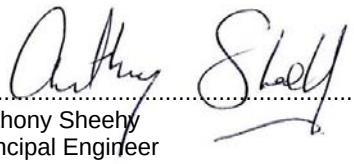
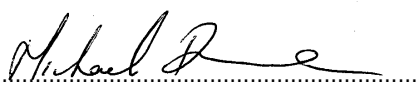
Kilkenny Abbey Quarters
Riverside Gardens

Outline Drainage Strategy

Prepared by: 
Anthony Sheehy
Principal Engineer

Checked by: 
Michael Dunne
Associate Director

Approved by: 
Cormac O'Brien
Director

Rev No	Comments	Checked by	Approved by	Date
1	Comment	MD	COB	14/10/2015
2	Final	MD	COB	29/10/2015
3	Final (incorporating comments from KCC)	MD	COB	13/11/2015
4	Final (incorporating additional comments from KCC)	MD	COB	19/11/2015

4th Floor, Adelphi Plaza, George's Street Upper, Dun Laoghaire, Co Dublin, Republic of Ireland
Telephone: +353 (0) 1 238 3100 Website: http://www.aecom.com

Job No: 60431708 Reference: RP02 Date Created: 12th October 2015

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Capabilities on project:
Civil Infrastructure

1 Introduction

1.1 Terms of Reference

AECOM has been appointed by John Mitchells & Associates to undertake an outline drainage strategy for the proposed development of the Kilkenny Abbey Quarter Riverside Gardens on behalf of Kilkenny County/ Borough Council. The proposed development will comprise the construction of a new urban linear park within the grounds of the former brewery and bottling plant (Smithwicks Brewery) and lands north of the brewery site encompassing the St. Francis Abbey, Evans Turret and a section of the Old City Walls.

The brief for the report is to provide an outline a drainage strategy to inform the masterplan for the linear park and to ensure a sustainable urban drainage system is accommodated for in the earliest designs, considering the use of attenuation systems to meet development needs in line with local environment requirements.

- The drainage strategy report will include the following:
- Review project masterplan and supporting information, including existing studies;
- Review of Office of Public Works (OPW) flood map data existing studies & historical flooding records.
- Assessment of other sources of flooding from artificial sources, including liaison with statutory undertaker and acquirements of sewer records.
- Outline proposals for surface water drainage and associated attenuation;
- Outline proposals for SuDS; Masterplanning constraints, levels etc;
- Drainage strategy report.

1.2 Site Location

The site is located in the heart of Kilkenny City. It is situated along the western banks of the River Nore, and the River Breagagh flows west to east through site.

The site forms part of the city centre and is predominately occupied by the former brewery and bottling plant (Smithwicks Brewery). Operations at the brewery ceased in 2013 and the site is now disused.

1.3 Site Description

The old brewery site comprises of a number of large facilities with associated lands, measuring approximately 10.9 acres in the heart of Kilkenny Borough/ County Council owns a further 3.8 acres in the immediate vicinity of the brewery site, bringing the total area covered by the Abbey Creative Quarter Masterplan to approximately 14.7 acres. The site itself, and the general vicinity, is urban in nature. The zoning for the site is ‘General Business’. The size of the linear park site is approximately 1.25 hectares extends for John’s Bridge to New Road. Part of the current site forms the boundary between the River Nore and the existing brewery site.

The site includes three National Monuments - St. Frances Abbey, Evans Turret and the City Wall, as well as several other protected structures.

A bridge is currently under construction over the River Nore at the development site, as part of the Kilkenny Central Access Scheme. This bridge is a five span structure supported at each end by abutments with paired concrete piers supporting the intermediate bridge spans.

The site is flat and low lying relative to lands located further inland from the River Nore and the River Breagagh. Typical levels at the site vary between 44.2 and 45.2 mOD. The lowest part of the site is in the vicinity of the ruins of St. Francis Abbey.

1.4 Existing Drainage / Flooding Infrastructure

The eastern boundary of the site is bounded by the River Nore. The River Breagagh flows from west to east through the site. The River Breagagh discharges to the River Nore within the site.

The brewery site to the west of the linear park site is completely covered by a concrete slab. Service records have indicated that all surface water from the brewery site is collected and passed through a petrol interceptor before being discharged to the River Nore and Breagagh. Areas outside of the brewery site are thought to drain directly to either the River Nore or the Breagagh River.

The Kilkenny Flood Relief Scheme was completed in 2005. It consisted of a combination of river widening and deepening, flood walls, embankments and associated drainage works. The scheme was designed to protect against a 100 year flood (1% AEP).

The location of flood defences in the area is shown in Figure 1.1. This has been prepared from information provided by the OPW. The defences vary in type along the site. To the north of the River Breagagh is a wall which acts as a flood defence. Along the Breagagh River are parapet walls which act as floodwalls. Along the brewery site is a stone revetment sloping down to the River Nore. South of the brewery site there is a grassed embankment set back from the river. From a preliminary visual inspection, the flood defences adjacent to the site appear to be in good condition. The defences are maintained by the OPW.

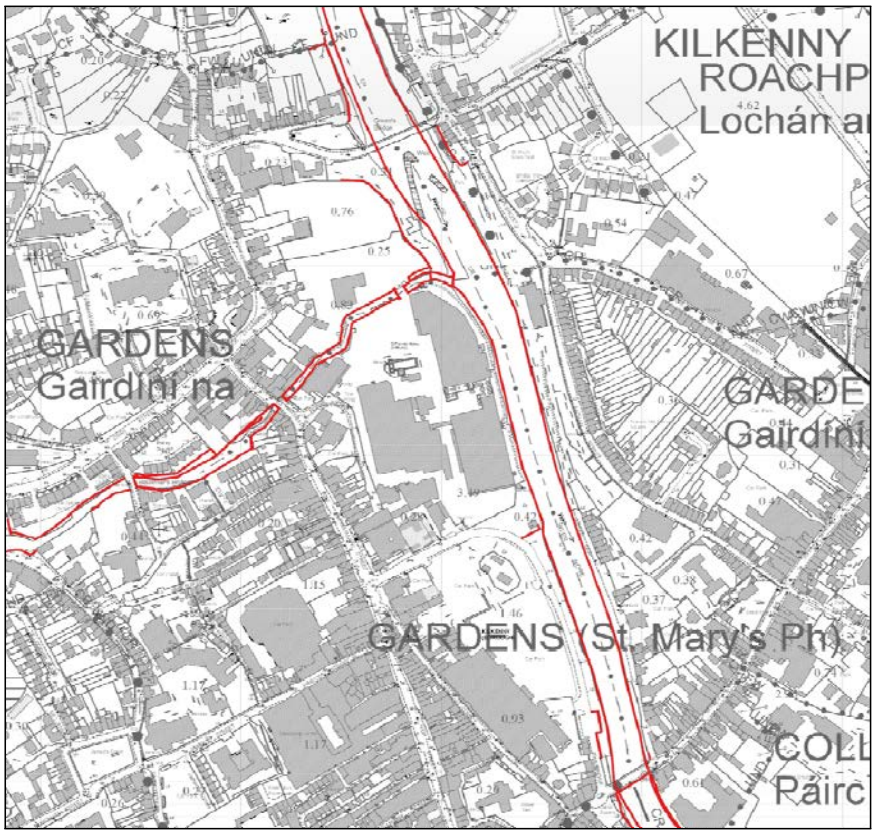


Figure 1.1 Flood defences in the area

There were more than 20 recorded flood events in Kilkenny City prior to the completion of the Flood Relief Scheme in 2005. Many of the past recorded floods affected the site which, according to an OPW engineering report on the Kilkenny City Flood Relief Scheme, was liable to flood on average every five years (OPW, 1999). Flooding at the site arose from both the River Nore and the River Breagagh.

Since the completion of the flood relief scheme, there have been three flooding events in Kilkenny City due to the Breagagh overtopping its banks (October 2006, November 2006 and August 2008). However, none of these events affected the development site.

1.5 Planning Policy Framework

Kilkenny City & Environs Development Plan (2014 – 2020) adopted on 22nd April 2014, states the City's policy (Section 8.2.5) on flood management is as follows;

To adopt a comprehensive risk-based planning approach to flood management to prevent or minimise future flood risk. In accordance with the Planning System and Flood Risk Management – Guidelines for Planning Authorities, the avoidance of development in areas where flood risk has been identified shall be the primary response.

