ARDENT CONSULTING ENGINEERS

GENERATOR GROUP LLP
MANSFIELD BOWLING CLUB, CROFTDOWN ROAD

REDEVELOPMENT DEVELOPMENT:
CROFTDOWN ROAD, KENTISH TOWN NW5 1EP

FLOOD RISK AND DRAINAGE STATEMENT

REPORT REF NO J671-02A
PROJECT NO. J671
JANUARY 2015

RESIDENTIAL DEVELOPMENT:
CROFTDOWN ROAD, KENTISH TOWN, NW5 1EP

FLOOD RISK AND DRAINAGE STATEMENT

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REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	Final	KC	JT	BC	10.12.14
A	Final	KC	SJH	BC	15.01.14

1.0 INTRODUCTION

1.1. Ardent Consulting Engineers has been commissioned by the Generator Group to undertake a Flood Risk and Drainage Statement, for the proposed residential redevelopment at Mansfield Bowling Club. This statement has been undertaken to support the Planning Application for the redevelopment of the existing Mansfield Bowling Club. This document has been written with specific reference to the requirements of the National Planning Policy Framework (NPPF).

1.2. The development site is located on Croftdown Road, Kentish Town London, NW5 1EP and is located at Ordnance Survey grid reference 528748mE, 186249mN. The location of the site is shown below in **Figure 1-1**;

Figure 1-1: Site Location Plan

1.3. The site is currently the premises of Mansfield Bowling Club and comprises an outdoor bowling green, two hard surfaced tennis courts, clubhouse building and associated parking. The overall site area is approximately 0.85ha, with approximately 0.68ha or 80% of area currently classified as impermeable.

Development Proposals

1.4. Proposal includes the creation of a new publicly accessible open space; enhanced tennis facilities including the reconfiguration and extension of the courts to provide an additional court and increased playing area to accord with LTA requirements; the provision of a new ancillary pavilion (Class D2) to replace existing ancillary buildings; a new community garden; and the demolition and replacement of the existing bowling club building with a new part three storey, part 2 storey building providing 21 residential dwellings (Class C3) with associated access, parking and landscaping.

1.5. Access to the Site remains unchanged for the proposed development and will be via Croftdown Road from the southwest through the existing car parking area.

1.6. The proposals will result in an impermeable area of approximately 0.62 ha, which is approximately 600m^2 less than the existing impermeable surfaces.

1.7. An extract of the Masterplan is shown in **Figure 1-2** overleaf. A Copy of the full Masterplan undertaken by PRP Architects is provided in **Appendix A**.

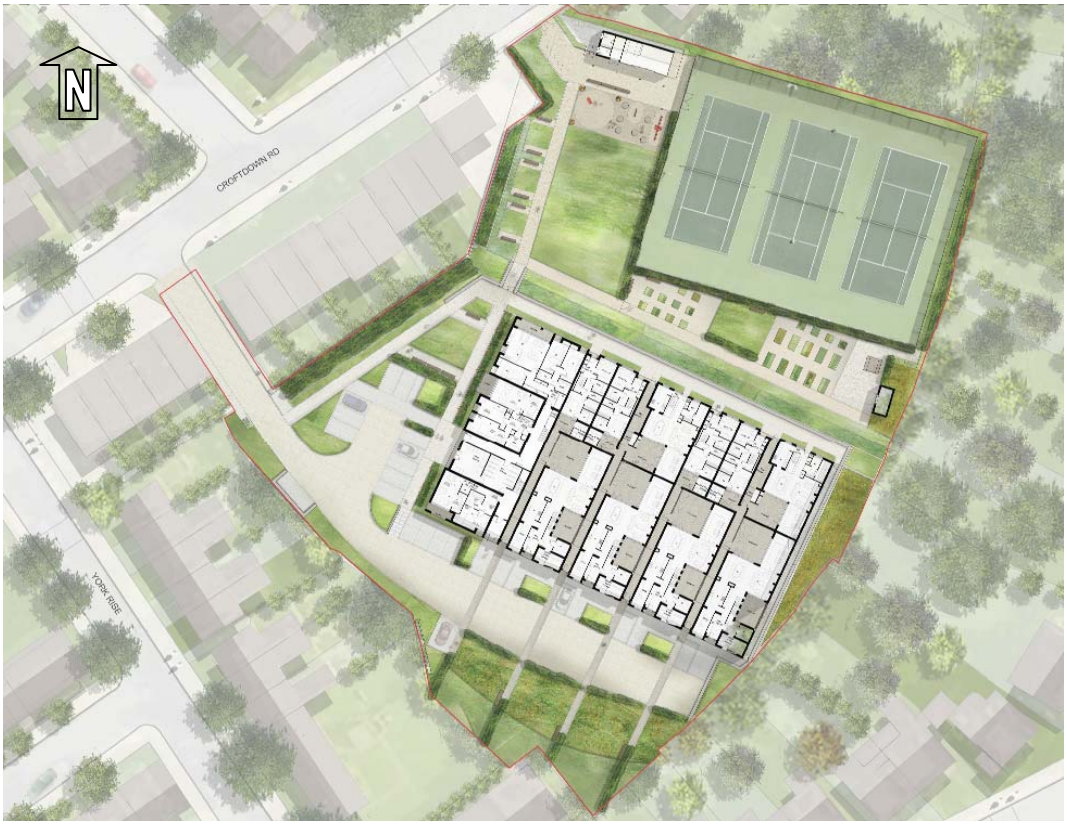


Figure 1-2: Development Proposals

2.0 SITE DESCRIPTION

2.1 The site is bounded by residential properties to the north, south, east and west with a section of the site along the north eastern boundary bordered by Croftdown Road. The existing site access is via Croftdown Road towards the south west of the site.

Topography

2.2 The topographical survey undertaken at the site show that the ground falls from north to south, from a level of approximately 53.30m AOD along the northern boundary, to a level of 51.52m AOD on the southern boundary, this is a gradient of 1 in 56.

Geology

2.3 British Geological Survey records indicate that the site is located within the London Clay Formation. The London Clay is of low permeability and has been classified as 'Unproductive Strata' by the Environment Agency.

2.4 The site is not located within a Source Protection Zone.

Existing Sewer Network

2.5 Thames Water's sewer records indicate public sewers running within the site boundary and to the east, west and south of the site. The Thames Water sewer records are provided within **Figure 2-1** overleaf.

2.6 A combined 1143 x 787mm brickwork trunk sewer runs through the site, entering via the site's eastern boundary. The combined sewer passes below the existing clubhouse building, running in a north-westerly direction towards the existing bowling green where it turns through 90 degrees before running parallel with the north western boundary and exiting the site in the southwest.

