Proof of evidence on the interaction between the Planned Cambridge South Infrastructure Enhancements and the Medical Research Council laboratory

Reference:
DP1/OBJ/9

Proof of evidence:
David Purcell
IEng AMIStructE MCIHT

On behalf of:
The Medical Research Council

January 2022

CONTENT:

1. QUALIFICATIONS AND EXPERIENCE

1.1 My full name is David Anthony Purcell and I am a Civil, drainage and flood risk engineer, a registered incorporated Engineer, an Associate member of the Institute of Structural Engineers and a Member of the Chartered Institution of Highways and Transportation. A registered incorporated engineer is a professional engineer that is responsible for the maintenance and management and application of current and developing technology.

1.2 I have 30 years' experience in a mixture of civil engineering, drainage, flood risk, structural and infrastructure engineering projects, predominantly within the United Kingdom but also within, Europe, Africa and the United Arab Emirates.

1.3 I have a great deal of experience in complex master-planning, drainage engineering, civil engineering and flood mitigation projects

1.4 I am a technical director within the Civil Engineering and infrastructure team at AKTII.

1.5 AKTII was founded in 1996 and is a medium sized multi-disciplinary practice that specialises in complex structures and the practice has undertaken a number of science and laboratory projects and, in this specific case, the civil engineering and structural design of the Laboratory of Molecular Biology was undertaken by AKTII Limited who formed part of the design team that delivered the Medical Research Council Laboratory for Molecular Biology (LMB) building competed in 2013.

1.6 I have been actively involved in the following relevant projects and taken the technical lead and overseen the civil engineering design related to:

1.7 **Birchwood Science Laboratories – Cambridge -** Project Birchwood is a new science-research campus that joins the existing Melbourn Science Park, in Cambridgeshire. I led the AKTII infrastructure team on the design of the drainage system and carried out local and wider flood risk assessments to ensure that the proposed construction did not put stress on to the existing Anglian Water drainage system nor the water courses that surround the development land and feed into a wider water network.

1.8 **Bankside Yards – Blackfriars – London** – a mixed used development built directly adjacent to Blackfriars Railway station and the associated station trackside and River Thames crossing. This project involved deep basement construction and alterations to the live Network Rail drainage system involving multiple liaisons and approvals with Network Rail and the Port of London Authority.

1.9 **100 Liverpool Street – Broadgate – London** – a large multi-storey office development built adjacent to Liverpool Street station and adjacent to a new ticket hall access built to service the cross-rail development. Liaison and technical approval with Network Rail, Crossrail and all affected stakeholders.

I have also recently been involved in providing civil engineering advice and guidance with regard to:

1.10 **The Francis Crick Institute – Kings Cross London** - A restricted urban site beneath a new research centre which demanded an innovative approach to construction. The project consisted of a large continuous basement beneath the entire site which was built in and around the remains of a former steelworks, a Thameslink station box with service ducts, tube tunnels and a 120-year-old cast-iron sewer and the associated liaison with stakeholders and statutory bodies related to the proposed works to obtain permission for construction and complex drainage works.

2. INTRODUCTION AND SCOPE OF EVIDENCE

2.1 I am engaged by the MRC Laboratory of Molecular Biology (LMB) to advise on drainage and flooding matters associated with The Network Rail (Cambridge South Infrastructure Enhancements) Order (CSIE).

2.2 My evidence deals primarily with the works proposed at Cambridge South station and the associated track works component as these are most relevant to the LMB and most relevant to the existing drainage system serving the same.

2.3 My evidence is a review of the Network Rail Environmental Statement (ES) and a review of the supporting water resources and flood risk information related to the proposed drainage construction works and how these relate to the existing foul and surface water drainage system serving the LMB building.

2.4 My evidence explains the impact of the CSIE works on the existing LMB access road drainage system and upon the wider LMB drainage network considering the CSIE temporary construction works and whilst in permanent operation once the Network Rail works are completed.

2.5 Network Rail advised during consultation meetings with the LMB team (16th December 2021 – minutes contained in Appendix A3 of this document) that their consultants were due to provide an additional `initial technical note' related to the drainage and flooding matters and specifically related to the interaction between the CSIE and the LMB drainage system.

2.6 This additional technical note does not form part of the published ES and, this supplementary supporting information was made available on the 21st December 2021 in the form of a 6-page unreferenced document entitled `Cambridge South Infrastructure Enhancement MRC LMB interface' dated 17th December 2021 (the initial technical report is contained in Appendix A4 of this document)

2.7 The initial technical note explains the proposed methodology and design considerations that relate to the proposed CSIE drainage works that are linked directly to the LMB site. The technical note also provides an abridged hydraulic explanation of the proposed culverting of the northern ditch below the station structure. The initial note does not include hydraulic modelling at this stage and does include a covering statement to confirm that the proposed CSIE works will not put the LMB land at any greater surface water flood risk than the current arrangement.

2.8 This initial supplementary technical note (ITN) has been considered as part of my evidence.

2.9 It is understood and minuted in the meeting minutes noted in paragraph 2.5 above that following the release of the ITN, that a detailed technical note will be provided by Network Rail and this detailed note will provide hydraulic calculations and modelling to prove that the proposed CSIE works will not impede the surface water flows from the LMB land and the land to the North, suspected to drain to the LMB ditch. This modelling should evidence that the proposed CSIE works will not put the LMB land at any more surface water flood risk than the current arrangement. This supporting information will need to be considered as part of my evidence, when the information is made available.

2.10 I have attended meetings 25th November and 2nd December 2021 with Network Rail and their technical team to discuss the drainage proposals related to the Cambridge South infrastructure enhancements and to use these meetings to explain how the LMB drainage system functions currently so that this is understood relative to the CSIE works.

2.11 At these meetings (outlined in paragraph 2.10), I described the existing LMB foul and surface water drainage arrangement and the level of protection that this affords the LMB building currently and also explained how the proposed works may temporarily and permanently affect the operation of these drainage systems.

2.12 My evidence reviews the impact of the proposed works as reported in the ES which is a key area of concern. I have also reviewed the anticipated construction activities from the proposed track works which are close to the LMB site.

2.13 My instruction has been to review the CSIE ES and supporting documentation to assess the likely impact of the adjacent track works and wider station works to determine if the construction methods proposed will provide sufficient protection against flooding in the temporary and permanent cases.

2.14 I have identified specific undertakings relating to construction methods, drainage, flooding and monitoring or surveys that will be required to mitigate the impact of the proposed works on the existing drainage network.

2.15 I have provided a glossary of drainage and civil engineering terminology in Appendix A1.

2.16 I have provided a list of figures at the end of the document in Appendix A2.

2.17 I have provided the meeting minutes taken by Hilson Parry 16th December 2021 which acknowledge the need for supplementary information related to the interface between the CSIE works and LMB in Appendix A3

2.18 I have provided the Network Rail CSIE MRC LMB interface `initial technical note' ITN dated 17th December 2021 in Appendix A4

2.19 I have provided supporting surface water drainage drawings and calculations that relate to the LMB drainage design in Appendix A5

2.20 I have provided supporting foul water drainage drawings that relate to the LMB drainage system in Appendix A6

3. DESCRIPTION OF THE LABORATORY OF MOLECULAR BIOLOGY DEVELOPMENT

3.1 The existing Laboratory of Molecular Biology comprises of a state-of-the-art laboratory complex for the Medical Research Council, to the west of the Addenbrookes Hospital site in Cambridge (refer to Figures A2.1 to A2.5 in Appendix A2 for the location of the laboratory in context to the proposed CSIE works)

3.2 The site is approximately 10 hectares in size, and it is located to the south of Cambridge, between Addenbrookes Hospital and the village of Trumpington. To the west of the site is an existing railway line which forms the main rail route between Cambridge and London Liverpool Street and Kings Cross.

3.3 On the southern boundary of the site is the route for the Cambridge Guided Bus way (CGB), a bus based rapid transit system which runs between Huntingdon and Cambridge and the Astra Zeneca headquarters.

3.4 The northern boundary meets the playing field to a neighbouring college, with the north eastern corner being adjacent to Robinson Way.

3.5 The eastern boundary is formed by a moderately busy local carriageway. The laboratory building is formed from two lines of three modules, separated longitudinally by a full height atrium between. The module lines are arranged in plan to form the shape of a chromosome. Each module is approximately 53m long by 19m wide, combining to form a total building length of 160m. The building width varies from 50m at the centre to 65m at each end.

3.6 The laboratory building is three storeys high, with each storey double height such that an interstitial service void is formed above each floor. This void is used for services distribution and maintenance to the laboratories. In addition to the main building there are four remote external plant towers and an energy centre which feed the services into the laboratory facilities.

3.7 Within the site boundary there is a large amount of car parking, a cycle storage area, access roads, landscaped areas, and space for potential future expansion.

4. DESCRIPTION OF THE LABORATORY OF MOLECULAR BIOLOGY DRAINAGE SYSTEM

EXISTING SURFACE WATER DRAINAGE SYSTEM

4.1 The surface water drainage system serving the LMB Laboratory relies on the use of `soakaway' infiltration systems in conjunction with permeable `infiltration' paving within the car parking areas. Other sustainable urban drainage features utilised within the development comprise of filter drains and pre-treatment structures such as deep trapped road gullies, catch pits and oil and petrol separators.

4.2 Surface water run-off is collected from roof and hard paved areas and disposed of via gravity into the various infiltration systems. These infiltration systems are generally located under hardstanding (parking) areas (refer to figures A2.6 and A2.7 in Appendix A2)

4.3 The system is, in simple terms, an infiltration system, where water is collected and drains into the ground with no requirement for discharge to public sewers outside the development land.

4.4 The surface water drainage system has been designed not to surcharge (transmit flows above and beyond the pipework capacity, under pressure rather than by gravity) for the 1 in 2 year storm event and not to flood for the 1 in 100 year storm event with an allowance of 20% for future climate change.

4.5 The surcharge and flooding requirements outlined in 4.1.4 are building regulations requirement (Building Regulations Part H3 and British Standard BSEN752 – Part 4.11.2 - surcharge) and planning authority baseline requirement (Cambridgeshire Flood and Water supplementary planning document - Section 6.4.1 and 6.4.2 – Flooding), respectively.

4.6 There are three main infiltration (soakaways) points of discharge within the development area, one located to the northwest parking area, one to the north east parking area and one to the southern parking area (the approximate location of each infiltration system is shown in Figure A2.7 of Appendix A2).

4.7 There is a surface water storage `buffer' tank to the centre north of the site that acts as a holding tank where surface water runoff generated from the roof and the hardstanding areas can be held temporarily before being discharged to the adjacent infiltration soakaways in the ground. The storage vessel is designed to create a 'time lag' between water being collected rapidly in heavy rainfall events and then being more slowly dispersed into the underlying strata, by infiltration.

4.8 In the event that any part of the surface water network fails or reacts too slowly to very heavy rainfall events or, in the event of a storm event rarer than the designed 1 in 100 year event (with a 20% allowance for climate change), it is possible that surface level flooding would occur.

4.9 This flooding would occur principally at manhole locations within the car park areas and in the event that this flooding did occur, the external tarmac levels have been designed to allow surface water runoff to be conveyed overland to the west of the development, where there is a conveyance ditch at the LMB boundary with the network rail track structure.

4.10 This overland flood flow is known as `exceedance' and this exceedance overland flow has been designed to discharge into the western ditch, which would act as an exceedance conveyance ditch running to the south-west of the site, parallel to the Network Rail line.

4.11 The conveyance ditch is then piped and continues south, beneath the Cambridge guided bus way and continues west out into Hobson's Park and ultimately outfalls to Hobson's Brook to the west of the site (refer to Figures A2.6 and A2.12 in Appendix A2).

4.12 There is also a retention basin (RBI) located outside the between Robinson Way and the southern site boundary between the LMB land and the Cambridge guided bus route and it is not clear what catchment this retention basin serves. Although the retention basin serves no direct purpose to the LMB drainage system, this retention basin discharges to the same ditch as the LMB site and therefore assumed to perform a supporting function to the shared outfall under the Cambridge guided bus route in terms of flood alleviation in periods of heavy rainfall.

4.13 Refer to Appendix A5 for the as-built surface water drainage drawings and a summary of the associated design calculations upon which the surface water evidence statement above is based.

EXISTING FOUL WATER DRAINAGE SYSTEM

4.14 The foul water drainage system serving the LMB site has been designed to convey the foul water flows collected from the new laboratory to the external public sewer system which is owned and maintained by Anglian Water.

4.15 The LMB drainage network for foul water drainage has been split into 2 networks. Network 1 drains the North and East side of the new building and Network 2 drains the western and southern side. (refer to Appendix A6 for the as-built foul water drainage drawings and a summary of the associated design calculations upon which the foul water evidence statement is based.)

4.16 The two networks are separate and connect into separate outfalls.

4.17 The foul water drainage networks generally run to the north and south of the LMB building and do run partly within the circulatory access road to the south of the LMB building.

4.18 The foul water drainage networks are relatively remote from the proposed track side alteration works and very remote from the proposed station infrastructure works south of the Cambridge guided bus route.

4.19 As long as the capacity of the wider Anglian Water foul drainage network were not exceeded by the proposed CSIE works, then there should be limited interaction between the works and the private LMB drainage system.

4.20 The exception to statement 4.19 is that there may be temporary access rights taken by Network Rail on the private car park access road within the LMB development to the south of the laboratory.

4.21 If the southern car park access were used as a temporary construction access to facilitate the track side works then there would be an interaction between the proposed CSIE works and the existing drainage system in the form of heavy construction vehicle movement and vibration and the risk of damage to the existing drainage network.

4.22 A condition survey of the existing drainage system should be undertaken prior to the Network Rail access to determine the condition of the existing foul water network and identify any defects prior to any CSIE works having taken place.