Published in 2009 by the Office of Public Works (OPW) the Planning System and Flood Risk Management – Guidelines for Planning Authorities outlines three key principles that should be adopted by regional authorities, local authorities, developers and their agents when considering flood risk. These are:

- Avoid the risk, where possible,
- Substitute less vulnerable uses, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

Where flood risk may be an issue for any proposed development, a flood risk assessment shall be carried out that is appropriate to the scale and nature of the development and the risks arising. This shall be undertaken in accordance with the Flood Risk Assessment Guidelines. Proposals for mitigation and management of flood risk will only be considered where avoidance is not possible and where development can be clearly justified with the Guidelines' Justification Test.

Section 8.25 of City & Environs Development Plan, the Development Managements Standards are outlined as follows;

- Development must, so far as is reasonably practicable, incorporate the maximum provision to reduce the rate and quantity of runoff e.g.:- Hard surface areas (car parks, etc.), should be constructed in permeable or semi-permeable materials;
- On site storm water ponds to store and/or attenuate additional runoff from the development should be provided;
- Soak-aways or french drains should be provided to increase infiltration and minimise additional runoff. In the case of driveways, drainage measures shall be provided to a detail acceptable to the planning authority so as to avoid run-off from the site to the adjoining public road;
- For all other green-field developments in general the limitation of surface water run-off to pre-development levels will be required. Where a developer can clearly demonstrate that capacity exists to accommodate run-off levels in excess of green-field levels then the planning authority shall give consideration to such proposals on a case by case basis;
- In the case of brown-field development, while existing surface water drainage measures will be taken into account, some attenuation measures for surface water may be required at the discretion of the planning authority in the interests of balanced and sustainable development;
- In line with the above Kilkenny CityCouncil will consider all drainage proposals consistent with SuDS (Sustainable Urban Drainage Systems);
- For developments adjacent to watercourses of a significant conveyance capacity any structures (including hard landscaping) must be set back a minimum of 5-10m from the edge of the watercourse to allow access for channel clearing/maintenance. Any required setback may be increased to provide for habitat protection;
- All new development must be designed and constructed to meet the following minimum flood design standards:-
- Where streams open drains or other watercourses are being culverted - the minimum permissible culvert diameter is 900mm. (Access should be provided for maintenance as appropriate);
- To give adequate allowance for climate change in designing surface water proposals a multiplication factor of 1.2 shall be applied to all river return periods up to 100 years except in circumstances where the OPW have provided advice specifying the particular multiplication factor for return periods up to 100 years. In the case of rainfall a multiplication factor of 1.1 shall be applied to rainfall intensities to make allowance for climate change requirements;

- In the design of surface water systems, regard shall be had to the Greater Dublin Regional Code of Practice for Drainage Works148 and associated GDSDS technical documents.

1.6 Proposed Development

In 2012, the elected members of Kilkenny Borough and County Councils decided to purchase the 10.9 acre Smithwicks Brewery site from Diageo. To maximise this opportunity, the Councils concluded that the development of an Urban Framework Plan/ Masterplan setting the parameters for the urban regeneration of the former St. Francis Abbey Brewery site in was essential.

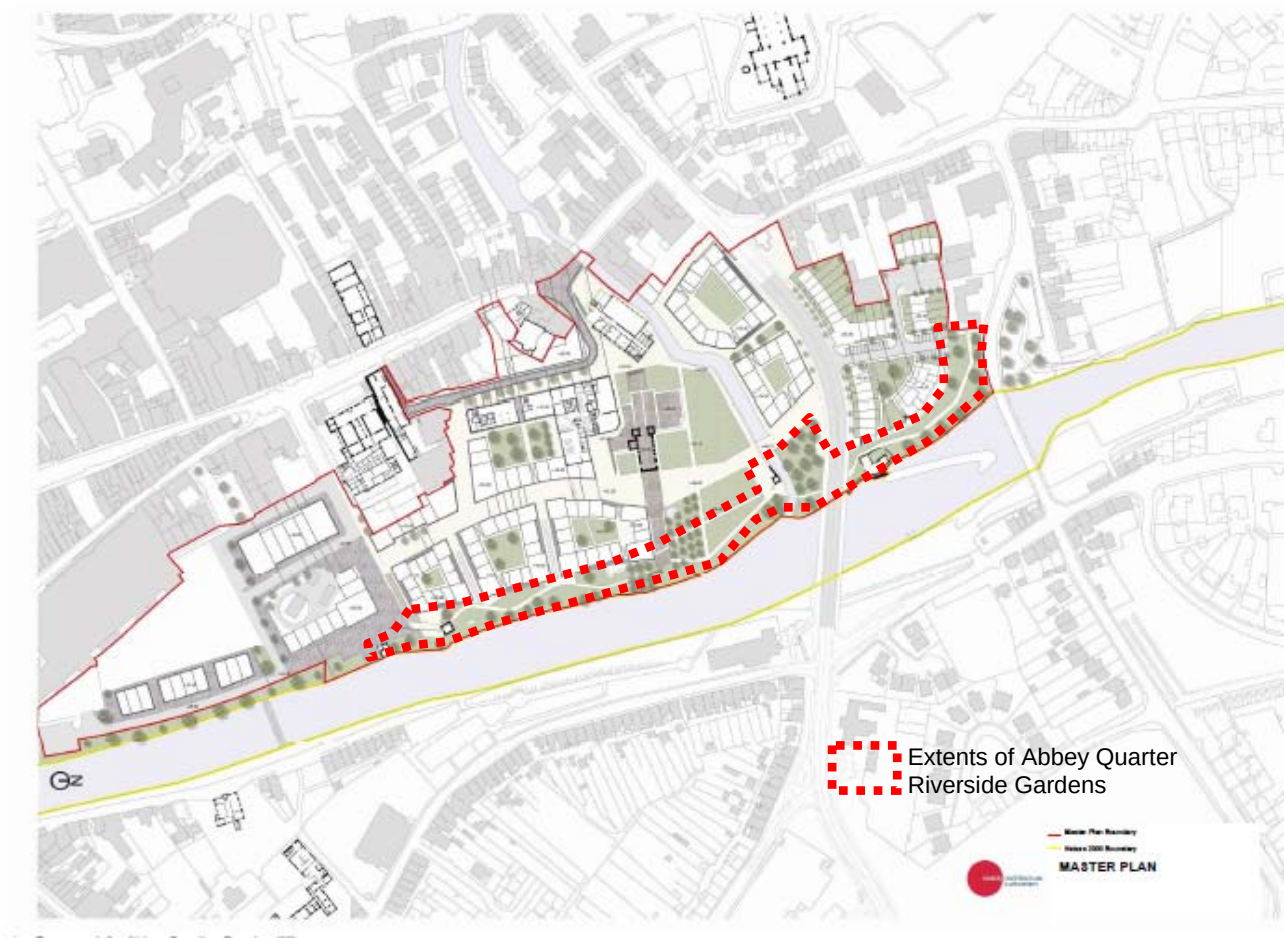


Fig 1.2 – Current Masterplan (2015) for the Abbey Creative Quarter

As well as directly determining the redevelopment of the site itself, the Masterplan would inform the policies and objectives of the Councils in respect to the ongoing development of Kilkenny City and its Environs.

The Urban Framework Plan defines the principles for the regeneration of the site in respect of planning policies and objectives as identified in the National Spatial Strategy, the Kilkenny City & Environs Development Plan and the Kilkenny City Centre Local Area Plan, The Plan sets out Conservation, Sustainability, Public Realm and Urban Design strategies for the site. These

strategies aim to ensure that a variety of uses are delivered within the proposed scheme and therefore would provide a vibrant and successful addition to the City which is both an attraction in its own right and an enhancement to the medieval core.

As part of the implementation of the initial stages of this Framework Plan, Kilkenny Borough and County Council will progress the linear park, known as Abbey Quarter Riverside Gardens. The linear park will link Johns Bridge Road to the New Road and beyond. The extents of the park are shown in Appendix A. The parks will incorporate the following elements;

- Hard Landscaping area including footways and public area
- Planting
- Restoration of the area around St, Francis Abbey and the City Walls
- Provision of public amenities such skate park and boat facilities
- Soft landscaping.

1.7 Vulnerability

The 'Planning System and Flood Risk Management Guidelines' classify different types of development in terms of their vulnerability class (Table 3.2 of the guidelines). Table 3.2 of the Guidelines identifies the type of development that would be appropriate to each flood zone and those that would need the Justification Test. This table has been reproduced as Figure 1.3.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Table 3.2: Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test.