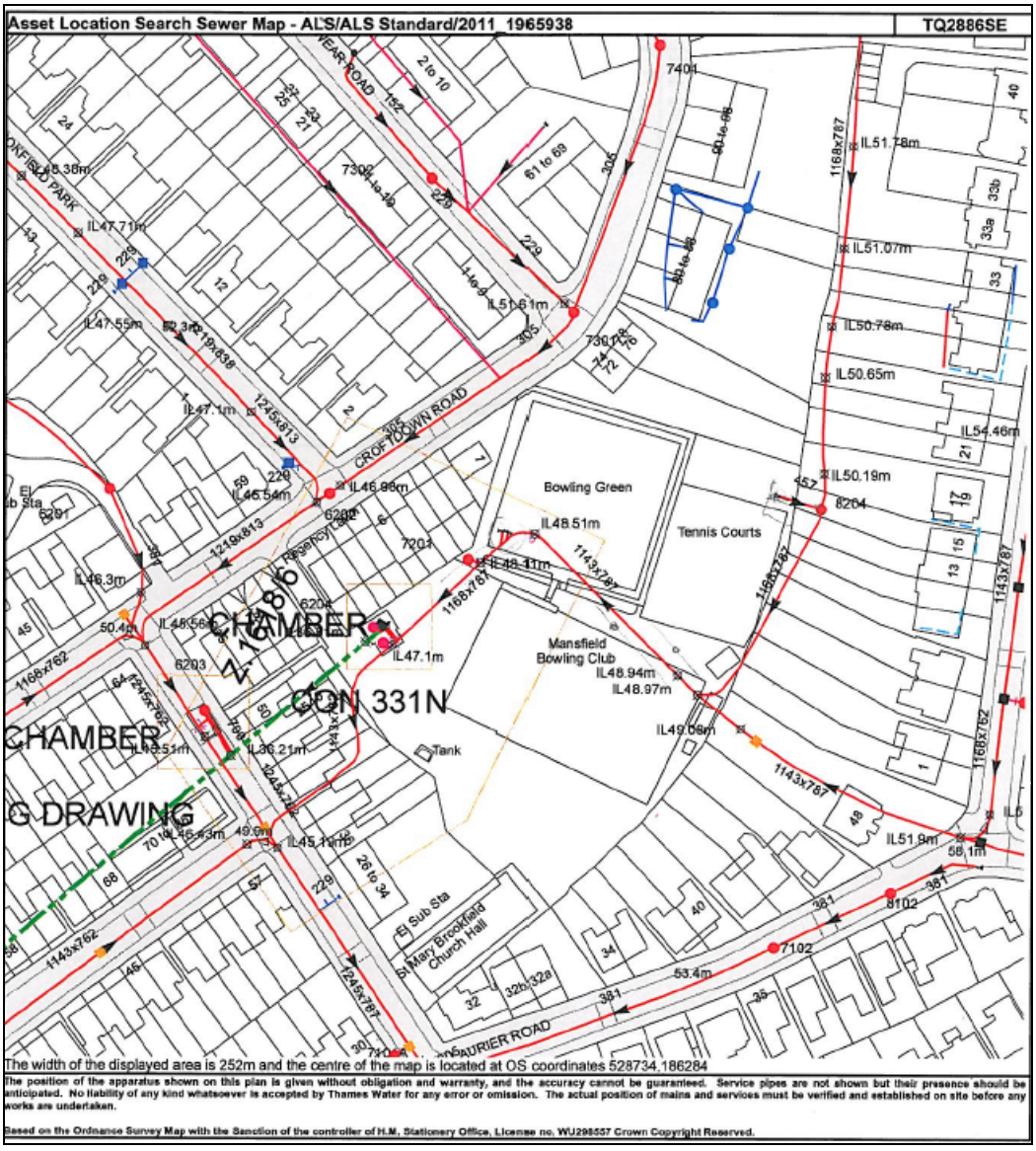


Figure 2-1: Thames Water Asset Plan

2.7 A 3D Gyroscopic alignment survey of a section of the combined 1168 x 787mm sewer was carried out between manholes 6204 to 7201 and beyond, by Infotec Surveys in Oct 2012 which determined the exact alignment and depth of the sewer and established the location at which the sewer passes from under the clubhouse building. The sewer survey is provided with **Appendix C** of this report.

2.8 A minimum easement width of 3.0m either side of the existing brickwork trunk sewer is required by Thames Water.

2.9 Thames Water sewer records indicate a storm relief sewer located within the north western corner of the site. The 1168 x 787mm trunk sewer connects to the storm relief sewer via an adjacent chamber. The relief sewer runs in a south westerly direction exiting the site through the south western boundary. It should be noted that the relief sewer and chamber is not located within the area of the proposed residential development.

2.10 A combined Thames Water 1168 x 787mm brickwork sewer is located to the east of the eastern site boundary, situated within the gardens of the bounding properties. This sewer enters the site via the south eastern boundary, connecting into the 1143 x 787mm sewer immediately to the east of the clubhouse building.

2.11 Additional Thames Water combined sewers are located within Croftdown Road (a 305mm diameter pipe increasing to a brickwork 1219 x 813mm diameter) to the west and a brickwork 1245 x 787mm diameter sewer located in York Rise, to the south west of the site.

Thames Water Build Over Agreement

2.12 As the trunk sewer currently runs through the Site, Thames Water dictates that any works within 3m of a Thames Water's assets will require a build over/ close to a public sewer agreement.

2.13 In the first instance, Thames Water would need to confirm that diversion of the sewers is not feasible before a build over/close to agreement is being considered. Due to the size of the trunk sewer at 1168x787mm, it is not considered practical to undertake a sewer diversion.

2.14 As the trunk sewer is over 375mm in size, it is classified as Build over Class 3 application.

2.15 As part of the investigation, a Closed Circuit Television (CCTV) will be carried out to trace the sewer and the minimum distance established between the sewer and any pilings.

2.16 Application and discussion will need to be undertaken with Thames Water before work can commence within 3m of the existing public sewers.

3.0 SOURCES OF FLOODING

3.1 The NPPF requires flood risk from the following sources to be assessed, each of which are assessed separately below:

- Fluvial sources (river flooding);
- Tidal sources (flooding from the sea);
- Groundwater sources;
- Pluvial sources (flooding resulting from overland flows);
- Artificial sources, canals, reservoirs etc; and,
- It also requires the risk from increases in surface water discharge to be assessed (surface water management).

