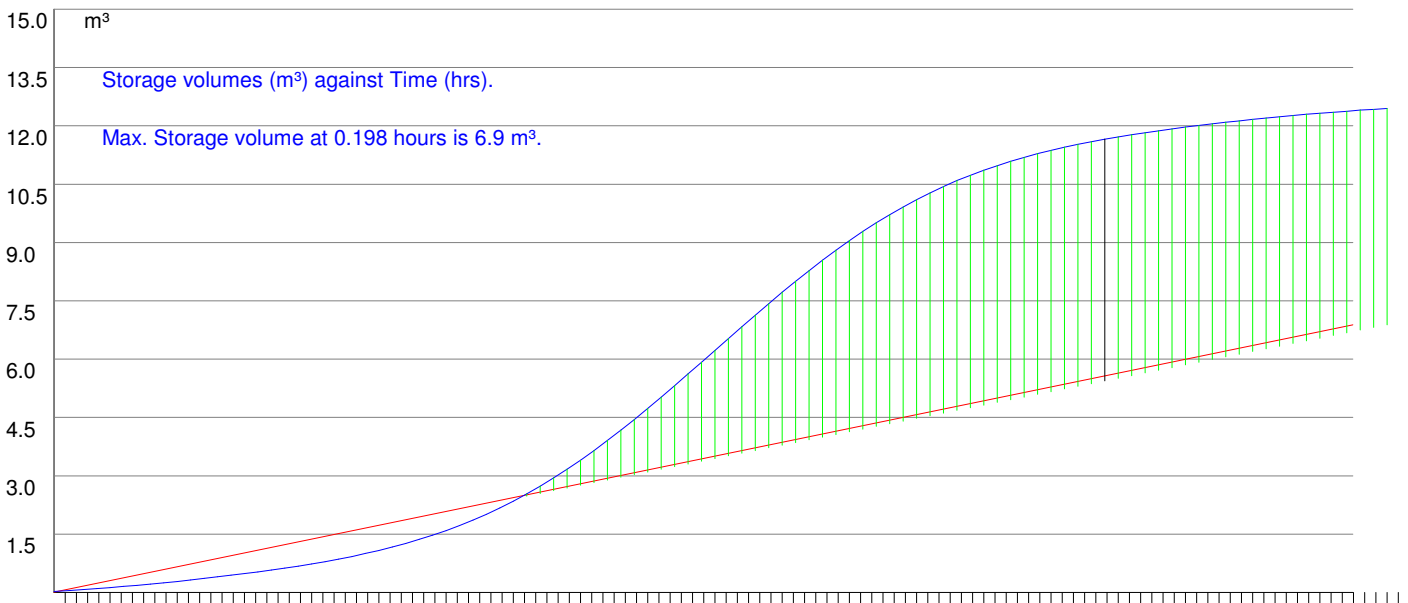
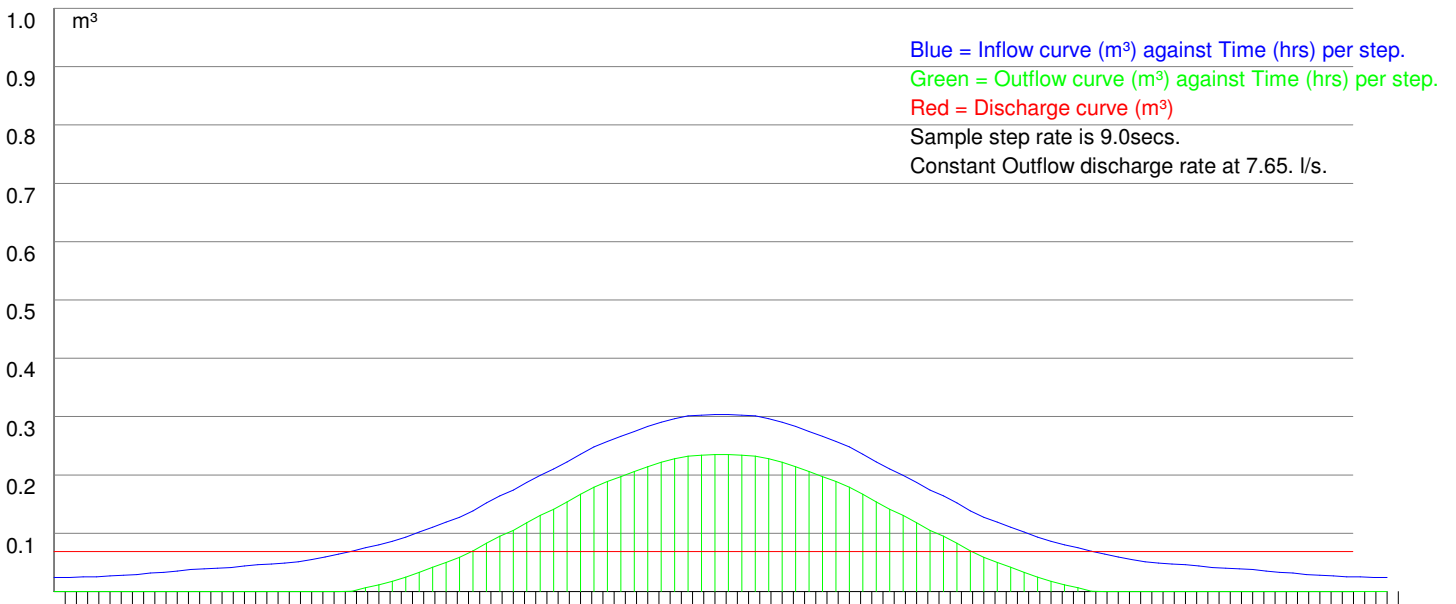
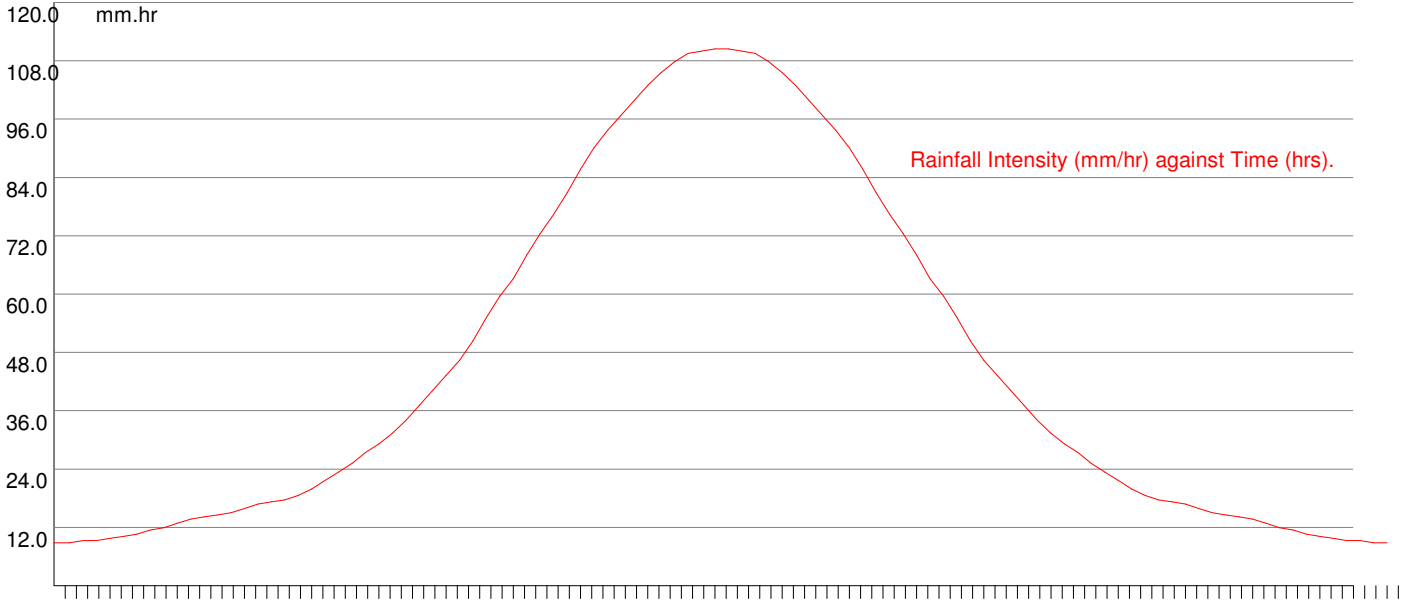
By

Checked

Reviewed

Project
11 York Street

Title
1 in 1 Year (+40%) Attenuation Storage Volume





MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 4		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 1 Year (+40%) Attenuation Storage Volume

Maximum storage volumes for varying duration storms.

Storm length (hrs)	Max. Vol (m ³)	Max. Vol time	Mean intens (mm/hr)	Step time. (mins)	Peak found
0.25	6.88	0.25	44.17	0.2	Peak found
0.5	6.48	---	28.48	0.3	
1	4.22	---	17.76	0.6	
2	0.41	---	10.91	1.2	
3	0.00	---	8.18	1.8	
4	0.00	---	6.67	2.4	
5	0.00	---	5.70	3.0	
6	0.00	---	5.02	3.6	
7	0.00	---	4.50	4.2	
8	0.00	---	4.09	4.8	
9	0.00	---	3.77	5.4	
10	0.00	---	3.50	6.0	
12	0.00	---	3.07	7.2	
15	0.00	---	2.62	9.0	
18	0.00	---	2.31	10.8	
20	0.00	---	2.14	12.0	
24	0.00	---	1.88	14.4	
30	0.00	---	1.61	18.0	
36	0.00	---	1.41	21.6	
42	0.00	---	1.27	25.2	
48	0.00	---	1.15	28.8	
54	0.00	---	1.06	32.4	
60	0.00	---	0.99	36.0	
66	0.00	---	0.92	39.6	
72	0.00	---	0.87	43.2	
84	0.00	---	0.78	50.4	
96	0.00	---	0.71	57.6	
120	0.00	---	0.61	72.0	
150	0.00	---	0.52	90.0	
175	0.00	---	0.47	105.0	
200	0.00	---	0.42	120.0	
250	0.00	---	0.36	150.0	
300	0.00	---	0.32	180.0	
375	0.00	---	0.27	225.0	
500	0.00	---	0.22	300.0	
750	0.00	---	0.17	450.0	
1000	0.00	---	0.14	600.0	
1250	0.00	---	0.12	750.0	
1500	0.00	---	0.10	900.0	
1570	0.00	---	0.10	942.0	
2000	0.00	---	0.08	1200.0	
2500	0.00	---	0.07	1500.0	
3000	0.00	---	0.06	1800.0	
3500	0.00	---	0.06	2100.0	
4000	0.00	---	0.05	2400.0	



MasterDrain
SW

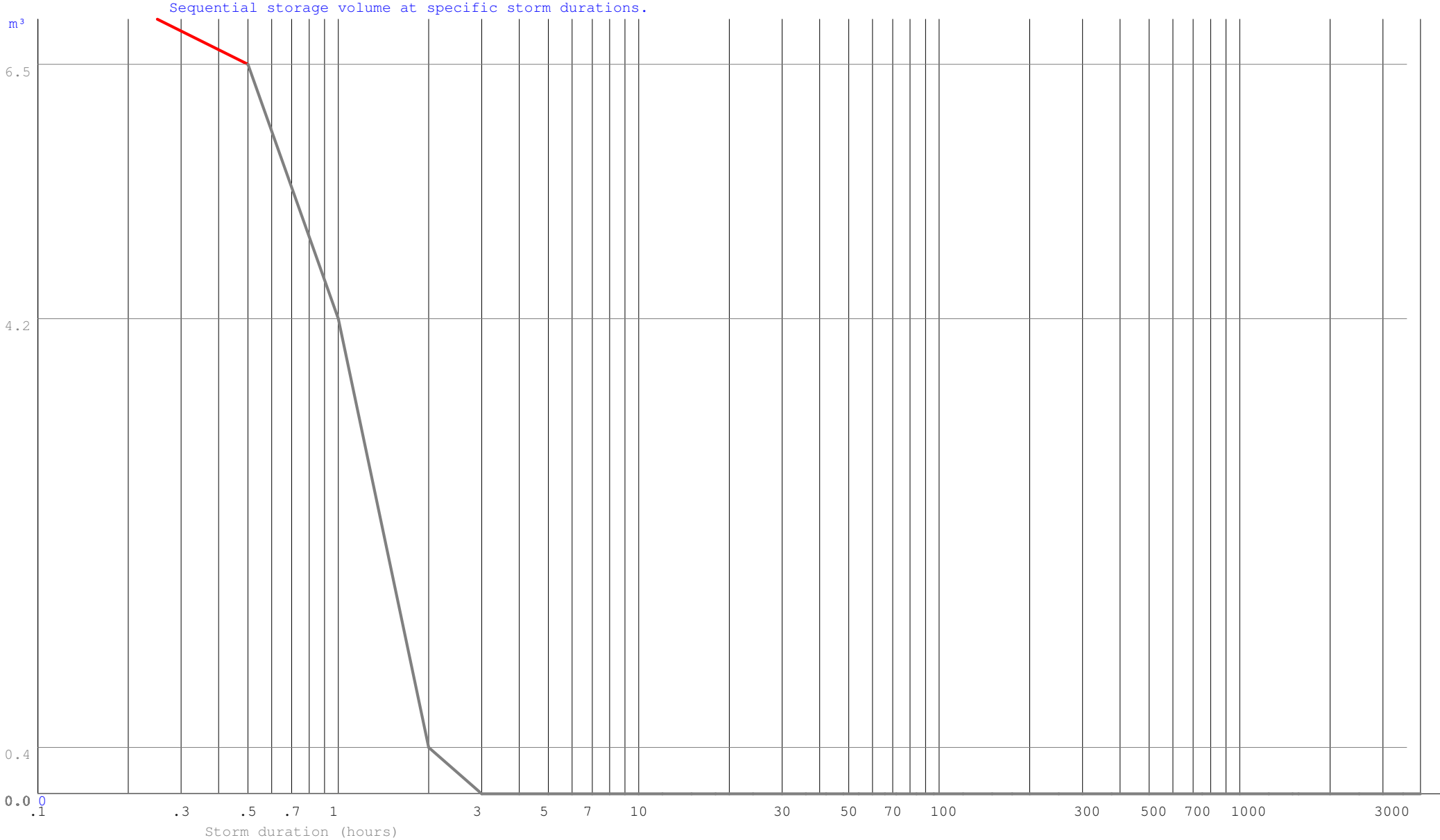
KRS Environmental
Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 5		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 1 Year (+40%) Attenuation Storage Volume





MasterDrain
SW

KRS Environmental Limited. www.krsenvironmental.com		3 Princes Square, Princes Street, Montgomery Powys, SY15 6PZ Tel: 01686 668957 Mob: 07857 264 376 email: keelan@krsenvironmental.com		Job No.
				Sheet no. 6
				Date 09/05/17
Project	11 York Street	By	Checked	Reviewed
Title	1 in 1 Year (+40%) Attenuation Storage Volume			

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 1		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 30 Year (+40%) Attenuation Storage Volume

Data:-

Location = MANCHESTER (CENTRAL) Grid reference = SJ8397
M5-60 (mm) = 17.8 r = 0.36
Soil index = 0.45 SAAR (mm/yr) = 900
Return period = 30 WRAP = 4
UCWI = 96.2 Climate change = 40%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Pipeline storage = 0.0 m³ Available MH storage = 0.0 m³
Offline storage = 0.0 m³

Percentage runoff = 100.0% (manual setting)

Imperv. area = 1100 m² Pervious area = 0 m²
Total area = 1100 m² Equiv area = 1100 m² (Tot. area x % runoff).
Total runoff = 42.1 m³ Discharge rate = 7.650 l/s
Storage (m³) = 21.9 m³ (Sum of all balance quantities)
Total rainfall depth = 38.3 mm

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.010	20.0	7.7	0.084	0.275	0.000	0.000
0.020	20.0	7.7	0.084	0.275	0.000	0.000
0.030	21.0	8.0	0.088	0.275	0.000	0.000
0.040	21.0	8.0	0.088	0.275	0.000	0.000
0.050	22.0	8.4	0.093	0.275	0.000	0.000
0.060	23.0	8.8	0.097	0.275	0.000	0.000
0.070	24.0	9.2	0.101	0.275	0.000	0.000
0.080	26.0	10.0	0.109	0.275	0.000	0.000
0.090	27.0	10.3	0.114	0.275	0.000	0.000
0.100	29.0	11.1	0.122	0.275	0.000	0.000
0.110	31.0	11.9	0.130	0.275	0.000	0.000
0.120	32.0	12.2	0.135	0.275	0.000	0.000
0.130	33.0	12.6	0.139	0.275	0.000	0.000
0.140	34.0	13.0	0.143	0.275	0.000	0.000
0.150	36.0	13.8	0.152	0.275	0.000	0.000
0.160	38.0	14.5	0.160	0.275	0.000	0.000
0.170	39.0	14.9	0.164	0.275	0.000	0.000
0.180	40.0	15.3	0.168	0.275	0.000	0.000
0.190	42.0	16.1	0.177	0.275	0.000	0.000
0.200	45.0	17.2	0.189	0.275	0.000	0.000
0.210	49.0	18.8	0.206	0.275	0.000	0.000
0.220	53.0	20.3	0.223	0.275	0.000	0.000
0.230	57.0	21.8	0.240	0.275	0.000	0.000
0.240	62.0	23.7	0.261	0.275	0.000	0.000
0.250	66.0	25.3	0.278	0.275	0.002	0.002
0.260	71.0	27.2	0.299	0.275	0.023	0.026
0.270	77.0	29.5	0.324	0.275	0.049	0.075
0.280	84.0	32.1	0.354	0.275	0.078	0.153
0.290	91.0	34.8	0.383	0.275	0.108	0.261
0.300	98.0	37.5	0.413	0.275	0.137	0.398
0.310	105.0	40.2	0.442	0.275	0.167	0.564
0.320	114.0	43.6	0.480	0.275	0.205	0.769
0.330	125.0	47.8	0.526	0.275	0.251	1.020
0.340	135.0	51.7	0.568	0.275	0.293	1.313
0.350	143.0	54.7	0.602	0.275	0.327	1.639
0.360	154.0	58.9	0.648	0.275	0.373	2.012
0.370	164.0	62.8	0.690	0.275	0.415	2.427
0.380	173.0	66.2	0.728	0.275	0.453	2.880
0.390	183.0	70.0	0.770	0.275	0.495	3.375
0.400	194.0	74.2	0.817	0.275	0.541	3.916



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

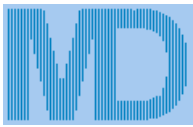
Job No.		
Sheet no. 2		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 30 Year (+40%) Attenuation Storage Volume

Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.410	204.0	78.1	0.859	0.275	0.583	4.499
0.420	212.0	81.1	0.892	0.275	0.617	5.117
0.430	219.0	83.8	0.922	0.275	0.647	5.763
0.440	226.0	86.5	0.951	0.275	0.676	6.439
0.450	233.0	89.2	0.981	0.275	0.705	7.144
0.460	239.0	91.5	1.006	0.275	0.731	7.875
0.470	244.0	93.4	1.027	0.275	0.752	8.627
0.480	248.0	94.9	1.044	0.275	0.769	9.396
0.490	249.0	95.3	1.048	0.275	0.773	10.168
0.500	250.0	95.7	1.052	0.275	0.777	10.945
0.510	250.0	95.7	1.052	0.275	0.777	11.722
0.520	249.0	95.3	1.048	0.275	0.773	12.495
0.530	248.0	94.9	1.044	0.275	0.769	13.264
0.540	244.0	93.4	1.027	0.275	0.752	14.016
0.550	239.0	91.5	1.006	0.275	0.731	14.746
0.560	233.0	89.2	0.981	0.275	0.705	15.452
0.570	226.0	86.5	0.951	0.275	0.676	16.128
0.580	219.0	83.8	0.922	0.275	0.647	16.774
0.590	212.0	81.1	0.892	0.275	0.617	17.391
0.600	204.0	78.1	0.859	0.275	0.583	17.975
0.610	194.0	74.2	0.817	0.275	0.541	18.516
0.620	183.0	70.0	0.770	0.275	0.495	19.011
0.630	173.0	66.2	0.728	0.275	0.453	19.464
0.640	164.0	62.8	0.690	0.275	0.415	19.879
0.650	154.0	58.9	0.648	0.275	0.373	20.252
0.660	143.0	54.7	0.602	0.275	0.327	20.578
0.670	135.0	51.7	0.568	0.275	0.293	20.871
0.680	125.0	47.8	0.526	0.275	0.251	21.122
0.690	114.0	43.6	0.480	0.275	0.205	21.326
0.700	105.0	40.2	0.442	0.275	0.167	21.493
0.710	98.0	37.5	0.413	0.275	0.137	21.630
0.720	91.0	34.8	0.383	0.275	0.108	21.738
0.730	84.0	32.1	0.354	0.275	0.078	21.816
0.740	77.0	29.5	0.324	0.275	0.049	21.865
0.750	71.0	27.2	0.299	0.275	0.023	21.888
0.760	66.0	25.3	0.278	0.275	0.002	21.891
0.770	62.0	23.7	0.261	0.275	0.000	21.876
0.780	57.0	21.8	0.240	0.275	0.000	21.841
0.790	53.0	20.3	0.223	0.275	0.000	21.789
0.800	49.0	18.8	0.206	0.275	0.000	21.719
0.810	45.0	17.2	0.189	0.275	0.000	21.633
0.820	42.0	16.1	0.177	0.275	0.000	21.535
0.830	40.0	15.3	0.168	0.275	0.000	21.428
0.840	39.0	14.9	0.164	0.275	0.000	21.317
0.850	38.0	14.5	0.160	0.275	0.000	21.201
0.860	36.0	13.8	0.152	0.275	0.000	21.077
0.870	34.0	13.0	0.143	0.275	0.000	20.945
0.880	33.0	12.6	0.139	0.275	0.000	20.809
0.890	32.0	12.2	0.135	0.275	0.000	20.668
0.900	31.0	11.9	0.130	0.275	0.000	20.523
0.910	29.0	11.1	0.122	0.275	0.000	20.370
0.920	27.0	10.3	0.114	0.275	0.000	20.208
0.930	26.0	10.0	0.109	0.275	0.000	20.042
0.940	24.0	9.2	0.101	0.275	0.000	19.868
0.950	23.0	8.8	0.097	0.275	0.000	19.689
0.960	22.0	8.4	0.093	0.275	0.000	19.506
0.970	21.0	8.0	0.088	0.275	0.000	19.319
0.980	21.0	8.0	0.088	0.275	0.000	19.132
0.990	20.0	7.7	0.084	0.275	0.000	18.941
1.000	20.0	7.7	0.084	0.275	0.000	18.750

Storage volume (m³) = 21.9 m³ (Sum of all balance quantities)



MasterDrain
SW

KRS Environmental Limited.

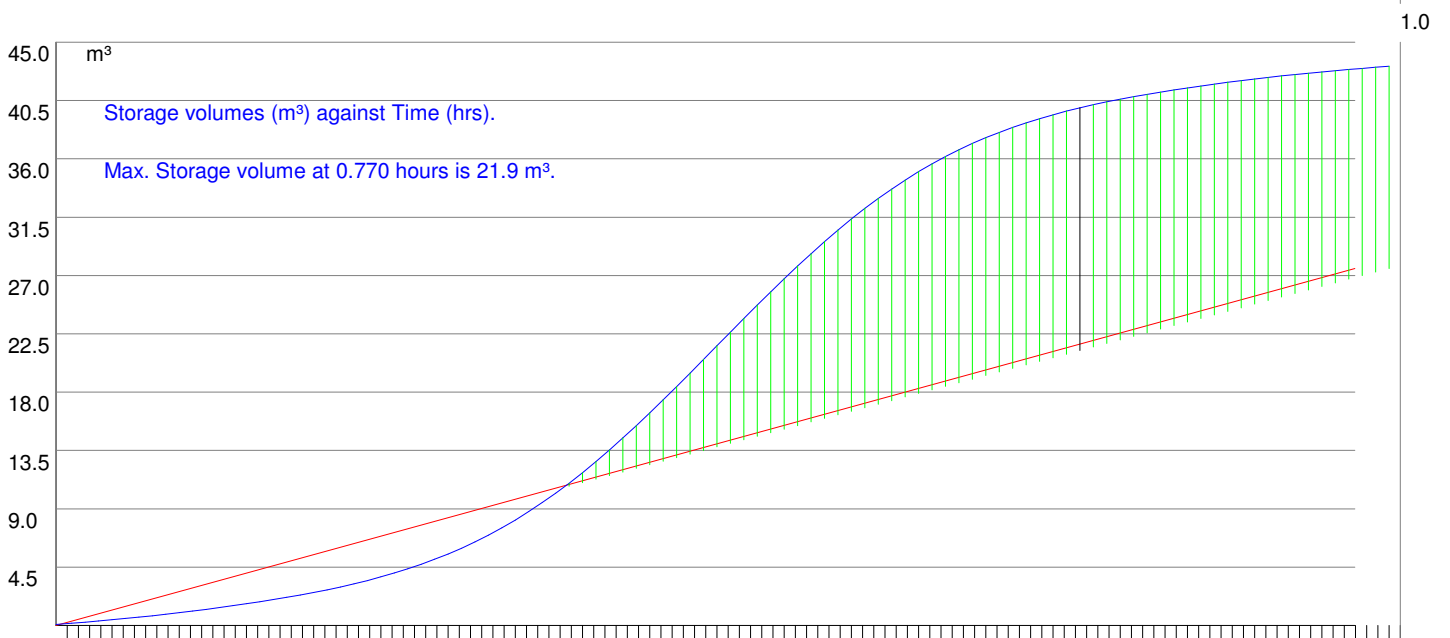
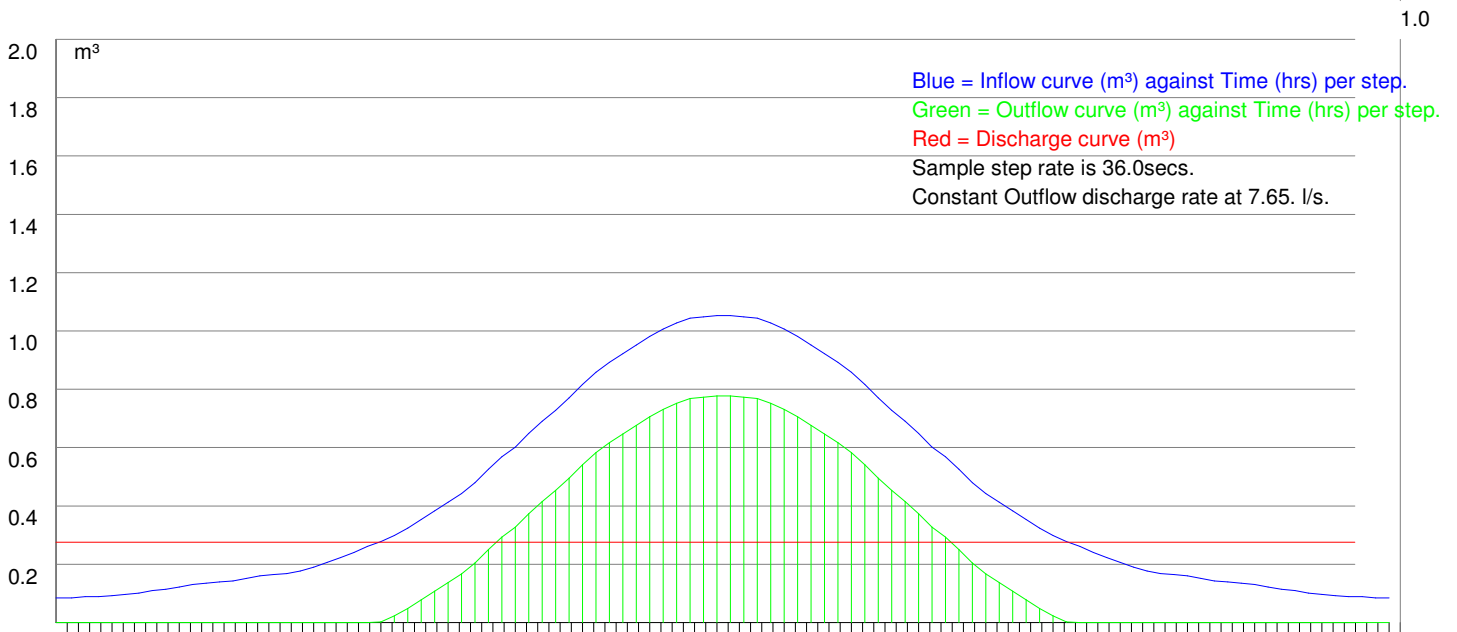
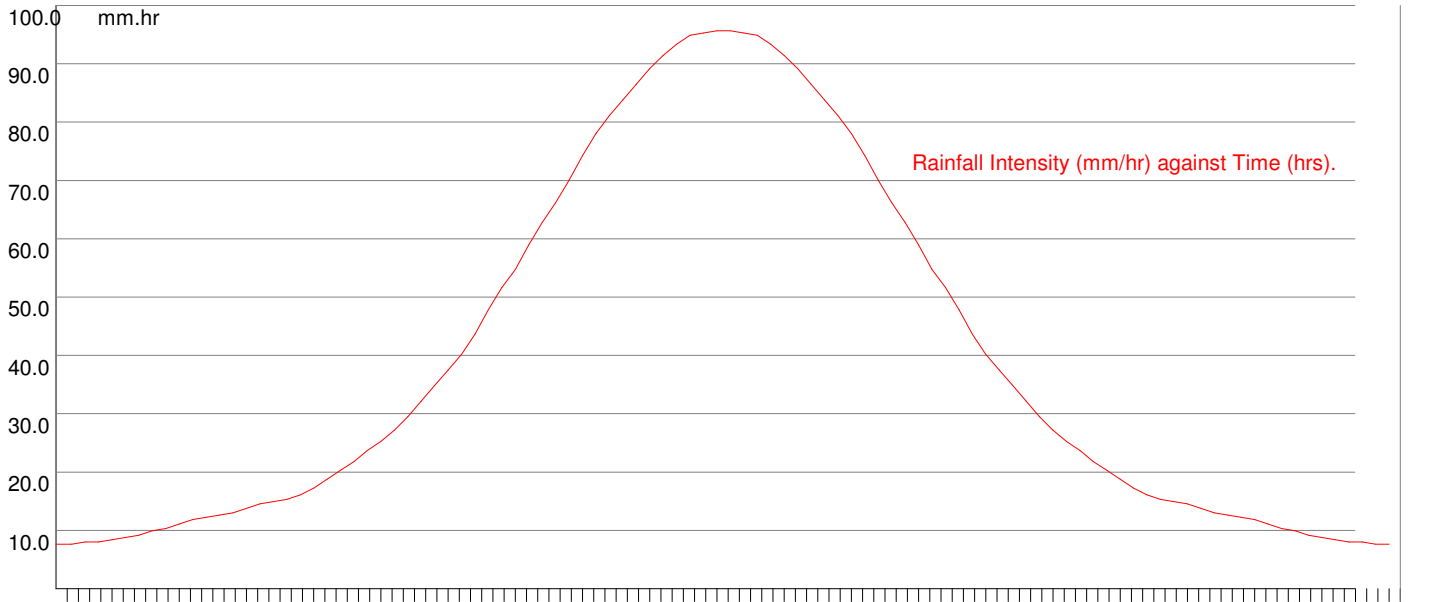
www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 3		
Date 09/05/17		
By	Checked	Reviewed

Project **11 York Street**

Title **1 in 30 Year (+40%) Attenuation Storage Volume**





MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 4		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 30 Year (+40%) Attenuation Storage Volume

Maximum storage volumes for varying duration storms.

Storm length (hrs)	Max. Vol (m ³)	Max. Vol time	Mean intens (mm/hr)	Step time. (mins)	Peak found
0.25	18.93	0.25	90.79	0.2	
0.5	21.71	0.50	60.20	0.3	
1	21.89	1.00	38.27	0.6	Peak found
2	17.68	---	23.66	1.2	
3	12.47	---	17.68	1.8	
4	7.58	---	14.31	2.4	
5	3.48	---	12.12	3.0	
6	0.63	---	10.56	3.6	
7	0.00	---	9.41	4.2	
8	0.00	---	8.52	4.8	
9	0.00	---	7.80	5.4	
10	0.00	---	7.20	6.0	
12	0.00	---	6.28	7.2	
15	0.00	---	5.30	9.0	
18	0.00	---	4.62	10.8	
20	0.00	---	4.26	12.0	
24	0.00	---	3.71	14.4	
30	0.00	---	3.13	18.0	
36	0.00	---	2.72	21.6	
42	0.00	---	2.42	25.2	
48	0.00	---	2.19	28.8	
54	0.00	---	2.00	32.4	
60	0.00	---	1.84	36.0	
66	0.00	---	1.71	39.6	
72	0.00	---	1.60	43.2	
84	0.00	---	1.42	50.4	
96	0.00	---	1.28	57.6	
120	0.00	---	1.08	72.0	
150	0.00	---	0.91	90.0	
175	0.00	---	0.81	105.0	
200	0.00	---	0.73	120.0	
250	0.00	---	0.61	150.0	
300	0.00	---	0.53	180.0	
375	0.00	---	0.45	225.0	
500	0.00	---	0.36	300.0	
750	0.00	---	0.26	450.0	
1000	0.00	---	0.21	600.0	
1250	0.00	---	0.18	750.0	
1500	0.00	---	0.16	900.0	
1570	0.00	---	0.15	942.0	
2000	0.00	---	0.12	1200.0	
2500	0.00	---	0.11	1500.0	
3000	0.00	---	0.09	1800.0	
3500	0.00	---	0.08	2100.0	
4000	0.00	---	0.07	2400.0	



MasterDrain
SW

KRS Environmental
Limited.

www.krsenvironmental.com

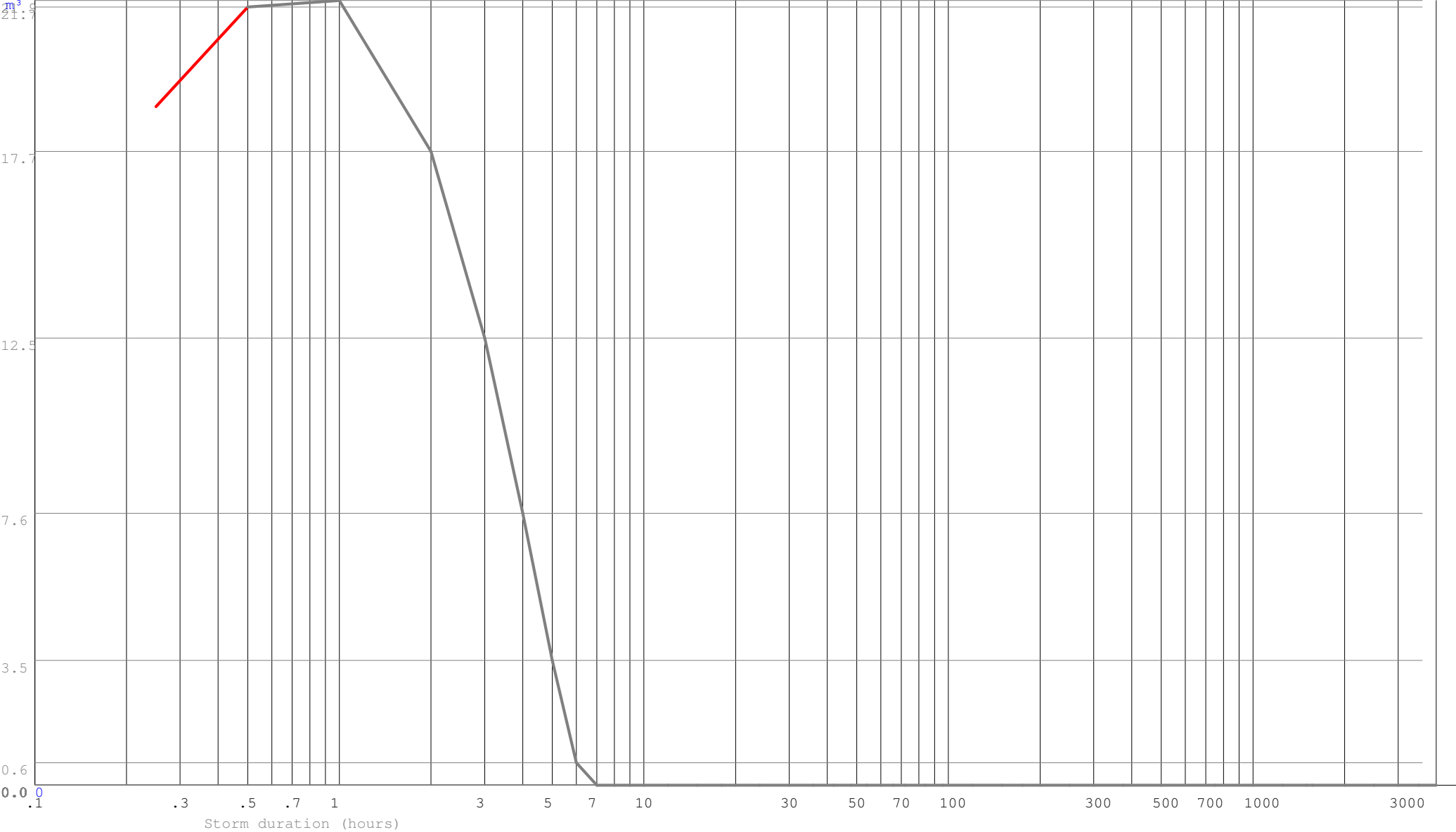
3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 5		
Date 09/05/17		
By	Checked	Reviewed

Project 11 York Street

Title 1 in 30 Year (+40%) Attenuation Storage Volume

Sequential storage volume at specific storm durations.