Figure 1.3 Extract from Planning Guidelines- Vulnerability versus flood zones

The type of development proposed for the site is amenity open space. This type of land use would be considered water-compatible and would be considered appropriated in Flood Zone A (Area with a high probability of flooding).

1.8 Watercourses

A Flood Risk Assessment was completed for the brewery site including the Abbey Quarter Garden area in June 2015 (prepared by RPS). RPS prepared a detailed computer model for Kilkenny using the MIKE suite of software as part of the South Eastern Catchment-based Flood Risk Assessment and Management (CFRAM) Study. The model encompasses the mid and lower reaches of the River Nore, and includes the River Breagagh and other tributaries. The total contributing area at the downstream limit of the model is 1,744.5 km2, 4% of the total contributing area comes from the River Breagagh catchment. Predicted flood levels were extracted from the computer model at a number of points close to the linear park. These levels are shown in Table 1.1 and the node locations can be seen in Figure 1.4.

Node ID	Water level (m OD) 1% AEP	Water level (m OD) 0.1% AEP
A	45.08	45.86
B	44.83	45.54
C	44.55	45.37
D	44.30	45.10
E	44.15	44.91

Table 1.1 – Predicted Flood Levels (Table extracted from Abbey Creative Quarter, Flood Risk Assessment (2015) prepared by RPS).

As part of this assessment, RPS considered the presence of the new Nore Bridge Crossing currently in construction as part of the Central Access Project. RPS compared the flood flows and predicted levels from the bridge model to those used in the CFRAMS model. The 1% AEP predicted flood level from the bridge model is 44.8m OD, compared with 44.55m OD from the CFRAMS model. The report concluded the impact of the proposed bridge being so minimal, as demonstrated by this study, RPS considers the levels produced by the CFRAMS model to be applicable without the need to incorporate the bridge.

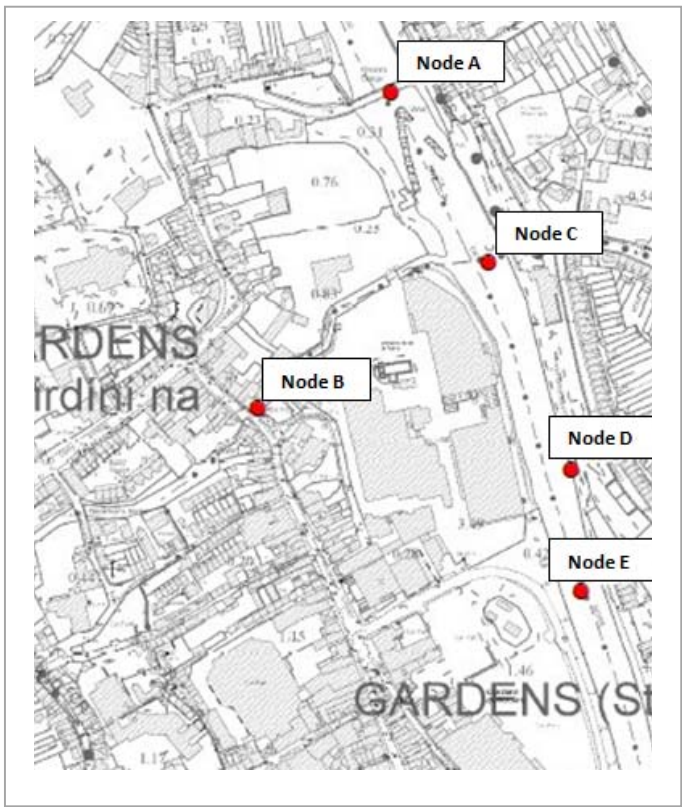


Fig 1.4 – Location of Nodes for Water Levels (Fig extracted from Abbey Creative Quarter, Flood Risk Assessment (2015) prepared by RPS

1.9 Groundwater Flood Risk

The site is located over the Karst Limestone aquifer consisting of the Ballyadams (BM) and Clogrennan (CL) formations (County Kilkenny Ground Water Protection Scheme, July 2002). Geological Survey Ireland has records indicating 4 no. wells/ springs within 100m of the site (See Fig 4 below). Although highly variable depending on season and local topography, County Kilkenny Ground Water Protection Scheme (2002) indicates that (See Fig 4.17 of the report) water levels within aquifer never exceeds a depth of approximately 6m below existing ground level. This suggests the risk of groundwater flooding is low.

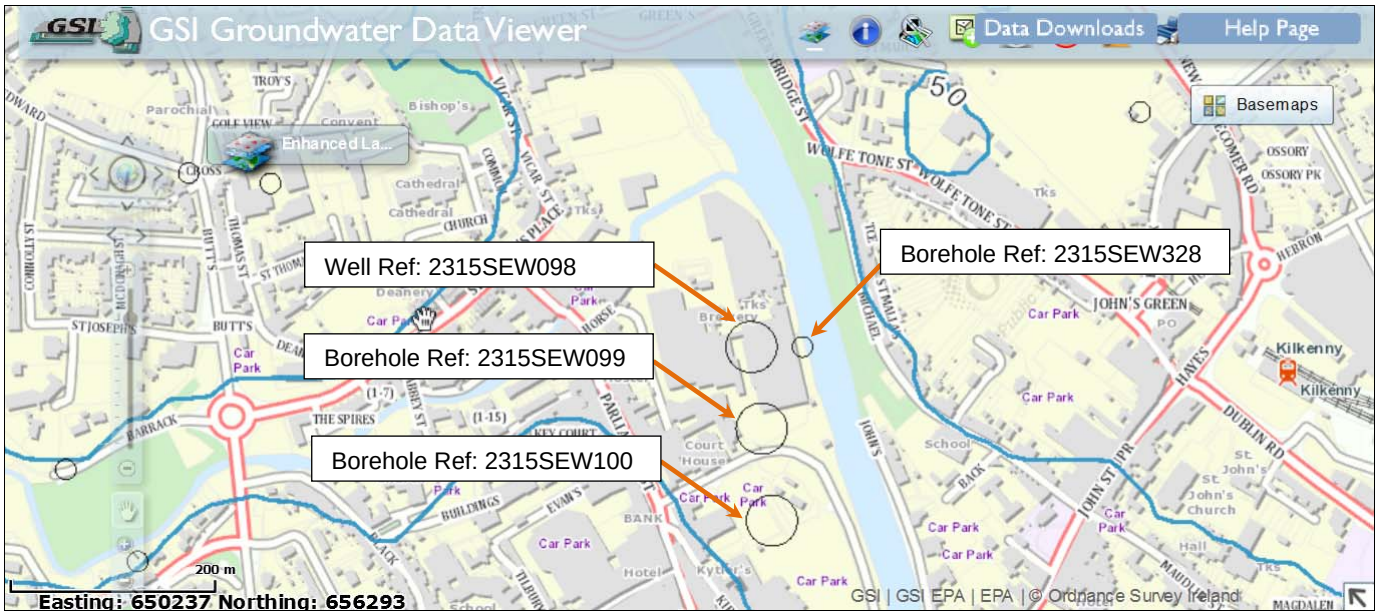


Fig 1.5 – GSI Groundwater Data

1.10 Flood Risk from Sewers and Drainage

Service records (See Appendix B) for the area indicate that there is a redundant surface water drainage system associated with the brewery site is within the extents of the linear park. This system has been replaced by 225mm dia PVC high level surface water collector pipe to collect rainwater from the existing rainwater downpipe, penetrating through the cladding above the solid water level of the adjacent building. The old system could be removed as part of the park works to eliminate the risk of flooding from this system.

When the development for the Abbey Creative Quarter commences it is assumed that the storm water generated by the site will be catered for within the site and no runoff will reach the linear park and require collection within the linear park drainage system.

1.11 Flood Risk from Reservoirs, Canals, Lakes and other Artificial Sources

There are no artificial sources located in the vicinity of the site.

2 Climate Change

In May 2015, the Office of Public Works (OPW) published the Climate Change Sectoral Adaption Plan – Flood Risk Management (2015-2019) for consultation. In the report, it was reiterated that The National Catchment Flood Risk Assessment and Management (CFRAM) Programme is central to the assessment of future flood risk and the planning of future Flood Risk Management (FRM) activity in Ireland, and was designed as the vehicle through which climate change adaptation policies would be implemented with respect to flood defence. It will hence be the cornerstone of climate change adaptation in the sector. This Programme includes the assessment of risk for two potential future scenarios; the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). These scenarios include an increase in peak flood flows of 20% and 30% for the MRFS and HEFS respectively.