Fluvial and Tidal Flooding

3.1. According to the Environment Agency's indicative flood mapping, the site is located within a Flood Risk Zone 1 area. The site is considered to be at a low probability of flooding from tidal and fluvial sources.

3.2. As the site is less than 1ha in size and is situated within a Flood Risk Zone 1 Area, in accordance with the National Planning Policy Framework (NPPF) no requirement for fluvial and tidal flood risk analysis is considered necessary. This is confirmed from EA's published standing advice, which is applicable to the site. Refer to **Appendix B** for the Environment Agency's standing advice.

Pluvial Flooding

3.3. The site generally falls from north to south and east to west. The EA online Surface Water Flood Map is shown in **Figure 3-1**.

Figure 3-1: EA Online Surface Water Flood Map

3.4. The EA online map shows that the site has a low risk of flooding from surface water and the strip of land between the Mansfield Bowling Club and the Tennis Courts/Bowling Green has a medium risk of surface water flooding.

3.5. The Surface Water Management Plan (SWMP) for London Borough of Camden indicates that the Site is located within the critical drainage areas (CDA Ref: Group3_001 – LFRZ3034 – Parliament Hill).

3.6. Streets that experienced flooding in the vicinity occurred in 1975 and 2002 in York Rise and Woodsome Road to the west of the Site. Swain's Lane, approximately 200m to the north of Croftdown Road also experienced flooding in 2002.

3.7. Surface water runoff is proved to be a concern in the area, especially the steep topography with high ground to the north and lower flatter ground to the south causes relatively fast flows down the York Rise, located to the west of the Site, towards the railway line.

3.8. The map of surface water runoff in Camden North within The Camden Flood Risk Management Strategy does not show that the site would be affected by neither potential overland flows nor the

risk of ponding with 1.33% chance of occurring in any one year (1 in 75 year return period).

3.9. According to the existing ground levels across the site and the surrounding areas, there is a potential risk of overland flows entering the site via Croftdown Road. However, an assessment of the topographic survey indicates that any surface water flowing along Croftdown Road is more likely to bypass the site as a result of the steeper gradients along the road.

3.10. Furthermore, the existing finished floor levels for the building are currently set at approximately 51.53m AOD, which is some 0.72m above the ground levels at the entrance to the site. Therefore, the risks of surface water flooding the buildings within the site, is considered to be very low.

3.11. In addition to the above, it is assessed that the residual risk of surface water flooding would be mitigated by the implementation of the proposed surface water drainage strategy. Refer to **Section 4** of this report, for more details on the drainage strategy.

3.12. Other overland flow routes will be intercepted by Chester Road to the north and Dartmouth Park Avenue and Laurier Road to the East. The land to the south and west of the site, is shown on the topographic survey to fall away from the site.

Artificial Sources

3.13. The site is located to the west of Dartmouth Park Reservoir and there is a low residual risk of flooding in the event of a breach of the reservoir. This is confirmed in the Environment Agency's risk of reservoir flood map (available on their website).

3.14. Therefore, the risk to the site from reservoir flooding is considered to be negligible.

3.15. There are no other artificial features in close vicinity of the Site with the nearest ponds in Hampstead Heath more than 500m away. The risk of flooding at the Site from artificial sources is therefore considered to be low.

Groundwater

3.16. As discussed previously, the underlying Geology of the site is formed of London Clay Formation. The presence of clay will create a barrier and prevent groundwater rising to the surface, therefore reducing the risk of groundwater flooding.

3.17. London Borough of Camden online website confirms that groundwater flooding is not a major risk in the borough although there have been some incidents of properties, particularly basements, being affected by it.

4.0 SURFACE WATER DRAINAGE STRATEGY

Pre and Post-Development Run-off

4.1 A review of the existing Thames Water sewer records and the topographical survey of the site, indicate that there are existing connections from the site to the existing combined water sewer.

4.2 A connection located in the vicinity of the tennis courts indicate that area drains into the combined sewer at manhole MH8204. An additional 150mm diameter connection to the combined sewer is located near to the Bowling Green and connects into manhole MH7201.

4.3 Approximately 0.68ha of the existing site discharges surface water into the Thames Water combined sewer via the existing sewer network.

4.4 In order to assess the current discharge from the site, the Modified Rational Method has been used to predict the current surface water discharge rate from the Site.

*Q = C*2.78*i*A*

Where:

Q = Peak Discharge (l/s)
i = Rainfall Intensity (mm/hr)- (50mm/hr–1yr 5 min storm TRRL Report 595)
A = 0.46 ha

Thus, Q = 2.78 x 50 x 0.68 = 96 l/s

4.5 Therefore based on the Wallingford Procedure Modified Rational Method, a 1 in 1 year, 5 minute storms will generate a peak discharge of 96 l/s from the Site. This calculation was replicated for the 30 and 100 year events (with rainfall intensities of approximately 113mm/hr and 143mm/hr respectively - Ref. TRRL Report 595) which generated peak discharges of 213 l/s and 272 l/s respectively. Copies of the calculations are located in **Appendix D**.

4.6 Surface water currently discharges offsite via the two existing outfalls which eventually end up in the same combined sewer that flows away from the Site in south-westerly direction.

4.7 In accordance with the guidance set out within the London Plan, the London Borough of Camden (LBC) planning guidance expects, as a minimum, a 50% reduction in the peak surface water run-off generated from the developed site compared to the pre-development condition.

4.8 The total peak surface water discharge from the development site will be restricted to 48 l/s for all storm events. Thames Water has confirmed (**Appendix E**) that they are able to accept 50% of the existing surface water flows into their sewers.

4.9 The current site proposals indicate a total impermeable area of 0.62ha discharging to the surface water sewer network, a net decrease of 600m^2 or 0.06ha compared with the pre-development condition.

Proposed Surface Water Drainage Strategy

4.10 All roof areas and adoptable carriageway will drain to the existing combined sewer network. Private paved areas, including private parking areas, will drain directly to surrounding landscaped areas.

4.11 The surface water carrier drain will be sized to convey flows up to the 1 in 30 year rainfall event with a 30% allowance for the impact of climate change.

4.12 Flows generated from the 1 in 100 year rainfall event + 30% for climate change will be contained within the landscaped/garden area located to the south of the site, ensuring that any flooding will be accommodated in areas of low risk to both buildings and people and that safe means of access and egress are not impacted.

4.13 **Table 4-1** below, shows the surface water discharge rate before and after the proposed development and the maximum storage requirement.