4.23 Appendix A6 provides detail of the foul water drainage arrangement drawings and a summary of the associated design calculations which are not rehearsed in this proof of evidence

5. FLOOD RISK IN THE EXISTING ARRANGEMENT

5.1 The Environment Agency's Risk of Flooding maps showing the existing flooding risk from the sources listed in 5.2 and 5.3 below.

5.2 **Rivers and sea** (Refer to Figure A2.8 in Appendix A2). The Rivers and Sea Flood Map indicates the extent of flood risk to the south of the LMB development which is a low risk and at a very low risk to the south west corner, where the western LMB ditch meets the open ditch (east to west) that runs parallel to and south of the Cambridge guided bus route.

5.3 **Surface water** (Refer to Figure A2.9 in Appendix A2). The Surface Water Flood Risk Map indicates that there is a low to medium risk of surface water flooding to the south-west corner of the LMB land where the western LMB ditch meets the east to west open ditch that runs parallel to and south of the Cambridge guided bus route.

5.4 There is evidence of a 'vein' of surface water flooding running north-west to south-east through the LMB land but this is assumed to be an anomaly in the Environment Agency flood modelling that continues through the Astra Zeneca site (Refer to Figure A2.9 in Appendix A2). The Environment Agency flood modelling is based upon digital terrain modelling which is generally accurate to 2m resolution but there are areas known to be based upon a more coarse 5m resolution of mapping and, these anomalies may be as a result of this more coarse definition. The anomaly does not materially affect the evidence given.

5.5 **Artificial sources** (e.g. reservoirs and canals - refer to Figure A2.10 in Appendix A2). The Reservoir Flood Risk map does not indicate any evidence of flood risk to the LMB site.

5.6 The flood risk maps shown are based on the current arrangement and an assessment of any increase in risk will need to be carried out by Network Rail taking on board the CSIE scheme proposals which involve the culverting (below grounding) of the open ditch to the south of the Cambridge guided bus route.

5.7 Network Rail will need to ensure that the proposals do not throttle existing flows and cause any residual upstream flood risk, and this will need to be evidenced by surface water modelling and simulation.

6. DESCRIPTION OF THE POTENTIAL IMPLICATIONS AND RISKS OF NETWORK RAIL PROPOSALS TO THE MRC / LMB LABORATORY CAMPUS

The potential risks and implications to the LMB Laboratory are as follows

MISSING INFORMATION

6.1 An initial technical advisory note has been provided by Network rail setting out a statement that explains the proposed CSIE trackside works and access requirements to the works site and how it is intended to manage surface water run-off in the temporary and permanent cases. The technical note provides clarity on the hydraulic risks related to the culverting of the North ditch below the proposed station structure and how it is intended `in principle' to manage surface water run-off in the permanent case – this initial technical note needs a detailed hydraulic assessment and further topographic survey work to fully understand and validate the drainage mitigation works proposed by Network Rail.

6.2 A detailed technical advisory note is still to be provided by Network Rail setting out the hydraulic modelling evidence to support the initial technical note assumptions highlighted in paragraph 6.1 above

6.3 The Network Rail red line boundary encroaches onto the LMB Laboratory research centre land and the exact location of the land take required for construction access is yet to be agreed and this will impact on the extent of existing drainage that would require surveying and protection.

SURFACE WATER DRAINAGE

6.4 The surface water drainage exceedance conveyance and storage ditch on the LMB Laboratory land falls within the overlap between the Network Rail red line boundary and also within the LMB site boundary and it is not clear how this will be impacted by the proposed temporary construction works – further details are to be provided by Network Rail to clarify the proposed temporary works.

6.5 The western conveyance ditch is effectively an 'emergency overflow' from the LMB development, it does currently serve as an important protective mechanism in the case of extreme rainfall events. This ditch is necessary to convey exceedance flows from the LMB car park and roof areas and potentially some flows from the land to the North of the LMB site – Network Rail should prove that these flows would not be impeded temporarily or permanently as a result of the CSIE works

6.6 It is not clear if the exceedance ditch also conveys flows from the school land to the North of the LMB development land conveying surface water to the wider Hobson's Brook and a topographic LIDAR survey should be undertaken to verify the catchment to the ditch – Network Rail have acknowledged these further survey works requirements (refer to the ITN produced by Network Rail in Appendix A4)

6.7 The main ditch to the south of the LMB site, outside the site boundary and retention basin that runs from east to west, outside the LMB Laboratory demise fall outside the Network Rail red line boundary (Refer

to Figures A2.12 and A2.13 in Appendix A2) into the off-site conveyance ditch leading to Hobsons' Brook.

6.8 It is not clear at this stage to the extent that these existing drainage features will be impacted by the proposed works and Network Rail are due to issue a more detailed technical update note to confirm the proposals in this area once additional topographic survey work has been undertaken on site.

6.9 This `detailed' information is not available at this stage and Network Rail have acknowledged the need for further survey works to validate the principle approach laid out in the initial technical note (refer to the ITN produced by Network Rail in Appendix A4)

FOUL WATER DRAINAGE

6.10 The existing foul water drainage to the west of the LMB building is located between the building and the eastern edge of the main circulatory LMB service road. It is evident that the proposed Network Rail works are remote from this area and therefore there will be no physical interactions between this section of foul water drainage and the proposed works.

6.11 The circulatory access road to the south of the LMB building in the affected area highlighted in Figure 13 in Appendix A2 contains part of the main foul water outfall drainage from the LMB laboratory site and it is understood that this may be utilised as a construction access route. It is not clear what the proposals are for this route other than construction access and plant movement and Network Rail should confirm what type of construction vehicles will be required to access the circulatory road so that any impact on the buried foul water drainage can be assessed.

6.12 The main southern and western access roads within the LMB Laboratory land falls inside the red line boundary with Network Rail. Any encroachment on the circulatory road within the LMB site would have a potential impact on the day to day access for routine maintenance of the drainage system, this could be mitigated by carrying out maintenance and cleaning prior to commencement of the CSIE works and an emergency access strategy for the site put in place, as the LMB Laboratory operations rely on full access of the LMB Laboratory western road (Refer to Figure A2.15 and 2.17 in Appendix A2).

LANDSCAPING WORKS

6.13 The Network Rail proposals in terms of landscaping and planting strategy plan show some existing key structural vegetation that will be removed and reinstated to the north, south and the west of the development – refer to Network Rail drawings 158454-ARC-00_ZZDRG-EEN-000074 and 000075.

6.14 It is evident that the proposed Network Rail landscape works are remote from the development's boundary and therefore there will be limited interaction between the LMB drainage system and the proposed works.

CONSTRUCTION ACCESS

6.15 Figure A2.16 in Appendix A2 shows an overlay of the LMB ownership boundary on an extract of the Network Rail (Cambridge South Infrastructure Enhancements) order mapping. This overlay identifies three key interactions areas between the proposed works (in terms of temporary use of land, acquired land and acquisition rights) and the existing circulatory access road within the LMB land and the existing conveyance swale to the west.

6.16 It is assumed, but not verified at this stage, that this interaction is access only and not intrusive, and that all construction vehicle loading will be 'normal' i.e. suitable for public carriageways with no special licenses.

6.17 Details of the proposed construction access requirements are outlined in Section 2.2 of the `initial technical note' dated 17th December 2021 (contained in Appendix A4) and provide clarity around the temporary protection measures to be applied to the existing conveyance ditches during construction and the permanent proposals for future maintenance are outlined in Section 2.1 of the ITN document.

6.18 The Network Rail design approach in both the temporary and permanent works cases is appropriate `in principle'.

6.19 The design approach and detailed design drawings and calculations are reliant on further survey work, both topographic and site walk over works to validate the proposals.

6.20 This information should be made available to the LMB team when it becomes available.

7. SUGGESTIONS AND RECOMMENDATIONS

7.1 Although more detailed proposals and technical submissions are anticipated from Network Rail, in order to fully assess the impact of the infrastructure enhancement proposals, I would recommend the following information is obtained and made available in order to protect the development from the impact of the proposed works:

SURFACE WATER DRAINAGE

7.2 Obtain a measured survey to define size/volume/dimensions of the existing ditch running to the west of the LMB Laboratory - it is recommended as a minimum, to provide, in the Network Rail surface water drainage design, an equivalent cross sectional area in terms of pipe diameter or culvert or conveyance to match the existing.

7.3 Network Rail should carry out a modelled surface water flow assessment to determine the existing capacity of the ditch to the west of the LMB building (the exceedance conveyance ditch) and also accurately assess any other function of this conveyance ditch from other properties and land to the north and west.

7.4 Any temporary infill works to the existing ditch be fitted with apertures to ensure water can enter the ditch and escape the site unimpeded. This is to ensure that the flood risk is not made worse by the proposed works in either the temporary or permanent case.

7.5 Network Rail should provide a detailed catchment assessment for surface water and modelled calculations to verify that the new below station culvert running east to west parallel to the south side of the Cambridge guided bus route will not throttle the existing flows from the LMB land.

7.6 Currently the LMB land drains to the west via a series of open ditches, with the exception of the piped section below the Cambridge guided bus route and Network Rail should ensure that the capacity and conveyance of the surface water flows will not be reduced in any events up to the 1 in 100 year event with a suitable allowance for climate change.

7.7 Network Rail should carry out a pre-commencement CCTV (closed circuit televisual survey) of the foul and surface water drainage network where construction access is required and where construction vehicles will pass over the existing drainage network. This pre-commencement CCTV survey would identify and record any existing defects in the existing drainage system and this would protect Network Rail and the LMB in the event of future issues with the drainage system, locally.

FOUL WATER

7.8 Network Rail should provide clarity on the construction access requirements to the southern and western access roads within the LMB curtilage as these are designed as private circulatory for heavy goods vehicle access (not adopted carriageways in terms of volume of traffic movements) and these

access roads have embedded drainage systems and these have loading limitations. Network Rail should verify and ensure that no onerous imposed loads are proposed in the construction methodology that might cause loading stress on the road structure and buried drainage contained within.

7.9 Network Rail should carry out a pre-commencement walk over recorded survey of the car park areas over which construction access is required to complete the track gantry works and a pre-commencement CCTv survey of the embedded drainage in those areas where construction vehicle access is proposed.

8. WITNESS DECLARATION AND STATEMENT OF TRUTH

I hereby declare as follows:

This proof of evidence includes all facts which I regard as being relevant to the opinions that I have expressed, and that the inquiry's attention has been drawn to any matter which would affect the validity of that opinion.

I confirm that I am not instructed under any conditional or other success-based fee arrangement.

I confirm that I have no conflicts of interest.

I believe the facts that I have stated in this proof of evidence are true and that the opinions I have expressed are correct; and

I understand my duty to the inquiry to help it with matters within my expertise and I have complied with that duty which overrides any obligation to those instructing or paying me. I have prepared my report impartially and objectively, and that I will continue to comply with that duty throughout these proceedings.

I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.

David Purcell

AKTII Consulting Limited 7th January 2022

APPENDIX A1 – CIVIL ENGINEERING TERMINOLOGY

Soakaway – a soakaway is method of conveying or infiltrating surface water into the ground naturally by gravity. Infiltration systems such as soakaways are generally stone filled devices with 30% voids between the stones to allow water to be stored and slowly percolate into the ground. These systems are reliant on permeable strata below ground – sand / gravel / chalk and are unsuitable for clay or silt strata

Permeable parking – is an infiltration system where water is allowed to pass through the parking surface into a single sized stone reservoir below. The stone below the parking area has 30% voids between the stones to allow water to be cleaned and stored and slowly percolate into the ground

Surcharge - Sewers are surcharged when the supply of water to be carried is greater than the capacity of the pipes to carry the flow. The surface of the water in manholes rises above the top of the sewer pipe, and the sewer is under pressure or a head, rather than at atmospheric pressure.

LIDAR – a LIDAR survey functions by pointing a laser at a target surface on the ground and the surface reflects the light back to the LIDAR equipment, and the sensor records the reflected light to measure the distance travelled. This type of survey can be carried out quickly and relatively inexpensively (in comparison to the traditional level survey methodology) by drone or database ordnance survey purchase.