2.1 Surface Water Drainage

2.1.1 Development Surface Water Discharge Rates

The first point of discharge of surface water from the development is to be River Nore/ River Breagagh.

For the purposes of the drainage strategy, the linear park will be broken into the following 4 no. catchments;

Catchment 1 – Southern Entrance

Catchment 2 – Urban Park

Catchment 3 – Amenity Area

Catchment 4 – Rural Park

The extents of the catchments are shown in Appendix A. The proposed impermeable areas of the campus have been assessed as based on the areas within the site extent shown on drawing number LKIL042 102 (see Appendix C) prepared by Mitchells & Associates. The approximate areas are shown in Table 2.1.

Catchment Ref	Area of Catchment (m2)	Area of Impermeable Areas (m2)
1	1260	1260
2	5980	2830
3	1300	320
4	4260	0

Table 2.1 – Catchment Size and Impermeable Areas

2.1.2 Surface Water Drainage Strategy

Catchment 1 is located at the southern entrance to the linear park in the area of the Tea Houses at Bateman Quay. The current design is shown (See Appendix C), the area to be surfaced with feature paving. The overall surface has been assumed as 95% impermeable. The area is currently to an existing storm water drainage system (See Appendix E) that discharges directly into the River Nore. As there is no increase in the area draining to the existing storm water drainage system, it proposed to retain the existing drainage strategy in this area. It is however proposed to include additional gullies in the paved areas to ensure improve surface water drainage flows and to catch grit/ debris, preventing it from reaching the river. A schematic layout of the proposed surface water layout and discharge are shown in Appendix D.

Catchment 2 is located between Bateman Quay and the River Breagagh. This section of the Riverside Gardens will incorporate the main urban garden element of the scheme with sections of planting and hard paving. The overall area of the catchment has an area of approximately 0.6 ha with an area of 0.28 ha of impermeable surfacing. As mentioned in the previous section, the area is subject to regular flooding hence flood attenuation will provide limited benefit at this location. To maximise the opening times of the park, it is proposed to positively drain the paved and unpaved area with filter/ french drains. These drains can be located on either side of the footways to ensure ponding issues are minimised, thus making the footways usable to visitors for the maximum amount of time during inclement weather. The filter/ French drains will also provide subsurface drainage to the landscaped area preventing them from becoming water logged during times of heavy rains and high water in the adjacent River Nore. These filter drains would be connected to a series of carrier drains that will infiltrate to the River Nore reflecting the current natural drainage processes on site. This risk of contamination to the discharge waters is low as the park will not serve vehicular assess (apart from maintenance vehicles). Should such a source of pollution arise, the filter drains should prevent the contaminant from reaching the River Nore.

Additional linear drainage channels will be provided in key points along the park where the footways widen into larger plazas. These will drain directly into the filter drains. A schematic layout of the proposed surface water layout and discharge are shown in Appendix D.

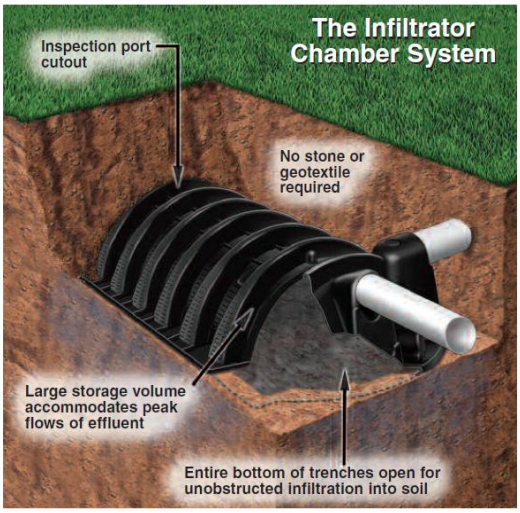


Fig 3.1 – Possible Filter Drain Options (taken from www.microstrain.ie)

Catchment 3 is located between the River Breagagh and the Central Access Bridge. The current proposal for this area is an amenity area including a skate park. The use of this area would be sensitive to ponding. To limit this potential issue, it is proposed to use a combination of swales and filter drains to ensure the area around the skate park would remain unaffected by storm water runoff. A schematic layout of the proposed surface water layout and discharge are shown in Appendix D.

Catchment 4 comprises of the rural section of the park. This section is located between the Central Access Bridge and R693 New Road. Access through this section will be served by a compacted gravel walkway. It is proposed to retain much of the current natural landscaping within this section. Because of this limited level of development within the site, greenfield runoff volume will remain relatively unchanged. No intensive drainage works will be required besides localised profiling of the

compacted gravel walkway to ensure it is above the flood levels indicated in Table 1.1. This will assist in the retention of the natural quality of this section of the linear park.

2.1.3 Surface Water Attenuation Volume

The volume of attenuation required is to be determined in the detail design of the development but is based on the Table 2.1. The volume of attenuation required is dependent on the impermeable area that will discharge to the surface water sewerage system/ River Nore, the ability to infiltrate and the surface water discharge rate.

For the purpose of assessment of volumes required it is assumed that no infiltration to ground is possible and that the surface water discharge rate is to be limited to 5 l/s for each catchment. An assessment of the attenuation required has been carried out using HR Wallingford software (see Appendix F) and are summarised in Table 2.2 below.

Capabilities on project:
Civil Infrastructure

Catchment Ref	Impermeable Area	Allowable Discharge - Qbar Greenfield Rates (l/s)	Estimate Volume of Attenuation Required (m^3)
1	1260	5	57
2	2830	5	130
3	320	5	10
4	0	5	N/A

Table 2.2 – Surface Water Attenuation Volume

3 Sustainable Drainage Systems (SuDS)

3.1 Sustainable Drainage Systems (SuDS)

To ensure there are no hard structures along the river bank of the River and Breagagh, it is proposed that all surface water runoff will be dissipated generally through filtration. However on the south side of park (the area around the Tea Rooms) will be discharged into the existing surface water piped network.

Drainage arrangements will incorporate sustainable drainage systems (SuDS) in order to:

- Reduce volumes of water and peak flows discharging; and
- Improve water quality, compared with conventional surface water sewers, by removing pollutants from diffuse pollutant sources.

The most commonly found elements of SuDS fall into two categories: surface; and sub-surface elements.

3.2 Effective Application of SuDS

A hierarchical approach is recommended for selection of SuDS techniques for disposal of surface runoff.

The SuDS Manual (CIRIA 697) advises that ‘wherever possible, storm water should be managed in small landscape features located within small sub-catchments rather than being conveyed to and managed in a large single storage system at the bottom of drainage area.

Generally ground conditions play a vital role in determining the suitability of SuDS. At this particular location however, the vicinity of the River Nore will play a larger part. Therefore the most suitable forms of SuDS for this site would be:

- Infiltration
- Porous paving
- Filtration
- Attenuation – Cellular Storage
- Attenuation – Ponds and basins
- Bio Retention Areas

3.3 Site Specific SuDS Proposals

At this outline stage it is proposed that filter drains/ swales will be utilised to provide temporary attenuation volume and water quality improvements. However, site specific SuDS proposals are to be further assessed during the detail design to ensure that adequate attenuation volume and water quality improvement is provided. While the proposed surface water attenuation features will provide the required attenuation and water quality improvements additional SuDS features which may be implemented where appropriate could comprise some of those shown as follows.

Attenuation Ponds and Basins: Areas that may be utilised for surface runoff storage. The provision of wetland areas depends upon space being available. Generally, these solutions require a large footprint. These solutions are unsuitable at this location due to the proximity of the River Nore/ Breagagh and the width restrictions presented by the width of the linear park.

Infiltration: The use of infiltration to dispose of surface water is dependent on the infiltration rate of the soil across the site. This is to be determined by site investigation and will reduce the required volume of attenuation. This solution is ideal as it will allow the surface drainage of the hard landscaping and sub-surface drainage of the soft landscaping in the park.

Pervious surfaces: Surfaces that allow inflow of rainwater into the underlying construction or soil, such as porous surfacing (e.g. gravel) or permeable hard surfacing (e.g. permeable block paving, porous tarmac and porous concrete).

