

<b>NODE TABLE ABBREVIATIONS</b>	
<b>MANHOLE FUNCTION</b>	
F Foul	T Transition
S Surface	O Overflow
C Combined	U Unspecified
<b>MANHOLE / NODE TYPE</b>	
M Manhole	Z Ghost in Rising Main
J Junction	C Cascade
L Lamphole	Y Gully
H Hatchbox	E Ejector
R Racking Eye	O Oil Injector
F Outfall	I Inlet
V Combined Sewer	B Hydrobrake
O Overflow	T Vent Column
P Pumping Station	X Valve
S Sockaway	U Unspecified
D Dual Function	C Expediency Node
M Manhole	G Ghost
W Treatment Works	(to allow pipe bends)
<b>SEWER SHAPE</b>	
C Circular	T Trapezoidal
E Egg	A Arch
O Oval	B Barrel
F Flat Top	H Horseshoe
R Rectangular	U Unspecified
S Square	

SEWER MATERIAL
AC Asbestos Cement
BR Brick
CI Cast Iron
CS Spun (Grey) Iron
CC Concrete
CS Concrete Segments (Bolted)
CS Concrete Segments (Unbolted)
CC Concrete Box Culvert
DI Ductile Iron
GR Glass Reinforced Concrete
GR Glass Reinforced Plastic
PS Plastic / Steel Composite
PV Polyvinyl Chloride
PE Polythene
RP Reinforced Plastic Matrix
ST Steel
VC Vitrified Clay (All Clayware)
PP Polypropylene
PF Pitch Fibre
MA Masonry - In Regular Courses
MA Masonry - Randomly Coursed
U Unspecified

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Scale 1:1250 Date: 19-Oct-2006  
125 Nodes  
Sheet 1 of 1



OS Sheet No: SJ3693SW  
Scale 1:1250 Date: 19-Oct-2006

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## Appendix C. Drainage Strategy





# Liverpool Football Club Anfield Redevelopment



## PROPOSED DRAINAGE STRATEGY

- STAGE D
- Draft
- April 2014



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- Draft
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# 1. Introduction

The existing Liverpool Football Club Anfield Stadium ground is to be expanded by providing a new Main Stand and Anfield Road Stand that will increase crowd capacity and the corporate hospitality offer. It is planned to undertake the expansion works in 2 phases. Phase 1 is the redevelopment of the Main Stand and is the development under primary consideration in this report. However phase 2, the redevelopment of the Anfield Road Stand, has been considered where necessary in the design of phase 1.

Phase 1 comprises extensive works to the existing Main Stand, increasing its capacity from the current 12,000 (approx.) to a new capacity of 20,000. The significant construction works will create accommodation over 6 levels below the new seating terraces, providing additional General Admissions (GA) concourse areas and access to additional corporate hospitality areas. A new covered entrance will provide a coach drop off point and below ground car park.

The existing stand, hospitality areas and players' areas will be kept in operation until end of the season 2015. During the closed season the ground and first floor extensions will be demolished to facilitate the construction of the new stand, providing a 9m clear access for spectators to egress the existing stand during the 2015/16 season.

The construction works and associated design will need to respond to the construction programme and the requirement of keeping the stadium operational for matches during the construction period.

The drainage strategy considers the redevelopment of the Main Stand and the potential future expansion of the Anfield Road stand however the drains associated with the future Anfield Road improvements will be provided during that phase of the works.

CCTV surveys were undertaken to the existing public sewers and private drainage of the main stand to assess the condition of the same. As the redevelopment of the Main Stand must be undertaken whilst maintaining beneficial use of the seating and hospitality areas, upgrades to the current network will be required to allow the system to be functional whilst accommodating the proposed works.



## 2. Development Overview

### 2.1. Design Aims

The purpose of the Civil Engineering input to this project is to define the external infrastructure required for the stadium's redevelopment proposal. SKM used exploratory CCTV methods to determine the existing drainage routes in order to provide a solution that is cost effective as well as adhering to current legislation complying with planning requirements imposed by Liverpool City Council and United Utilities.

Consideration has also been taken into the potential future expansion of the Anfield Road Stand.