Table 4-1: Pre and Post Surface Water discharged off the site

Return Period	Pre-Development	Controlled Post-Development	% Betterment	1 in 100 year plus CC Storage Required	
				Min	Max
1 Year	95 l/s	48 l/s	50%	4.5	32
30 Year	214 l/s	48 l/s	78%	64	119
100 Year	270 l/s	48 l/s	82%	101	171
100 yr + CC	-	48 l/s	-	150	246

4.14 After consideration of the CIRIA C697 approach, the most viable SuDS options for this Site are permeable paving, conveyance swales, sedum greenroofs and underground storage.

4.15 The proposed permeable paving will provide attenuation and treatment to the surface water runoff collected from the road areas via the gravel medium below the paving. The attenuated water will be discharged slowly into the new manholes through a new surface water drainage network before connecting into the existing the trunk sewer for discharge.

4.16 Other SuDS features will also provide temporary storage volume onsite. Sedum greenroofs can be provided on the roof of the block of flats, which would reduce runoff from the roof by a minimum of 20% in extreme rainfall events. Conveyance swale will provide storage for overland flow during extreme storm events. Overland flow from the north would be intercepted by the bowling green and the tennis courts. Any excess overland flow from the Site that could not be drained to the sewers during extreme events would be

intercepted by the open space and swale to the south to ensure surface water runoff from the Site will have minimal effect to the surrounding area.

4.17 Additional storage is also provided in oversized pipes and underground storage under the permeable paving where required. The drainage strategy plan is illustrated in **Appendix F** of this report.

4.18 A throttle control (hydro-brake, vortex control, orifice plate) will be installed at the last manholes to limit the total positive surface water discharge from the site to 50% of the pre development flow before surface water is discharged into the combined sewer via existing Manhole MH7201 and MH8204.

4.19 As there is no net increase in impermeable area discharging off the site, the strategy conforms to the Sur 1 requirements stipulated within the Code for Sustainable Homes.

4.20 Thames Water has confirmed capacity in the existing sewer network for foul and surface water (**Appendix E**), and that access arrangements will need to be discussed with the Trunk Sewers department. This would be addressed and connection can be made following a S106/107 agreement.

5.0 FOUL WATER DRAINAGE STRATEGY

5.1 The proposed foul water flows for 21 residential units and the new ancillary pavilion combine to approximately 1.2 l/s, this is an increase of 0.2 l/s from the existing flow rate. The reduced surface water flow will offset the increase in the proposed foul flow and result in an overall decrease in the combined flow into Thames Water's sewers.

5.2 Thames Water has confirmed capacity in the existing sewer network for foul and surface water, a connection can be made following a S106/107 agreement.

5.3 A connection to the combined sewer which passes through the site was confirmed by Thames Water in a previous drainage strategy (Ardent Report Ref: J670-06), which stipulated that any connection to the brickwork sewer should be a minimum of 300mm from the invert of the existing sewer to the invert of the connecting pipe.

5.4 Private (house) drainage will be subject to the current requirements of Part H of the Building Regulations and a formal consent to connect from Thames Water will be required.

5.5 Under the Private Sewer Transfer Regulations 2011, all new sewers which connect to the Public Sewer network will be required to be adopted by the local Water and Sewer Authority. Subsequently, any sewer carrying flow from more than one property should be located in publicly accessible areas.

6.0 CONCLUSION

6.1 This report has been prepared for the Generator Group LLP by Ardent Consulting Engineers to support the planning application for the proposed redevelopment at Mansfield Bowling Club, Kentish Town.

6.2 As the site is less than 1 hectare in area and located within Flood Risk Zone 1, the Environment Agency has confirmed that the site does not require a formal site-specific Flood Risk Assessment. The Environment Agency's Flood Risk Standing Advice is applicable for the site.

6.3 The proposed development seeks to provide a new publicly accessible open space, enhanced tennis facilities including the reconfiguration and extension of the courts, to provide an additional court and increased playing area in accord with LTA requirements; the provision of a new ancillary pavilion (Class D2), to replace existing ancillary buildings; a new community garden; and the demolition and replacement of the existing bowling club building with a new part three storey, part 2 storey building providing 21 residential dwellings (Class C3) with associated access, parking and landscaping areas.

6.4 The Site generally has a low risk of flooding from fluvial, groundwater and artificial sources. However, there is a risk of surface water flooding at the Site.

6.5 According to the existing ground levels across the site and the surrounding areas, there is a potential risk of overland flows entering the site via Croftdown Road. However, an assessment of the topographic survey indicates that any surface water flowing along Croftdown Road is more likely to bypass the site as a result of the steeper gradients along the road.

6.6 Furthermore, the existing finished floor levels for the building are currently set at approximately 51.53m AOD, which is some 0.72m

above the ground levels at the entrance to the site. Therefore, the risks of surface water flooding the buildings within the site, is considered to be very low.

6.7 In addition to the above, the proposed surface water drainage strategy and the associated SuDS systems will provide sufficient surface water attenuation at source, therefore reducing the surface water on site.

6.8 Other overland flow routes will be intercepted by Chester Road to the north and Dartmouth Park Avenue and Laurier Road to the East. The land to the south and west of the site, is shown on the topographic survey to fall away from the site.

6.9 The proposed drainage strategy has been developed to connect both the foul and surface water flows generated from the development into the existing Thames Water combined sewer located within the site boundary through existing connections onsite. Proposed foul and surface water sewers will be separated onsite up till the last manhole before it is connected into the combined sewer.

6.10 The London Plan stipulates that a minimum of 50% attenuation of pre-development surface water run-off should be achieved for the post development condition. All flows in excess of the maximum run off rate will be attenuated on site up to the 1 in 100 year return period plus a 30% allowance for climate change.

6.11 The SuDS strategy has been developed to make use of permeable paving, sedum greenroofs, conveyance swale and oversized piped system on the Site before surface water is being discharged into combined trunk sewer located to the west of the site.

6.12 Thames Water has confirmed capacity in the existing sewer network for foul and surface water, a connection can be made following a S106/107 agreement.

6.13 The reduced surface water flow will offset the increase in the proposed foul flow and result in an overall decrease in the combined flow into Thames Water's sewers.

6.14 Application and discussion will need to be carried out with Thames Water on the build over/close to a public sewer agreement before construction work can commence within 3m of the existing public sewers.

Appendix A

Proposed Development Layout

01 Proposed Ground Level Masterplan

notes

- The contractor is responsible for checking dimensions, tolerances and references. Any discrepancy to be verified with the Architect before proceeding with the works.
- Where an item is covered by drawings to different scales the larger scale drawing is to be worked to.
- Do not scale drawing. Figured dimensions to be worked to in all cases.