The source control (informal storage) can be created within the sub-base of these surfaces given careful selection of the stone fill or use of plastic box systems.

Bio-retention areas: Vegetated areas designed to collect and retain runoff, and permit settlement of suspended solids & biological removal of pollutants before discharge via a piped system or infiltration to the ground. Again this solution requires a large footprint which would not be suitable for this location as this would result in the loss of usable public areas.

Swales/SuDS channel: Shallow linear features to convey surface water while providing water quality improvements through filtration from the grass vegetation could be introduced around the development to provide water quality improvements and water conveyance. This solution can be used in Catchment 4 to mimic the natural landscaping used to this section of the park.

3.4 Future maintenance of SuDS

The future ownership and management of all elements of the SuDS system will need to be addressed at an early stage as the maintenance responsibility must be given to durable and accountable bodies which have the resources to meet the long term needs of the system. Kilkenny Borough/ County Councils will adopt the filter drains and swales in addition to the piped sewerage network, and therefore it is proposed that the sewerage network is designed in accordance with their requirements and adopted by them.

4 Conclusion

4.1 Flood Risks

The Kilkenny Abbey Quarter Riverside Gardens will be subject to flooding during storm event from both the River Nore and Breagagh. The runoff from the Riverside Gardens will not have a significant impact on the frequency or severity of the flooding of either river.

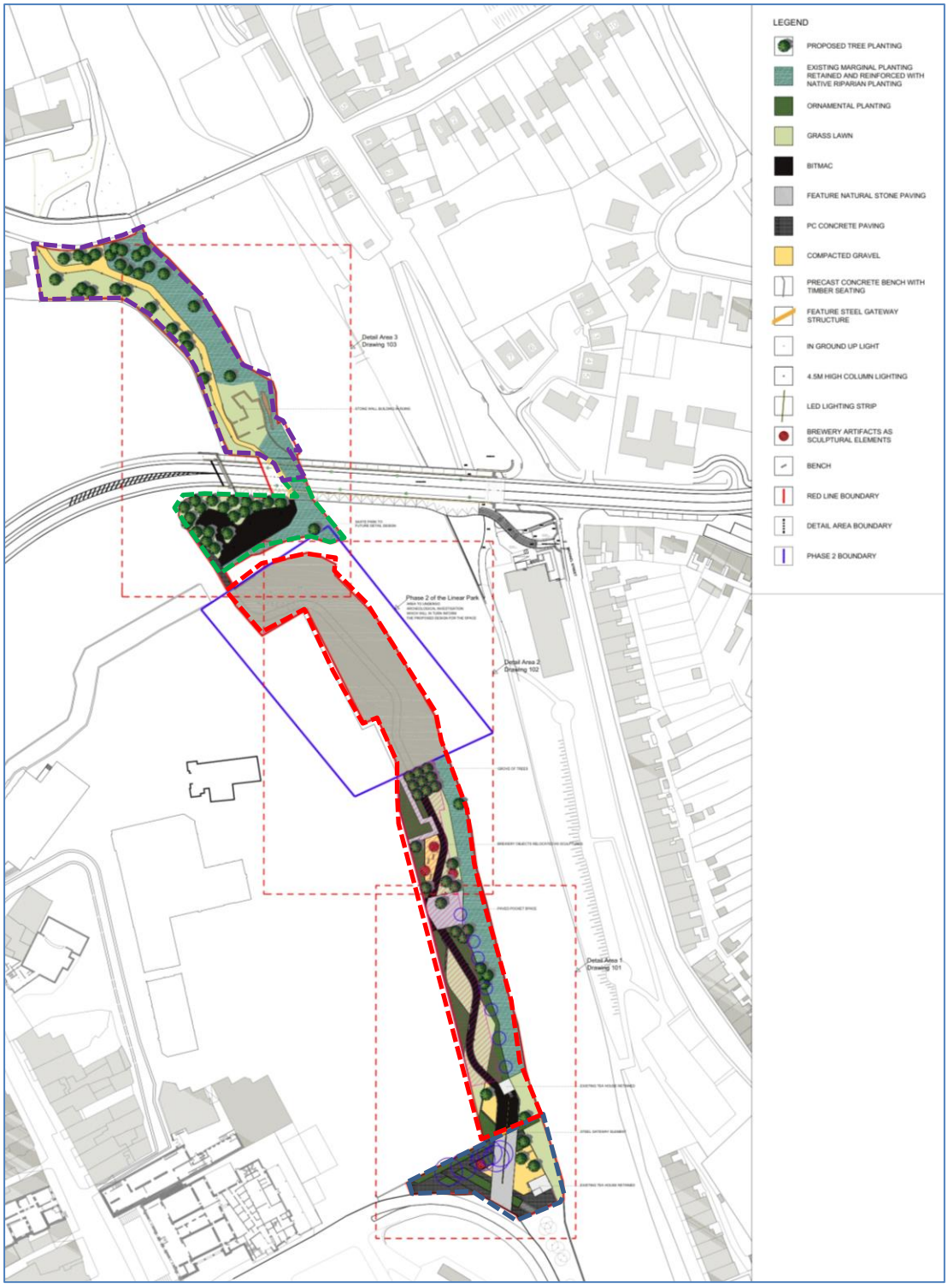
To maximise public access to the park and usage of the park facilities all footpaths and amenity areas should be located about the project 100 year storm event river levels outlined in the Flood Risk Assessment for the Abbey Creative Quarter prepared by RPS.

Filter drains and swales will provide both surface and subsurface drainage for hard and soft landscaping areas during non-peak rain events to minimise inconveniences to the public such as ponding to footways and water saturation off grassed area.

4.2 Water quantity improvements will be provided for the development through the use of SuDS Strategy

Surface Water will discharge to ground through filtration and directly into the River Nore and Breagagh in accordance with Kilkenny County Council Policy requirements.

APPENDIX A – Catchment Locations



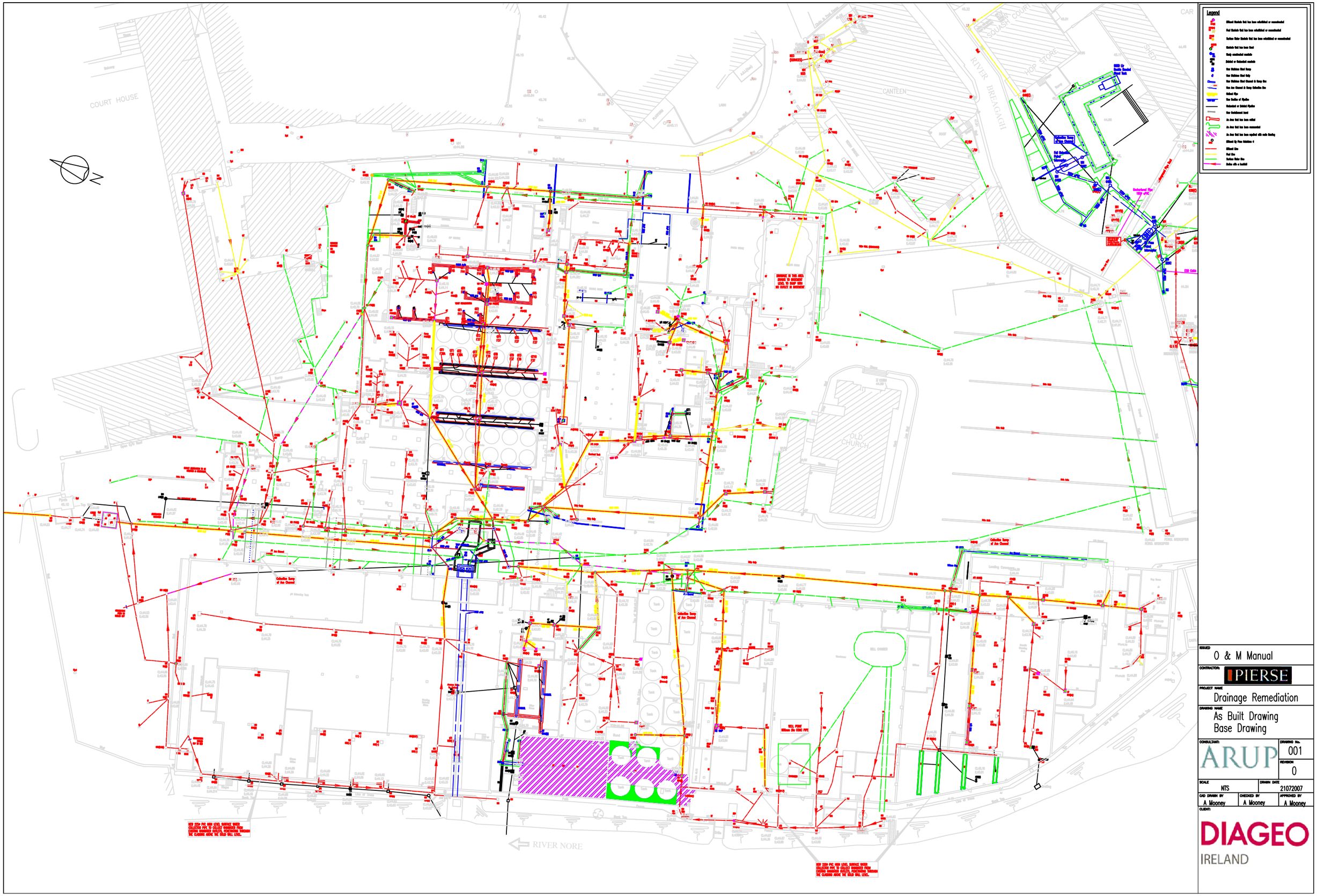
CATCHMENT 1 – Hard landscaping drainage to gulley and pipe system discharging to existing street drainage system on St.Johns Bridge (Road)