APPENDIX A2 – FIGURES

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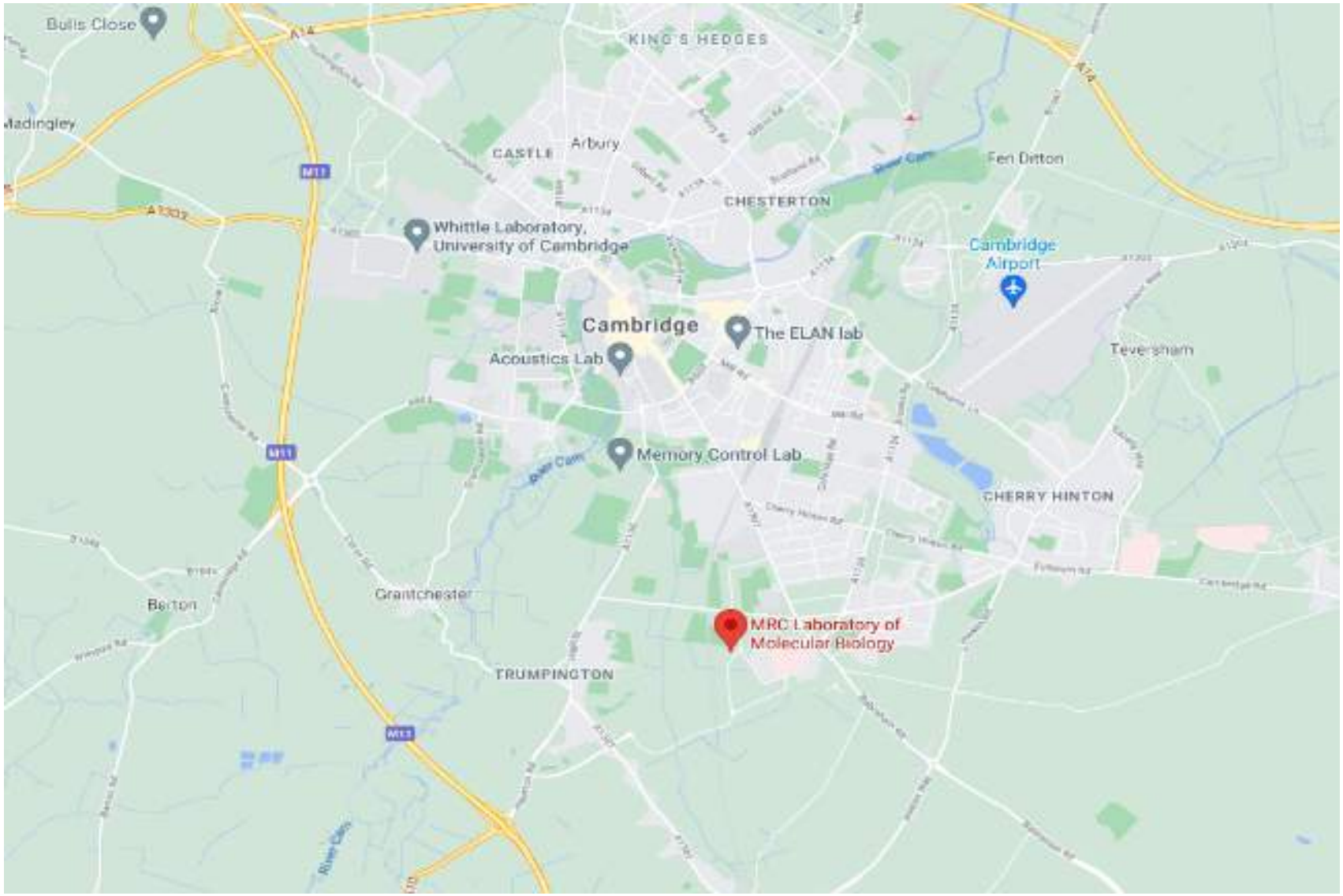

Fig A2.1: Laboratory (LMB) Location Plan relative to Cambridge

Fig A2.2: Location of the Laboratory of Molecular Biology

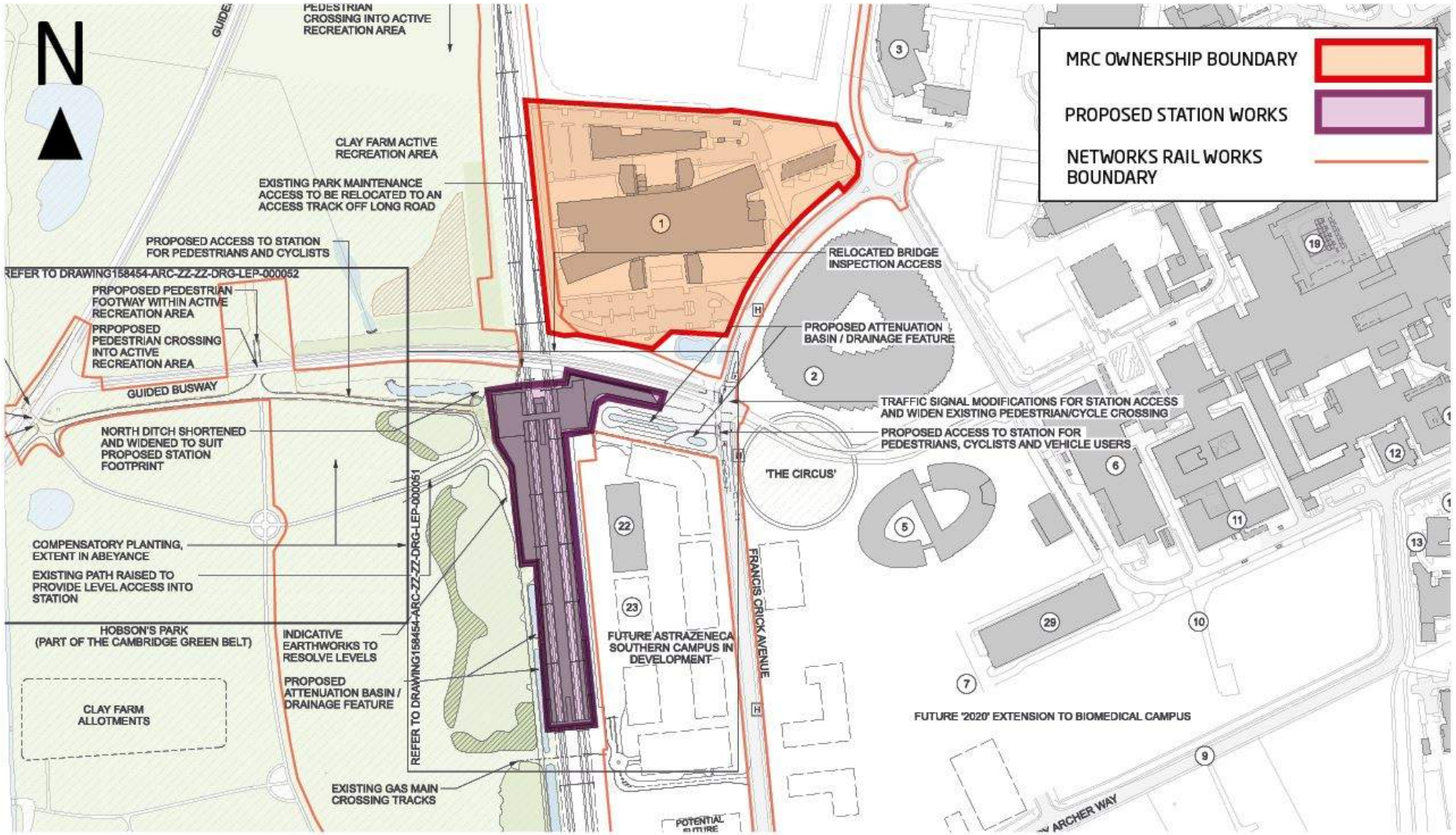

Fig A2.3: Location of proposed station work in relation to the Laboratory of Molecular Biology

Fig A2.4: Local (LMB) Laboratories Location Plan

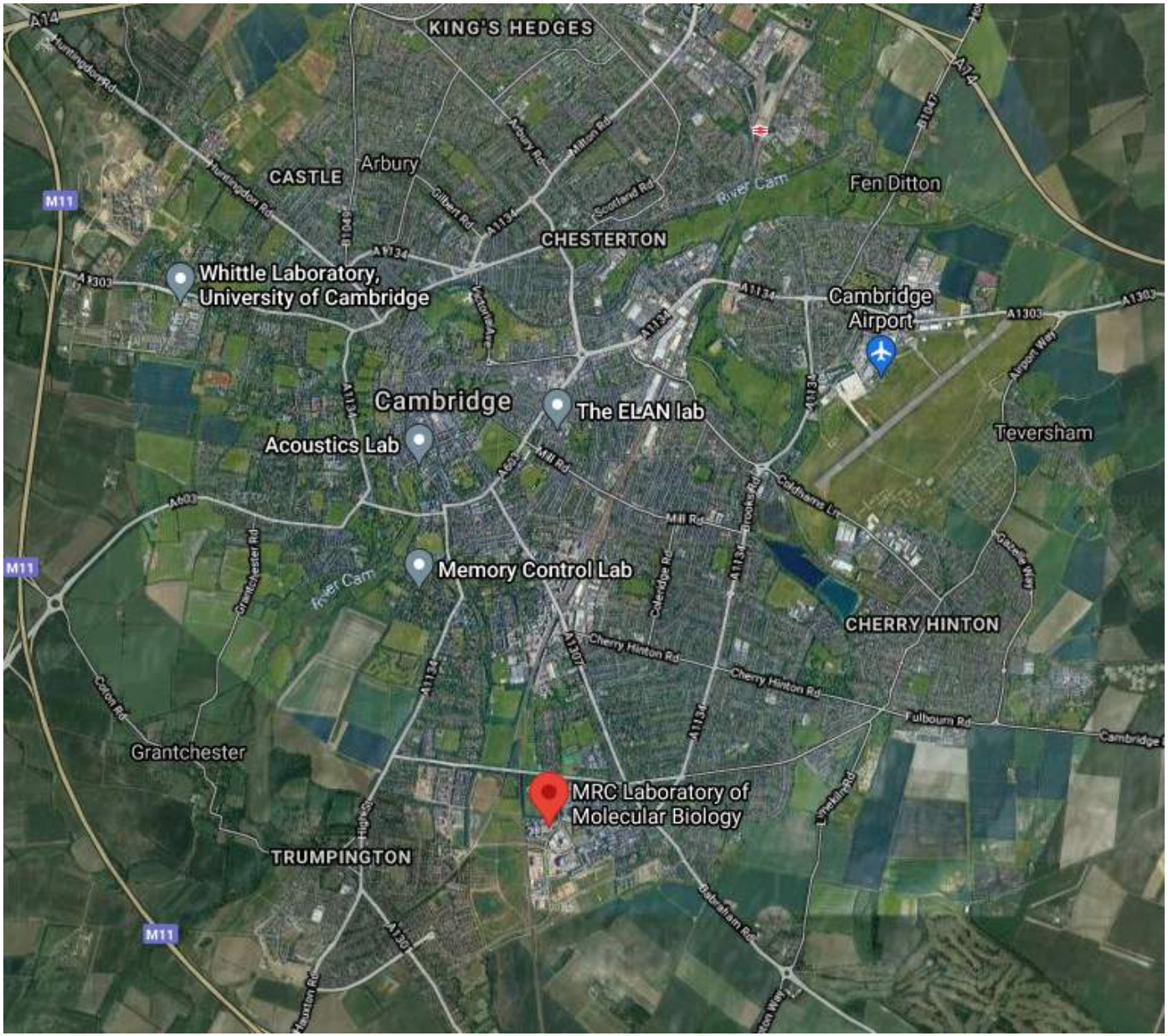

Fig A2.5: Site location satellite image

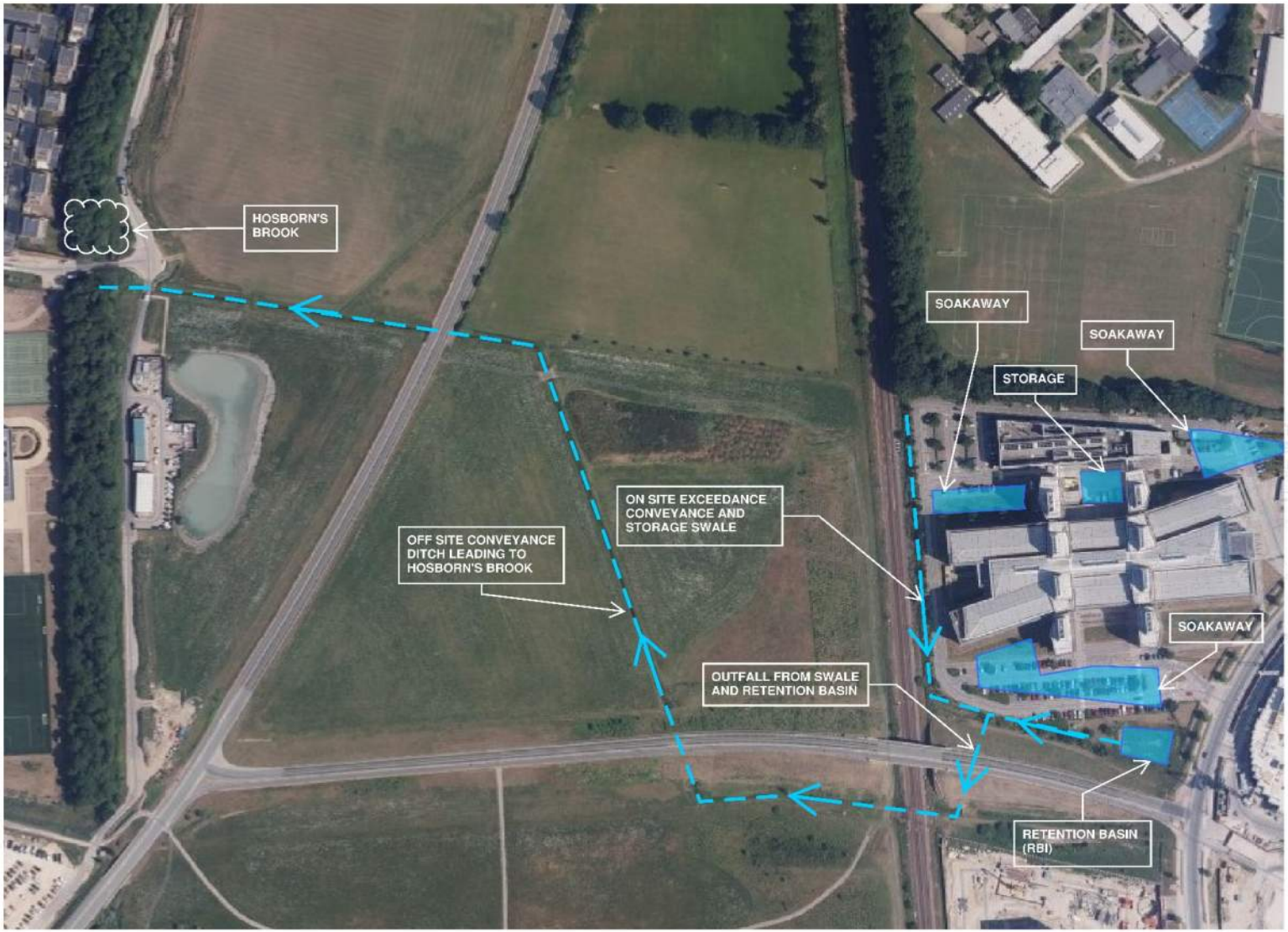

Fig A2.6: Aerial view with as-built drainage on site and assumed direction of flow of 'off site' drainage