CDM Regulations 2007

ALL current drawings and specifications for the project must be read in conjunction with the Designer's Hazard and Environmental Assessment Record.

0 1 2 5 10
SCALE

N

date	rev	revision/author/checker
09-12-14	A	Draft Issue (EC) (BW)

purpose of issue
INFORMATION

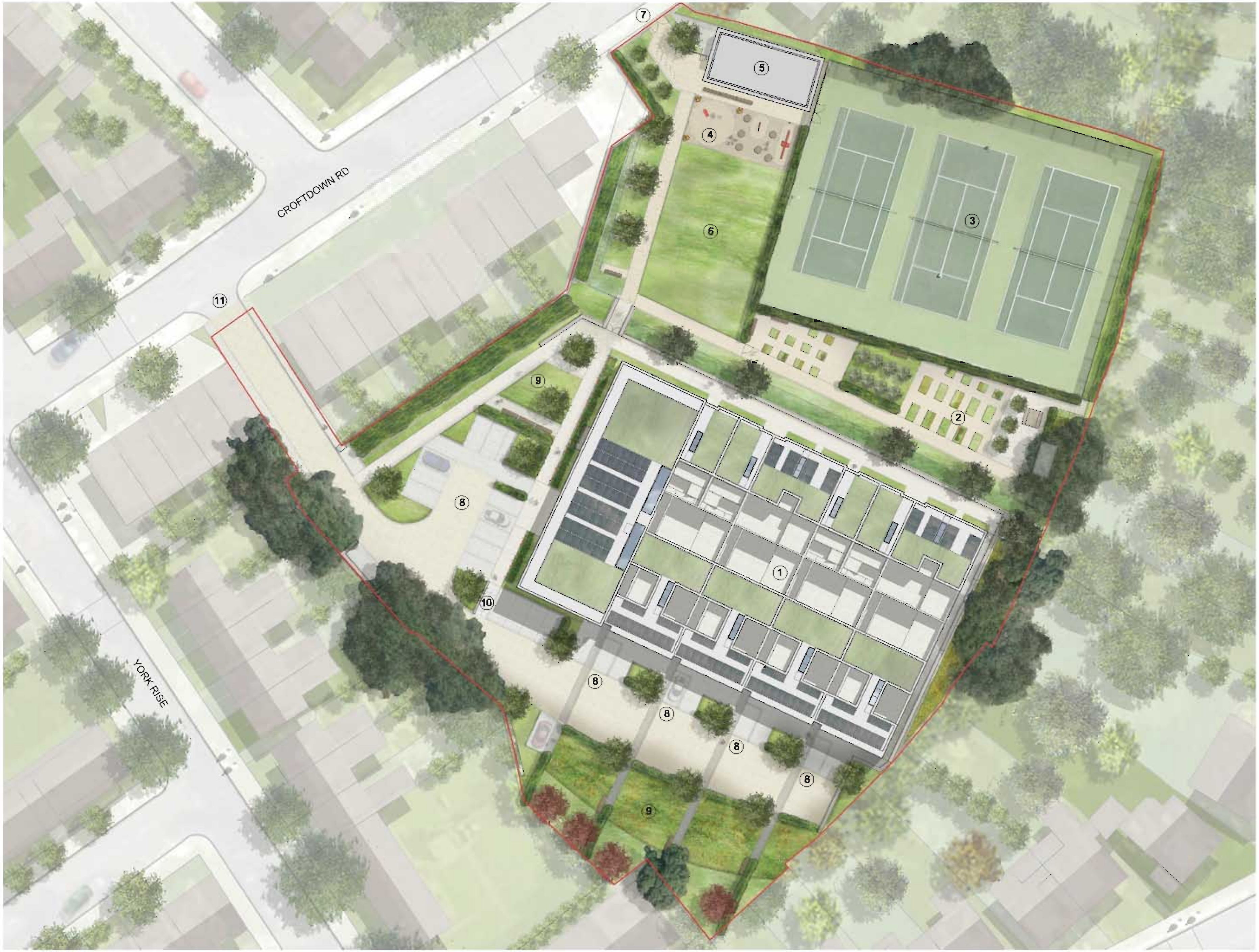
project
Mansfield Bowling Club

drawing
Proposed
Ground Level Masterplan

drawing no	rev
AA4437/2131	A

drawn EC	checked BW
scale @ A1/A3 1:250/1:500	date 22/09/2014

London



01 Proposed Roof Level Masterplan

notes

- The contractor is responsible for checking dimensions, tolerances and references. Any discrepancy to be verified with the Architect before proceeding with the works.
- Where an item is covered by drawings to different scales the larger scale drawing is to be worked to.
- Do not scale drawing. Figured dimensions to be worked to in all cases.

CDM Regulations 2007

ALL current drawings and specifications for the project must be read in conjunction with the Designer's Hazard and Environmental Assessment Record.

0 1 2 5 10
SCALE

N

1 - Proposed Residential Development
2 - Community Garden
3 - Tennis Courts
4 - Play Equipment
5 - Pavilion
6 - Lawn
7 - New Entrance from Croftdown Road
8 - Parking
9 - Garden
10 - Bin Storage
11 - Existing Entrance Reused

date	rev	revision/author/checker
09-12-14	A	Draft Issue (EC) (BW)

purpose of issue
INFORMATION

project
Mansfield Bowling Club

drawing
Proposed Roof Level Masterplan

drawing no	rev
AA4437/2130	A

drawn EC | checked BW
scale @ A1/A3 1:250/1:500 | date 22/09/2014

PRP Architects
London

Appendix B

Environment Agency Standing Advice

Environment Agency

Route to this page | -->Step by Step-->up to 1ha-->Flood Zone 1-->No Culvert/20m

Restart | Print Form

Development less than 1ha in Flood Zone 1 - surface water drainage information

Exceptions to this guidance note:

This note does not apply in the following circumstances;

- Where an area with critical drainage problems has been identified by the Environment Agency and notified to the Local Planning Authority (LPA) and formal consultation is required (paragraph (ze) DMPO 2010).
- In areas where the LPA has identified drainage problems through a Strategic Flood Risk Assessment (SFRA) or Surface Water Management Plan (SWMP) and they have indicated that a formal Flood Risk Assessment is required, FRA guidance note 1 should be followed; for more information see http://www.environment-agency.gov.uk/research/planning/93498.aspx

In all other cases, the following notes set out good practice to achieve sustainable surface water management.