### 2.2. The Site

In this report the Stadium has been assessed in separate sections, these sections are as follow:

- Main Stand and Car Park
- Anfield Road and Fanzone / Car Park
- Anfield Plaza
- The Spion Kop
- Centenary Stand



### 3. Standard Documentation

The Standards and Guidance Notes that are applicable to this report are as follows:

- The Building Regulations 2000 Part H, Drainage and waste disposal
- BS EN 752:2008, Drain and sewer systems outside buildings
- National Planning Policy Statement
- Pollution Prevention Guidelines 3 (PPG3), Use and design of oil separators in surface water design
- CIRIA C697, The SUDs Manual
- Civil Engineering Specification for the Water Industry 7<sup>th</sup> Edition
- Sewers for Adoption 7<sup>th</sup> Edition
- BRE Digest 365, Soakaway Design
- National Building Specification (NBS)
- BS EN 7533-13:2009, Guide for the design of permeable pavements.
- Liverpool City Council Strategic Flood Risk Assessment 2008 (SFRA)

## 4. Existing Drainage

### 4.1. Surface Water

For existing drainage layout drawing refer to Appendix A.

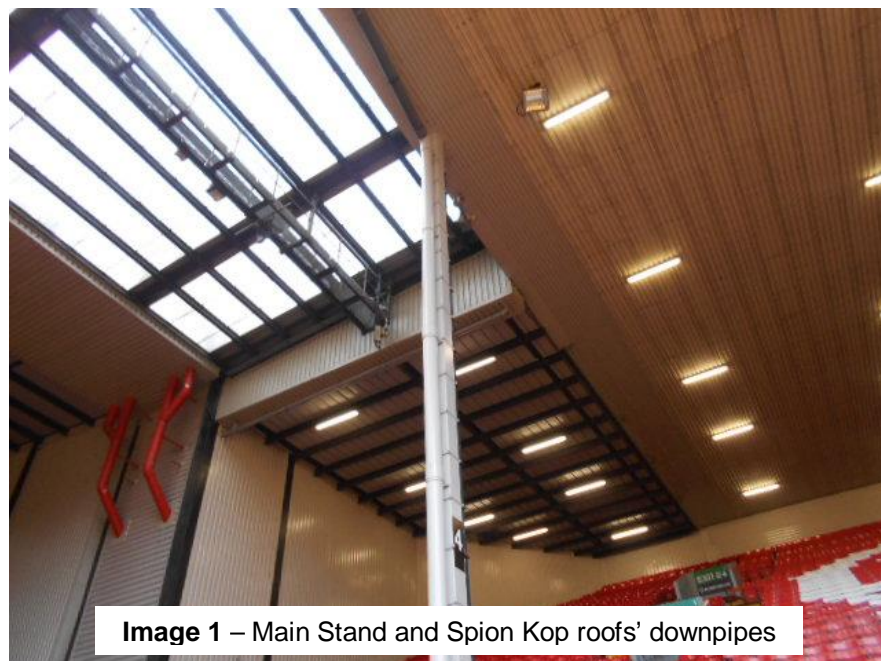
#### a) Main Stand and Car Park

The Main stand's roof is drained by two down pipes located to the front of the stand, these drain approximately one third of the roof. The remaining two thirds of the roof is drained by numerous down pipes located to the back of the stand. The down pipes are currently collected by a private network which runs underneath the stand to the southwest corner of the site where it discharges into public combined sewer located in the alleyway behind the houses on Lothair Road.

The public sewer then runs into United Utilities manhole 1104, which discharges into the 1520x910 brick egg sewer on Back Rockfield Road.

The Northern section of the Main Stand Roof which is connected to the Anfield Road Stand roof utilises the Anfield Road Stand drainage system and discharges to a public sewer on Anfield Road.

The Southern section of the Main Stand Roof which is connected to The Spion Kop roof utilises the Spion Kop drainage system.