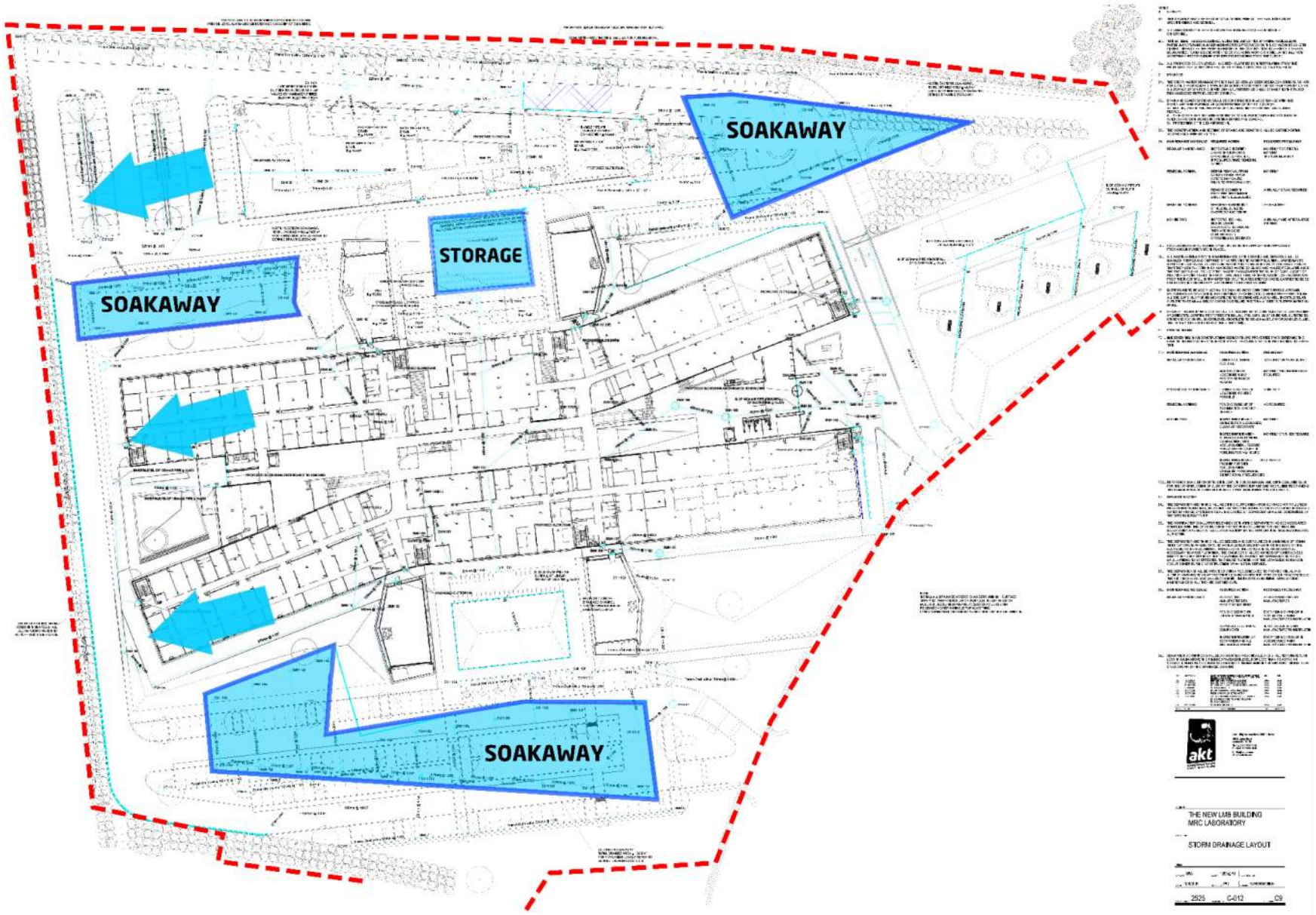

Fig A2.7: Schematic of SuDS built on site

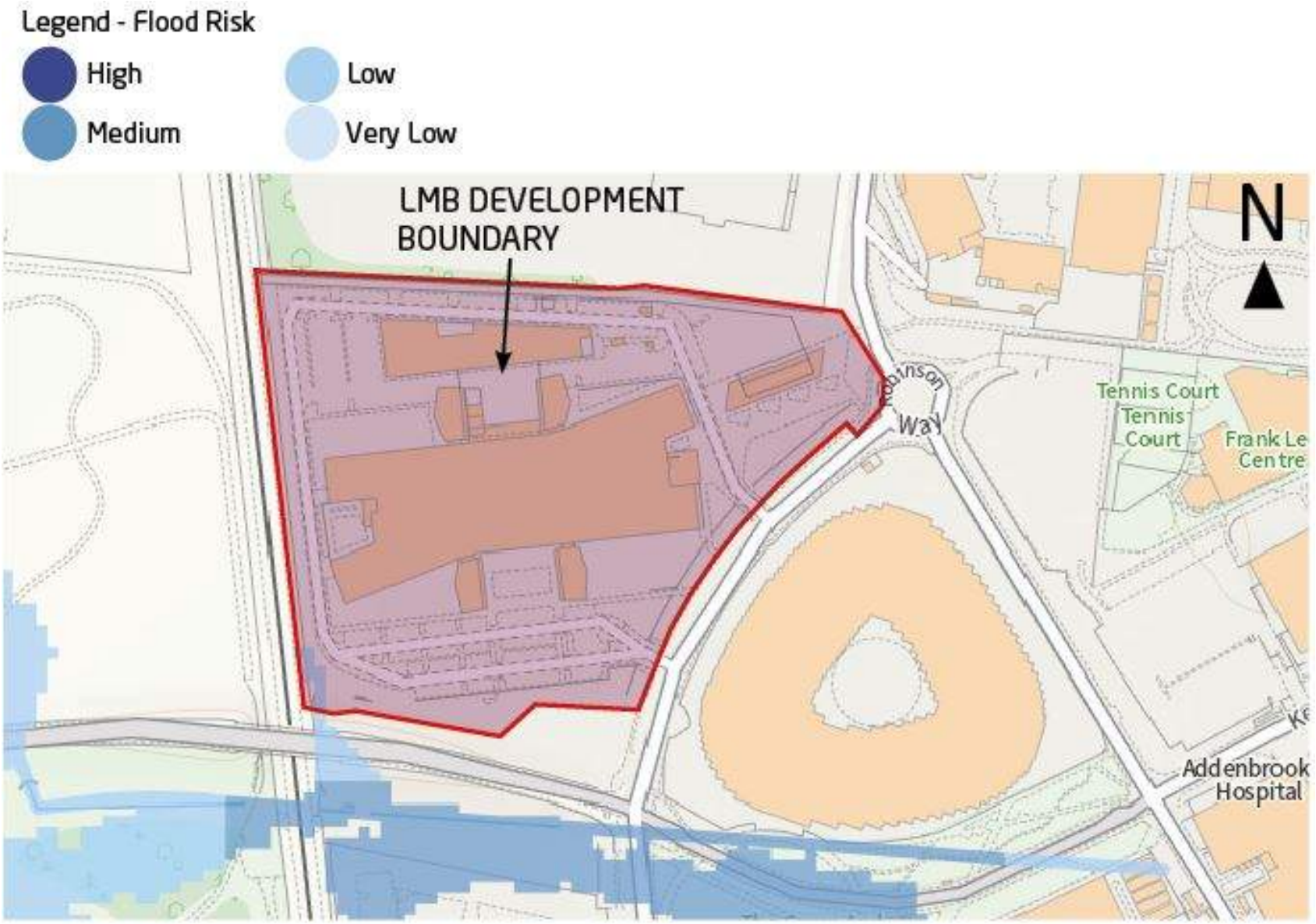

Fig A2.8: Environment Agency Flood Risk Map (Rivers and Sea)