MasterDrain
SW

KRS Environmental Limited. www.krsenvironmental.com		3 Princes Square, Princes Street, Montgomery Powys, SY15 6PZ Tel: 01686 668957 Mob: 07857 264 376 email: keelan@krsenvironmental.com		Job No.
				Sheet no. 6
				Date 09/05/17
Project	11 York Street	By	Checked	Reviewed
Title	1 in 30 Year (+40%) Attenuation Storage Volume			

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 1		
Date 09/05/17		
By	Checked	Reviewed

Project 11 York Street
Title 1 in 100 Year (+40%) Attenuation Storage Volume

Data:-

Location = MANCHESTER (CENTRAL) Grid reference = SJ8397
M5-60 (mm) = 17.8 r = 0.36
Soil index = 0.45 SAAR (mm/yr) = 900
Return period = 100 WRAP = 4
UCWI = 96.2 Climate change = 40%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Pipeline storage = 0.0 m³ Available MH storage = 0.0 m³
Offline storage = 0.0 m³

Percentage runoff = 100.0% (manual setting)

Imperv. area = 1100 m² Pervious area = 0 m²
Total area = 1100 m² Equiv area = 1100 m² (Tot. area x % runoff).
Total runoff = 55.2 m³ Discharge rate = 7.650 l/s
Storage (m³) = 33.4 m³ (Sum of all balance quantities)
Total rainfall depth = 50.2 mm

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.010	20.0	10.0	0.110	0.275	0.000	0.000
0.020	20.0	10.0	0.110	0.275	0.000	0.000
0.030	21.0	10.5	0.116	0.275	0.000	0.000
0.040	21.0	10.5	0.116	0.275	0.000	0.000
0.050	22.0	11.0	0.122	0.275	0.000	0.000
0.060	23.0	11.5	0.127	0.275	0.000	0.000
0.070	24.0	12.1	0.133	0.275	0.000	0.000
0.080	26.0	13.1	0.144	0.275	0.000	0.000
0.090	27.0	13.6	0.149	0.275	0.000	0.000
0.100	29.0	14.6	0.160	0.275	0.000	0.000
0.110	31.0	15.6	0.171	0.275	0.000	0.000
0.120	32.0	16.1	0.177	0.275	0.000	0.000
0.130	33.0	16.6	0.182	0.275	0.000	0.000
0.140	34.0	17.1	0.188	0.275	0.000	0.000
0.150	36.0	18.1	0.199	0.275	0.000	0.000
0.160	38.0	19.1	0.210	0.275	0.000	0.000
0.170	39.0	19.6	0.215	0.275	0.000	0.000
0.180	40.0	20.1	0.221	0.275	0.000	0.000
0.190	42.0	21.1	0.232	0.275	0.000	0.000
0.200	45.0	22.6	0.249	0.275	0.000	0.000
0.210	49.0	24.6	0.271	0.275	0.000	0.000
0.220	53.0	26.6	0.293	0.275	0.017	0.017
0.230	57.0	28.6	0.315	0.275	0.039	0.057
0.240	62.0	31.1	0.342	0.275	0.067	0.124
0.250	66.0	33.1	0.365	0.275	0.089	0.213
0.260	71.0	35.7	0.392	0.275	0.117	0.330
0.270	77.0	38.7	0.425	0.275	0.150	0.480
0.280	84.0	42.2	0.464	0.275	0.189	0.668
0.290	91.0	45.7	0.503	0.275	0.227	0.896
0.300	98.0	49.2	0.541	0.275	0.266	1.162
0.310	105.0	52.7	0.580	0.275	0.305	1.466
0.320	114.0	57.2	0.630	0.275	0.354	1.820
0.330	125.0	62.8	0.690	0.275	0.415	2.235
0.340	135.0	67.8	0.746	0.275	0.470	2.706
0.350	143.0	71.8	0.790	0.275	0.514	3.220
0.360	154.0	77.3	0.851	0.275	0.575	3.796
0.370	164.0	82.4	0.906	0.275	0.630	4.426
0.380	173.0	86.9	0.956	0.275	0.680	5.106
0.390	183.0	91.9	1.011	0.275	0.735	5.842
0.400	194.0	97.4	1.072	0.275	0.796	6.638



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 2		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 100 Year (+40%) Attenuation Storage Volume

Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.410	204.0	102.4	1.127	0.275	0.851	7.489
0.420	212.0	106.5	1.171	0.275	0.896	8.385
0.430	219.0	110.0	1.210	0.275	0.934	9.319
0.440	226.0	113.5	1.248	0.275	0.973	10.292
0.450	233.0	117.0	1.287	0.275	1.012	11.304
0.460	239.0	120.0	1.320	0.275	1.045	12.349
0.470	244.0	122.5	1.348	0.275	1.072	13.421
0.480	248.0	124.5	1.370	0.275	1.094	14.515
0.490	249.0	125.0	1.375	0.275	1.100	15.615
0.500	250.0	125.5	1.381	0.275	1.106	16.721
0.510	250.0	125.5	1.381	0.275	1.106	17.826
0.520	249.0	125.0	1.375	0.275	1.100	18.926
0.530	248.0	124.5	1.370	0.275	1.094	20.021
0.540	244.0	122.5	1.348	0.275	1.072	21.093
0.550	239.0	120.0	1.320	0.275	1.045	22.138
0.560	233.0	117.0	1.287	0.275	1.012	23.150
0.570	226.0	113.5	1.248	0.275	0.973	24.123
0.580	219.0	110.0	1.210	0.275	0.934	25.057
0.590	212.0	106.5	1.171	0.275	0.896	25.953
0.600	204.0	102.4	1.127	0.275	0.851	26.804
0.610	194.0	97.4	1.072	0.275	0.796	27.600
0.620	183.0	91.9	1.011	0.275	0.735	28.336
0.630	173.0	86.9	0.956	0.275	0.680	29.016
0.640	164.0	82.4	0.906	0.275	0.630	29.646
0.650	154.0	77.3	0.851	0.275	0.575	30.222
0.660	143.0	71.8	0.790	0.275	0.514	30.736
0.670	135.0	67.8	0.746	0.275	0.470	31.206
0.680	125.0	62.8	0.690	0.275	0.415	31.621
0.690	114.0	57.2	0.630	0.275	0.354	31.976
0.700	105.0	52.7	0.580	0.275	0.305	32.280
0.710	98.0	49.2	0.541	0.275	0.266	32.546
0.720	91.0	45.7	0.503	0.275	0.227	32.773
0.730	84.0	42.2	0.464	0.275	0.189	32.962
0.740	77.0	38.7	0.425	0.275	0.150	33.112
0.750	71.0	35.7	0.392	0.275	0.117	33.229
0.760	66.0	33.1	0.365	0.275	0.089	33.318
0.770	62.0	31.1	0.342	0.275	0.067	33.385
0.780	57.0	28.6	0.315	0.275	0.039	33.424
0.790	53.0	26.6	0.293	0.275	0.017	33.442
0.800	49.0	24.6	0.271	0.275	0.000	33.437
0.810	45.0	22.6	0.249	0.275	0.000	33.410
0.820	42.0	21.1	0.232	0.275	0.000	33.367
0.830	40.0	20.1	0.221	0.275	0.000	33.312
0.840	39.0	19.6	0.215	0.275	0.000	33.252
0.850	38.0	19.1	0.210	0.275	0.000	33.187
0.860	36.0	18.1	0.199	0.275	0.000	33.110
0.870	34.0	17.1	0.188	0.275	0.000	33.023
0.880	33.0	16.6	0.182	0.275	0.000	32.930
0.890	32.0	16.1	0.177	0.275	0.000	32.831
0.900	31.0	15.6	0.171	0.275	0.000	32.727
0.910	29.0	14.6	0.160	0.275	0.000	32.612
0.920	27.0	13.6	0.149	0.275	0.000	32.485
0.930	26.0	13.1	0.144	0.275	0.000	32.354
0.940	24.0	12.1	0.133	0.275	0.000	32.211
0.950	23.0	11.5	0.127	0.275	0.000	32.062
0.960	22.0	11.0	0.122	0.275	0.000	31.909
0.970	21.0	10.5	0.116	0.275	0.000	31.749
0.980	21.0	10.5	0.116	0.275	0.000	31.590
0.990	20.0	10.0	0.110	0.275	0.000	31.425
1.000	20.0	10.0	0.110	0.275	0.000	31.260

Storage volume (m³) = 33.4 m³ (Sum of all balance quantities)



MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.

Sheet no.

3

Date

09/05/17

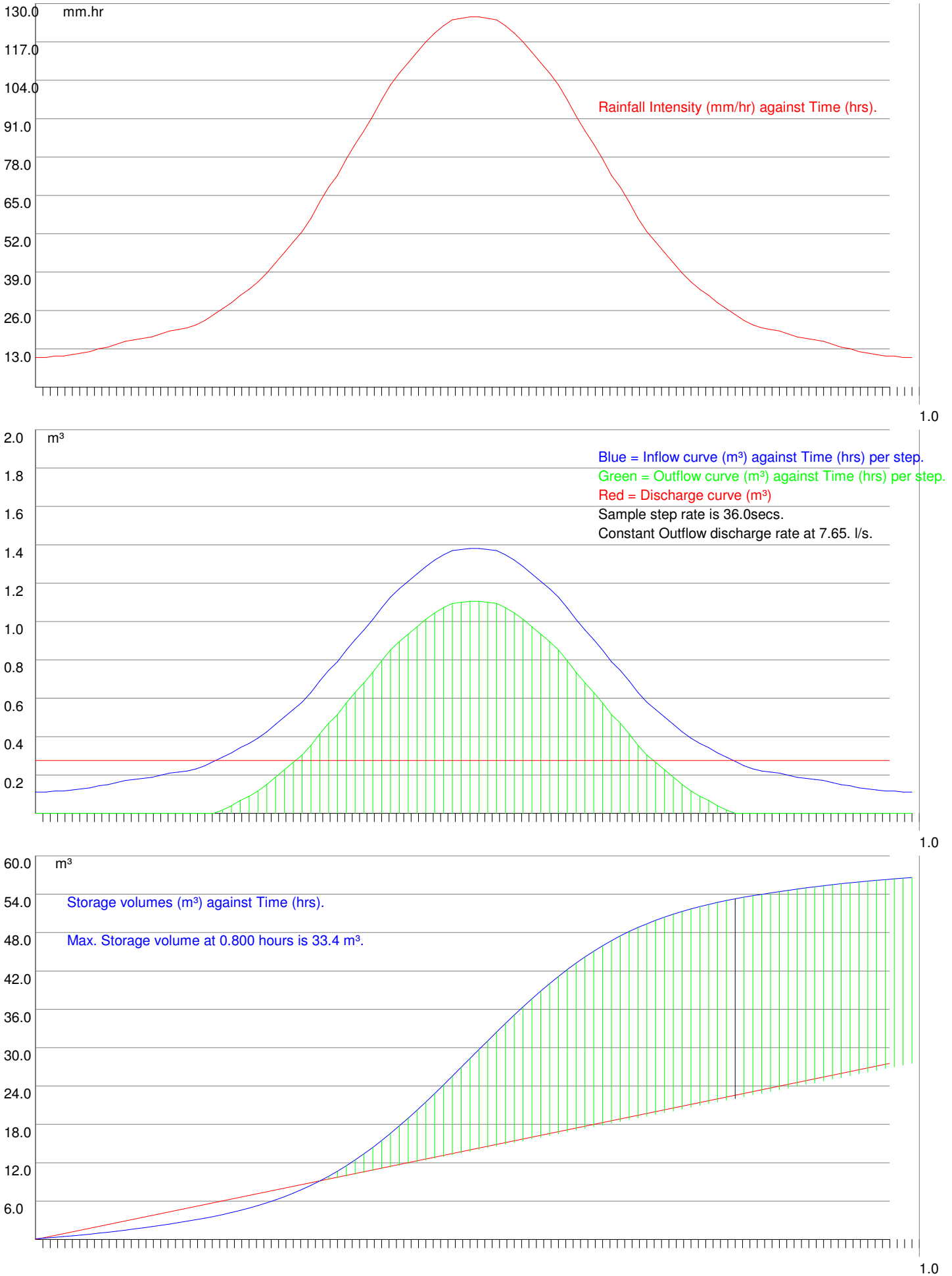
By

Checked

Reviewed

Project
11 York Street

Title
1 in 100 Year (+40%) Attenuation Storage Volume





MasterDrain
SW

KRS Environmental Limited.

www.krsenvironmental.com

3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 4		
Date 09/05/17		
By	Checked	Reviewed

Project	11 York Street
Title	1 in 100 Year (+40%) Attenuation Storage Volume

Maximum storage volumes for varying duration storms.

Storm length (hrs)	Max. Vol (m ³)	Max. Vol time	Mean intens (mm/hr)	Step time. (mins)	Peak found
0.25	26.16	0.25	117.17	0.2	
0.5	31.21	0.50	78.45	0.3	
1	33.44	1.00	50.22	0.6	Peak found
2	30.63	---	31.12	1.2	
3	25.45	---	23.22	1.8	
4	19.81	---	18.75	2.4	
5	14.34	---	15.83	3.0	
6	9.35	---	13.75	3.6	
7	5.21	---	12.22	4.2	
8	1.98	---	11.04	4.8	
9	0.05	---	10.08	5.4	
10	0.00	---	9.30	6.0	
12	0.00	---	8.08	7.2	
15	0.00	---	6.80	9.0	
18	0.00	---	5.91	10.8	
20	0.00	---	5.44	12.0	
24	0.00	---	4.72	14.4	
30	0.00	---	3.97	18.0	
36	0.00	---	3.44	21.6	
42	0.00	---	3.05	25.2	
48	0.00	---	2.74	28.8	
54	0.00	---	2.50	32.4	
60	0.00	---	2.30	36.0	
66	0.00	---	2.13	39.6	
72	0.00	---	1.99	43.2	
84	0.00	---	1.76	50.4	
96	0.00	---	1.58	57.6	
120	0.00	---	1.32	72.0	
150	0.00	---	1.11	90.0	
175	0.00	---	0.98	105.0	
200	0.00	---	0.88	120.0	
250	0.00	---	0.74	150.0	
300	0.00	---	0.64	180.0	
375	0.00	---	0.53	225.0	
500	0.00	---	0.42	300.0	
750	0.00	---	0.31	450.0	
1000	0.00	---	0.25	600.0	
1250	0.00	---	0.21	750.0	
1500	0.00	---	0.18	900.0	
1570	0.00	---	0.17	942.0	
2000	0.00	---	0.14	1200.0	
2500	0.00	---	0.12	1500.0	
3000	0.00	---	0.11	1800.0	
3500	0.00	---	0.09	2100.0	
4000	0.00	---	0.09	2400.0	



MasterDrain
SW

KRS Environmental
Limited.

www.krsenvironmental.com

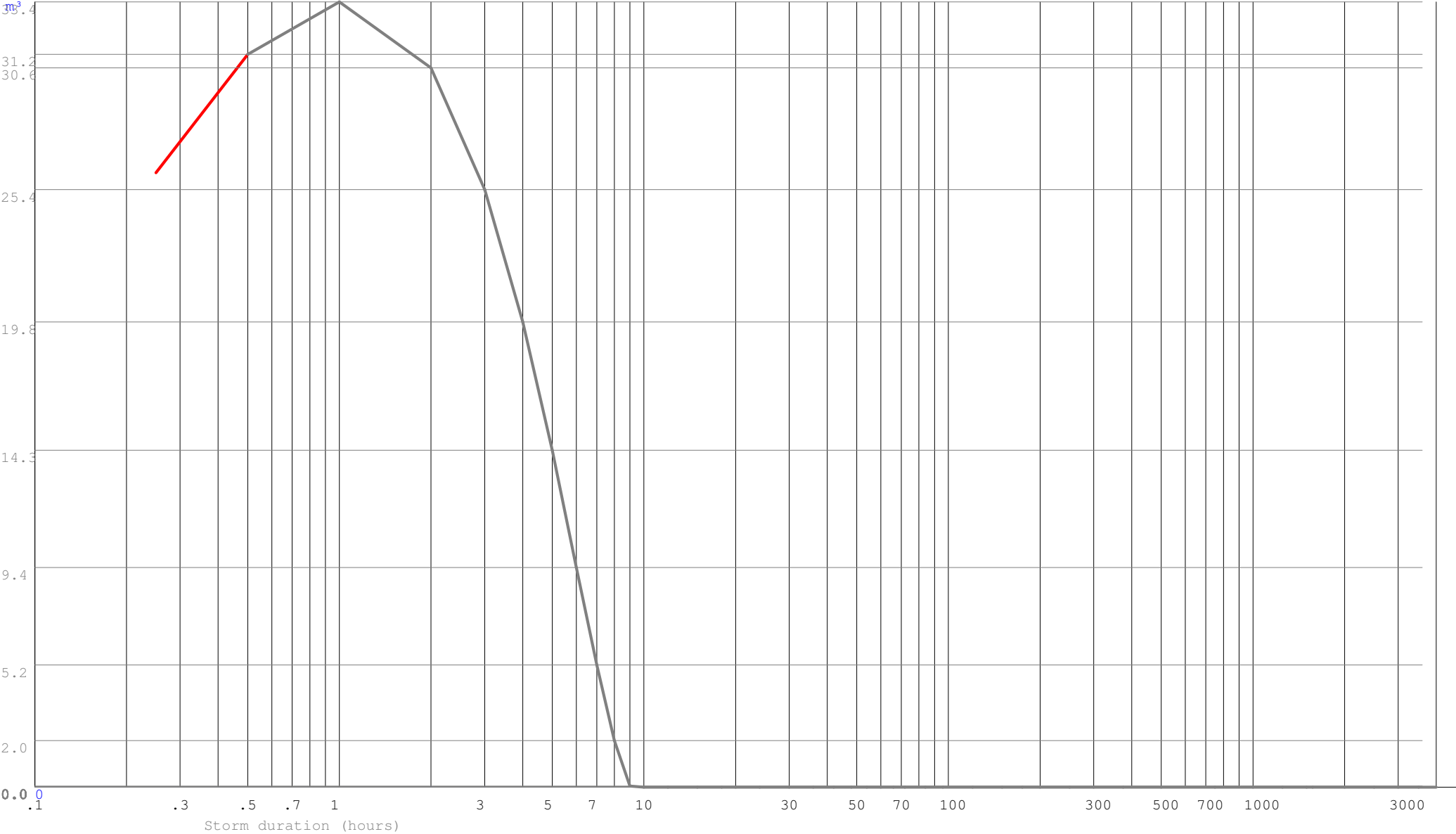
3 Princes Square, Princes Street,
Montgomery
Powys, SY15 6PZ
Tel: 01686 668957 Mob: 07857 264 376
email: keelan@krsenvironmental.com

Job No.		
Sheet no. 5		
Date 09/05/17		
By	Checked	Reviewed

Project 11 York Street

Title 1 in 100 Year (+40%) Attenuation Storage Volume

Sequential storage volume at specific storm durations.





MasterDrain
SW

KRS Environmental Limited. www.krsenvironmental.com		3 Princes Square, Princes Street, Montgomery Powys, SY15 6PZ Tel: 01686 668957 Mob: 07857 264 376 email: keelan@krsenvironmental.com		Job No.
				Sheet no. 6
				Date 09/05/17
Project	11 York Street	By	Checked	Reviewed
Title	1 in 100 Year (+40%) Attenuation Storage Volume			

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function.
Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



**PROPOSED COMMERCIAL DEVELOPMENT,
11 YORK STREET, MANCHESTER.**

SuDS Management and Maintenance Plan

Tier Consult
7-9 New Wakefield St
Manchester
M1 5NP

27.01.2021



STORM WATER / SuDs MAINTENANCE PLAN

TM/16/1145 – Surface Water Maintenance Plan

1. Introduction

This document outlines the storm water SUDs maintenance proposal plan.

The considered drainage solution comprises an attenuated network with discharge rates to the private surface water sewer within the adjacent Marble Street limited by a flow control unit. Storage volume is provided in an underground tank beneath the basement floor slab constructed from modular cell units. Backflow from the public sewer system is prevented by the incorporation of one way valves within the underground drainage

The attenuated (storage) system differs from a traditional unrestricted drainage system and requires a different maintenance regime as the consequence of poor maintenance upon these systems is likely to be more onerous than with a traditional unrestricted piped system.

A plan of routine inspections and maintenance should therefore be adopted and adhered to in order to prevent failure due to inadequate maintenance. This document describes the drainage systems used and provides a framework for future maintenance procedures.

2. Site Drainage Components

The main drainage components are:-

1. Roof water from the building collected in gullies and above ground pipe work and routed to the underground storage tank.
 - Requires periodic inspection and de-silting as required
2. Run off from internal vehicle access ramp from Marble Street to the basement collected by a linear drainage channel connected to the piped drainage network.
 - Requires periodic inspection and de-silting as required
3. Storage tank formed with a modular crate system wrapped with an impermeable membrane to prevent escape of water and ingress of soil particles.



- Requires periodic inspection and de-silting.
4. Flow control unit limiting the discharge of surface water to the receiving sewer to an agreed rate.
- Requires periodic inspection for blockages

3. Maintenance Schedule

The drainage systems will be fully maintained by the Managing Agent or the Managing Agent's Appointed Contractor and the Managing Agent will bear all costs associated with cleaning and regular inspections as required.