Surface water management good practice principles and standards

For developments (other than changes of use) less than 1 hectare in Flood Zone 1, the main flood risk issue to consider is usually the management of surface water run-off. Drainage from new development must not increase flood risk either on-site or elsewhere. Government policy strongly encourages a sustainable drainage system (SuDS) approach to achieve these objectives. Guidance on how to address specific local surface water flood risk issues may also be available through the SFRA or SWMP produced by the LPA.

For on/near site flooding, the flood risk Practice Guide at paragraph 5.51 states that:

"*For events with a return-period in excess of 30 years, surface flooding of open spaces such as landscaped areas or car parks is acceptable for short periods, but the layout and landscaping of the site should aim to route water away from any vulnerable property, and avoid creating hazards to access and egress routes (further guidance in CIRIA publication C635 Designing for exceedence in urban drainage - good practice). No flooding of property should occur as a result of a one in 100 year storm event (including an appropriate allowance for climate change). In principle, a well designed surface water drainage system should ensure that there is little or no residual risk of property flooding occurring during events well in excess of the return-period for which the sewer system itself is designed. This is called designing for event exceedence.*"

The CIRIA publication `Designing for exceedence in urban drainage-good practice' can be accessed via the following link http://www.ciria.org.uk/suds/publications.htm

For off-site flooding, the flood risk Practice Guide states at paragraph 5.54:

"For the range of annual flow rate probabilities up to and including the one per cent annual exceedence probability (1 in 100 years) event, including an appropriate allowance for climate change, the developed rate of run-off into a watercourse, or other receiving water body, should be no greater than the existing rate of run-off for the same event. Run-off from previously-developed sites should be compared with existing rates, not greenfield rates for the site before it was developed. Developers are, however, strongly encouraged to reduce runoff rates from previously-developed sites as much as is reasonably practicable. Volumes of run-off should also be reduced wherever possible using infiltration and attenuation techniques. Interim guidance on calculation of site run-off rates can be found at http://www.ciria.org/suds/pdf/preliminary_rainfall_runoff_mgt_for_development.pdf "

Sustainable Drainage Systems (SuDs)

SuDs seek to mimic natural drainage systems and retain water on or near to the site, when rain falls, in contrast to traditional drainage approaches, which tend to pipe water off site as quickly as possible.

SuDs offer significant advantages over conventional piped drainage systems in reducing flood risk by reducing the quantity of surface water run-off from a site and the speed at which it reaches water courses, promoting groundwater recharge, and improving water quality and amenity. The range of SuDs techniques available means that a SuDs approach in some form will be applicable to almost any development.

Government policy set out in paragraph 103 of the NPPF expects LPAs to give priority to the use of SuDs in determining planning applications. Further support for SuDs is set out in chapter 5 of the flood risk Practice Guide.

Approved Document Part H of the Building Regulations 2000 establishes a hierarchy for surface water disposal, which encourages a SuDs approach beginning with infiltration where possible e.g. soakaways or infiltration trenches .

Where SuDs are used, it must be established that these options are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. For example, using soakaways or other infiltration methods on contaminated land carries groundwater pollution risks and may not work in areas with a high water table. Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under BRE Digest 365.

Provision for long-term maintenance should be provided as part of any SuDs scheme submitted to the LPA. Model legal agreements that provide a mechanism for SuDs maintenance can be accessed on the CIRIA web site at http://www.ciria.org/suds/icop.htm.

Further information on SuDs can be found in chapter 5 of the flood risk Practice Guide which gives an extensive selection of references. The Interim Code of Practice for Sustainable Drainage Systems provides advice on design, adoption and maintenance issues and a full overview of other technical guidance on SuDs. The Interim Code of Practice is available on CIRIA's web site at: http://www.ciria.org

Is the proposal part of a larger development?

A Reserved matters application in Flood Zone 1 might be part of a larger site that already has outline permission. If so, the LPA should ensure that any conditions applied previously in relation to drainage are taken into account in the reserved matters application. This is to prevent a piecemeal approach to drainage taking place.

Disposal to public sewer

Where it is intended that disposal is made to public sewer, the Water Company or its agents should confirm that there is adequate spare capacity bearing in mind all known development proposals in the area.

Other flood risk issues to consider for development in Flood Zone 1

Dry Islands

Some areas within Flood Zone 1 are surrounded by areas at a higher risk of flooding i.e. areas falling within Flood Zones 2 and 3. In certain cases development within such `dry islands' can present particular hazards to public safety such as people being surrounded by water and needing to be rescued. The distribution of dry islands and the risks posed by them in terms of access/exit vary considerably across the country. If you are in any doubt about how flood risks associated with `dry islands' may affect your Authority area, please contact your local Environment Agency office by calling 08708 506 506.

Climate Change

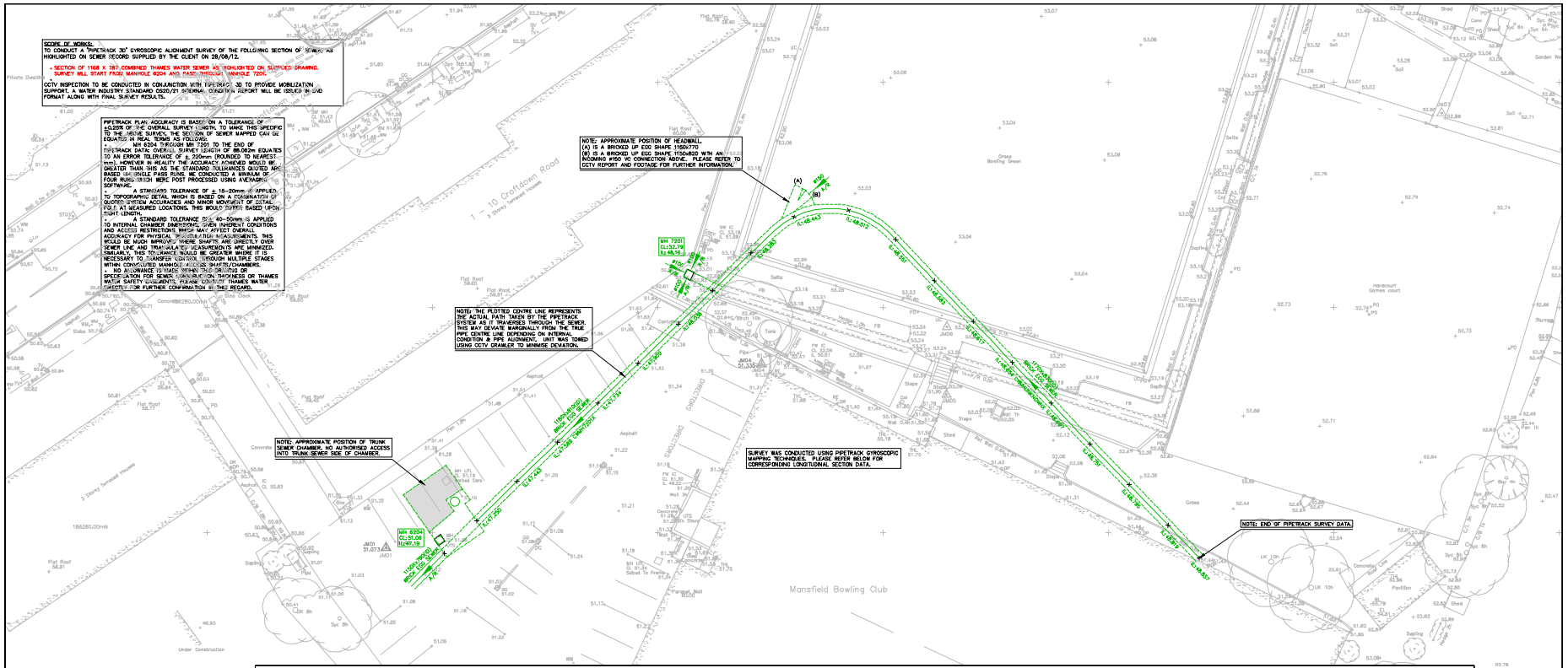
As highlighted above, the frequency and intensity of rainfall is predicted to increase as a result of climate change and an allowance for how this will affect the proposal will need to be factored into design.