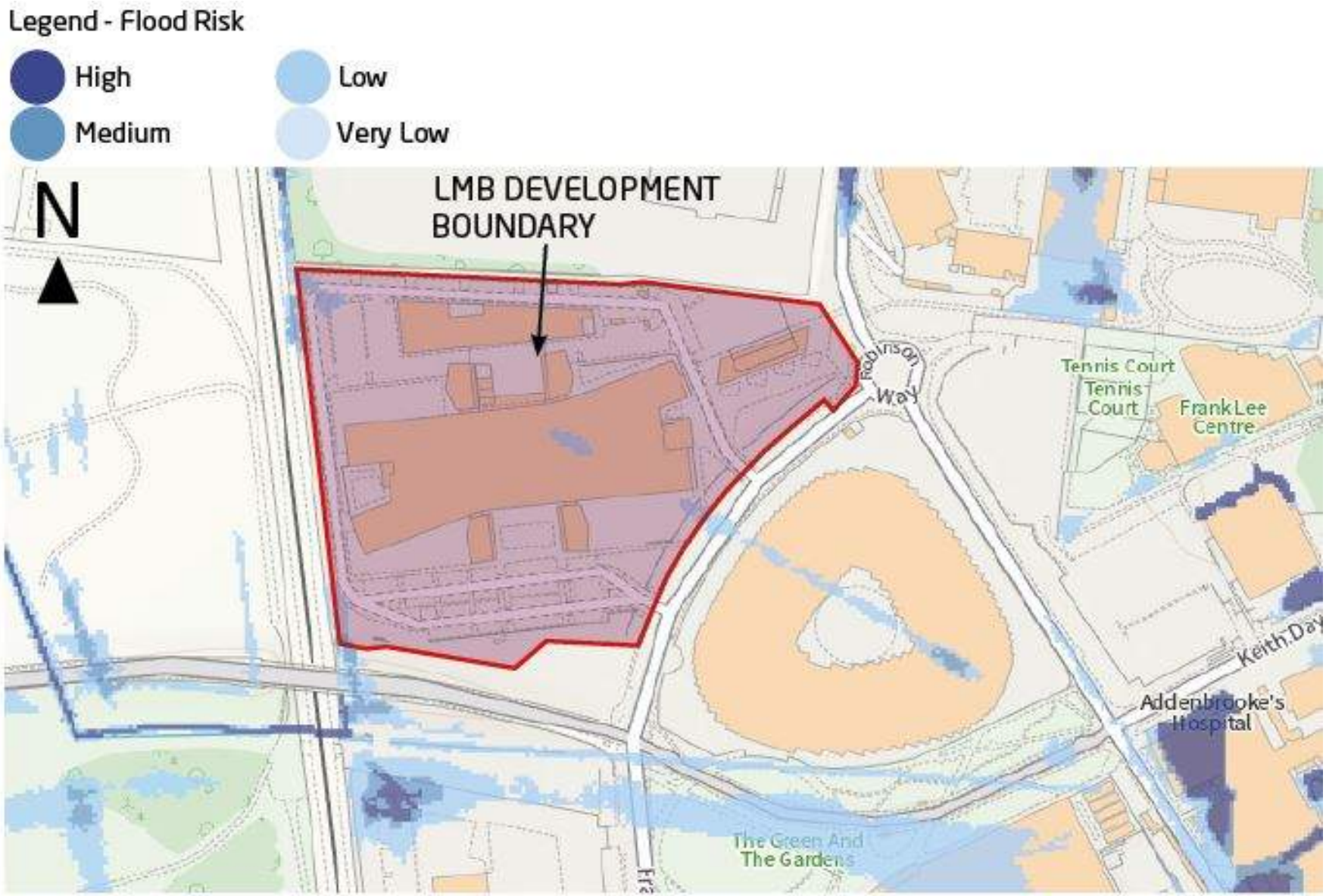

Fig A2.9: Environment Agency Flood Map – Extent of flooding from surface water

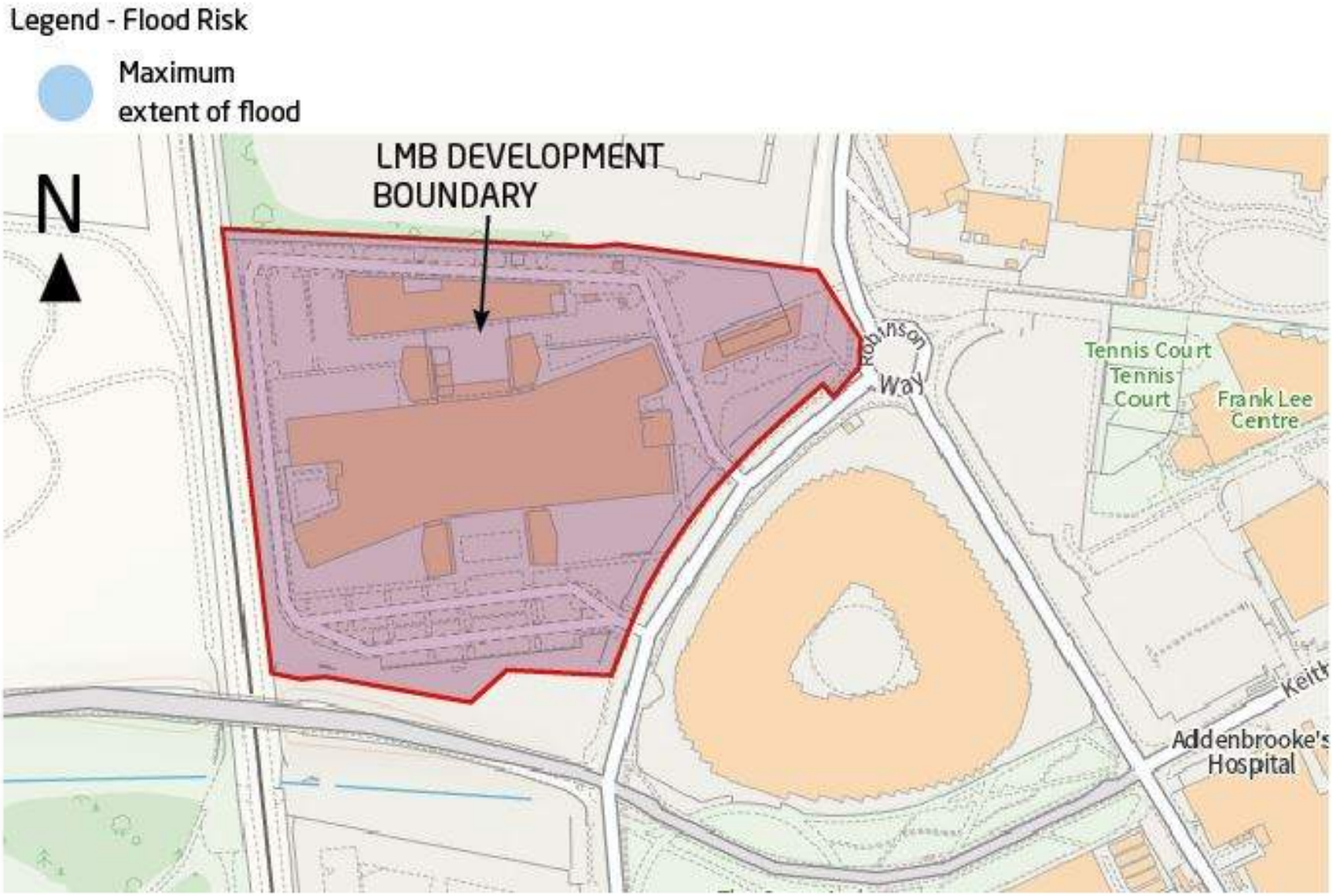

Fig A2.10: Environment Agency Flood Map – Reservoirs

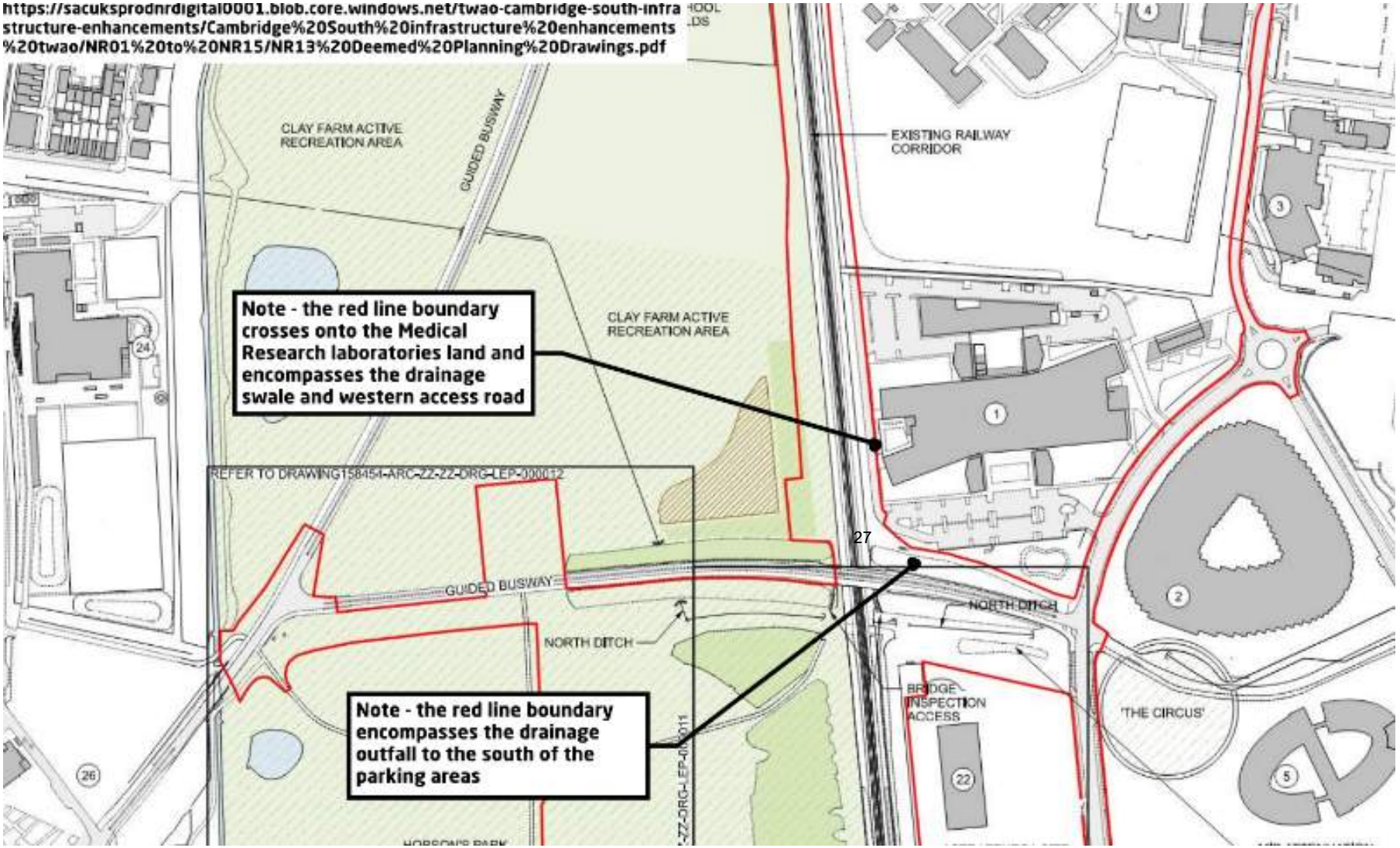

Fig A2.11: Network rail infrastructure enhancements proposals conflicting with the LMB Laboratory land

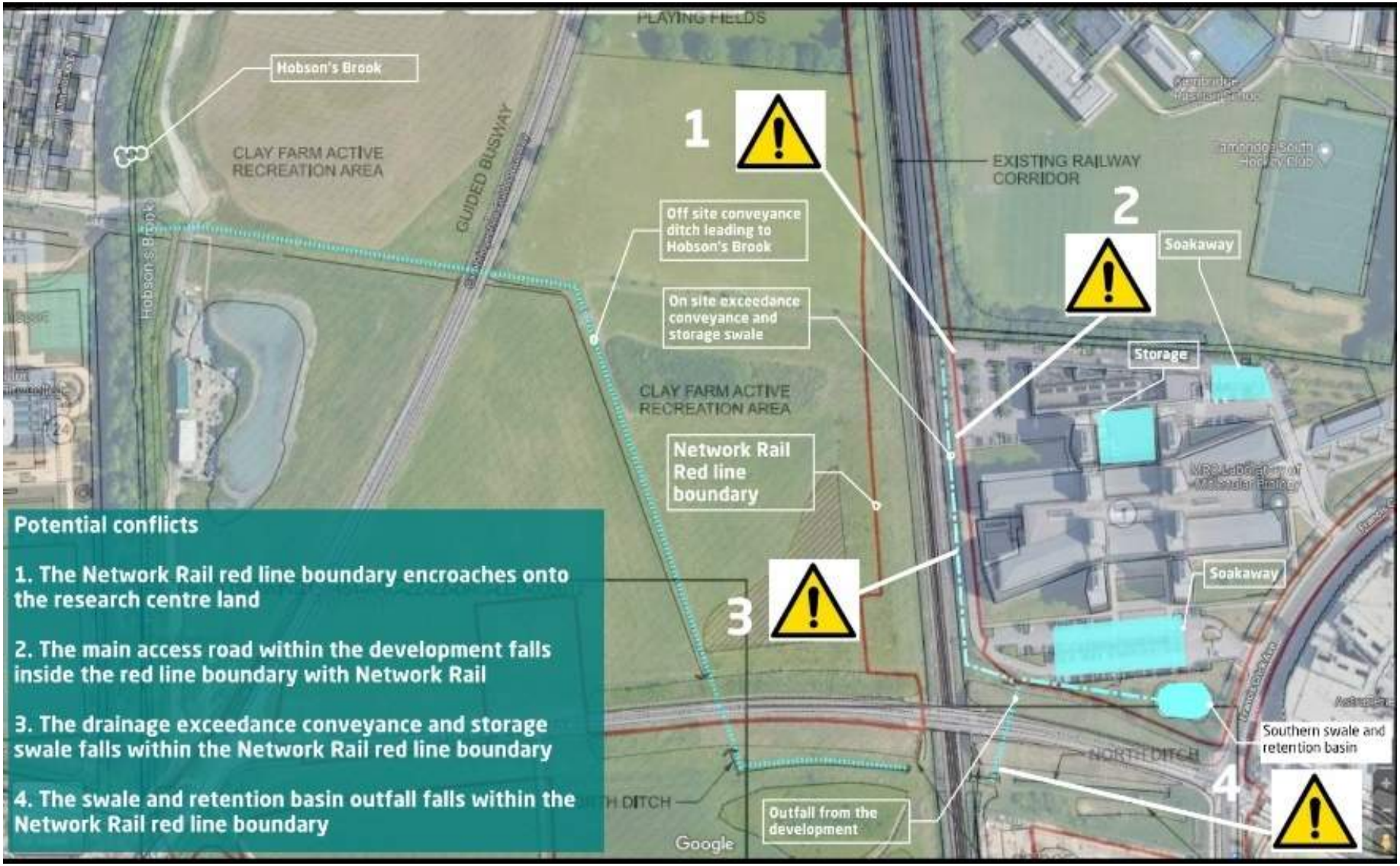

Fig A2.12: Implications of Network rail infrastructure enhancements proposals to the with the LMB Laboratory land

Fig A2.13: Network rail infrastructure enhancements proposals - planning drawings - compared to LMB complex.

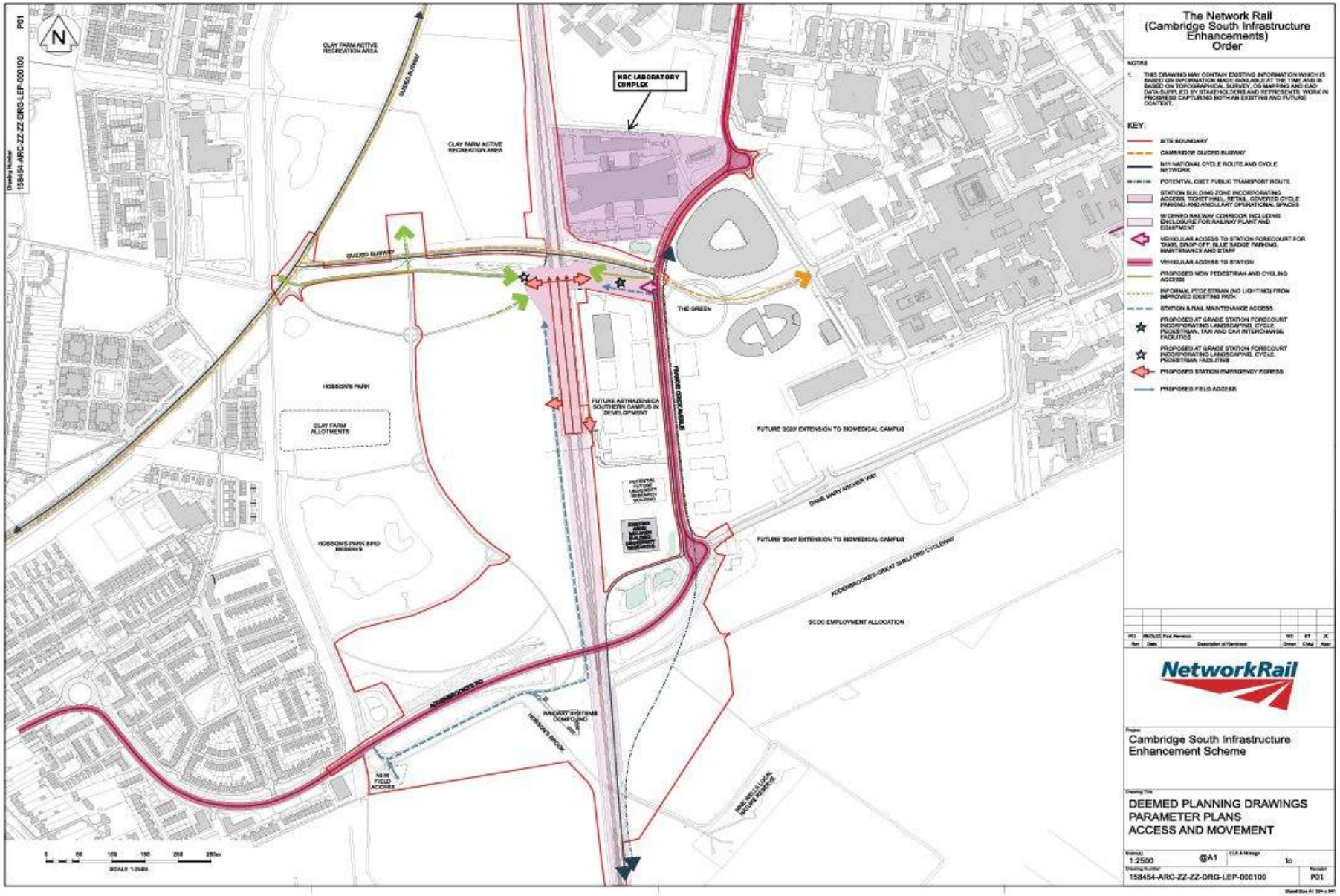

Fig A2.14: Network rail access and movement proposals compared to LMB complex.