The rate of build up of silt and debris within a drainage system varies from site to site and is dependent upon individual site characteristics. Therefore the frequency of actions below should be adopted as a MINIMUM standard for a period of 24 months after development completion. This period will be sufficient to assess the system performance over 2 complete seasonal cycles after which the maintenance activity schedule may be reviewed accordingly.

ACTION	FREQUENCY
Clear guttering and roof gullies of leaves and debris.	Twice yearly. Spring and Autumn after leaf fall
Inspect all rainwater manhole chambers and channel drains for debris and blockages.	6 Monthly and after heavy rainfall. Remove debris / silt as encountered.
Inspect all tank access points for sediment.	Monthly for 3 months, then 6 Monthly and after heavy rainfall. Remove debris /silt as encountered.
Flow Control	6 monthly Inspect and remove debris
Remove sediment from catch-pits and flow diffusers	Minimum 6 monthly. More frequently if required.
One – way anti flood valves	6 monthly Inspect and remove debris



4. Storage Tank – Additional Notes

Upon completion of the works the appointed maintenance contractor will carry out regular monthly inspections for the first 3 months and thereafter at 6 monthly intervals.

The cellular storage SUDS system as specified allows the system to be inspected via CCTV.

Flushing of the system can be achieved using a jetting system with a 150 bar pump pressure. The jet nozzle should be introduced to the system via the incoming pipework. The silt should be flushed to the downstream manhole and removed from there.



Tier Consult

7-9 New Wakefield Street,
Manchester M1 5NP
0161 876 2900

07_21_TM-16-1145_RJH_MB_3

Kier Construction
2nd Floor
Optimum House
Clippers Quay
Salford
Manchester
M50 3XP

Date 7th July 2021

F.A.O. Mr D. Rostron

Dear Sirs

11 YORK STREET, MANCHESTER

SUSTAINABLE DRAINAGE INSTALLATION

The sustainable drainage on the above scheme has been designed in accordance with the recommendations in the Tier Consult Flood Risk Assessment, in which the surface water run off from the site is restricted to 50% of the pre-development flow rate.

To achieve this reduction in discharge rate a flow restriction and onsite surface water attenuation has been specified. Due to the site limitations the attenuation has been provided in the form of proprietary cellular storage located beneath the basement slab. The cellular storage has been sized to accommodate the discharge up to 1 in 100 year + 40% climate change event.

The following products were proposed and approved for the attenuation tank:

- Alderburgh Pluvial Cube
- Alderprufe Tuflex Membrane
- Alderburgh Geotex 300PP Protection Fleece

Details are appended to this letter.

In accordance with the terms of our Appointment, Tier Consult has undertaken periodic site inspections on the basis of these observations and our consideration of the Contractor's submissions we confirm that the works relating to the surface water drainage have been constructed in compliance with the construction drawings and specifications or any agreed deviation therefrom.



Contemporary photographs of the installation below.



Photograph 1 – Attenuation Tank Installation



Photograph 2 – Attenuation Tank Installation



We trust that the above is in order, however should you require anything further please do not hesitate to contact the undersigned.

Yours Faithfully

A handwritten signature in black ink that reads "R Harmston." The signature is written in a cursive style.

Robert Harmston

Director

CC Kier Property - Mr O. Butler + encl.

PLUVIAL CUBE MODULE – DATA SHEET

Pluvial Cube Module Dimensions* (mm)	Module Configuration	Units per m ³	Module Volume (m ³)	Storage Volume (m ³)
500 (L) x 500 (W) x 550 (D)	Single	7.27	0.1375	0.132
500 (L) x 500 (W) x 1075 (D)	Double	3.72	0.2688	0.258
500 (L) x 500 (W) x 1600 (D)	Triple	2.5	0.4	0.384

* Bespoke modules with different configuration available



Single Module



Double Module



Triple Module

Product Data	Pluvial Cube Module
Application	Stormwater Management
Average Weight (kg) – single module	7
Compressive Strength* (kN/m ²)	320
Lateral Strength* (kN/m ²)	200
Long Term Creep Testing** (kN/m ²)	200
Void Ratio (%)	96
Surface Void Ratio (%)	Greater than 90
Minimum Backfill Cover Landscaped areas# (mm)	450
Maximum Depth to Invert# (mm)	7000
Material	Polypropylene
Chemical resistance	Good
Bacterial Resistance	Good
UV Resistance	Good

Note: Other Modules with Compressive Strength more than 1500 kN/m² available

* Modules tested using UKAS calibrated test machine, range 0 – 60 Tons, UDL, loading rate 0.2 kN/m²

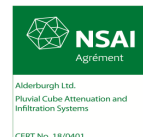
** Modules tested for long term creep testing for 90, 180 and 208 days / 5000 hours = 50 years design life / CIRIA C737.

Any cover less than 450 mm and for Min. backfill cover for trafficked areas – contact ESS design department

Maximum depth to invert based on soil type dense sand and gravel for different soil type–contact ESS design department

Note: All Alderburgh products are manufactured to the highest quality, being subjected to rigid quality control. However the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. Alderburgh Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products. All transactions are subject to our standard condition of sales, copies of which are available on request. Product design and specification are subject to change without further notice

Solutions House, Dane St.
Rochdale, OL11 4EZ,
Tel: 01706 374416
Fax: 01706 376785
Email: sales@alderburgh.com



GEOMEMBRANES

ALDERPRUFE TUFLEX



Features

Excellent Barrier Properties

High Puncture Resistance

**Exceptional Multiaxial Stress
and Strain Properties**

Good Tear Resistance

High Surface Friction

**Good Low Temperature
Behaviour**

**Low Coefficient of Thermal
Expansion**

Very Good Chemical Resistance

Very Good UV Resistance

**Excellent Environmental Stress
Crack Resistance (ESCR)**

**Excellent Welding Properties -
Wide Seaming Temperature
Window**

General Description

Alderprufe Tuflex is a single layer cold applied geomembrane suitable for environmental protection to structures, containments and cut-off trenches.

Alderprufe Tuflex combines excellent chemical resistance with low flexural modulus to provide a malleable, flexible membrane suitable for non-smooth surfaces and factory prefabrication to optimise on-site installation.

Alderprufe Tuflex is the ideal membrane for building protection systems and cut-off trench containment particularly on contaminated sites which would otherwise prove too difficult or costly to develop.

Building Protection Membrane

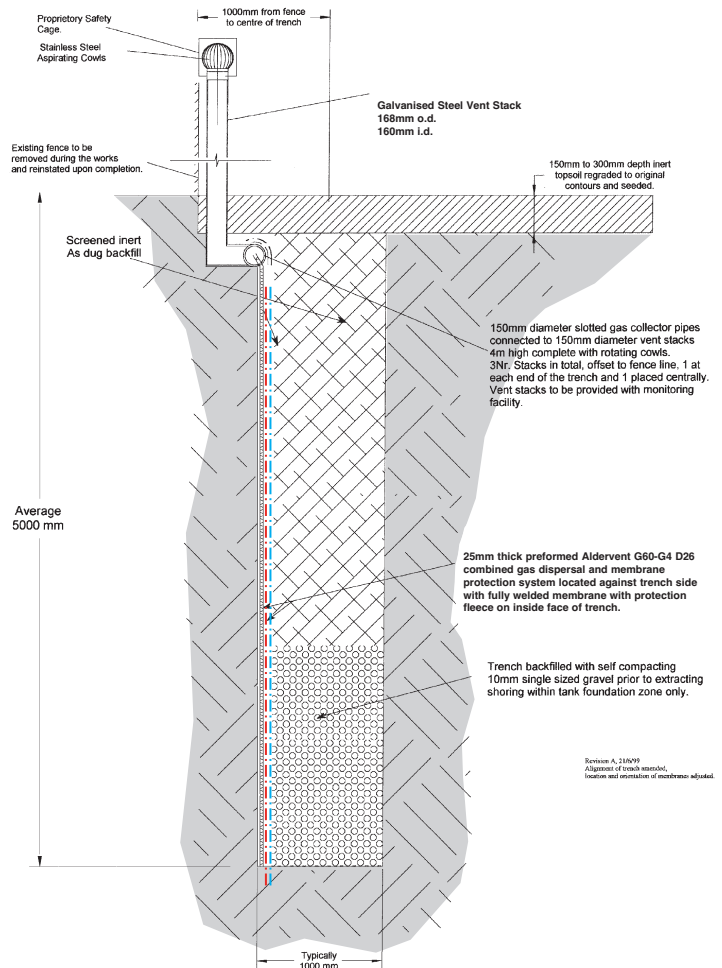
Applied as a Gas Barrier Membrane to protect the building against the ingress of all land borne gases - Methane, Carbon Dioxide and Radon. Tuflex is laid in a single layer over a prepared site. Due to its inherent weldability and on site quality assurance monitoring, the membrane is recommended to be laid by trained operatives certified for the purpose. On smaller sites factory fabricated panels can be supplied for application by others. Applied to cover the whole of the slab area above Aldervent gas ventilation system if required.

All membrane penetrations (i.e. steel stanchions and service entry points) to be sealed with factory formed units welded to the membrane on site.

At all points where the membrane passes through load bearing walls, Aldercourse Tuflex DPC or GRA DPC is installed and welded to the overlying Tuflex membrane.



Pressure testing of welded joints
(part of standard CQA procedures)



Membrane Protection

Protect finished membrane with Geotex or Alderway protection mats if following trades are erecting steel fabrication for slab reinforcement.

All punctures to be repaired by a minimum overlap of 150mm.

Cut-off Trench Containment

Alderprufe Tuflex has been successfully installed up to 8 metres deep as a vertical barrier to contain contaminants and gases on brown fields sites and around landfill.

Installed by accredited contractors.

Bespoke systems have been designed to suit site specific parameters.

Trilaminate membranes with exceptionally high puncture resistance are available.

Cut-off trenches for contaminant control, with large volume gas and liquid dispersal properties, are possible, utilising Aldervent Geogrid, Geovoid, or Geocell systems. (see separate data sheets.)



This product satisfies the criteria set out in BS 6920: Part 1: 1996 "Specification" and thus complies with the requirements of the Water Bylaws Scheme Tests of Effect on Water Quality (BS 6920: 1996). It is suitable for use with cold but not hot water.

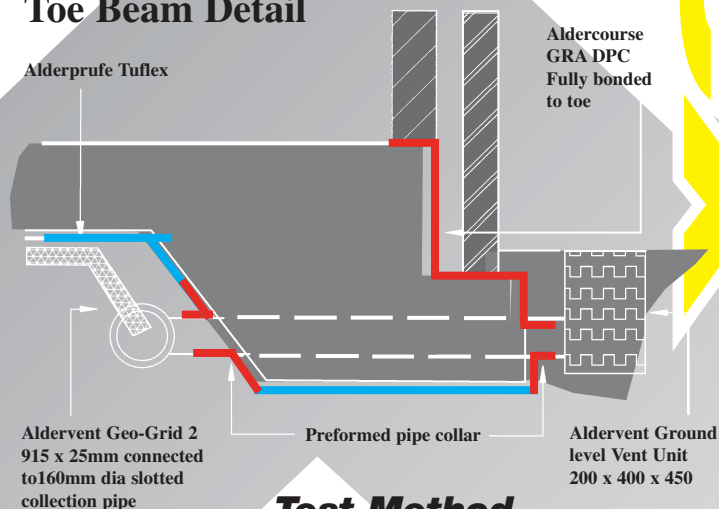
In-service performance

The demands made on Alderprufe Tuflex in landfill, water containment or pollution control are considerable. The flexibility of Alderprufe Tuflex is due to the polymeric structure of the resin. There are no plasticisers in the Alderprufe Tuflex formulation that can be leached out by exposure to chemicals or sunlight causing the membrane to become brittle.

Design and Specification

All Alderprufe Tuflex systems carry Product Guarantee Insurance including efficacy cover. Bespoke system designs with third party accreditation including P.I. cover are available to the developer to offer full security and warranties.

Toe Beam Detail



Test Method

Thickness mm +/- 10%	0.75	1.0	1.5	ASTM D - 751
Density g/cm ³	0.9	0.9	0.9	ASTM D - 792
Tensile Stress @ break Min N/mm ²	13	18	26	ASTM D - 638
Elongation @ Break %	>700	>700	>750	ASTM D - 638
Puncture Resistance Min N	120	150	200	FTMS 101C Method 2065
Tear Resistance Min N	45	60	90	ASTM D - 1004
Dimensional Stability	+/-2%	+/- 2.0	+/-2%	ASTM D - 1204
% Change Max				1 Hr @ 1000C
Stress Crack Resistance	100%	100%	100%	ASTM 5397
Volatile Loss 5%	0.2	0.2	0.2	ASTM D - 1203
Loss Max				Method A
Ozone Resistance	No cracks	No Cracks	No Cracks	ASTM D - 1149
Carbon Black Content	2-3%	2 - 3%	2-3%	ASTM 1063
Moisture Vapour g/m ² /day	<0.01	< 0.1	<0.01	ASTM E96
Friction Angle (Non Woven Geotextile)		21°		Shear Box
Methane Permeability	0.14	0.11	0.007	European standard g/m ² /day/atm
Methane Transmission Rate		1.8 x 10 ⁻⁹ m ³ /m ² /s/atm		BRE
Permeability Coefficient		1,8 x 10 ⁻¹²		



Alderprufe Tuflex possess exceptional flexibility, tear and puncture resistance qualities for all water containment projects, even at very low temperatures.

Ornamental ponds and water storage lakes used in landscaping and irrigation projects utilise the special attributes of the Alderprufe Tuflex geomembrane.



Alderprufe Tuflex geomembranes are used as liners and capping to contain both the gas and liquids produced by a landfill operation. The multiaxial strain qualities of Alderprufe Tuflex are so good that the geomembrane will resist out of plane forces caused by subsidence which occurs with differential waste consolidation and unstable site substrates





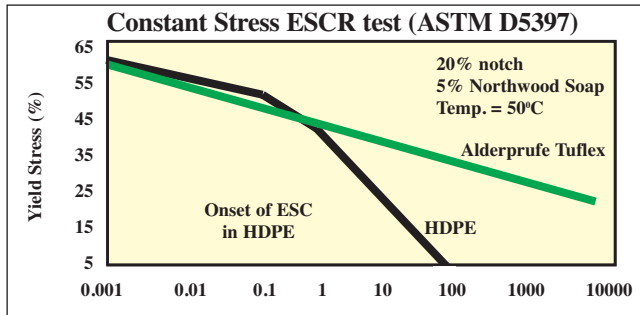
The flexibility of Alderprufe Tuflex geomembranes ensures that most ponds, ditches, lagoons, lakes and dams can be lined including those with inherently complex shapes.



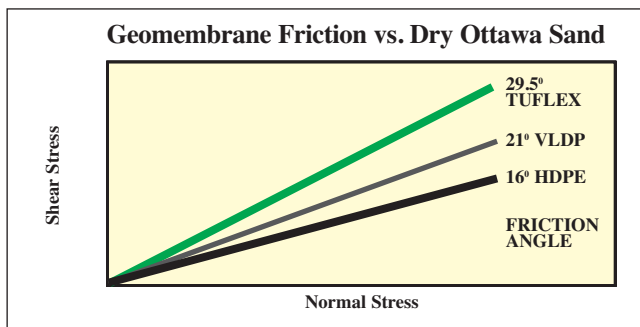
The exceptionally wide seaming temperature window ensures a reliable weld is achieved in most weather conditions. Fluctuations in temperature are not as critical as they are with other geomembranes.

Tuflex

Environmental Stress Crack Resistance (NCTL)



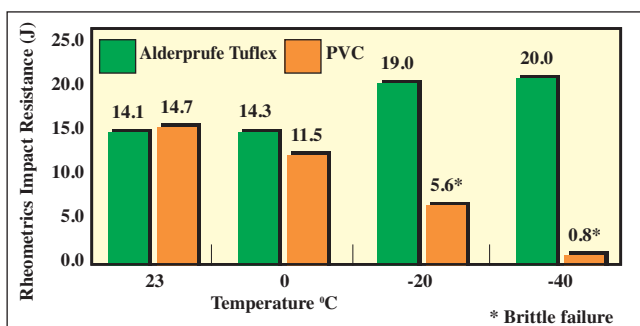
Comparative Friction Angles



Alderprufe Tuflex possesses outstanding environmental stress crack resistance compared to other materials. Alderprufe Tuflex also retains its flexibility at low temperatures and does not become brittle even at temperatures as low as -40°C. This feature is particularly important as it enables the Geomembrane to be handled or installed during severe weather conditions or at high altitude.

The friction angle of Alderprufe Tuflex measured by this method is higher than that of all the commonly used smooth geomembrane materials. This allows the construction of steeper side slopes, increasing the capacity and, in the case of landfills, speeding up waste settlement.

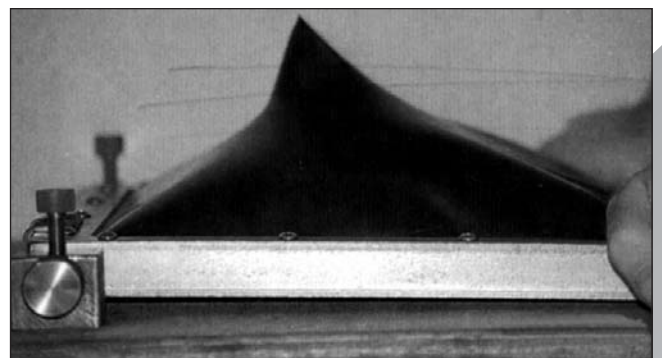
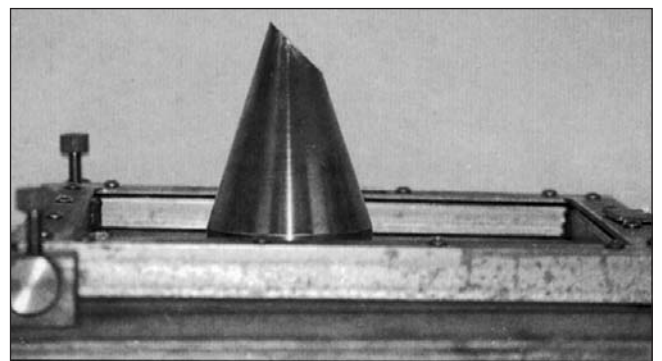
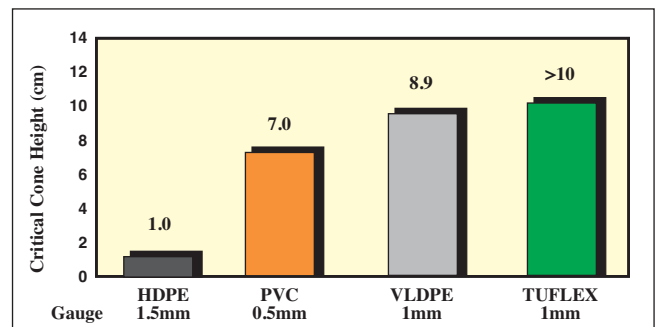
Low Temperature Impact Resistance



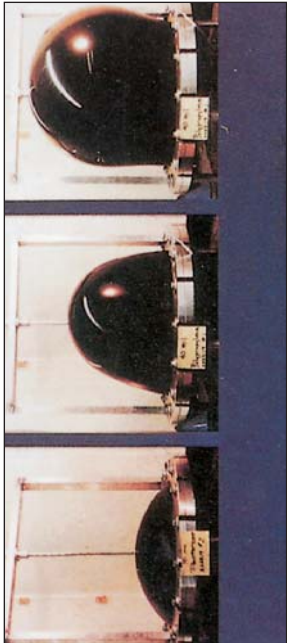
Puncture Resistance Truncated Cone

Alderprufe Tuflex, when placed under load on uneven or rocky substrates, has an exceptionally high puncture resistance. It even exceeds the specifications of GRI test method GM - 3 and possesses the highest puncture resistance of all geomembrane materials measured by this test.