CATCHMENT 2 – Urban Linear Park – Footway and grassed areas drained by fin drains. Runoff dissipated through infiltration

CATCHMENT 3 – Amenity Area/ Skate Park – Area drained with combination of linear drains and fin drains

CATCHMENT 4– Rural Park – Area to be drained naturally (filtration) through swales adjacent to footway. Minimal drainage infrastructure.

APPENDIX B – Additional Site Services



ISSUED
O & M Manual

CONTRACTOR:
PIERSE

PROJECT NAME
Drainage Remediation

DRAWING NAME
As Built Drawing
Base Drawing

CONSULTANT:
ARUP

DRAWING No.
001

REVISION
0

SCALE	DRAWN DATE
NTS	21072007

CAD DRAWN BY	CHECKED BY	APPROVED BY
A Mooney	A Mooney	A Mooney

CLIENT:
DIAGEO
IRELAND

APPENDIX C – Proposed Park Surfacing

LEGEND

- PROPOSED TREE PLANTING
- EXISTING MARGINAL PLANTING RETAINED AND REINFORCED WITH NATIVE RIPARIAN PLANTING
- ORNAMENTAL PLANTING
- GRASS LAWN
- BITMAC
- FEATURE NATURAL STONE PAVING
- PC CONCRETE PAVING
- COMPACTED GRAVEL
- PRECAST CONCRETE BENCH WITH TIMBER SEATING
- FEATURE STEEL GATEWAY STRUCTURE
- IN GROUND UP LIGHT
- 4.5M HIGH COLUMN LIGHTING
- LED LIGHTING STRIP
- BREWERY ARTIFACTS AS SCULPTURAL ELEMENTS
- BENCH
- RED LINE BOUNDARY
- DETAIL AREA BOUNDARY
- PHASE 2 BOUNDARY

Detail Area 3
Drawing 103

STONE WALL BUILDING IN RUINS

SKATE PARK TO
FUTURE DETAIL DESIGN

Phase 2 of the Linear Park
AREA TO UNDERGO
ARCHEOLOGICAL INVESTIGATION
WHICH WILL IN TURN INFORM
THE PROPOSED DESIGN FOR THE SPACE

Detail Area 2
Drawing 102

MICHAEL STREET

GROVE OF TREES

BREWERY OBJECTS RELOCATED AS SCULPTURES

PAVED POCKET SPACE

Detail Area 1
Drawing 101

EXISTING TEA HOUSE RETAINED

STEEL GATEWAY ELEMENT

EXISTING TEA HOUSE RETAINED

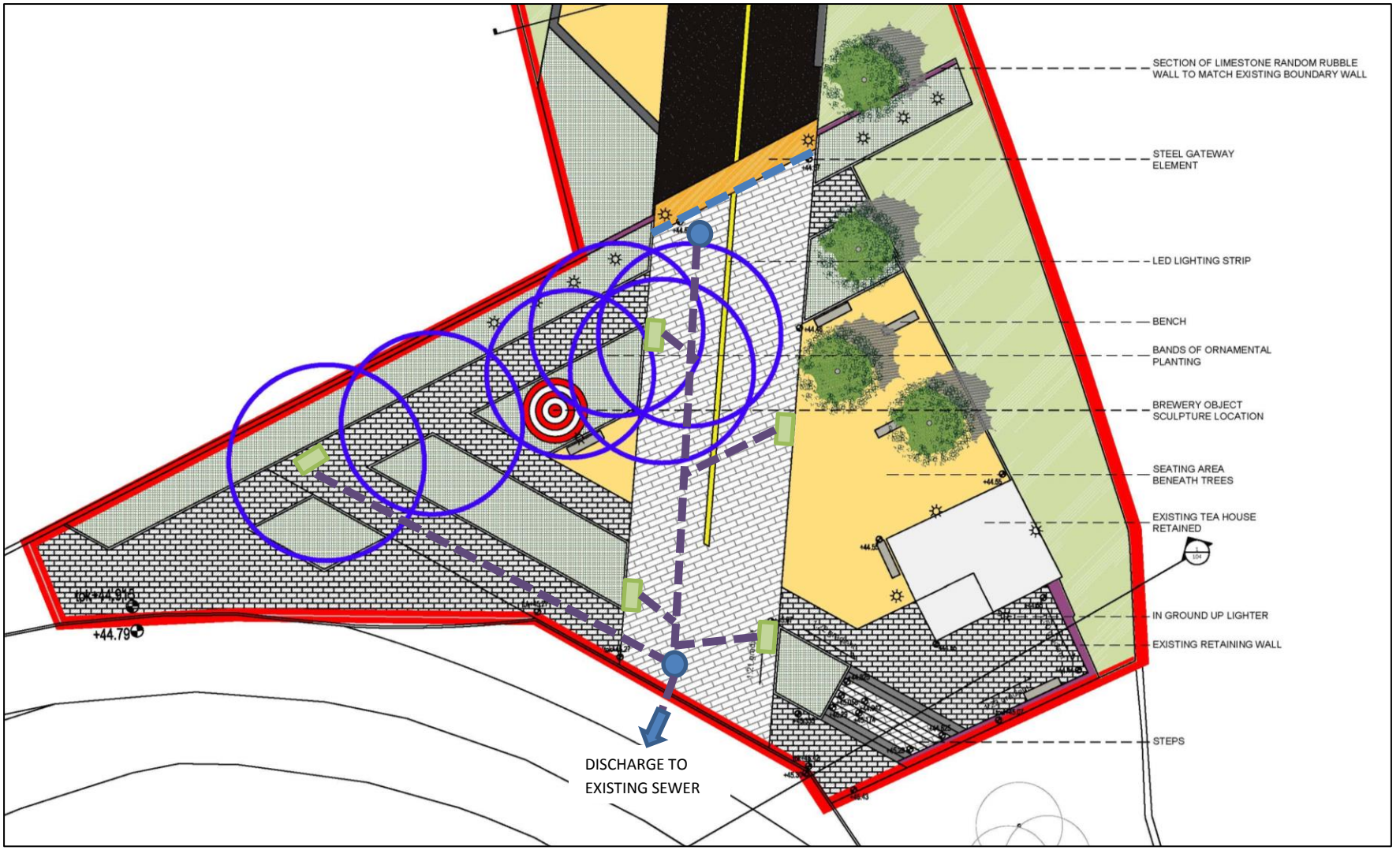
NORTH

scale1:500
@A0

MITCHELL + ASSOCIATES
Landscape Architecture Urban Design
Unit 5 Woodpark The Rise Glasnevin Dublin 9 Ireland
t: + 353 1 454 5066
info@mitchellassoc.net

CLIENT KILKENNY COUNTY COUNCIL	**PROJECT:** ABBEY GARDENS LINEAR PARK		**JOB NO.** LKIL042
	DRAWING: LANDSCAPE MASTERPLAN	**DATE:** 2015.10.15 / **SCALE:** 1:500@A0	**DRAWING NO.** 100
NOTES Do Not Scale. Use Figured Dimensions Only. Not for Construction Purposes unless Specifically Marked.	**DRAWN BY:** CAROLINE MASSEY	**CHK'D:** MC	**REVISION.** A
	STATUS: PART VIII DRAFT		