In addition rising sea levels may put some areas currently within Flood Zone 1 at risk from tidal flooding. These areas should have been identified in your LPA's SFRA.

End of Comment

Appendix C

Existing Sewer Survey



LONGITUDINAL SECTION

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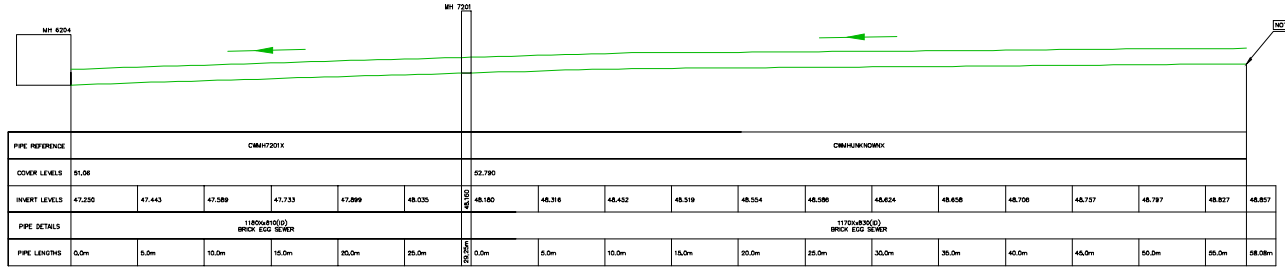

PIPE REFERENCE	CMH7201X							CMH/UNKNOWN/X															
COVER LEVELS	51.06							52.790															
INVERT LEVELS	47.250	47.443	47.589	47.733	47.899	48.035	48.150	48.150	48.316	48.452	48.519	48.554	48.586	48.624	48.658	48.708	48.757	48.797	48.827	48.857			
PIPE DETAILS	1180x810(H) BRICK EGG SEWER							1170x830(H) BRICK EGG SEWER															
PIPE LENGTHS	0.0m	5.0m	10.0m	15.0m	20.0m	25.0m	30.25m	0.0m	5.0m	10.0m	15.0m	20.0m	25.0m	30.0m	35.0m	40.0m	45.0m	50.0m	55.0m	58.08m			

LEGEND

CL	COVER LEVEL	IL	INVERT LEVEL
VC	VITRIFIED CLAY	CI	CAST IRON
CO	CONCRETE	BR	BRICK
□	MANHOLE	RS ⊙	ROAD SIGN
LP ⊙	LAMP POST	GVG	GAS VALVE
CWS	COMBINED WATER SEWER		
#100	PIPE DIAMETER		
	DIRECTION OF FLOW		
A/R	ASSUMED ROUTE		
TFR	TAKEN FROM RECORDS		
33.210	GROUND LEVEL		
D0.7	DEPTH OF SERVICE		
O/H	OVERHEAD SERVICE		

STAT/UTILITY	CHECKED ON DRAWING
SEWERAGE	19.09.2012 DB
WATER	N/A
GAS	N/A
BT	N/A
EDF ELEC	N/A
COMMS	N/A
OTHER	N/A

NOTE: ALL CO-ORDINATES AND LEVELS RELATE TO CLIENT STATIONS USED BELOW.

STATION CO-ORDINATES

STATION	EASTING	NORTHING	LEVEL	DESCRIPTION
JM01	528695.886	186258.649	51.073	CLIENT STATION
JM04	528729.218	186274.971	51.335	CLIENT STATION

The topographic information used, was supplied by the client. Infotec will not be held responsible for inaccuracies or omissions resulting from this transfer of information. As all services are positioned relative to the topographic features shown on this drawing, under no circumstances should any information be scaled or positioned from the data shown. Where site markings are provided these should be protected by the client during construction work. For further information contact Infotec.

All Surveys are undertaken in accordance with our standard terms and conditions of survey and these are available for inspection.

Electromagnetic Utility Location
Every effort is made to overcome problems encountered during the tracing operation. However where limited access denies adequate signal application and the use of surface induction techniques etc., certain pipe or cable routes may be deemed untraceable. Trial holes should be used by the client to prove unidentified services, or investigate lost signals. This may provide access to allow further signal application and the client may elect to commission Infotec to undertake additional route tracing beyond these points. Any invasive work planned to be undertaken within close proximity or major services, should be preceded by sufficient trial holes to verify the positions and depths shown.

Important Notice
Depth indications are given for guidance purposes only as they are likely to be influenced by Electromagnetic fields, particularly those generated by other utility services or structures in close proximity.

The function of any sewer should be taken from Public Sewer Records. Where no records are available at the time of survey, an attempt will be made to determine the sewer function. This should however be verified formally before undertaking or finalising any design proposals.

The client should refer to the public utility records to ascertain the configuration of pipe or cable layout. We recommend an appropriate band width & safe working easement be applied prior to undertaking any adjacent works.

Ground Penetrating Radar
Every effort is made to overcome problems encountered during the radar survey. However where survey area is limited and interference is caused by external sources, certain features may be deemed untraceable.
Depth indication is given for guidance purposes only as they will be influenced by the material and structure of the ground surveyed.
Trial holes should be excavated to investigate unidentified services and area of concern, and to obtain precise depth information of features located.