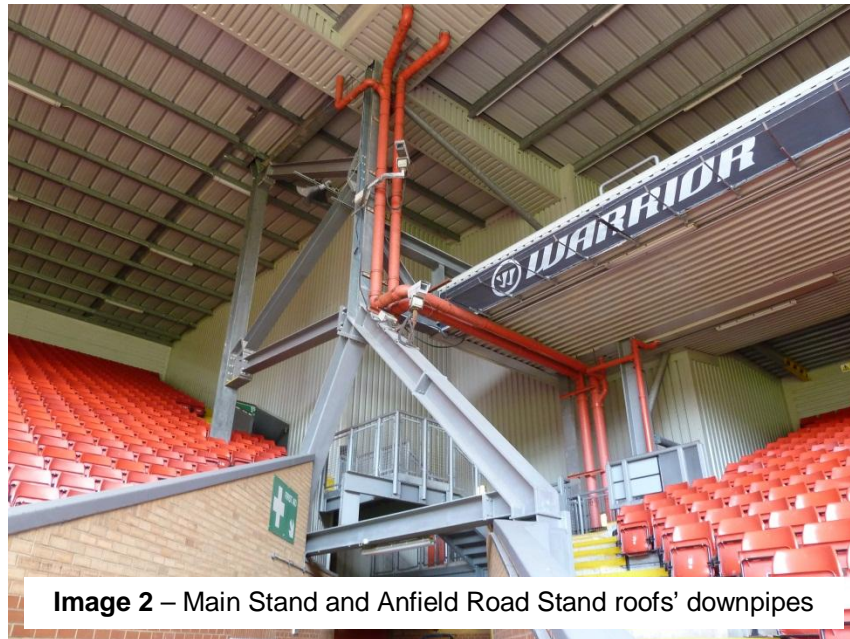
**Image 1 – Main Stand and Spion Kop roofs' downpipes**

The Main Stand car park area drains towards the Main Stand and is collected by the private drainage through a series of linear drainage channels located along the building.



### **b) Anfield Road Stand and Fan Zone / Car park**

The Northwest half of the Anfield Road Stand drains to the Main Stand corner of the ground where rainwater pipes convey the water into a combined private sewer in the Main Stand Car Park



**Image 2 – Main Stand and Anfield Road Stand roofs' downpipes**

The Private sewer then runs under the Hillsborough Memorial and discharges into the United Utilities Public Sewer at Manhole 2201 on Anfield Road.

The Northeast half of the Anfield Road Stand drains to the Centenary Stand corner of the stadium where two rain water pipes convey the water to an internal manhole S10 located in the Anfield Road Stand concourse, which discharges into a manhole in the Centenary Stand Car Park, this sewer then runs parallel to the stand to southwest towards the Spion Kop where it connects to combined manhole C30 discharging into United Utilities manhole 2001, the 1520x910mm brick egg combined public sewer referred above.

The Fanzone and car park (North of Anfield Road) has not been surveyed as part of these works. Historically the now demolished houses which were built in this location discharged to the United Utilities public sewer located at the edge of Stanley Park. There is no apparent positive surface drainage shown on the topographical survey, which leads to the assumption that the car park is no longer discharging into this sewer. The surface water runoff is likely to overrun the embankment and soak away.

### **c) Anfield Plaza**

The Anfield Plaza area consists of three streets located to southwest of the stadium where the houses have been demolished.

These are:

- Baltic Street;
- Gilman Street;
- Tinsley Street.

The sewers within these streets are yet to be decommissioned and are still shown as adopted combined sewers on the United Utilities records as shown in Appendix A. The majority of the sewers in this area contain large amounts of debris, consequently could not be surveyed as part of the onsite CCTV investigation undertaken. The sewers connect to the main United Utilities sewer on Walton Breck Road and could be utilised as part of the proposed works (subject to United Utilities Approval).

#### **d) The Spion Kop**

The south-western side of The Spion Kop Stand is drained by two rainwater pipes which discharge into private manhole C22 located to the west of the Kop near the Main Stand. As previously mentioned, part of the Main Stand roof is also drained by these two rainwater pipes.



**Image 3 – Spion Kop roof's downpipes**

The roof water then combines with the foul resultant from the two toilets located at the base of the Kop tower and is collected by the 600mm diameter pipe runs through the stadium between the Spion Kop Stand and the pitch towards the east end of the Kop, connecting into manhole C30 located upstream of United Utilities manhole 2001. This is the manhole mentioned previously which collects runoff from half of the Anfield Road Stand and the Centenary Stand.