APPENDIX D – Proposed Surface Water Drainage Layout

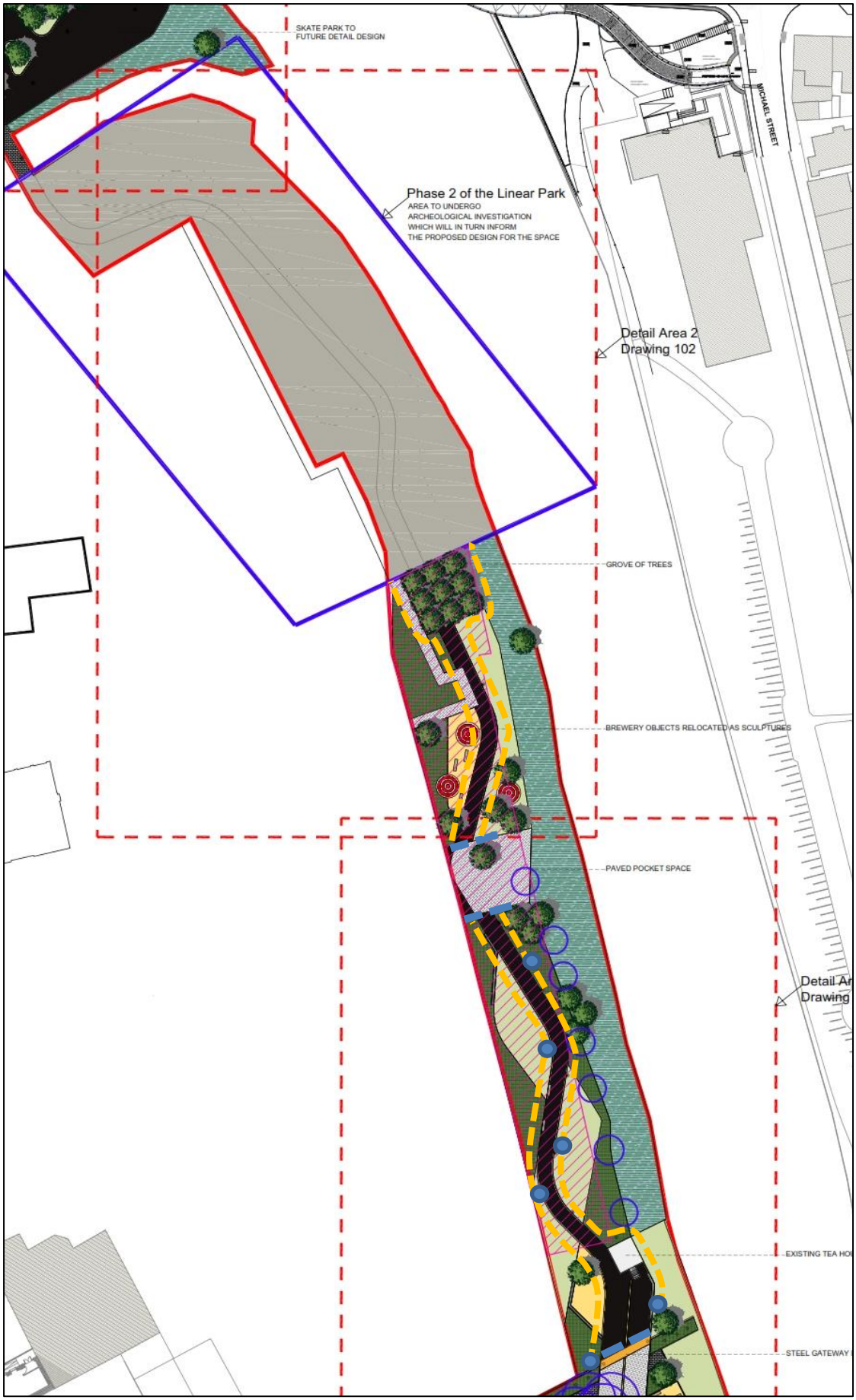


Surface Water Gully

900mm dia Manhole

Linear Drain at Entrance to Gardens

Connector/ Carrier Pipe (150mm dia Connector/ 225mm dia Carrier)

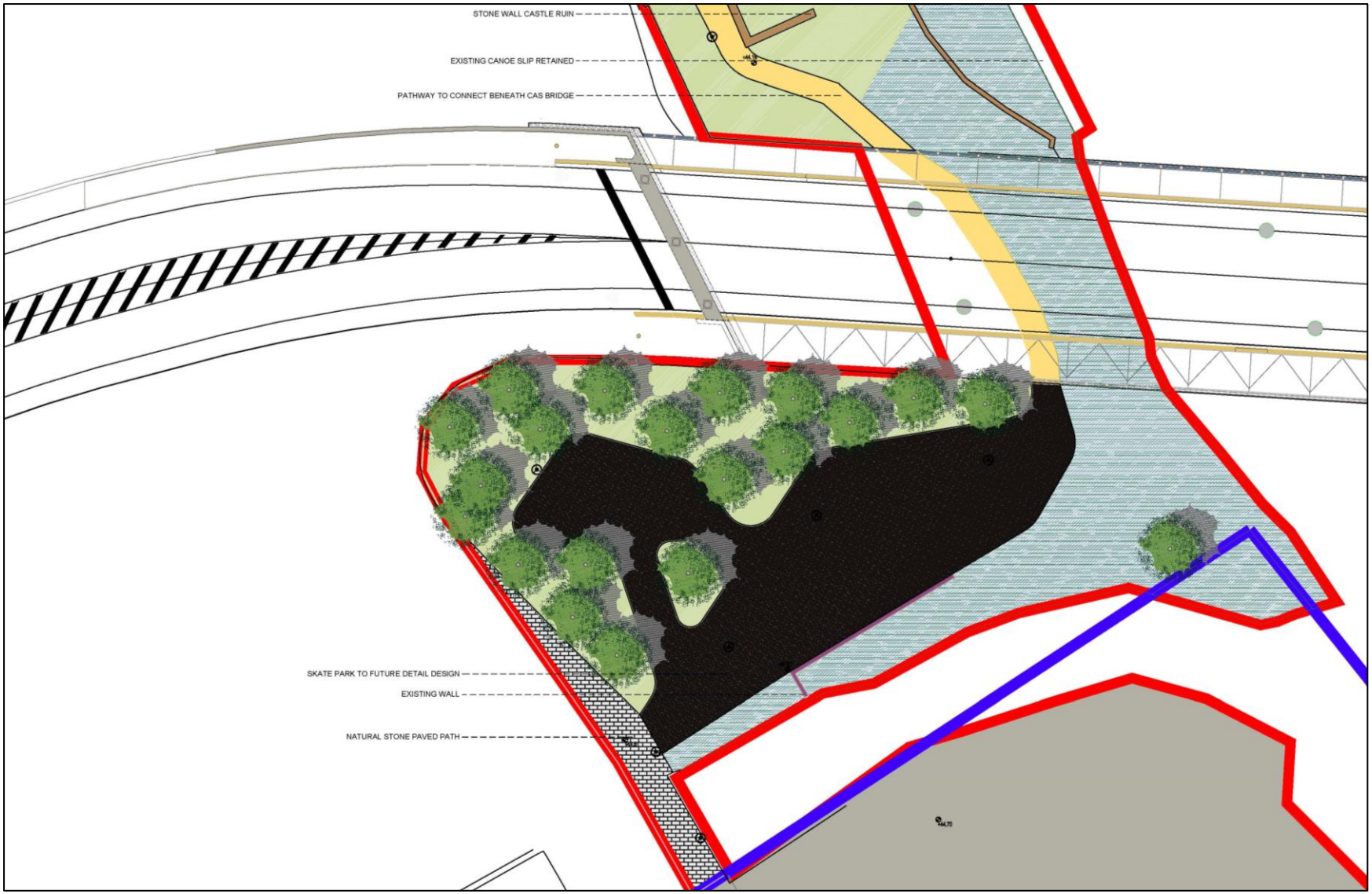


Surface Water Gully

900mm dia Manhole

Linear Drain at Entrance to Gardens

Filter/ Fin Drain


STONE WALL CASTLE RUIN
EXISTING CANOE SLIP RETAINED
PATHWAY TO CONNECT BENEATH CAS BRIDGE
SKATE PARK TO FUTURE DETAIL DESIGN
EXISTING WALL
NATURAL STONE PAVED PATH