Alderprufe Tuflex readily conforms to projections and deforms easily when under static load. Stresses are evenly distributed throughout the material's structure as it deforms thus allowing the membrane to maintain its "barrier" properties when subjected to both short and long term static loads.



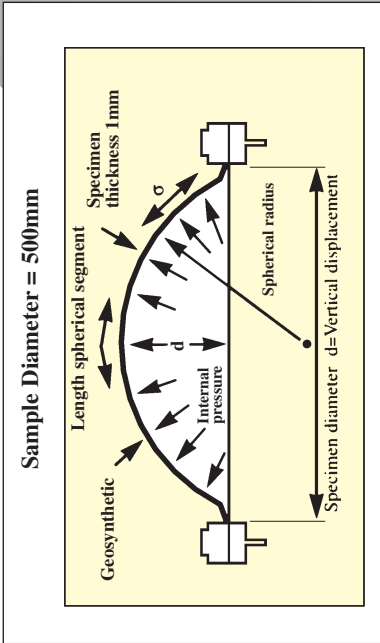
Large Scale Multiaxial Stress-Strain Test



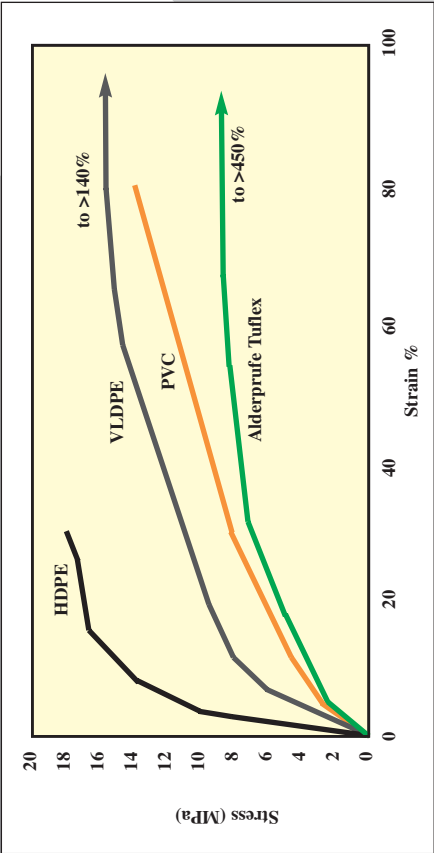
One of the most noteworthy features of Alderprufe Tuflex is the inherent ability to elongate when subjected to out of plane stresses. Localised deformation typically occurs in a landfill capping as the solid waste subsides or under slabs as piled sites are subject to ground subsidence.

The outstanding multiaxial performance of Alderprufe Tuflex is most beneficial in these applications where a high degree of subsidence is anticipated.

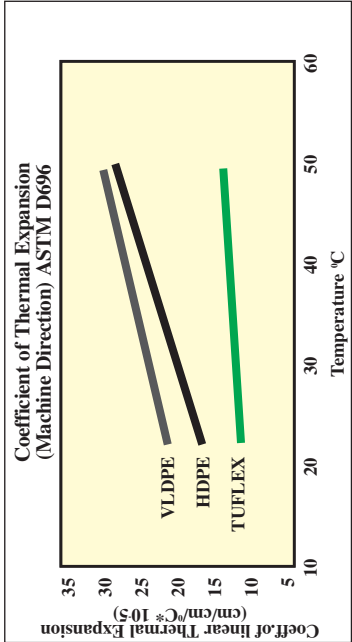
the excellent multiaxial elongation demonstrated by Alderprufe Tuflex indicates that it can accommodate more differential settlement than other membranes.



Geomembrane Multiaxial Stress-Strain Behaviour

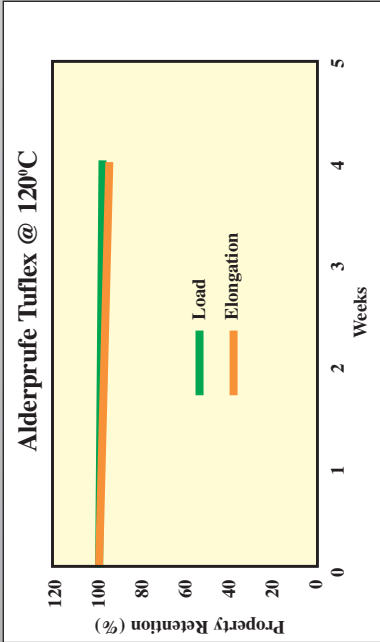


Coefficient of Thermal Expansion



Alderprufe Tuflex has an unusually low coefficient of thermal expansion (CLTE), as little as half that of some other geomembranes. During installation, Alderprufe Tuflex geomembrane does not expand or contract as much and therefore forms fewer and smaller wrinkles. Also, placement of cover material may be simplified since the liner has a better tendency to lay flat. These factors lead to easier and higher quality installations.

Thermal Ageing tests of Alderprufe Tuflex Geomembranes



The high melting point of Alderprufe Tuflex makes it particularly suitable for environments such as black liquor effluent ponds with operating temperatures of 70°C and solar ponds where liners must withstand temperatures fluctuating from 10° - 80°C. Alderprufe tuflex maintains its mechanical properties across an unusually broad range of temperatures.

TUFLEX-P CHEMICAL RESISTANCE

The following chemical resistance values are provided only as a guide

Chemical	Concentration	Temperature °C	Resistant	Chemical	Concentration	Temperature °C	Resistant
A							
Acetic acid	100%	50	S	Ethanol	100%	23	S
Acetic anhydride	100%	50	S	Ethyl acetate	50%	23	S
Acetone	100%	50	S	Ethyl alcohol (denatured)		30	S
Acrylonitrile	100%	50	S	Ethylene glycol	100%	23	S
Aluminium hydroxide							
Aluminium sulphate	38%	23	S	F			
Ammonia water (conc)	100%	23	S	Ferric chloride	15%	30	S
Ammonium chloride	30%	50	S	Ferric sulphate	17%	30	S
Ammonium hydroxide	100%	23	S	Formaldehyde	37%	23	S
Ammonium nitrate	50%	50	S	Formic acid	99%		U
Ammonium phosphate(monobasic)	20%	50	S	Furfural		30	S
Ammonium phosphate (di-basic)	24%	30	S				
Ammonium sulphate	43%	30	S	G			
Amyl acetate	100%	30	U	Gasoline	35%	23	U
Amyl alcohol		30	S	Glycerine		30	S
Aniline		30	S				
B				H			
Barium Chloride	27%	30		Hexane	100%	23	U
Barium Hydroxide	20%	30	S	Hydrochloric acid		30	S
Barium Sulphate	sat	30	S	Hydrofluoric acid	40%	30	S
Benzene		23	U	I			
Benzyl alcohol				Indolene			U
Boric acid	5%	30	S	Iso-butyraldehyde			U
N-butanol	100%	30	U	Isoctane			U
Butyraldehyde				Isopropanol	30%	23	U
				Iso-propyl ether			U
C				K			
Calcium carbonate	sat	50	S	Kerosene	100%		U
Calcium chloride	50%	30	S				
Calcium hydroxide	100%	23	S	L			
Chloroacetic	25%	30	S	Lactic acid	pure	50	S
Chloroform	100%	23	U	Linseed oil			U
Chlorosulphonic acid	98%	30	U				
Chromic acid	50%	30	U	M			
Citric acid	33%	30	S	Magnesium chloride	sat	30	S
Cresol (Meta)				Methanol	50%	23	S
Cupric chloride	sat	30	S	Methylene chloride	100%	23	U
Cupric sulphate	sat	50	S	Methyl acetate			U
Cychlorohexane	100%	30	U	Methyl alcohol			S
Cyclohexanol				Methyl ethyl ketone			U
				Methylisobutylketone	60%	23	U
D				Methyl methacrylate			U
Decalin				N-methylmorpholine oxide	60%	23	S
Di-butyl phthalate		30	U				
Di-ethyl ether		30	S	N			
Di-octyl phthalate		23	S	Nickel chloride	33%	30	S
Dimethylamine	40%			Nickel sulphate	50%	30	S
				Nitric acid	38%	30	S
E				Nitric acid	65%		U
Ethanediol	40%	23	S				

The following chemical resistance values are provided only as a guide

Chemical	Concentration	Temperature °C	Resistant	Chemical	Concentration	Temperature °C	Resistant
Nitrobenzene			U	Sodium hydroxide	50%	23	S
N-n-di-methyl formamide				Sodium hydroxide	100%	50	S
O				Sodium hyperchloride	20%	30	S
Oil ASTM 1	pure		U	Sodium hyperchlorite	20%	30	S
Oil ASRM 2	pure		U	Sodium nitrate	43%	30	S
Oil ASTM 3	pure		U	Sodium phosphate (monobasic)	43%	30	S
Oil OB/22-AT	35%		U	Sodium sulphate	40%	30	S
Oil of Linseed	pure	30	U	Sodium thiosulphate	45%	30	S
Oil of olive	pure	23	U	Solna 100	30%	23	U
Oil of chicken	pure	23	U	Stearic acid	100%	50	S
Oil of beef	pure	23	U	Sulphuric acid	35%	23	S
Oil of pork	pure	23	U	Sulphuric acid	50%	50	S
Oleum			U	Sulphuric acid	96%		U
Oxalic acid	10%	30	S	T			
P				Tannic acid	10%	30	S
Pentane	pure	23	U	Tartaric acid	20%	30	S
Phenol	sol.	30	S	Tetralin	100%	23	U
Phosphoric acid	85%	30	S	Tin chloride	62%	30	S
Potassium bi-chromate	20%	30	S	Toluene	pure	50	U
Potassium bromide	sat.	23	S	Tri-butyl phosphate			U
Potassium chloride	27%	30	S	Trichloroethylene	pure	50	U
Potassium hydroxide	50%	30	S	Triethanolamine		30	S
Potassium iodide	57%	30	S	V			
Potassium phosphate	17%	30	S	Vaseline oil	pure	30	U
Potassium sulphate	11%	30	S	W			
N-propanol	pure	23	S	Wine	pure	30	S
Propionic acid	100%	23	S	X			
Propyl ether			U	Xylene	pure	30	U
N-propyl nitrate			U				
Pyridine			U				
S							
Sodium chloride	sat.	23	S				

CODE:
S = Satisfactory
L = Limited application possible
U = UNSATISFACTORY
- = Not tested

CONCENTRATION:
Sat. sol. = Saturated aqueous solution

prepared at 20°C (68°F)
sol = aqueous solution with concentration above 10% but below saturation level
dil. sol = diluted aqueous solution with concentration below 10%
cust. conc = customary service concentration



All Alderburgh products are manufactured to the highest quality, being subject to rigid quality control. However, the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. Alderburgh Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products. All transactions are subject to our standard condition of sale, copies of which are available on request.



Alderburgh Limited.
Sladen Mill, Halifax Road, Littleborough, OL15 0LB.
For Further Assistance Tel: 01706 374416, Fax: 01706 376785
E&OE. Without Guarantee.

GEOTEX 300 PP

DESCRIPTION

A needle punched non woven geotextile made from 100% virgin polypropylene staple fibres, UV resistant, produced without the addition of chemical binders and without thermal bonding of the filaments.

PRIMARY FUNCTIONS

Fabric used for ground stabilisation and membrane protection.
Enclosing granular layers in formed drainage systems.

TECHNICAL DATA

Roll Size:	Width	6 m	
	Length	50m, 100m	
Weight:	300g/m ²		
Fabric Thickness:	4.0mm nom.		BS 2544 AS
Tensile strength:	MD	13KN/M	BSEN ISO 10319
	CD	21KN/M	BSEN ISO 1996
Extension:	MD	103%	BSEN ISO 1996
	CD	80%	BSEN ISO 1996
Water Transmittivity	@ 100mm head	140 lt/m/sec	BSEN ISO 10319
Apparent Opening size	90% finer	90 microns	BS6906 PE2 1989
CBR (Puncture):	Part 4	2400N	
Displacement (mm)		70	
Cone PropTest (mm)		17mm	

The above are typical mean values of 5 samples taken at random for test purposes, as defined in BSEN ISO standard.

SPECIFICATION

The Geotex 300PP filter fabric should be specified by name with specific reference to the technical requirements of its use

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS TOGETHER WITH THE APPROPRIATE SPECIFICATION. IT IS THE CONTRACTORS RESPONSIBILITY TO CHECK ALL DIMENSIONS ON SITE. DIMENSIONS MUST NOT BE SCALED FROM THIS DRAWING. ANY DISCREPANCIES TO BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT IN WRITING. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
- ALL LEVELS ARE IN METRES, UNLESS NOTED OTHERWISE.

- THIS DRAWING TO BE READ IN CONJUNCTION WITH THE TIER CONSULT SPECIFICATION FOR DRAINAGE BELOW GROUND TOGETHER WITH 'CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY' 6th EDITION
- MH ILS RELATE TO OUTGOING MAIN PIPE. WHERE INCOMING PIPES ARE OF A SMALLER DIAMETER TO OUTGOING PIPE THEY ARE TO BE POSITIONED WITH PIPE SOFFITS LEVEL (UNO).
- MH CLs ARE APPROX. ONLY AND MUST TIE IN WITH PROPOSED FINISH LEVELS.
- ALL RWP CONNECTIONS TO BE COMPATABLE WITH RWP SIZE AND LOCATION. [SEE ARCHITECTS DRAWINGS]
- ALL PIPES UNDER THE BUILDING AND UNDER PAVED AREAS WHERE THE DEPTH OF COVER IS LESS THAN 0.9m ARE TO BE GIVEN A CLASS 2 CONCRETE SURROUND
- WHERE PIPES CROSS FOUNDATIONS PROVIDE ADDITIONAL FLEXIBLE COUPLINGS.
- FOR EXACT LOCATION OF ALL SOIL PIPES AND FLOOR GULLIES REFER TO ARCHITECTS DRAWINGS. FOR LOCATION OF RWP REFER TO ARCHITECTS LAYOUT DRAWINGS.
- ALL PIPES TO BE 150mm UNLESS NOTED OTHERWISE.
- CHECK IL OF ANY EXISTING DRAINS PRIOR TO COMMENCEMENT AND REPORT ANY DISCREPANCIES TO TIER CONSULT.
- BACKFILL TO TRENCHES MAY BE SUITABLE EXCAVATED MATERIAL IN IN LANDSCAPED AREAS. GRANULAR MATERIAL TO BE USED UNDER ROADS AND HARDSTANDINGS.
- ALL MANHOLE AND DRAINAGE CHANNEL COVERS SHALL COMPLY WITH BS EN 124, STRENGTHS TO BE: CLASS C250 IN CAR PARK AREAS

KEY

SURFACE WATER DRAINAGE	
FOUL DRAINAGE	
COMBINED DRAINAGE	
RAINWATER PIPE	RWP
GULLY	G
SHOWER GULLY	SG
SOIL VENT PIPE	SVP
SOIL PIPE	SP

C5	20.08.19	RJH	LAYOUT AMENDED TO RESOLVE CLASH	
C4	19.06.19	RJH	S1 TO S2 RE-ROUTED TO AVOID CRANE BASE, S4 ADDED	
C3	30.04.19	RJH	NR VALVE ADDED TO MH S1, DRAIN S1-S2 REPOSITIONED TO AVOID CRANE ANCHORS	
C2	10.04.19	RJH	DRAINAGE POINTS AND LAYOUT REVISED TO SUIT CLIENT INSTRUCTION, NR VALVE ADDED, DETAIL THROUGH CRANE BASE ADDED	
C1	22.01.18	RJH	CONSTRUCTION ISSUE	
Rev	Date	By	Description	Appd

Revisions	
Status	

STATUS A0



Client



Architect

AHR

Project

11 YORK STREET

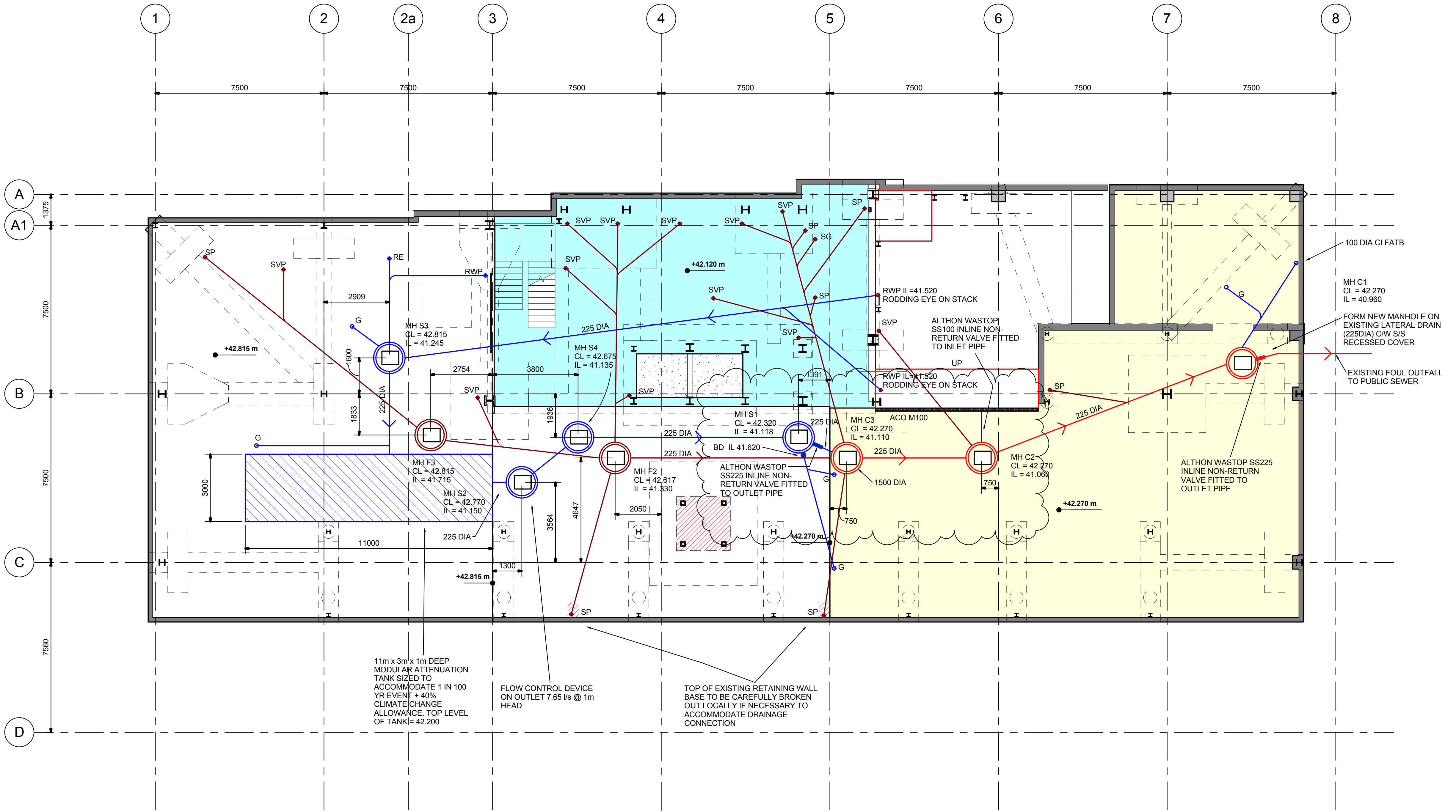
Title

BASEMENT DRAINAGE LAYOUT

Scale	Drawn	Revision
As indicated@A1	IM	C5
Date	Checked	
06/05/17	RJH	

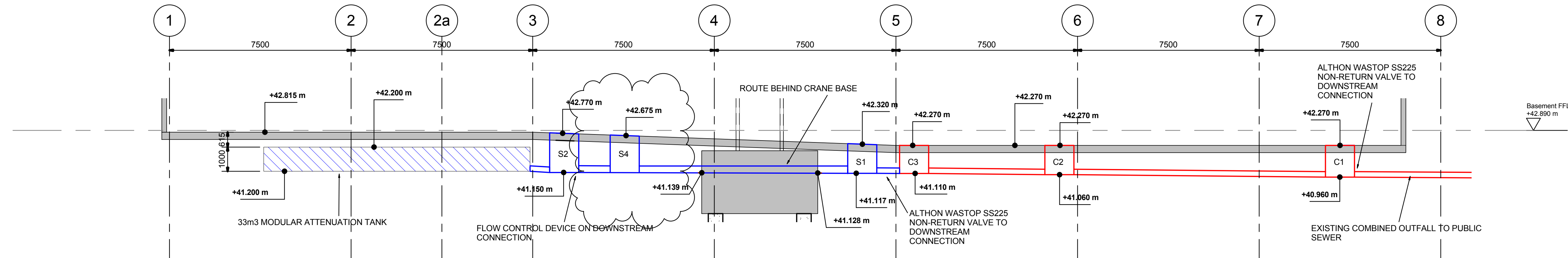
Drawing Ref: Project no\Originator\Zone\level\Type\Pipe\Number