PipeTrack Gyroscopic Mapping
Every effort is made to overcome problems encountered during the PipeTrack survey. However where sufficient access is denied to online manhole chambers or is denied to online manhole chambers or obstructions/silt are encountered, overall survey accuracy may be affected. CCTV surveys are always recommended prior to introduction of PipeTrack unit to prevent these instances. In additions, detailed Q.C. reports are provided for each PipeTrack survey to verify reliability of the data achieved and those not meeting the quoted accuracies are discarded and re-surveyed.

For clarity purposes within this drawing, the clients supplied topographical survey has been edited. Infotec are not liable for any information eradicated from this survey.

PRELIMINARY

(FINAL CONDOS DRAWINGS AVAILABLE UPON REQUEST ONCE FULL PAYMENT HAS BEEN RECEIVED AND ALL RELEVANT PUBLIC UTILITY RECORDS HAVE BEEN SUPPLIED TO SATISFY QA/QC PROCEDURE)

REV.	DESCRIPTION	DRAWN	CHKD	APPD	DATE
–	CHECKED PRELIMINARY ISSUE	DB	DP		24.09.12

DRAWN: DB CHKD: DP APPR:
SCALE : 1: 2000@A1
DATE : 19/09/2012

TITLE :
PIPETRACK GYROSCOPIC MAPPING SURVEY

CLIENT NAME : ARDENT CONSULTING
JOB : MANSFIELD BOWLING CLUB, HIGHGATE
DRWG. No: INF-3078-D01(P) REV: –

infotec
Underground Surveying & Mapping Specialists
Unit 30 Rutherford Close, Leigh on Sea, Essex SS9 5LQ
Tel: 01702 421390 Fax: 01702 421070 email: sales@infotec.net

Appendix D

Surface Water Calculations

SURFACE WATER CALCULATION - Mansfield Bowling Club

EXISTING

Modified Rational Method Q = 2.78 x i x A

Q = Peak Discharge (l/s)
i = Rainfall Intensity (mm/hr from TRRL Report 595)
A = Area in hectare (ha) = **0.68**

Return Period	Rainfall Intensity	Q (l/s)
1 in 1	50	94.5
1 in 30	113	213.6
1 in 100	143	270.3

Appendix E

Thames Water Email Correspondence

Fao: Mr Adam Sierens

Developer Services

Ardent Consulting Engineers
1 Alie Street
London
E1 8DE

Your ref
Our ref 50038852/CA
Name Christopher Allen
Phone 0800 009 3921
Fax developer.services@thameswater.co.uk

15 December 2014

Re: Pre-Development enquiry application.
Site: Mansfield Bowling Club, 5 Croftdown Road, London, NW5 1EP

Dear Mr Sierens,

I write in relation to the above site and further to your Pre-Development Enquiry application regarding the proposed development of 25 domestic units at the above site.

Thames Water expects a surface water reduction strategy in accordance with the London Plan. There are strategic sewers crossing the site and the configuration of the development needs to take account of this. There are access requirements for sewer reception chambers to the storm relief sewer that Thames Water will require to retain. Please liaise with Trunk Sewers department about access arrangements.

"The London Plan Policy 5.13 identifies a hierarchy of drainage options for surface water drainage and as such we would expect the development proposal to follow this. Policy 5.13: The Mayor will, and boroughs should, seek to ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy: 1. Store rainwater for later use, 2.Use infiltration techniques, such as porous surfaces in non-clay areas, 3. Attenuate rainwater in ponds or open water features for gradual release to a watercourse 4. Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse, 5.Discharge rainwater direct to a watercourse 6. Discharge rainwater to a surface water drain, 7. Discharge rainwater to the combined sewer.
The use of sustainable urban drainage systems should be promoted for development unless there are practical reasons for not doing so. Such reasons may include the local ground conditions or density of development.''

Under these conditions Thames Water will have no concerns regarding the proposed FW and surface water flows being discharged into the existing network.

Please submit a section 106/107 connection application in due course.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I
www.thameswater.co.uk

If you have any questions please give the helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely

Christopher Allen
Technical Coordinator
Developer Services – Wastewater

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I
www.thameswater.co.uk

Appendix F

Proposed Preliminary Drainage Strategy

N

Ø150 CONNECTION TO EXISTING COMBINED SEWER

FLOW CONTROL IN MANHOLE TO RESTRICT SURFACE WATER TO 13 l/s

FLOW CONTROL IN MANHOLE TO RESTRICT SURFACE WATER TO 35 l/s

Ø150 EXISTING CONNECTION INTO COMBINED SEWER - TO BE REPLACED WITH Ø225 IL 48.16

EXISTING COMBINED SEWER

EXISTING 1170 x 830mm THAMES WATER COMBINED SEWER

OPEN SPACE TO ACCOMMODATE OVERLAND FLOW FROM EXTREME EVENTS

FFL 51.300

MH 7201
CL:52.79
IL:46.16

MH 6204
CL:51.06
IL:47.19

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER
2. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY
3. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED
4. ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS
5. THIS DRAWING IS BASED ON A TOPOGRAPHICAL SURVEY PRODUCED BY SURVEY SOLUTIONS, DATED APRIL 2012 AND A 'PIPETRACK 3d' GYROSCOPIC ALIGNMENT SURVEY OF THE EXISTING THAMES WATER SEWER CARRIED OUT BY INFOTEC, DATED SEPTEMBER 2012.

KEY

- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL WATER SEWER
- PERMEABLE PAVING WITH UNDERGROUND STORAGE
- PROPOSED GREENROOF
- CONVEYANCE SWALE
- STORAGE AREA FOR EXTREME EVENTS

REV	AMENDMENTS	DRN	CHK	APP	DATE

ARDENT CONSULTING ENGINEERS

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One Alie Street
London
E1 8DE

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Fax: 020 7488 3736

Web: www.ardent-ce.co.uk
E-mail: enquiries@ardent-ce.co.uk

CLIENT:
MANSFEILD BOWLING CLUB

PROJECT TITLE:
MANSFIELD BOWLING CLUB
CROFTDOWN ROAD, KENTISH TOWN

DRAWING TITLE:
PRELIMINARY
DRAINAGE STRATEGY

SCALE:	DATE:	DESIGNED:
1:200 @ A1	DEC 2014	KC
DRAWN:	CHECKED:	APPROVED:
KC	JT	BC

DRAWING NO. J671-02 REV: -