The water from the south-eastern side of The Spion Kop roof is collected by two rain water pipes and also outfalls into this 600mm run at (Manhole C27).

#### **e) Centenary Stand**

The Centenary Stand has not been surveyed as part of these works; however it was apparent from the drains inspected that the roof drains into the sewer located at the back of the Centenary stand which also collects half of the Anfield Road Stand roof.

### **4.2. Foul Water**

For existing drainage layout drawing refer to Appendix A.

#### **a) Main Stand and Car Park**

A private foul drainage network runs under the Main Stand, it outfalls into the United Utilities public sewer on Anfield Road into manhole 2201. The network collects the foul discharge from the Main Stand as well as the discharge from a building situated to the northwest of the Main Stand's car park the Formerly The Club shop.



**Image 4** – Formerly The Club Shop situated within the Main Stand Car Park



### **b) Anfield Road Stand and Fan Zone / Carpark**

The majority of the toilets appear from the Anfield Road Stand to saddle straight onto the adopted United Utilities sewer located on Anfield Road.

Some of the Foul water from the west side of Anfield Road Stand does appear to discharge into the combined system within the Main Stand Car Park (Manhole C7).

A foul drain from the northeast corner of the stadium discharges into a private foul sewer that is situated in the Centenary Stand Car Park (Manhole C31). This sewer runs parallel to the Centenary Stand before discharging into the private manhole (Manhole C30) and then into the United Utilities Public System at (Manhole 2001).

The Fanzone and car park off Anfield Road was not surveyed as part of these works. Historically the houses that used to be located here discharged to the United Utilities sewer to the edge of Stanley Park. There are no apparent foul discharge points from this site.

### **c) Anfield Plaza**

Due to the demolition works to Baltic Street, Gilman Street & Tinsley Street we anticipate there to be no foul water connections to the United Utilities public network with the exception of any discharge from The Albert Public House (Manhole 1007) or half of Baltic Street which still remains and is outfalling into Manhole 0004.

### **d) The Spion Kop**

The internal foul connections from The Spion Kop toilets were not surveyed as part of this report. However, it was noted that there are a couple of external toilets which connected into Manhole C22 which resulted in The Spion Kop roof drainage becoming combined.



**Image 5 – Toilets at the base of the Kop tower**

### **e) Centenary Stand**

The Centenary Stand was not surveyed as part of these works, however the Foul water from the Northeast corner of the Anfield Road stand runs parallel to the Centenary Stand through the car park and we assume is picking up the majority of the foul discharge from this stand.

## **5. Proposed Drainage**

### **5.1. Local Authority Consultation**

United Utilities (UU) have been made aware of the club's intention to develop the site and therefore the need for discharging into the local public sewers. Sewer record plans have been provided to assist with the design; (see Appendix A).

As the majority of sewers in the area are combined systems the private surface and foul water drainage for the proposed buildings will be combined immediately upstream of the connection to the public sewer. The development proposals will impact on the existing public sewers within the site boundary (see Appendix A), therefore the following agreement applications need to be submitted to UU for approval.

- Section 104 (Water Industry Act 1991), sewer for adoption;
- Section 106 (Water Industry Act 1991), connection/discharge to public sewer;
- Section 116 (Water Industry Act 1991), closure/abandonment of public sewer.
- Section 185 (Water Industry Act 1991), diversion of public sewer;

SKM have received correspondence from John Lunt of United Utilities that indicate that a restrictive discharge will not be imposed over and above the existing regime; (see appendix B).

### **5.2. Local Planning Authority**

Liverpool City Council (LCC) has also been contacted regarding the intention to connect and discharge surface water into the public sewers. Further to this communication SKM has received confirmation of approval for a like-for-like surface water discharge from Fergal McEvoy (LCC Planning Department) and Laura Gilmore (LCC Drainage Department); (see appendix B).

### **5.3. Drainage Strategy**

Due to the discharge approvals received from the local authorities the drainage strategy has been reviewed from that shown at stage C, therefore the underground attenuation tanks have been removed.