YST-TC-ZZ-B1-DR-S-9001



1 | Basement Drainage Layout
9001 | SCALE: 1: 100

For drainage construction details refer to drawings 9007-9010 incl



2 | Longitudinal Drainage Section
9001 | SCALE: 1: 100

11 YORK STREET, MANCHESTER

PLANNING APPLICATION 126476/JO/2020

APPENDIX B

DISCHARGE OF PLANNING CONDITIONS 9, 11 & 12

9th July 2021



KIER CONSTRUCTION

11 YORK STREET, MANCHESTER

ACOUSTIC VERIFICATION REPORT

PLANNING APPLICATION NO: 126476/JO/2020

6 July 2021

AEC REPORT: P2643/R4/AGB

Acoustic & Engineering Consultants Limited

Suite 316, 3rd Floor, Broadstone Mill, Broadstone Road, Stockport, SK5 7DL
Telephone 0161 449 5900 mail@aecltd.co.uk www.aecltd.co.uk



CONTENTS

	Page
1.0 INTRODUCTION	3
2.0 DEVELOPMENT DESCRIPTION	3
3.0 NOISE MEASUREMENTS	4
4.0 ASSESSMENT	4
FIGURE B1 – Existing Site Showing Monitoring Locations	11
APPENDIX A – Acoustic Terminology in Brief	13
APPENDIX B – Noise Survey Details – 2013 Details	16
APPENDIX C – Noise Survey Details – 2019 Details	18
APPENDIX D – Glazing Specification	20
APPENDIX E – Noise Break-out Calculation	22

DOCUMENT STATUS

Prepared by: A G Burke BSc (Hons) MIOA(D)

Rev	Date	Document Details	Author	Checked
--	6/07/21	Original.	AGB	WSK

1.0 INTRODUCTION

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by Kier Construction to prepare an acoustic verification report for the newly constructed office block with ground floor A3 units at 11 York Street, Manchester.
- 1.2 This report is required to assist with discharging of three planning conditions associated with noise. The application number is 126476/JO/2020 and each condition is presented in detail below however, they are associated with the following elements:
- Noise Breakout from the A3 uses;
 - Atmospheric noise from mechanical plant and ancillary equipment;
 - Noise break-out from the rooftop amenity space.
- 1.3 This report details the results of the original noise surveys undertaken, presents the relevant planning conditions, provides details of the finished constructions and mechanical plant installed and presents an assessment with regard to achieving the set criteria.
- 1.4 Acoustic terminology is discussed in brief in Appendix A.

2.0 DEVELOPMENT DESCRIPTION

- 2.1 The site is bound by Marble Street to the north-east, Fountain Street to the south-east, York Street to the south-west and Milk Street to the north-west.
- 2.2 The building is located in a commercial area and is surrounded by other office buildings. There are no private residential properties nearby with the nearest residential property being the Hotel Gotham, located at 100 King Street some 90m to the south west of the building as identified on Figure 2.1 below.

Figure 2.1 – Site Location and Nearest Residential Receiver



- 2.3 The building is 8 Storeys high with associated basement car parking, two ground floor retail units and a rooftop amenity/event space. This rooftop space will provide space for up to 60 people and will include an open terrace area.

3.0 NOISE MEASUREMENTS

- 3.1 Night-time noise levels were undertaken by AEC on Monday 5 August 2019, between approximately 2300 and 0100h on Tuesday 6 August, 2019. Night-time noise levels were only measured at Location E, external to 50 Spring Gardens, as identified on the attached Figure B1.
- 3.2 Due to ongoing construction work, daytime noise level measurements were not possible in 2019 and, as such, background noise levels measured in 2013 have been used in this assessment. This is considered a reasonable approach as in reality background noise levels are more likely to increase over time than decrease.
- 3.3 All measurements were undertaken in general accordance with BS7445-1: 2003 'Description and measurement of environmental noise. Guide to quantities and procedures'.
- 3.4 A full measurement procedure is presented in Appendix B for the daytime noise level measurements, and Appendix C for the night-time noise level measurements. The measured data is presented in Tables B1 and C1, respectively.
- 3.5 Noise levels at all locations were due to road traffic from the surrounding roads. Distant plant and building construction noise also impacted on the measured noise levels. In summary, the lowest measured background noise levels were 55dBL_{A90,T} during the daytime and 47dBL_{A90,T} during the night-time. These are typical background noise levels for Manchester City Centre.

4.0 ASSESSMENT

Condition 9

- 4.1 Condition 9 states:

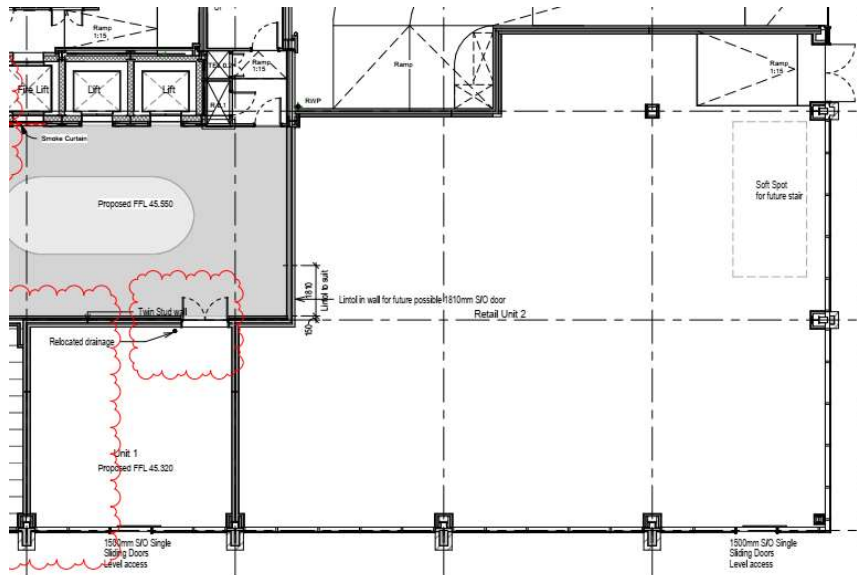
'Before any A3 uses hereby approved commence, the premises shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as local planning authority.'

Where entertainment noise is proposed the L_{Aeq} (entertainment noise) shall be controlled to 10dB below the L_{A90} (without entertainment noise) in each octave band at the facade of the nearest noise sensitive location.

Upon completion of the development a verification report to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report shall be submitted to and approved in writing by the City Council as local planning authority. The verification report shall also undertake post completion testing to confirm that acceptable criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria and timescales for the implementation of those measures.'

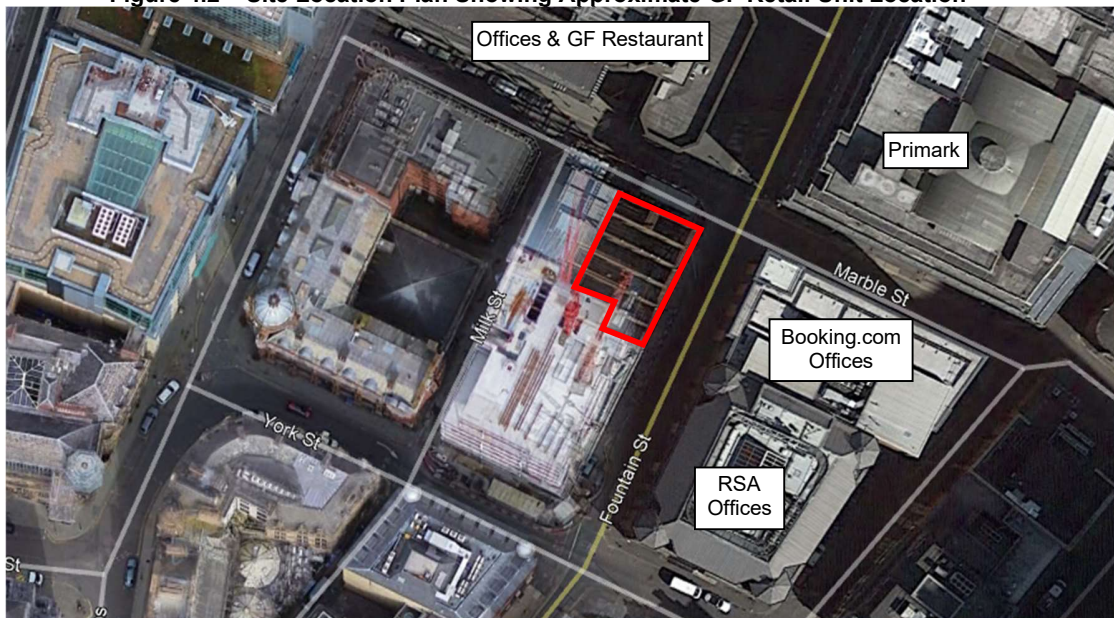
- 4.2 Condition 9 is concerned with noise break-out from the glazed facades of the 2 Retail units as identified on Figure 4.1 below.

Figure 4.1 – Plan Showing Ground Floor Retail Units



- 4.2 The location of the retail units is presented on Figure 4.2 below. As can be seen, all of the surrounding premises are offices or retail.

Figure 4.2 – Site Location Plan Showing Approximate GF Retail Unit Location



© Google 2021

- 4.3 The uses of the proposed A3 spaces on the ground floor are currently unknown. However, it is understood that the end users could potentially operate in the evening until

around 2300h, and that the potential noisiest activity would be a restaurant. AEC has previously measured noise levels in very busy restaurants and bars with low level background music in Manchester city centre on weekend nights. Ambient noise levels did not exceed 84dB_{LAeq,5min} even with a noisy party occurring and this noise data has been used in the noise break-out calculation.

- 4.3 The glazing installed on-site has a sound insulation performance of 41dBR_w and the specification is attached as Appendix D.
- 4.4 The worst-case situation relating to noise break-out relates to the offices & ground floor restaurant directly opposite the site to the north on Marble Street some 13m from the building façade where night-time background noise levels were 47dB_{LA90}.
- 4.5 With reference to the above, the resultant noise break-out has been calculated and the full calculation details are included in Appendix E with a summary presented in Table 4.1 below.

Table 4.1 – Resultant Noise Break-out

Details	Octave Band Centre Frequency, Hz								Overall
	63	125	250	500	1k	2k	4k	8k	
Restaurant Noise Level, dB _{LAeq}	78	77	76	77	79	77	75	75	84dB(A)
Window Sound Insulation, SRI	25	28	35	39	41	53	64	60	41dBR _w
13m Distance Attenuation, dB	-22	-22	-22	-22	-22	-22	-22	-22	--
Resultant Noise Level, dB _{LAeq}	37	33	25	22	22	8	-5	-1	25dB(A)
Background Noise Level, dB _{LA90}	51	50	47	44	43	38	30	20	47dB(A)
Resultant Minus Background	-14	-17	-22	-22	-21	-30	-35	-21	--

- 4.6 As the above table identifies, breakout noise levels from the A3 units comfortably comply with MCC requirements even as a worst-case situation. Furthermore, it should be noted that noise at any residential properties would be inaudible and in reality, during the night-time, offices would not normally be operational.
- 4.7 It is considered that the above provides sufficient information to discharge condition 9.

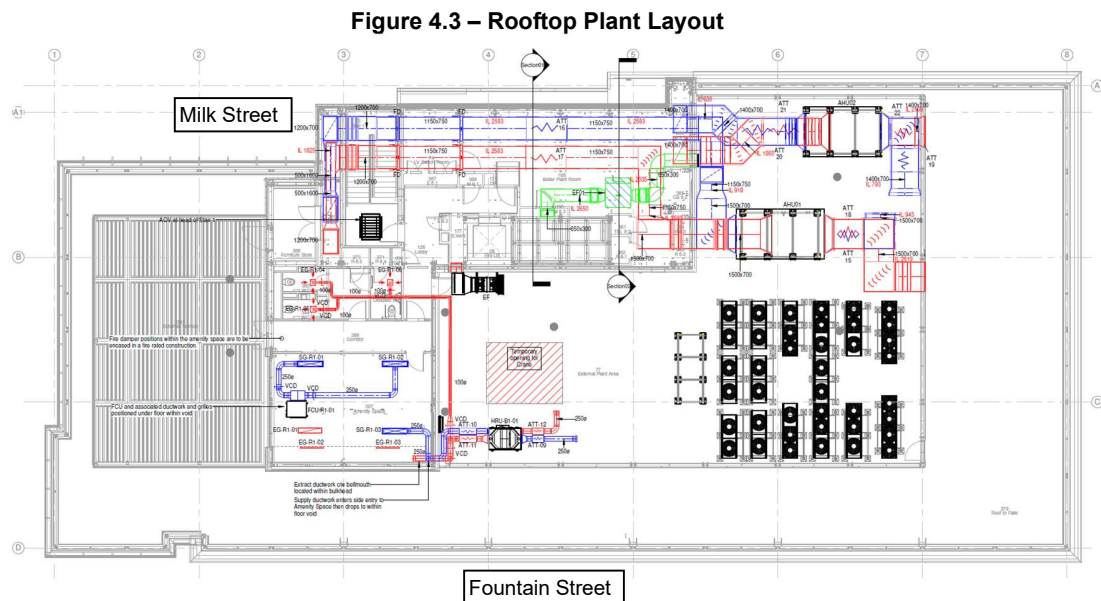
Condition 11

- 4.8 Condition 11 states:

‘11) Notwithstanding the approved details, before first occupation of the development the building, together with any externally mounted ancillary equipment, shall be acoustically insulated in accordance with a scheme submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the equipment. The scheme shall be designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.

Upon completion of the development a verification report to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report shall be submitted to and approved in writing by the City Council as local planning authority. The verification report shall also undertake post completion testing to confirm that acceptable criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria and timescales for the implementation of those measures.'

- 4.9 With regard to mechanical plant noise, AEC considers that the above noise limit would normally apply to residential receivers. With regard to commercial receivers, it is considered that an appropriate noise level limit for plant and ancillary equipment is 50dB(A). Based on this, assuming windows were open for ventilation purposes, noise levels within the commercial buildings would be no greater than 35-40dB(A) depending on how far the window was opened. As defined in BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' a noise limit of 35-40dBL_{Aeq,T} is appropriate for executive and cellular offices, which would represent a the most onerous receiver for an commercial / office building.
- 4.10 The rooftop plant layout as installed on-site is as per figure 4.3 below.



- 4.11 The rooftop items identified above are as presented in Table 4.3 below. Noise data for the items installed has been provided. This is included as Appendix F and is summarised in Table 4.2, below.

Table 4.2 – Rooftop Plant Items and Noise Emission Levels

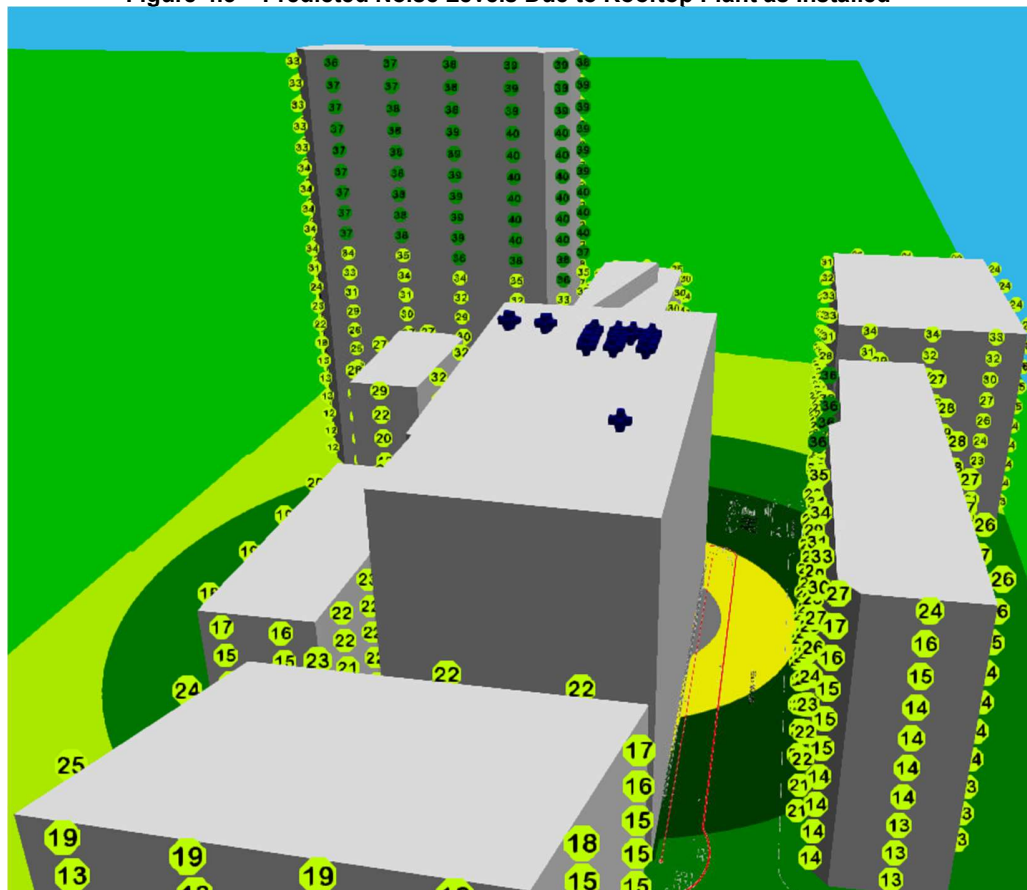
Item	Noise Level, dB @ 1m
VRF Toshiba MMY-MAP1406FT8P x 2	64dB(A) – per item
VRF Toshiba MMY-MAP1606FT8P x 11	64dB(A) – per item
VRF Toshiba MMY-MAP1806FT8P x 7	64dB(A) – per item
Office AHU 1 Exhaust (Attenuated)	57dB(A)
Office AHU 1 Inlet (Attenuated)	48dB(A)
Office AHU 1 Casing Breakout	50dB(A)
Office AHU 2 Exhaust (Attenuated)	58dB(A)
Office AHU 2 Inlet (Attenuated)	51dB(A)
Office AHU 2 Casing Breakout	50dB(A)
Rooftop Extract (Exhaust and Inlet Attenuated)	<55dB(A)

- 4.12 Using CadnaA® environmental noise prediction software the predicted noise levels at the facades of the nearest office buildings have been predicted using the above noise level data. Figure 4.4 shows the plan of the predicted noise levels and Figure 4.5 shows a 3D screen grab of the model showing the building heights used.