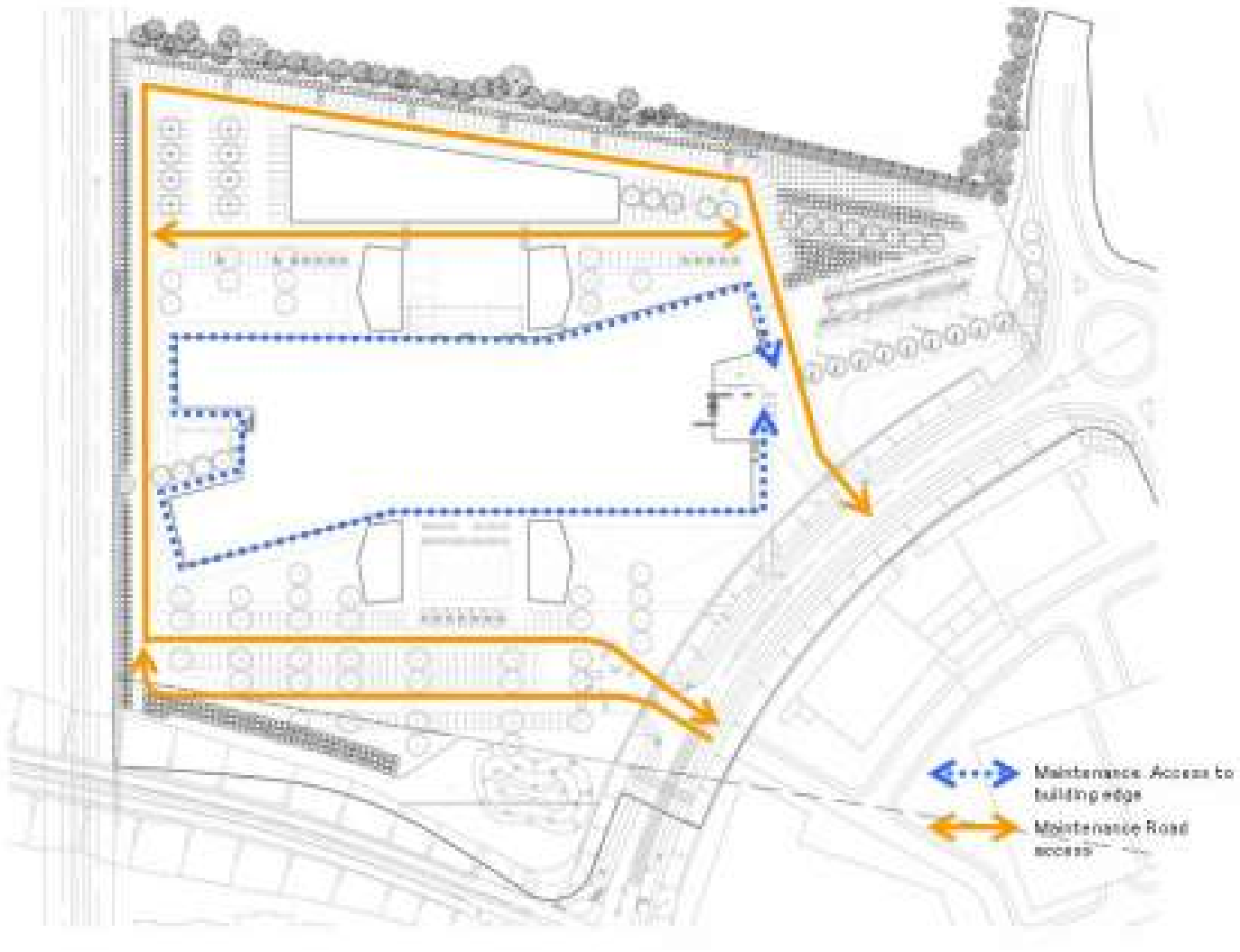

Fig A2.15: Maintenance access strategy for the LMB complex

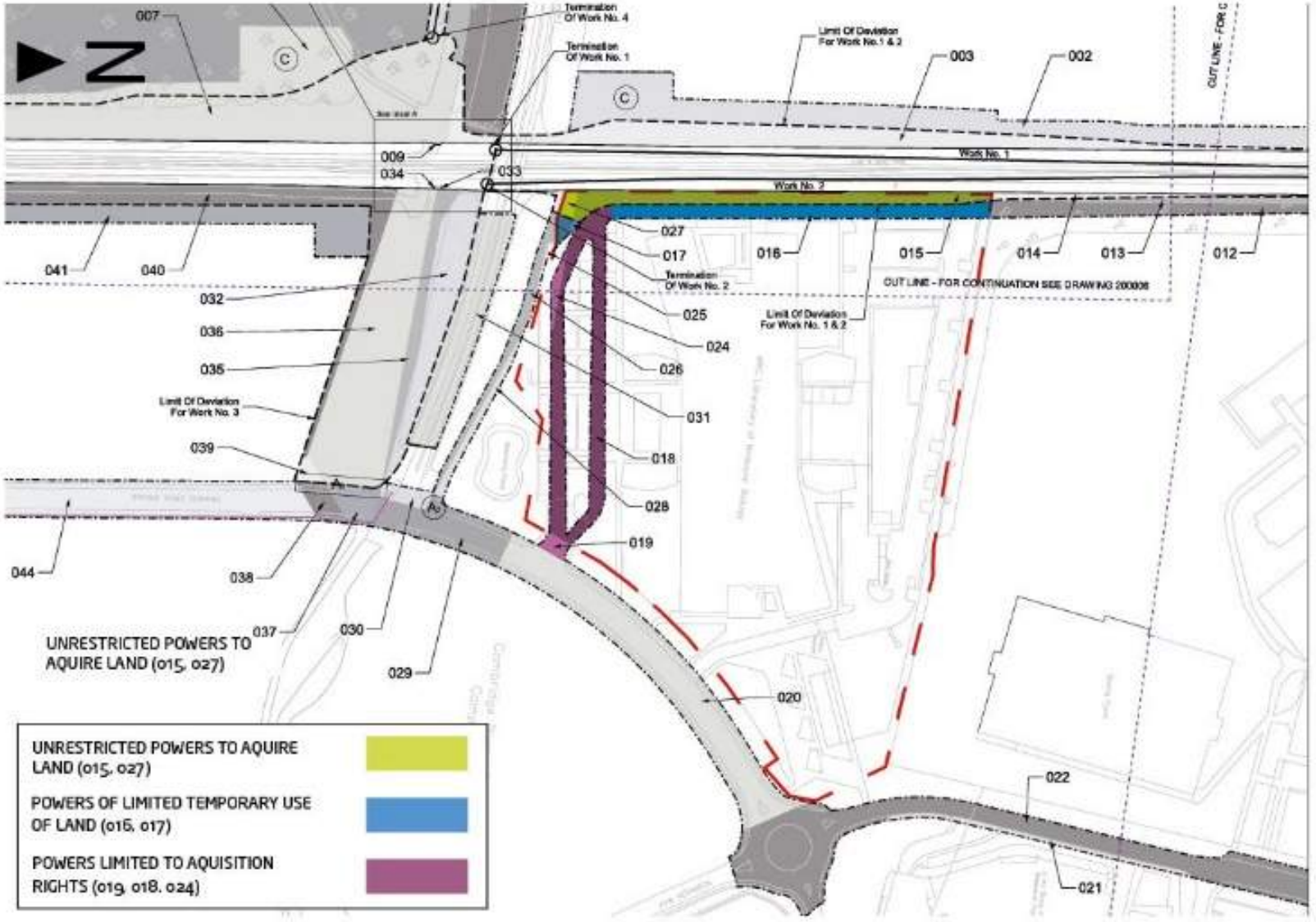

Fig A2.16: Extract of the Network Rail (Cambridge South Infrastructure Enhancement) order drawing 158454-ARC-00-ZZ-DRG-EMF-200002 sheet 2 of 10 overlaid with the LMB Laboratory legal boundary. Original access strategy (temporary and permanent

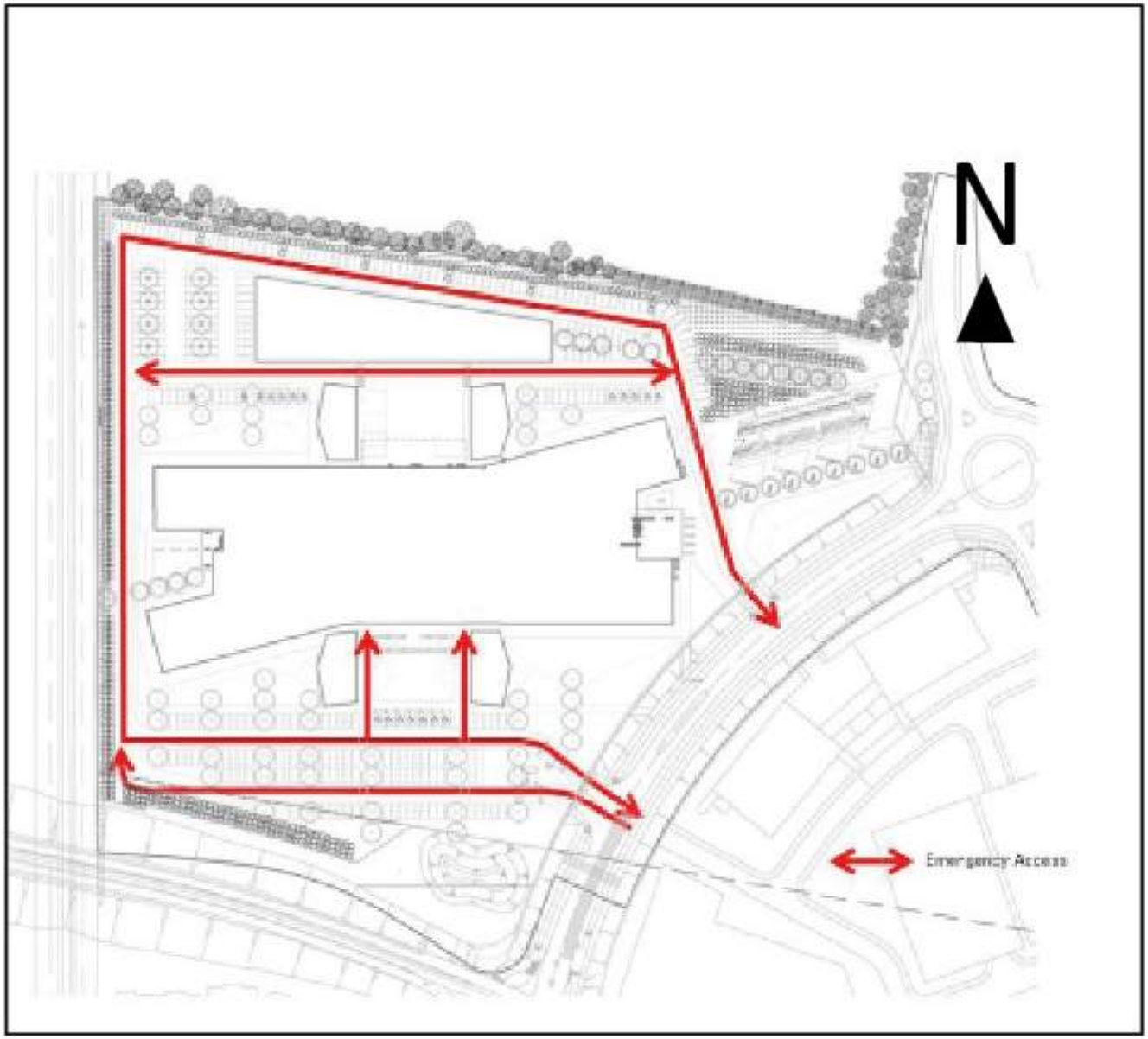

Fig A2.17: Emergency access strategy for LMB complex.

APPENDIX A3 – MEETING MINUTES 16th DECEMBER 2021 – LMB + NR TEAM

MINUTES OF A MEETING

UKRI – Cambridge

On: 16 December 2021

Present: Rebecca Evans – Hinson Parry & Company for MRC
Paul Humphries
Chris Renshaw
Gareth Morris
Chris Prior
Tim Spencer
Steven Holmes
Niamh Leonard

AGENDA

Vibration

- No one from Network Rail or LMB could attend but it was understood that Lyndon from Network Rail is awaiting a response from Sandy Brown another specialist.

  As Stephen confirmed, in reality, Network Rail are awaiting a response from us on the Heads of Terms to clear a number of issues.

Drainage

- Becky gave David's summary of his and Sue's meeting. This overall, was a positive meeting and she will be undertaking a draft technical note in the next week or so with a further detailed design following in the New Year. It is noted that Sue wasn't aware of the Heads of Terms assurances relating to the swale but she does now and wants to progress matters forward on this.

EMI

- There is a final review of the Network Rail/Arcadis Report and once completed they will get it issued to us, hopefully by Monday.

- This will set out the position of the EMI/EMC's.

- Steve confirmed that we should be issuing our comments to the Heads of Terms asap. Noise is just being finalised and then there will be a methodology of how this will be dealt with.

Steve then gave an overview of our Heads of Terms in very rough and ready format which is as follows:-

Vibration – what happens when there is an amber or red warning.

EMI – nothing worse than what we already have.

Dust and dirt - They accept the provisions that Network Rail will cover the costs of having additional filter replacements.

Impact of Haul Road Ongoing Right of Access for Maintenance

- Subject to agreeable reasonable terms MRC will allow for the carpark to be used for the construction of the railway line. Separate licence to be agreed and appendix to Heads of Terms. It was noted that the construction compound does need to go over the swale and design work needs to be undertaken for this. Paul Humphrey has suggested piping the swale by further design and perhaps a topographical survey needs to be undertaken so that they have a complete picture of the land

Goods Delivery

- By Agreement future power provisions. This is written into the agreement and can be discussed once they are sent over.

Utility Diversions

- MRC are happy that Network Rail has confirmed that there are no current diversions for utility proposed as part of CSIE Scheme.

Biodiversity and Security

- Biodiversity and Security were also discussed.