It is proposed that the surface water drainage design for the extension of the Anfield Stadium's Main Stand is to drain the new stand's roof and surrounding impermeable surfaces by means of an underground drainage network which is to discharge into a United Utilities combined sewer located on Back Rockfield Road.

The site is located in an area where ground permeability conditions are very low due to the shallow depths at which sandstone can be found. Consequently SUDS systems have not been considered and the proposed network has been developed on a 'like-for-like' basis where discharge conditions of the existing site are not exceeded. The design accounts for additional capacity for future climate change (CC) rainfall increase offering no flooding for 1 in 30 years return period (+CC) events and containment of any flooding resulting from 1 in 100 years return period (+CC) events.

#### **5.4. Surface Water**

The proposed works to the surface water network of the Anfield Stadium's Main Stand is to be carried out in two phases; these combine modifications to the existing and construction of new drainage. The phased work is resultant from the requirement for the existing stand to be in use during the construction of the new section of the stand. Therefore, phase one allows for use of existing stand during construction of proposed extension and the second phase of the drainage works will be undertaken during the refurbishment to the existing stand.

The first phase of works include abandonment of the extent of existing drainage that services the stand's extension building which is to be demolished prior to commencement of construction of the new stand and diversion of the existing private system which provides drainage to the existing roof. Construction of the new underground pipe network that will provide drainage to the runoff resultant from the proposed scheme will also take place during phase 1, the network will collect the new roof's downpipes and the runoff from external hard stand surfaces; (for phase 1 drawing see Appendix C).

Phase 2 of the surface water drainage works consists of decommissioning the existing network that drains the existing roof. These works will be coordinated with the demolition of the roof and refurbishment of the existing stand; (for phase 2 drawing see Appendix C).

#### **5.5. Foul Water**

As the existing stand's hospitality areas and players' areas will be kept in operation during the construction of the new stand the existing and proposed foul water networks will also require two coordinated stages of construction works.

Phase 1 works consist of abandonment of the drainage runs servicing the existing stand's extension building at the time of its demolition, diversion of the existing private runs connected to manholes C5 and C21 as these are located within the footprint of the proposed foundations for the new roof supports and, construction of the new underground drainage network located outside the extent of the existing stand's footprint. The diversions are to be carried out prior to commencement of works to the proposed foundations and are subject to coordination with structural design; (for phase 1 drawing see Appendix C).

The second phase of the foul drainage works is to be carried out during refurbishment works to the existing stand and includes the abandonment of the existing foul network of the stand due to the complete rearrangement of the building's ground floor layout; as well as the completion of the construction of the new network which is proposed within the footprint of the existing stand; (for phase 2 drawing see Appendix C).

## **6. Appendix A**

### **6.1. United Utilities Sewer Records**

### **6.2. Existing Drainage Layout**

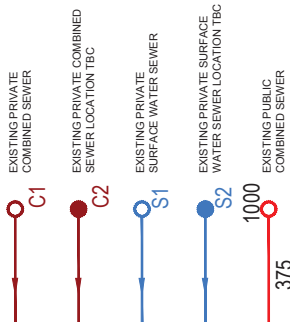
### **6.3. Public Sewer Diversion and Abandonment Works**











NOTES:

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS ARE IN FEET/US S'ATED OTHERWISE
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND DOCUMENTS ASSOCIATED WITH THIS PROJECT.
4. ALL SURVEYED INFORMATION INCLUDING LEVELS AND LAYOUT IS PROVIDED BY OTHERS.
5. ALL EXISTING AND PROPOSED DIMENSIONS, LEVELS AND LOCATIONS TO BE CHECKED AND VERIFIED BY THE MAIN CONTRACTOR ON SITE PRIOR TO BEGINNING OF THE WORKS AND ANY ADJUSTABLES REFERRED TO THE ENGINEER.
6. THE BUILDING AND SITE LAYOUT IS PROVIDED BY OTHERS.
7. ALL WORKS TO PUBLIC SERVICES TO BE AGREED WITH UNITED UTILITIES PRIOR TO BEGINNING OF WORKS ON SITE.
8. ALL ADAPTABLE DRAINAGE TO BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF "SEWERS FOR ADAPTATION 17TH EDITION".


DRAFT STAGE D



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