Figure 4.4 – Predicted Noise Levels Due to Rooftop Plant as Installed



Figure 4.5 – Predicted Noise Levels Due to Rooftop Plant as Installed



- 4.13 Based on the above even if all mechanical plant items were operating at full duty during the night-time period, MCC's plant noise limit of not greater than 42dB(A) (lowest measured background noise level minus 5dB) would be achieved.
- 4.14 It is important to note that in reality, it will be rare for all items of plant to operate at the same time and during the night-time the plant will operate at reduced capacity / duty, meaning that the above noise levels represent an over-prediction.
- 4.15 The above assessment demonstrates that for the atmospheric noise emissions for the items of mechanical plant installed at 11 York Street comply with MCC's requirements and, as such, condition 11 can be discharged.

Condition 12

- 4.16 Planning Condition 12 states:

'12) Before the use of the rooftop amenity space hereby approved commence, the premises shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that

has been submitted to and approved in writing by the City Council as local planning authority. Where entertainment noise is proposed the L_{Aeq} (entertainment noise) shall be controlled to 10dB below the L_{A90} (without entertainment noise) in each octave band at the facade of the nearest noise sensitive location.

Upon completion of the development a verification report to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report shall be submitted to and approved in writing by the City Council as local planning authority. The verification report shall also undertake post completion testing to confirm that acceptable criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria and timescales for the implementation of those measures'.

- 4.17 As this is a rooftop amenity space where the main noise source will be noise due to people attending events, the only possible method of demonstrating compliance is to predict noise levels to the surrounding buildings. It is not possible to set up an event and then measure at the surrounding buildings at high level.
- 4.18 AEC understands that the rooftop amenity/event space may operate until possibly 0100h, with no access allowed for the general public. It is understood that there could be up to 60 people in the amenity/event space.
- 4.19 The lowest background and ambient noise levels measured, during the night-time period, were 47dBL_{A90, T} and 57dBL_{Aeq, T}, respectively.
- 4.20 With regard to event attendee noise, the anticipated sound power level within the rooftop amenity/event space has been calculated with reference to the method presented in the J.H. Rindel, C.I Christensen, A.C. Grade research paper: 'Dynamic sound source for simulating the Lombard effect in room acoustic modelling software' (Proceedings of Inter-Noise 2012, New York, USA, (2012)).
- 4.21 As the area is associated with an interior bar, it has been deemed appropriate to use a noise level representative of 'raised' speech conversation levels. The sound power level of a person speaking in a *raised* voice is equal to roughly 76dBL_{WA} (ref. ANSI 3.5).
- 4.22 To calculate the number of people speaking at any one time the following method presented in the above research paper was used.
- 4.23 The first step is to calculate the number of speaking persons (NS) at any one time, where N is the total number of persons (60) and G is the assumed group size (typically 3.5).

$$\text{Number of speaking persons (NS)} = N/G$$

- 4.24 In this scenario, this equates to around 17 people speaking at any one time (60/3.5) on the rooftop amenity space. Taking this into account, as well as the sound power level of 'raised' conversation (76dBL_{WA}) a 3D acoustic model has been produced of the above scenario using CadnaA® environmental noise prediction software and the predicted noise levels are presented in Figures 4.6 and 4.7 below.
- 4.25 Figures 4.6 and 4.7 show the predicted L_{Aeq} noise levels and includes the 1.1m high glass balustrade around the rooftop amenity space. The circled numbers on the building show the highest predicted level. It is not possible to show the noise spectrum data used in the

calculation and, as such, the predicted noise spectrum data at the worst-case affected property is included in table 4.3 below.

Figure 4.6 – Predicted Noise Levels Due to Rooftop Use (Plan)

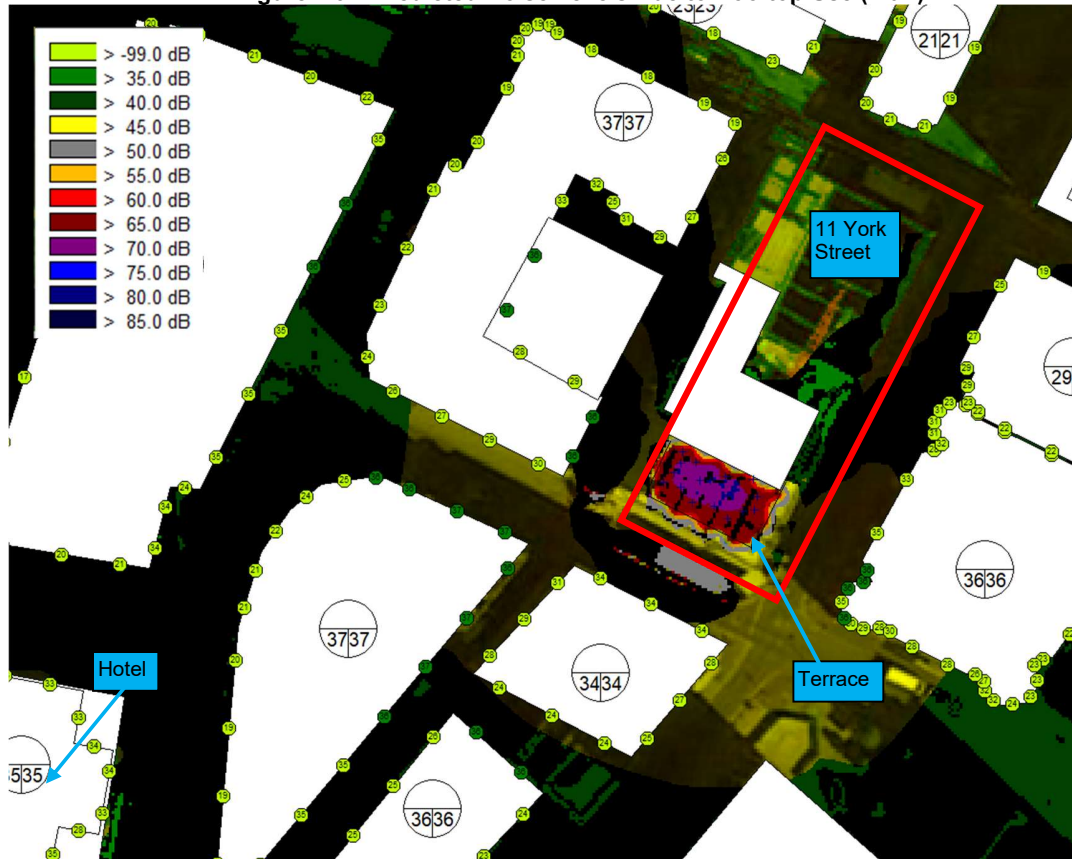


Figure 4.7 – Predicted Noise Levels Due to Rooftop Use (3D)

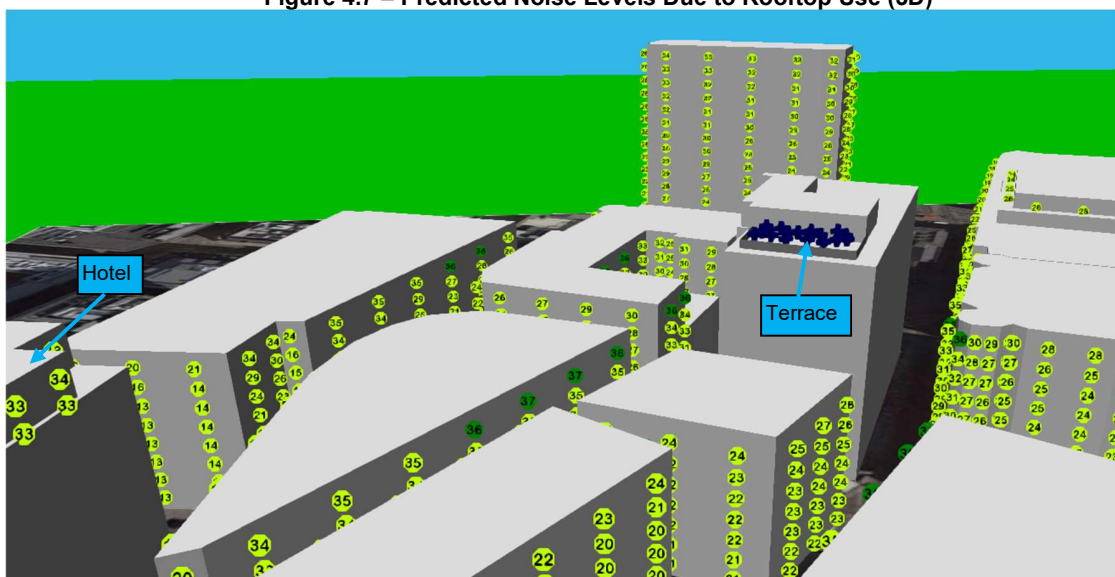


Table 4.3 – Rooftop Terrace Noise Compared to Background Noise

Details	Octave Band Centre Frequency, Hz								Overall
	63	125	250	500	1k	2k	4k	8k	
Restaurant Noise Level, dBL _{eq}	20	26	30	34	33	27	19	8	37dB(A)
Background Noise Level, dBL ₉₀	51	50	47	44	43	38	30	20	47dB(A)
Resultant Minus Background	-31	-24	-17	-10	-10	-11	-11	-12	--

- 4.26 As Table 4.3 demonstrates as a worst-case prediction the L_{Aeq} noise levels affecting the worst-case affected surrounding building will comply with the requirements of planning condition number 12. Furthermore, in reality, this prediction applies to surrounding offices in the night-time period which are not as noise sensitive as residential properties. The noise levels would be even lower at the Gotham Hotel, some 85m from the site.
- 4.27 The above provides sufficient information in order that condition 12 can be discharged.

FIGURE B1 – Existing Site Showing Monitoring Locations



Map data @2019 Google United Kingdom

APPENDIX A – Acoustic Terminology in Brief

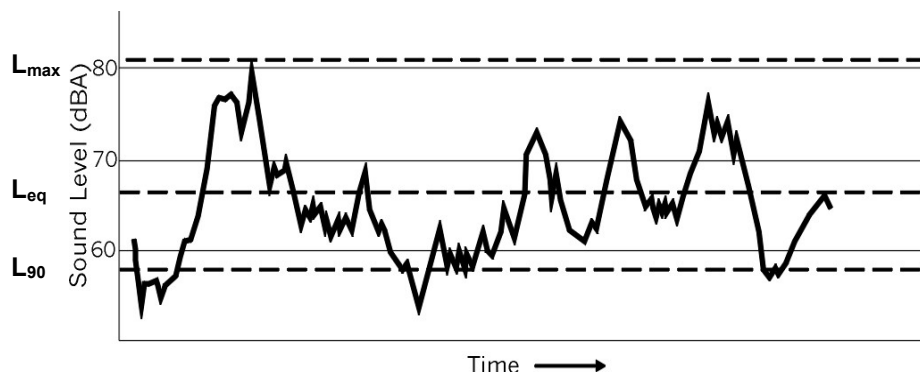
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most sound is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The *dBA* weighting emphasises or reduces the importance of certain frequencies within the audible range.

Sound Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the sound.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of sound can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be preceded by a *dB* descriptor in the report e.g. $L_{Aeq,T}$ could be written $dB_{L_{Aeq,T}}$.



Example of Sound Level Varying With Time

$L_{Aeq,T}$	The equivalent continuous (A-weighted) sound level. It may be thought of as the "average" sound level over a given time, <i>T</i> . It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the "ambient" noise level.
$L_{A90,T}$	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise.
L_{Amax}	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.

Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
Façade Level	This refers to the sound level measured outside, at 1m from a hard reflecting surface, typically 3dB greater than the free-field level.
NR	Noise Rating – a graphical method for assigning a single number rating to a noise spectrum and is often use to specify noise level limits for mechanical services.
R_w	Single number rating used to describe the <u>laboratory</u> airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.

APPENDIX B – Noise Survey Details – 2013 Details

Date & Time of Survey:	Friday 3 May, 2013, 1145 – 1345h.					
Personnel:	Ben Tomlin (AEC).					
Equipment Used:	B&K 2260 Real Time Analyser (Originally AEC Kit 1).					
Calibration:	The sound level analysers, which conforms to BS EN 61672-1: 2003 ' <i>Electro acoustics – sound level meters - Part 1 Specifications</i> ' for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.					
Weather Conditions:	Date	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	03/05/13	Daytime	Dry	16-18°C	Negligible wind speed & direction	60%
Measurement Locations:	Measurements were undertaken at 5 locations around the development site. Identified as A to E on Figure 1 and described below. A – On Fountain Street, about 5m from the edge of the carriageway, and 3m from the façade. B – On Marble Street, about 3m from the façade. C – On Milk Street, about 3m from the façade. D – On York Street, about 2m from the façade. E – At residential properties on Spring Gardens, about 3m from the façade.					
Measurement Details:	Measurements were undertaken over various periods in terms of L_{eq} , L_{10} , L_{90} , and L_{max} .					
Façade / Free-Field:	A, B, C, D, E - free-field					
	Full results for the attended measurements are given in Table B1.					
Measured Data:	Full octave band centre frequency data was obtained for all measurements.					

TABLE B1 – Measured Daytime Noise Levels (2013)

Location	Period, h	Noise Level, dB				Comments
		L _{Aeq}	L _{A10}	L _{A90}	L _{Amax, F}	
A	1146-1151	67.0	70.2	57.9	81.7	Noise levels due to local and distant traffic, distant plant, distant building work and pedestrian traffic.
	1151-1156	65.2	68.8	58.3	76.7	
	1157-1202	64.9	67.8	59.7	75.8	
	1248-1253	63.0	65.9	57.8	77.2	
	1254-1259	69.4	71.4	62.2	85.3	
B	1203-1208	63.1	66.0	57.9	77.9	Noise levels due to local and distant traffic, distant plant, distant building work and pedestrian traffic.
	1209-1214	60.9	63.1	55.4	78.8	
	1300-1305	60.8	63.5	56.1	72.6	
C	1216-1221	64.5	63.8	59.3	86.2	Noise levels due to local and distant traffic, distant plant, distant building work and pedestrian traffic (siren paused out in 2 nd measurement).
	1222-1227	62.2	64.2	58.5	75.7	
	1308-1313	61.9	64.1	58.5	76.9	
	1314-1319	60.3	61.7	57.7	73.2	
D	1229-1234	70.8	76.5	60.9	85.9	Noise levels due to local and distant traffic, distant plant, distant building work and pedestrian traffic (siren paused out in both 1 st and 2 nd measurement).
	1234-1239	65.4	68.5	59.1	78.7	
	1320-1325	69.8	72.7	60.3	85.7	
	1326-1331	70.2	73.4	60.3	87.1	
E	1241-1246	63.3	66.4	58.0	75.2	Noise levels due to local and distant traffic, distant plant, distant building work and pedestrian traffic.
	1333-1338	63.6	66.2	57.4	76.8	

APPENDIX C – Noise Survey Details – 2019 Details

Date & Time of Survey:	Monday 5 August 2019, 2300h to Tuesday 6 August 2019, 0100h.					
Personnel:	Ross Chamberlain (AEC).					
Equipment Used:	B&K 2250 Real Time Analyser (AEC Kit 1).					
Calibration:	The sound level analysers, which conforms to BS EN 61672-1: 2003 ' <i>Electro acoustics – sound level meters - Part 1 Specifications</i> ' for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.					
Weather Conditions:	Date	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	05/08/19 – 06/08/19	Night	Dry	15°C	Negligible wind speed & direction	60%
Measurement Locations:	Measurements were undertaken at 1 location around the development site. Identified as E on Figure 1 and described below. E – At residential properties on Spring Gardens, about 3m from the façade.					
Measurement Details:	Measurements were undertaken over various periods in terms of L_{eq} , L_{10} , L_{90} , and L_{max} .					
Façade / Free-Field:	E - free-field					
	Full results for the attended measurements are given in Table C1.					
Measured Data:	Full octave band centre frequency data was obtained for all measurements.					

TABLE C1 – Measured Night-Time Noise Levels (2019)

Location	Period, h	Noise Level, dB			Comments
		L _{Aeq}	L _{A90}	L _{Amax, F}	
E	2308 – 2320	60.1	48.5	76.6	The main contributing source of noise was road traffic along from where Spring Gardens road meets York Street. Maximum noise levels due to car pass-bys along these streets.
	2320 – 2334	58.6	50.0	68.8	
	2335 – 2348	57.9	48.4	70.2	
	2350 – 0005	60.3	47.1	75.7	
	0005 – 0020	57.7	47.4	74.4	
	0020 – 0034	57.2	46.5	69.2	
	0035 - 0047	60.0	48.9	75.0	

APPENDIX D – Glazing Specification



C397 York Street, Manchester

Glass specification document

YST-SCL-00-XX-SP-Y1-09001



REV	DATE	BY	DESCRIPTION	Issue Date
P1	16/12/2019	AS	First Issue	18/12/19
C1	22/01/2020	AS	Issued for Construction	22/01/2020
C2	14/02/2020	AS	G2 Specification Change (RAL colour and Insulation)	14/02/2020

Head Office
Thurston House
Thornfield Business Park
Standard Way, Northallerton
DL6 2XQ
Tel: 01609 768970

Divisional Office
Unit 11 Hayfield Bus.Park
Field Lane
Auckley, Doncaster
DN9 3FL
Tel: 01302 436400

Regional Office
Rock Farm Offices
Seckington
Tamworth
B79 0LA
Tel: 0121 6679481

Speedclad Ltd Company No: 6492516 E: info@speedclad.co.uk www.speedclad.co.uk





G1 - Glass Type 1 (as specification L40-370A & 372A)

For exact locations refer to Speedclad elevations

44mm overall insulating glass unit

Outer Pane: 13.5mm Coolite SKN176ii Heat Strengthened Laminate

Cavity: 20mm Black Warm Edge Spacer Bar; Argon Gas Filled Cavity

Inner Pane: 10mm Planiclear Toughened HST

Photometric Data

Transmission, reflexion, absorption

$\rho_v = 0,13$ (Light reflection factor outside)

$\rho'_v = 0,15$ (Light reflection factor inside)

$\rho_e = 0,23$ (direct radiation reflection factor outside)

$\rho'_e = 0,35$ (direct radiation reflection factor inside)

$\alpha_e = 1 = 0,44; 3 = 0,02$ (direct radiation absorption factor)

$T_{UV} = 0,00$ (ultraviolet transmittance)

$T_v = 0,67$ (Light transmission)

$T_e = 0,31$ (direct radiation transmission factor)

$R_a = 92$ (general color rendering index (CRI))

EN 410

SC = 0,40 (Shading Coefficient, g/0,87)

b-Faktor = 0,43 (VDI 2078, g/0,80)

$q_i = 0,03$ (secondary heat inside)

$g = 0,34$ (Total energy transmission factor)

EN 673 Installation angle = 90° vertikal

$U_g = 1,0 \text{ W/m}^2\text{K}$ (Heat transfer coefficient)

EN 13363-2 $T_e = 5,00 \text{ }^\circ\text{C}$ $T_i = 20,00 \text{ }^\circ\text{C}$

$g_{th} = 0,025$ (Thermal radiation factor)

$g_c = 0,018$ (Convection factor)

$g_v = 0,000$ (Ventilation factor)

$E_s = 300,00 \text{ W/m}^2$ System = 1,50 m

$h_{c,e} = 18,00 \text{ W/m}^2\text{K}$ $h_{c,i} = 3,60 \text{ W/m}^2\text{K}$

$q_i = 0,043$ (secondary heat inside)

$g = 0,35$ (Total energy transmission factor)

Acoustic Data

The acoustic performance data is determined by calculation, based on factors derived from certified data. Due to inherent variations in acoustic performance when testing in accordance with EN ISO 140-3, some variation in the calculated performance can also be expected. As such, the weighted performance, R_w , and adaptation terms, C and Ctr, should typically be considered to be accurate within +2dB. However, wider deviations can occur.