Surface Water Gully

900mm dia Manhole

Swale

Filter/ Fin Drain

APPENDIX E – Existing Stormwater Drainage Layout on Johns Bridge

DUNNES STORES

Court House
Car Park
Bank
Car Park
Car Park
School
Car Park
Library
Car Park
Bank
Bank
PO
Town Hall
Car Park
John's Bridge

RIVER NORE

225 ϕ S
375 ϕ BREWERY
600 ϕ
600 ϕ RISING MAIN (S)
600 ϕ RISING MAIN (F)
1800 ϕ F/S
S1V
P1S
600 ϕ S
900 ϕ S
900 ϕ S
F/V
450 ϕ S
225 ϕ F
450 ϕ S
225 ϕ F
450 ϕ F
450 ϕ S
225 ϕ F
P/V
450 ϕ S
225 ϕ F
450 ϕ RISING MAIN (S)
450 ϕ RISING MAIN (P)

APPENDIX F – Attenuation Volume Calculation

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name:	Kilkenny Abbey Quarter Gardens
Site location:	Catchment 1

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude:	52.65499° N
Longitude:	7.25208° W
Reference:	gc6gdcx1w394 / 0.13
Date:	12 Oct 2015

Site characteristics

Total site area	0.13	ha
Significant public open space	0	ha
Area positively drained	0.13	ha
Impermeable area	0.12	ha
Percentage of drained area that is impermeable	98.41	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.13	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage

Qbar estimation method	Specify QBar manually
SPR estimation method	Calculate from SOIL type
SOIL type	1
HOST class	N/A
SPR	0.10

Hydrological characteristics

	Default	Edited	
SAAR	1008	1008	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	1	1	
Hydrological region	13	13	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.4	1.4	
Growth curve factor: 30 year	1.65	1.65	
Growth curve factor: 100 year	1.95	1.95	

Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	0.03	5.00	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	8.25	l/s
1 in 100 years	5.00	9.75	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	4.96	4.96	m^3
Attenuation storage	106.55	0.00	m^3
Long term storage	52.83	52.83	m^3
Treatment storage	14.88	14.88	m^3
Total storage	164.34	57.79	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name:	Kilkenny Abbey Quarter Gardens
Site location:	Catchment 1

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude:	52.65499° N
Longitude:	7.25208° W
Reference:	gc6gdcx1w394 / 0.13
Date:	12 Oct 2015

Site characteristics

Total site area	0.13	ha
Significant public open space	0	ha
Area positively drained	0.13	ha
Impermeable area	0.12	ha
Percentage of drained area that is impermeable	98.41	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.13	ha

Methodology

Greenfield runoff method	FEH
Volume control approach	Use Long Term Storage

Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Calculate from dominant HOST	
HOST class	1	
BFI / BFIHOST	0.98	
SPR / SPRHOST	0.10	
Qmed	0.094	l/s
Qbar / Qmed Conversion Factor	1.053	

Hydrological characteristics

	Default	Edited	
SAAR	1008	1008	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	1	1	
Hydrological region	13	13	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.4	1.4	
Growth curve factor: 30 year	1.65	1.65	
Growth curve factor: 100 year	1.95	1.95	

Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	0.10	0.10	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	4.96	4.96	m^3
Attenuation storage	106.55	106.55	m^3
Long term storage	52.83	52.83	m^3
Treatment storage	14.88	14.88	m^3
Total storage	164.34	164.34	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name:	Kilkenny Abbey Quarter Gardens
Site location:	Catchment 2

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude:	52.65478° N
Longitude:	7.25189° W
Reference:	gc6gdcx26dqv / 0.3
Date:	12 Oct 2015

Site characteristics

Total site area	0.6	ha
Significant public open space	0.3	ha
Area positively drained	0.3	ha
Impermeable area	0.28	ha
Percentage of drained area that is impermeable	93.33	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.3	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage

Qbar estimation method	Specify QBar manually
SPR estimation method	Calculate from SOIL type
SOIL type	1
HOST class	N/A
SPR	0.10

Hydrological characteristics

	Default	Edited	
SAAR	1008	1008	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	1	1	
Hydrological region	13	13	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.4	1.4	
Growth curve factor: 30 year	1.65	1.65	
Growth curve factor: 100 year	1.95	1.95	

Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	0.08	5.00	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	8.25	l/s
1 in 100 years	5.00	9.75	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	11.20	11.20	m^3
Attenuation storage	237.27	0.00	m^3
Long term storage	118.34	118.34	m^3
Treatment storage	33.60	33.60	m^3
Total storage	366.81	129.54	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name: Kilkenny Abbey Quarter Gardens

Site location: Catchment 2

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude: 52.65478° N

Longitude: 7.25189° W

Reference: gc6gdcx26dqv / 0.3

Date: 12 Oct 2015

Site characteristics

Total site area	0.6	ha
Significant public open space	0.3	ha
Area positively drained	0.3	ha
Impermeable area	0.28	ha
Percentage of drained area that is impermeable	93.33	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.3	ha

Methodology

Greenfield runoff method	FEH
Volume control approach	Use Long Term Storage

Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Calculate from dominant HOST	
HOST class	N/A	
BFI / BFIHOST	0.00	
SPR / SPRHOST	0.0	
Qmed	N/A	l/s
Qbar / Qmed Conversion Factor	N/A	

Hydrological characteristics

	Default	Edited	
SAAR	1008	1008	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	1	1	
Hydrological region	13	13	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.4	1.4	
Growth curve factor: 30 year	1.65	1.65	
Growth curve factor: 100 year	1.95	1.95	

Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	---	---	l/s
1 in 1 year	---	---	l/s
1 in 30 years	---	---	l/s
1 in 100 years	---	---	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	---	---	m^3
Attenuation storage	---	---	m^3
Long term storage	---	---	m^3
Treatment storage	---	---	m^3
Total storage	---	---	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name:	Kilkenny Abbey Quarter Gardens
Site location:	Catchment 3

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude:	52.65499° N
Longitude:	7.25208° W
Reference:	gc6gdcx1w394 / 0.03
Date:	12 Oct 2015

Site characteristics

Total site area	0.13	ha
Significant public open space	0.1	ha
Area positively drained	0.03	ha
Impermeable area	0.02	ha
Percentage of drained area that is impermeable	84.62	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.03	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage

Qbar estimation method	Specify QBar manually
SPR estimation method	Calculate from SOIL type
SOIL type	1
HOST class	N/A
SPR	0.10

Hydrological characteristics

	Default	Edited	
SAAR	1008	1008	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	1	1	
Hydrological region	13	13	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.4	1.4	
Growth curve factor: 30 year	1.65	1.65	
Growth curve factor: 100 year	1.95	1.95	

Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	0.01	5.00	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	8.25	l/s
1 in 100 years	5.00	9.75	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	0.88	0.88	m^3
Attenuation storage	18.12	0.00	m^3
Long term storage	9.15	9.15	m^3
Treatment storage	2.64	2.64	m^3
Total storage	28.15	10.03	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name: Kilkenny Abbey Quarter Gardens

Site location: Catchment 3

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude: 52.65499° N

Longitude: 7.25208° W

Reference: gc6gdcx1w394 / 0.03

Date: 12 Oct 2015

Site characteristics

Total site area	0.13	ha
Significant public open space	0.1	ha
Area positively drained	0.03	ha
Impermeable area	0.02	ha
Percentage of drained area that is impermeable	84.62	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.03	ha

Methodology

Greenfield runoff method	FEH
Volume control approach	Use Long Term Storage

Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Calculate from dominant HOST	
HOST class	1	
BFI / BFIHOST	0.98	
SPR / SPRHOST	0.10	
Qmed	0.019	l/s
Qbar / Qmed Conversion Factor	1.053	

Hydrological characteristics

	Default	Edited	
SAAR	1008	1008	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	1	1	
Hydrological region	13	13	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.4	1.4	
Growth curve factor: 30 year	1.65	1.65	
Growth curve factor: 100 year	1.95	1.95	

Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	0.02	0.02	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	0.88	0.88	m^3
Attenuation storage	18.12	18.12	m^3
Long term storage	9.15	9.15	m^3
Treatment storage	2.64	2.64	m^3
Total storage	28.15	28.15	m^3