  Paul Humphrey confirmed that Denton once they have seen the Heads of Terms will amend into a formal agreement that we are all mutually happy with.

Draft Easement

- Draft Easement has been sent to CR Bedson with plan to follow.

Draft Licence

Awaiting some definitions in terms of hours, type of machinery, weight limits etc. and once they have been drawn up will send over. This licence won't have any specific dates but will have a draw down period e.g. 9 weeks from X date so it gives them a bit more flexibility as to when the works will be undertaken with Plan to follow.

Paul Humphrey confirms that they are working on the plan to show the overlay of the original and the new land take and this will follow with an aerial comparison. There were some technical issues but they will come back to us as soon as possible.

Chris Renshaw will be issuing a formal proposal for the acquisition of the land and hopefully have a draft over to us by next week.

NEXT STAGES

Following the pre-enquiry, proofs need to be submitted by the 7th January 2022. Network Rail have to submit all their Maps, books of references and the such like by the 18th January 2022.

Counter Response to proofs by the 11th January 2022.

Inquiry to start on 1st February 2022.

Thereafter, we discussed that from the 13th December 2021 all public Inquiries are to be done virtually and then there will be a further announcement in the first week of January 2022 as to whether or not the Inquiry can go ahead face to face or if it will have to be done virtually. It is noted that the planning inspectorate would prefer this to be face to face and this would overcome a lot of issues in terms of internet/break requirements and such like.

- At the moment the Inquiry are set to run for 6 weeks

Finally, Paul did raise the point that it is best to try and get all of MRC signatures lined up and ready to sign as if we don't want to submit proofs then we need to get everything signed and agreed by the 6th January 2022.

END OF MEETING

R L Evans

APPENDIX A4 – CSIE + MRC LMB INTERFACE – NETWORK RAIL `INITIAL TECHNICAL NOTE' 17th DECEMBER 2021

PROJECT	DOCUMENT NUMBER	
Cambridge South Infrastructure Enhancement	N/A	
SUBJECT	**DATE**	**REVISION**
CSET MRC LMB	17/12/21	P01
PRODUCER		
Sue Brocken		

CAMBRIDGE SOUTH INFRASTRUCTURE ENHANCEMENT

MRC LMB INTERFACE

1 BACKGROUND

1.1 Site description

The Cambridge Biomedical Campus (CBC) will house the largest concentration of biomedical expertise in Europe. There are local and national stakeholder aspirations for a new station to the south of Cambridge in the vicinity of Addenbrooke's Hospital. Cambridge South is located on the West Anglia Main Line and the Cross-Country corridor, as well as being served by services to and from London Kings Cross via the Shepreth Branch and East Coast Main Line. Thameslink services connect Cambridge (and hence could potentially connect Cambridge South) via Central London to Maidstone East and Brighton.

The proposed station is to be located in the land to the West of Francis Crick Avenue and immediately south of the Guided Busway.

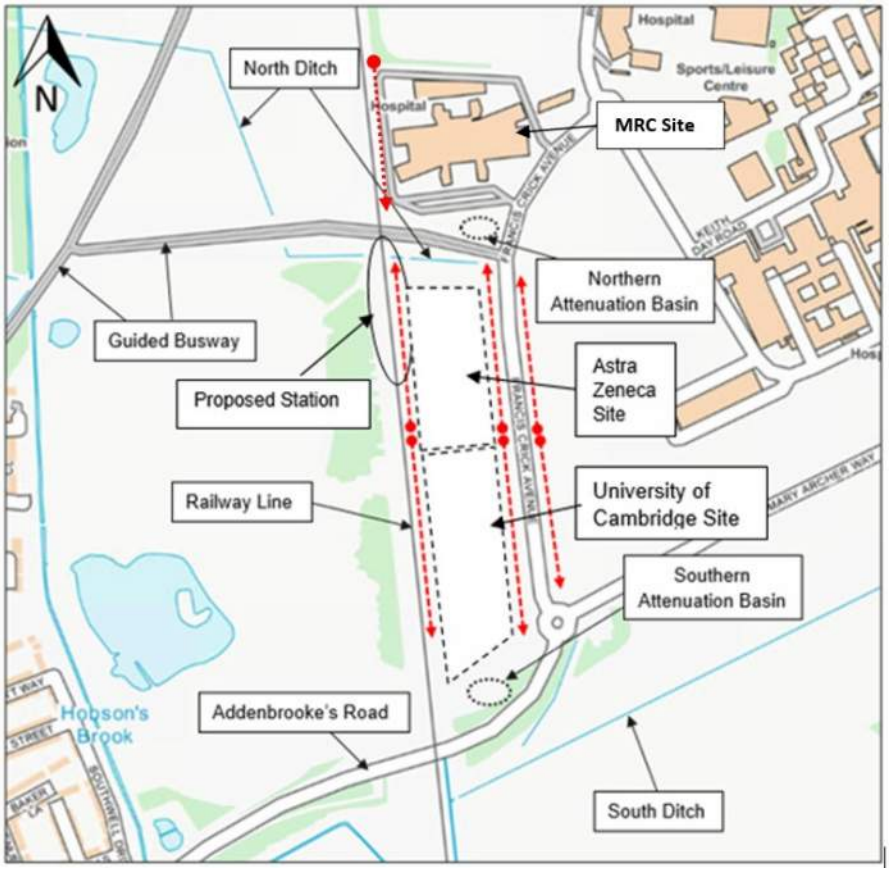

Figure 1 Existing Site Layout (red dash lines show existing swales)

1.2 Proposed development

Cambridge South Station will be served by four platforms, comprising two single-sided platforms and an island platform. The station building and main footbridge are located to the north of the platform arrangement, immediately to the south of the Guided Busway, with a secondary means of escape footbridge and ramps provided to the southern end of the platforms. A station building will be provided on both the east and west sides of the railway connected by an overbridge that provides access to the island platform. Access for pedestrians, cyclists, maintenance and emergency vehicles is provided from the east and west. Vehicular access for taxis, drop off, Blue Badge holders and staff is provided to the east only. Covered cycle storage will be provided to both entrances. Refer to Figure 2 below.

To facilitate the new station, the existing north ditch is to be culverted between Francis Crick Avenue and the railway. Also, the mid attenuation basin is to be replaced with a below ground geocellular attenuation tank

To the north and south of the station, the existing track alignment is to be slued to accommodate the new island platform and 2 new loop lines to service the outer platforms. The Down Main will be moved to the west and Up Main to the east. The existing overhead electrification will be relocated accordingly and upgraded to serve the new lines.

To the north east of the station, beyond the guided busway, it is proposed to provide permanent and temporary access via land owned by MRC Laboratory of Molecular Biology to a new Relocatable Equipment Building (REB).

To the west of the rail corridor, the land is generally park land with ground levels falling away from the railway. To the east of the rail corridor, the ground generally falls towards the railway. As a result, the various developments situated to the east have drainage networks which run parallel to the proposed widening of the rail corridor.

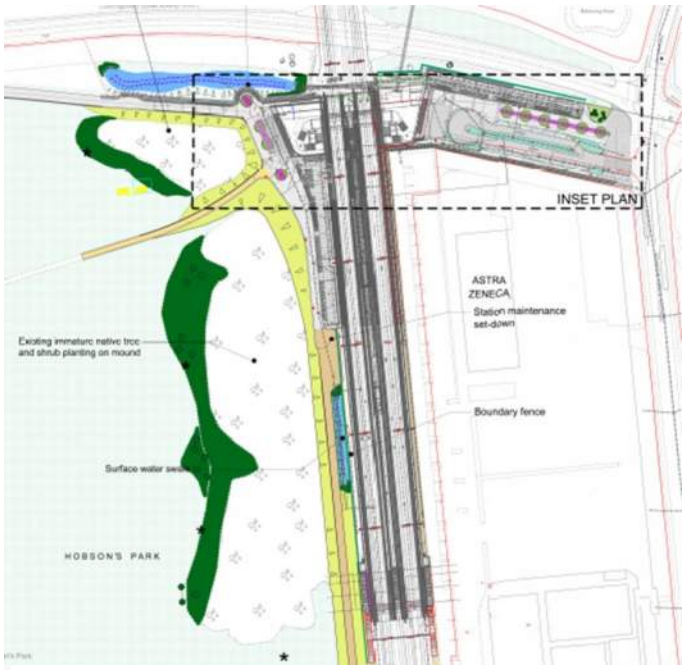

Figure 2 Proposed Station Development Layout

1.3 Interface Areas

The major stakeholders to the east of the rail corridor are Astra Zeneca, the University of Cambridge and the MRC Laboratory of Molecular Biology (MRC), refer to Figure 1 above.

This report relates to the interface with the MRC site to the north of the guided busway.

Currently, the site is drained via 3 No. soakaways situated within the MRC site, however, any exceedance flows will flow over land towards a conveyance swale which runs along the boundary between the MRC site and the rail corridor. It is likely that this swale also receives flows from Long Road Sixth Form College fields immediately to the north of the MRC site.

The outfall from the swale discharges into the existing outlet from the highway attenuation pond to the south east corner of the MRC site. The flows from the highway pond (north attenuation basin) are restricted to a rate of 3 l/s/ha at the chamber immediately downstream of the pond. No further flow control or restrictions are present within the system prior to discharge into the North Ditch. Refer to Figure 3 below for existing pond and swale arrangement.

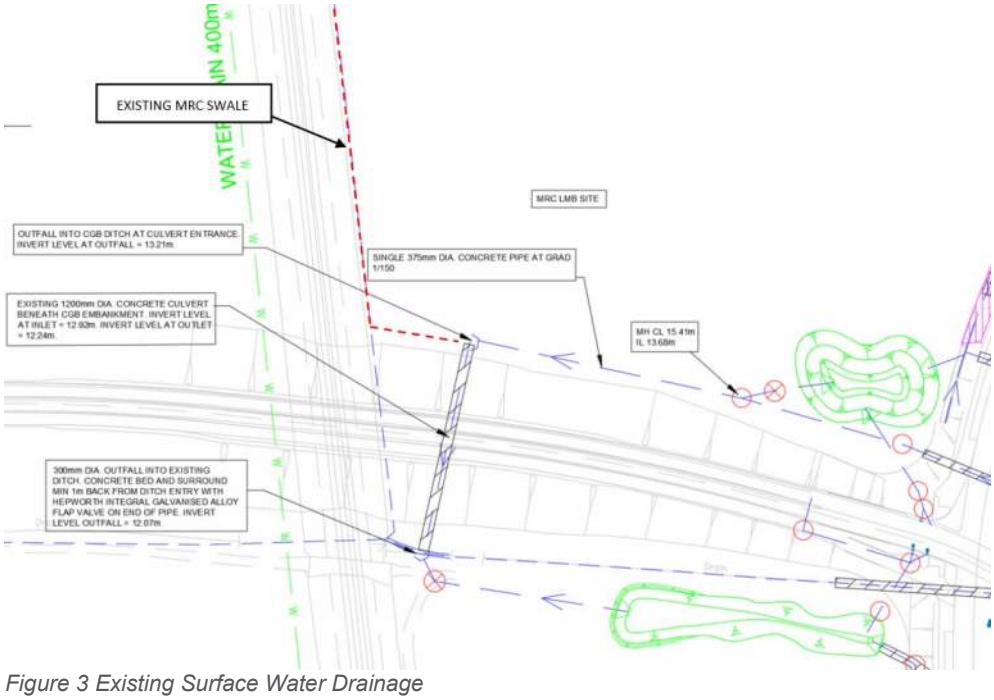

Figure 3 Existing Surface Water Drainage

Temporary access to facilitate construction of the overhead line equipment and the REB to the north of the MRC site and permanent access for maintenance is likely to be required. To facilitate this access, Network Rail intend to compulsory purchase a narrow strip of land to extend the current boundary into the MRC land. In addition to the land purchase, it is proposed to agree a permanent access for maintenance via the MRC land as noted in Figure 4 below to be sited in the south west corner of the MRC land.

A previous proposal to temporarily install a haul road, as shown in Figure 4 between Francis Crick Avenue and the access point to the south of the attenuation pond has now been removed in favour of infrequent access during both construction and for general maintenance via the MRC car park area.

The existing swale which runs north-south towards the guided busway before combining with the Francis Crick Avenue highway drainage network prior to entering a 1200mm diameter culvert under the busway to North Ditch as shown in Image 1 and Image 2 below. It is understood that there are no check dams present within the existing swale hence the swale operates as a conveyance swale only.

The existing western access road around the MRC site is bounded by a kerb drainage system which conveys surface water into a soakaway. This kerb network will also serve to contain exceedance flows until breached at which point, flows will enter the conveyance swale.