Sound Reduction Indices

Frequency, Hz / dB						Rw	C	Ctr	OITC	STC
125	250	500	1000	2000	4000	41	-1	-4	35	41
28	35	39	41	53	64					

Head Office

Thurston House
Thornfield Business Park
Standard Way, Northallerton
DL6 2XQ
Tel: 01609 768970

Divisional Office

Unit 11 Hayfield Bus.Park
Field Lane
Auckley, Doncaster
DN9 3FL
Tel: 01302 436400

Regional Office

Rock Farm Offices
Seckington
Tamworth
B79 0LA
Tel: 0121 6679481



Constructionline
Part of Capita plc



CN Specialists
Awards 2016
Winner



Speedclad Ltd Company No: 6492516 E: info@speedclad.co.uk www.speedclad.co.uk

APPENDIX E – Noise Break-out Calculation

	Contract No:	P2643		Date:	05-Jul						
	Client:	Kier									
	Project:	11 York Street		Consultant:	AGB						
NOISE BREAK OUT TO OUTSIDE											
Noise Source	City Centre Restaurant										
	Corrections to obtain Lp at element ? (eg distance/directivity)										
Building & Element	Glazing										
Area (S)	52 m²	Width(a)=	13 m	Height(b)=	4 m						
Position Directivity (Q)	4	(=4 for a wall, 2 for a roof)									
Additional Directivity											
Receiver	Offices Opposite										
Distance (R) from element	13 m										
Propagation Corrections											
Barrier	0										
Façade	0										
Calculation											
Frequency, Hz	63	125	250	500	1k	2k	4k	8k	dBA		
Internal Level, dB	78	77	76	77	79	77	75	75	84		
Internal Corrections, dB											
Corrected Internal Level, Lin, dB	78	77	76	77	79	77	75	75	84		
SRI of Element, dB	25	28	35	39	41	53	64	60			
Additional Directivity, dB											
Propagation Corrections											
Barrier, dB											
Façade, dB											
Level (1) at Receiver	dB	37	33	25	22	22	8	-5	-1	25	
Level (2) at Receiver	dB	35	31	23	20	20	6	-7	-3	23	
Criterion	dB	51	50	47	44	43	38	30	20	47	Measured BG
Shortfall (1)	dB	-14	-17	-22	-22	-21	-30	-35	-21		
Shortfall (2)	dB	-16	-19	-24	-24	-23	-32	-37	-23		
Calculation Method	(1)	Lp = Lin - R - 6 + 10Log(S) - 20Log(R) - 11 + 10Log(Q)									
	(2)	Lp = Lin - R - 6 + 10Log(ab/(pi²R²)) + 10Log(Q/2)									

APPENDIX F – Rooftop Plant Items As Installed

TOSHIBA Leading Innovation >>>

Toshiba Air Conditioning - VRF Data Sheet

MMY-MAP1406FT8P

Three-pipe SHRMe - Super Heat Recovery Condensing Unit

Features

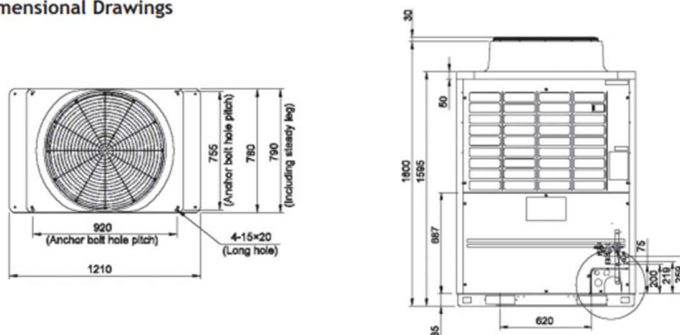
- Dual setpoint for more precision
- ESEER increased to >8
- UK-SEER achievable to >10
- New 4 series flow box with 50 m run
- New 4- and 6-port multi-flow boxes



Technical Data

Model reference		MMY-MAP1406FT8P
Nominal cooling	kW	40.0
Nominal heating	kW	45.0
Capacity code		14
Min./max. capacities connectable	kW	32.0/54.0
Power input (cool/heat)	kW	12.7/10.5
SEER/ESEER Value (Office Profile)		6.88/7.34
SCOP/ESCOP Value (Office Profile)		4.82/5.02
Starting current	A	1
Running current (cool/heat)	A	19.92/16.47
Suggested fuse size	A	32
Power supply	V-ph-Hz	380/415-3-50
Interconnecting cable		2-core screened 1.5 mm
Sound power (cool/heat)	dB(A)	81/83
Sound pressure (cool/heat)	dB(A)	62/64
Standard air flow	m ³ /h	12200
Standard air flow	l/s	3389
External static pressure	Pa	40
Maximum indoor units connectable		31
Dimensions (H x W x D)	mm	1830 x 1210 x 780
Unit weight	kg	316
R410A refrigerant base charge	kg	11

Dimensional Drawings



Cool Designs Ltd

Raising the Standards in Air Conditioning Distribution

www.cdlweb.info



All UK duties are based on Cooling Indoor air temperature 22°C DB/16°C WB Outdoor air temperature 28°C DB 50% RH, high fan speed, 5 m pipe run.
Heating Indoor air temperature 21°C DB Outdoor air temperature -4°C DB 100% RH, high fan speed, 5 m pipe run. Values are based on the maximum compressor output.
Data obtained from Toshiba Air Conditioning Web Data July 2019.

TOSHIBA Leading Innovation >>>

Toshiba Air Conditioning - VRF Data Sheet

MMY-MAP1606FT8P

Three-pipe SHRMe - Super Heat Recovery Condensing Unit

Features

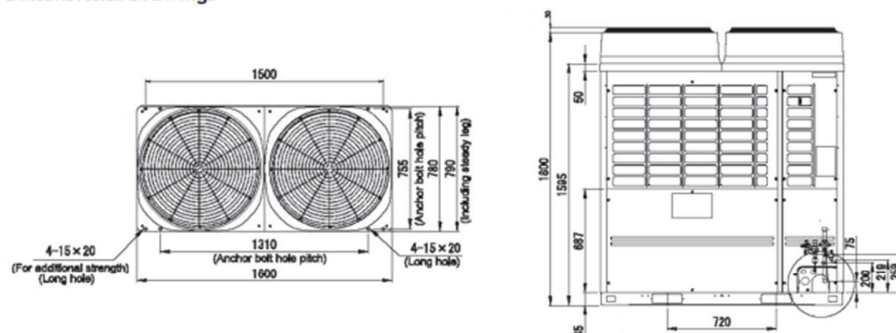
- Dual setpoint for more precision
- ESEER increased to >8
- UK-SEER achievable to >10
- New 4 series flow box with 50 m run
- New 4- and 6-port multi-flow boxes



Technical Data

Model reference		MMY-MAP1606FT8P
Nominal cooling	kW	45.0
Nominal heating	kW	50.0
Capacity code		16
Min./max. capacities connectable	kW	36.00/60.75
Power input (cool/heat)	kW	13.9/12.2
SEER/ESEER Value (Office Profile)		7.62/8.17
SCOP/ESCOP Value (Office Profile)		4.62/4.82
Starting current	A	1
Running current (cool/heat)	A	21.81/19.14
Suggested fuse size	A	40
Power supply	V-ph-Hz	380/415-3-50
Interconnecting cable		2-core screened 1.5 mm
Sound power (cool/heat)	dB(A)	83/84
Sound pressure (cool/heat)	dB(A)	61/62
Standard air flow	m ³ /h	17300
Standard air flow	l/s	4806
External static pressure	Pa	40
Maximum indoor units connectable		36
Dimensions (H x W x D)	mm	1830 x 1600 x 780
Unit weight	kg	377
R410A refrigerant base charge	kg	11

Dimensional Drawings



Cool Designs Ltd

Raising the Standards in Air Conditioning Distribution

www.cdlweb.info



All UK duties are based on Cooling Indoor air temperature 22°C DB/16°C WB Outdoor air temperature 28°C DB 50% RH, high fan speed, 5 m pipe run.
Heating Indoor air temperature 21°C DB Outdoor air temperature -4°C DB 100% RH, high fan speed, 5 m pipe run. Values are based on the maximum compressor output.
Data obtained from Toshiba Air Conditioning Web Data July 2019.

TOSHIBA Leading Innovation >>>

Toshiba Air Conditioning - VRF Data Sheet

MMY-MAP1806FT8P

Three-pipe SHRMe - Super Heat Recovery Condensing Unit

Features

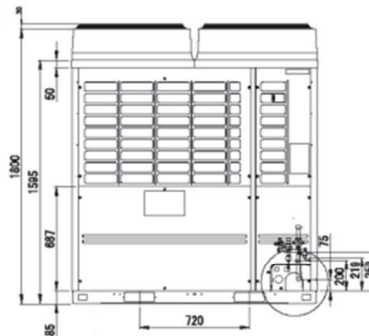
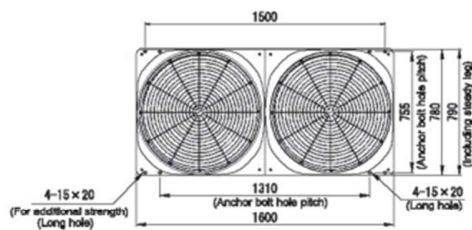
- Dual setpoint for more precision
- ESEER increased to >8
- UK-SEER achievable to >10
- New 4 series flow box with 50 m run
- New 4- and 6-port multi-flow boxes



Technical Data

Model reference		MMY-MAP1806FT8P
Nominal cooling	kW	50.4
Nominal heating	kW	56.5
Capacity code		18
Min./max. capacities connectable	kW	40.32/68.04
Power input (cool/heat)	kW	16.0/13.7
SEER/ESEER Value (Office Profile)		7.36/7.86
SCOP/ESCOP Value (Office Profile)		4.62/4.82
Starting current	A	1
Running current (cool/heat)	A	25.10/21.49
Suggested fuse size	A	40
Power supply	V-ph-Hz	380/415-3-50
Interconnecting cable		2-core screened 1.5 mm
Sound power (cool/heat)	dB(A)	83/84
Sound pressure (cool/heat)	dB(A)	61/62
Standard air flow	m ³ /h	17300
Standard air flow	l/s	4806
External static pressure	Pa	40
Maximum indoor units connectable		40
Dimensions (H x W x D)	mm	1830 x 1600 x 780
Unit weight	kg	377
R410A refrigerant base charge	kg	11

Dimensional Drawings



Cool Designs Ltd

Raising the Standards in Air Conditioning Distribution

www.cdlweb.info



All UK duties are based on Cooling Indoor air temperature 22°C DB/16°C WB Outdoor air temperature 28°C DB 50% RH, high fan speed, 5 m pipe run.
Heating Indoor air temperature 21°C DB Outdoor air temperature -4°C DB 100% RH, high fan speed, 5 m pipe run. Values are based on the maximum compressor output.
Data obtained from Toshiba Air Conditioning Web Data July 2019.



AIR HANDLING UNIT eQ

Project	28618 (117122180B07) / 11 York Street Manchester AHU's	Acon 2.49.35593
AOC	ACON-02621496	
Unit	9 (A) / Office AHU1	2020-06-03
Size	063	Page 5/23
Customer	Dodd Group	
Customers ref.	Will Tatterton	
Our ref.	Andy Window	
Supply air volume flow rate	6600 l/s	Exhaust air volume flow rate 6100 l/s
External static pressure	350 Pa	External static pressure 350 Pa
Mains electricity	3x400VAC±10%+N+PE, 50Hz	Weight 2988 kg
Specific el. power demand (SFPv)	1.90 kW/(m³/s)	Dimensioned for wet condition
Ref. density	1.2 kg/m³	Ref. altitude above sea level 0 m

Filter cross section air velocity	2.4	2.3 m/s
Air flow	6600	6439 l/s
Total pressure rise	689	590 Pa
Fan fan system effect	0	0 Pa
Fan total efficiency	69.8	68.8 %
Fan system input power (absorbed electrical power) according to SFP	6.8	5.79 kW

Fan system effect is taken into account in fan performance

Fan power supply data

Voltage, supply flow	3x400VAC+PE, 50Hz	Voltage, extract flow	3x400VAC+PE, 50Hz
Power, supply flow	2 x 4.6 kW	Power, extract flow	2 x 4.6 kW
Current, full load, supply flow	2 x 7.4 A	Current, full load, extract flow	2 x 7.4 A

SOUND POWER LEVELS (standard: EN13053 ISO/CD 13347-2)

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Fresh air connection	77	77	70	65	61	59	54	56	69
Supply air connection	84	90	84	86	82	79	75	73	88
Extract connection	75	77	72	67	59	57	52	54	69
Exhaust connection	82	87	83	84	80	76	73	71	85
To surroundings	73	71	61	50	47	46	41	35	58



FläktGroup



AIR HANDLING UNIT eQ

Project	28618 (117122180B07) / 11 York Street Manchester AHU's	Acon 2.49.35593
AOC	ACON-02621507	
Unit	10 (C) / Office AHU2	2020-06-03
Size	063	Page 5/23
Customer	Dodd Group	
Customers ref.	Will Tatterton	
Our ref.	Andy Window	
Supply air volume flow rate	6000 l/s	Exhaust air volume flow rate 5500 l/s
External static pressure	300 Pa	External static pressure 300 Pa
Mains electricity	3x400VAC±10%+N+PE, 50Hz	Weight 2912 kg
Specific el. power demand (SFPv)	1.65 kW/(m³/s)	Dimensioned for wet condition
Ref. density	1.2 kg/m³	Ref. altitude above sea level 0 m

Filter cross section air velocity	2.1	2.1 m/s
Air flow	6000	5839 l/s
Total pressure rise	598	510 Pa
Fan fan system effect	0	0 Pa
Fan total efficiency	69.8	68.5 %
Fan system input power (absorbed electrical power) according to SFP	5.36	4.55 kW

Fan system effect is taken into account in fan performance

Fan power supply data

Voltage, supply flow	3x400VAC+PE, 50Hz	Voltage, extract flow	3x400VAC+PE, 50Hz
Power, supply flow	2 x 4.6 kW	Power, extract flow	2 x 4.6 kW
Current, full load, supply flow	2 x 7.4 A	Current, full load, extract flow	2 x 7.4 A

SOUND POWER LEVELS

(standard: EN13053 ISO/CD 13347-2)

Octave band (Hz)	Lw per octave band (dB)								LwA dB(A)
	63	125	250	500	1k	2k	4k	8k	
Fresh air connection	72	75	68	63	58	56	52	53	66
Supply air connection	80	87	82	83	80	76	73	70	85
Extract connection	71	76	70	64	56	54	49	51	66
Exhaust connection	78	86	80	81	77	74	70	68	83
To surroundings	68	69	59	47	44	43	39	32	56

Attenuator Schedule

Notes

1. All attenuators shall be supplied by Caice or equal and approved.
2. The Contractor shall order the attenuators scheduled below, and shall send finalised drawings and equipment noise levels to the attenuator supplier to check the selections prior to manufacture.
3. The attenuator supplier shall then undertake acoustic calculations to ensure that the attenuators achieve the specified noise criteria, based upon the finalised information.
4. A Technical Submittal comprising acoustic calculations and a finalised schedule of attenuators shall then be issued to the Consultant for final approval.
5. If an alternative attenuator supplier is proposed then the Contractor shall allow for them to undertake witnessed tests to prove their claimed insertion loss performance in a UKAS accredited BS EN ISO 7235: 2009 test facility, for two sample units. This shall be undertaken prior to order.
6. Pressure losses are stated in accordance with ISO 7235, which is based on laminar airflow conditions. The system designer shall make allowance for increased attenuator pressure losses where turbulent airflow conditions exist on the attenuator entry or exit.
7. Unless stated otherwise all attenuators shall be constructed as follows: Galvanised sheet steel casings with 30mm profile flanges that are fully compliant with DW/TM1 at a high pressure rating (+2000/-750Pa). Profile flanges shall be compatible with Doby, Mez & Metu flanging systems. Elements shall be installed in the vertical plane, with side elements provided as standard, and all elements shall have aerodynamic inlet and outlet fairings. Element facings shall be constructed from expanded galvanised steel mesh with fibre glass tissue bonded to the inner face. Mineral wool infill shall be overpacked to minimise voids due to settlement. Attenuator ends shall be protectively wrapped, and all attenuators shall be delivered to site on pallets and individually labelled.

Ref.	Description	Type and Model Code	Dimensions (mm)			Insertion Loss (dB)								Vol (m³/s)	PL (Pa)	Qty	Features
			W	H	L	63	125	250	500	1k	2k	4k	8k				
ATT 15	AHU 1 FAI Atmosphere side	Rectangular SG02H/3C/L/S	1500	700	1500	2	5	14	19	11	9	7	7	6.52	32	1	Unit delivered in 2 sections, split in length. Horizontal elements.
ATT 18	AHU 1 EXH Atmosphere side	Rectangular SG01V/3C/L/S	1500	700	1500	5	7	15	31	27	17	11	8	6.03	42	1	
ATT 19	AHU 2 FAI Atmosphere side	Rectangular SG01H/3C/L/S	1400	700	1200	1	5	11	15	10	8	6	6	6.02	30	1	Horizontal elements.
ATT 22	AHU 2 EXH Atmosphere side	Rectangular SG01V/3C/L/S	1400	700	1200	4	5	12	25	22	14	10	7	5.50	38	1	

11 YORK STREET, MANCHESTER

PLANNING APPLICATION 126476/JO/2020
APPENDIX C
DISCHARGE OF PLANNING CONDITION 22

9th July 2021

Car park vehicle access

Shutter/traffic lights controlled by a traffic management system

- Access for authorised vehicles
 - o Traffic light is red
 - o Vehicle approaches from south on Marble St
 - o Vehicle holds in position shown
 - o Access control system long range RFID (Paxton) is activated by fob in vehicle
 - o Access control activates the security alarm to unset (if still set)
 - o Access control activates the traffic management system to lock all lights on red
 - o Traffic management system prevents any further activation of entry access control or basement vehicle beam detection.
 - o Traffic management activates shutter to rise once previous actions are complete
 - o Shutter is fully open- light turns green
 - o Vehicle accesses car park
 - o Shutter lowers when vehicle has cleared the internal safety beam just beyond the inside of the shutter and all lights return to red
 - o Traffic management reactivates entry access control and vehicle detection
- Access for unauthorised vehicles
 - o Traffic light is red
 - o Vehicle approaches from south on Marble St
 - o Vehicle holds in position shown
 - o Vehicle driver calls a predetermined telephone number linked to the building managers office.
 - o On receipt of call Building manager can view the vehicle on a CCTV camera set over the roller shutter.
 - o If vehicle is allowed access the Building manager will activate the shutter to open using a push button on the manager's office which is linked to the traffic management system
 - o The traffic management system to lock lights on red
 - o Traffic management system locks out any further activation of entry or exit access control
 - o Traffic management activates shutter to rise once previous actions are complete
 - o Shutter is fully open- light turns green
 - o Vehicle accesses car park
 - o Shutter lowers when vehicle has cleared the internal safety beam just beyond the inside of the shutter
 - o Traffic management reactivates entry and exit access control and returns all lights to red
- Egress for authorised vehicles
 - o Traffic light is red
 - o Vehicle approaches the exit ramp from either of two directions
 - o Vehicle holds in position at one of the two traffic lights which will be on red
 - o Traffic management vehicle detectors identify vehicle in hold position
 - o Traffic management system locks out any further activation of entry or exit access control
 - o Traffic management activates shutter to rise once previous actions are complete
 - o Shutter is fully open- light turns green
 - o Vehicle exits car park via ramp

11 YORK ST – CARPARK ACCESS SUMMARY

- o Shutter lowers when vehicle has cleared the external safety beam just beyond the outside of the shutter
- o Traffic management reactivates entry access control and exit detection and returns all lights to red