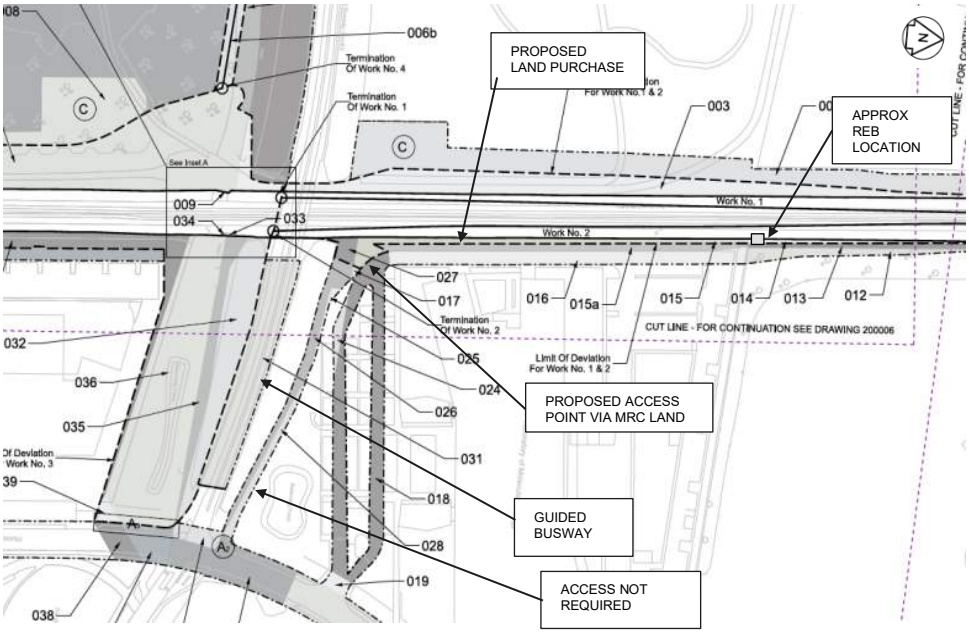

Figure 4 Proposed Land Boundaries

Image 1 Existing Swale

Image 2 South West Corner Swale

2 PROPOSED DESIGN

To date, no topographical survey has been undertaken within the MRC site, other than to determine the position of the existing western access road. The survey did not identify any existing drainage features or other furniture therefore it is not possible to determine the capacity of the existing MRC swale.
Prior to the next design stage, a detailed topographical survey is to be undertaken to confirm the existing swale arrangement. In addition, a detailed walkover survey will be undertaken. On receipt of the survey, an assessment will be undertaken to assess the capacity of the ditch and compare to the potential flows during a 1 in 100 year event plus 40% allowance for climate change.
Where possible, any interface with the existing assets will be minimised. Any existing drainage is to be maintained or replaced with an alternative system with equivalent capacity, during and post construction.

2.1 Permanent Case

As noted in 1.2 above, the existing North Ditch is to be culverted to facilitate the construction of the new station. Analysis of the culvert catchment during events up to and including a 1 in 1000 year storm event. These flows have been reviewed with the Environment Agency and the Lead Local Flood Authority who have accepted the estimates.

Return Period (years)	Peak Flow (m^3/s)
20	0.039
100	0.063
100 +20%CC	0.079
100 +40%CC	0.097
1000	0.132

Table 1 Peak Flow Estimates

The proposed culverting of the North Ditch has been designed to ensure that there will be no restrictions to flow based on the above estimates.
Contrary to the requirement within the initial TWAO application, further design development and construction methodology reviews have been undertaken since submission resulting in the reduction of the width of permanent land acquisition required, which previously extended up to the edge of highway. This is now reduced as noted in Figure 4 above. The area beyond the proposed permanent boundary will only be required during construction for infrequent access (to be covered separately). Therefore, there will be no impact on any existing highway drainage system.
A further review of the permanent land requisition is to be undertaken at the next design stage with the aim of maintaining the existing swale parallel to the NR rail boundary in its current position. Where this is not possible, the swale will be reconstructed in between the existing western access road and the new boundary fence.
As can be seen from Image 1 above, the Network Rail land is significantly lower than the MRC access road. The existing swale depth is envisaged to be circa 250-300mm maximum, this will be confirmed via the aforementioned topographical survey.

Due to the level difference between the road and the swale, and to maintain the existing bio diversity benefits of the swale, rather than replacing the existing swale with a network of filter drains, a nominal retaining wall may be required. The wall will be formed using gabion baskets to the road side of the relocated swale to maintain the current cross sectional area.

To the south west corner of the MRC site, the swale turns towards the culvert under the busway. Over the last section, the swale deepens to tie in with the culvert levels, this area is not used as an attenuation pond as the pipework through the busway is oversized to comply with Ciria design guide C786 and the Design Manual for Roads and Bridges HA107/04 (replaced by CD529 March 2020) which requires culverts longer than 12 metres to be 1200mm diameter. As the culvert is oversized, this will not restrict the exceedance flows hence no allowance for attenuation in this area is envisaged. The permanent access will be required to pass over the swale in this location, it is proposed that a culvert to match the diameter, or equivalent cross-sectional area, of the culvert under the guided busway will be provided under the access to not restrict the flows below the capacity of the downstream network. During the next design phase, the proposed access road levels will be determined and reviewed to confirm the exact details of any culvert.

2.2 Temporary Case

During construction, access will be required to facilitate installation of overhead line equipment and may require temporary infilling of the existing swale along the NR boundary in 4 to 5 discreet locations to coincide with the overhead line gantries. It is not currently proposed to infill the entire length of swale.

Where access is required over the existing swale along the boundary fenceline, a short section of pipe will be installed with equivalent cross-sectional area to the existing swale to ensure passage of flows is maintained during construction before installing the permanent solution as noted above. This will be required for a maximum of 2 weeks per location.

Where access along the existing Western access road is required during construction, existing services will be reviewed and protected as necessary to ensure no damage.

Should access be required over the swale to the south west corner of the site during construction, a temporary bridge structure will be utilised to ensure that there are no restrictions to flow. This will be reviewed when proposed highway levels for the access are confirmed. Where this is not possible, a culvert, as noted above may be installed.

APPENDIX A5 – SURFACE WATER CALCULATIONS SUMMARY AND DRAWINGS – LMB DESIGN PACKAGE

JPP

CONSULTING

CONSULTING CIVIL AND STRUCTURAL ENGINEERS

NEW LMB BUILDING
CAMBRIDGE

STORM DRAINAGE CALCULATIONS REPORT
REVISION 2

5th March 2009

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STORM WATER DRAINAGE CALCULATIONS REPORT

CONTENTS

Drawings Included In This Report

2525-C-012 – Storm Drainage Layout
2525-C-080 – Soakaway Test Locations
2525-C-081 – Overland Flow Routing Plan
STC0691H – 102 – Plan showing maximum groundwater level to ordnance datum.

STORM WATER DRAINAGE CALCULATIONS REPORT

1.0 INTRODUCTION AND BRIEF

1.1 This report presents the drainage calculations for the proposed drainage works for the new LMB building at Cambridge

1.2 The development will comprise the construction of a new purpose built laboratory and associated infrastructure for use by the MRC/LMB

1.3 The following calculations demonstrate design compliance with 'The Building Regulations 2000 – Approved Document H', BS EN 752 and the flood risk assessment produced by Environ. Submitted as part of the planning application for the development

1.4 Definitions of terminology used in this report are as follows

Windes	Computer design programme for drainage. Current version W.11.3
Pipe Number (PN)	Each pipe has been numbered for identification. Pipe numbers are presented in the relevant sections of this report.
Manhole Number	Each manhole has been numbered for identification. Manhole numbers are presented on each drawing.
Cover Level	Level of the manhole cover, in metres, relative to local datum.
Invert Level	Level of the pipe invert, in meters, relative to local datum.
Depth	Distance, in metres, between the cover level and invert level.
Pipe Length	Horizontal length of each pipe, in metres, between the centres of each manhole.
Slope	Slope of the pipe based on pipe length and difference in invert levels between upstream and downstream manholes.
Pipe Diameter	Internal pipe diameters.
Pipe Capacity (CAP)	Using the information determined above the capacity of the pipes has been assessed using WinDes using a pipe roughness, k=0.6mm for storm and k=1.5mm for foul.

Area (Ha)	The drained area to each pipe.
T.E	Time of entry.
Vel. (m/s)	Pipe full velocity
k (mm)	Pipe roughness.
Flow (l/s)	Calculated flow rate based in the above.
Units	Total Discharge Units for each pipe.
P.Vel (m/s)	Proportional pipe velocity.

Storm Water Drainage

2.1 Introduction

2.1.1 The detailed design of the storm water system proposed for this site relies on the recommendations outlined in the FRA. Our detailed design carries forward the recommendations outlined in the FRA, in particular Chapter 4.3, ***Proposed Surface Runoff Management*** of the FRA details SUDS techniques considered for the site. Table 4.2 ***SUDS Feasibility Matrix*** sets out the feasibility of the SUDS techniques considered. In accordance with the recommendations of this report we have adopted the use of soakaway systems across the site using permeable paving. Other SUDS included within the development include filter drains and pre-treatment structures such as gullies, catchpits and separators.

2.1.2 Our assessment has been limited to checking that storm water drainage will not surcharge for a 1 in 2 year storm event and not flood for a 1 in 100 year storm event plus an allowance of 20% for future climate change.

2.1.3 Storm water shall be collected form hardened areas and disposed of via gravity operated systems to soakaways, generally located under hardstanding areas.

2.1.4 Extensive investigations have been carried out by Soiltechnics Limited in determining soil infiltration rates and ground water levels for use in the design of the soakaways. Please refer to the Soiltechnics report and drawing STC0691H/102 for further details.

2.1.5 Soiltechnics carried out the soakaway testing in accordance with BRE 365 and the soakaway design for this site has used the lowest infiltration rate recorded in trial pits closest to the proposed location of the soakways. Refer to AKT drawing 2525-C-080 for details.

2.1.6 The soakaways have been designed using the maximum ground water levels recorded by soiltechnics over a period of 12 months from 11.05.06 to 03.05.07. Drawing STC0691H-102 presents the results of these investigations.

2.1.7 To reduce the impact of pollutants within the storm water that may affect existing ground water, a 1m buffer zone has been provided from the maximum ground water levels recorded by Soiltechnics. Refer to Soiltechnics drawing STC0691H-102 for details

2.1.8 In accordance with the Soiltechnics report the soakaways shall not be constructed closer than 10m from the buildings and boundary lines. In

addition, two areas have been identified for future expansion therefore the siting of the soakaways has been restricted to three locations as follows: (shown on drawing 2525-C-012)

- Northwest
- Northeast
- South

2.1.9 In addition to the soakaway testing carried out by soiltechnics, LBH Wembley was appointed to carry out further testing. For each soakaway area we have used the most appropriate results dependant on the depth relative to the soakaways and their location. AKT Drawing 2525-C-080 shows the locations and results of all test carried out by Soiltechnics and LBH Wembley.

2.1.10 The maintenance of the site storm water drainage shall be the responsibility of the owner of the site using their own maintenance team. Reference shall be made to AKT drawing 2525-C-012, which indicates the proposed methods for maintenance of the storm water drainage by the site owner.

2.1.11 Storm water drainage layouts are presented below.

Storm Water Drainage Layout Drawings

2525 – C-080-T3 – Soakaway Test Locations

2525 – C-081-T1 – Overland Flow Routing Plan

STC0691H – 102 – Plan Showing Maximum Groundwater Level to Ordnance Datum

LBH WEMBLEY
TP C
EXISTING GROUND LEVEL = 14.345m
NATURAL GROUND LEVEL = 13.545m
GROUND WATER LEVEL = 12.400m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 15.000m
INFILTRATION RATE = 1.2 x 10-5 m/s (1.5m DEEP, IN NATURAL)
GROUND WATER = 12.545m (LBH LOGS)

LBH WEMBLEY
TP D
EXISTING GROUND LEVEL = 16.530m
NATURAL GROUND LEVEL = 14.930m
GROUND WATER LEVEL = 13.300m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 16.500m
INFILTRATION RATE = 4.2 x 10-6 m/s (2.5m DEEP, IN NATURAL)
GROUND WATER = NONE ENCOUNTERED

SOILTECHNICS
TP01
EXISTING GROUND LEVEL = 14.600m
NATURAL GROUND LEVEL = 13.600m
GROUND WATER LEVEL = 12.400m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 15.350m
LOWEST INFILTRATION RATE = 1.2 x 10-5 m/s (1.18m TO 1.5m DEEP, IN NATURAL)

SOILTECHNICS
TP03
EXISTING GROUND LEVEL = 17.900m
NATURAL GROUND LEVEL = 15.800m
GROUND WATER LEVEL = 13.500m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 17.000m
INFILTRATION RATE = 8.25 x 10-6 m/s (2.1m DEEP, IN NATURAL)

LBH WEMBLEY
TP A
EXISTING GROUND LEVEL = 15.412m
NATURAL GROUND LEVEL = 12.732m
GROUND WATER LEVEL = 15.250m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 15.550m
GROUND WATER = 12.400m (LBH LOGS)

SOILTECHNICS
TP10
EXISTING GROUND LEVEL = 15.000m
NATURAL GROUND LEVEL = 12.800m
GROUND WATER LEVEL = 13.250m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 15.400m
INFILTRATION RATE = 1.16 x 10-5 m/s (0.82m - 094m, IN MADE GROUND)

SOILTECHNICS
TP11
EXISTING GROUND LEVEL = 15.500m
NATURAL GROUND LEVEL = 13.500m
GROUND WATER LEVEL = 13.250m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 15.550m
INFILTRATION RATE = 2.44 x 10-5 m/s (2.1m TO 2.4m DEEP, IN NATURAL)

SOILTECHNICS
TP12
EXISTING GROUND LEVEL = 15.500m
NATURAL GROUND LEVEL = 12.800m
GROUND WATER LEVEL = 12.250m (SOILTECHNICS REPORT)
PROPOSED GROUND LEVEL = 15.620m
INFILTRATION RATE = DID NOT SOAKAWAY (0.5m DEEP, IN MADE GROUND)

REV	DATE	DESCRIPTION	BY	CHECKED
T3	04/03/2009	REVISED STAGE E	WRA	PAB
T2	02/02/2009	REVISED STAGE E	WRA	PAB
T1	22/10/2008	REVISED STAGE E	WRA	PAB

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CLIENT
THE NEW LMB BUILDING
MRC LABORATORY

PROJECT
SOAKAWAY TEST LOCATIONS

TITLE

DRAWN	WRA	SCALE	1:250 @ A0
DATE	22/10/2008	CHECKED	PAB
CAD FILENAME		STATUS	FOR TENDER

PROJECT No. 2525 | DRAWING No. C-080 | REVISION T3

KEY

OVERLAND FLOW FLOOD ROUTE ARROW

APPROXIMATE LOCATION OF EXISTING DITCH AT BOUNDARY OF SITE

REV	DATE	DESCRIPTION	BY	CHECKED
T1	04/03/2009	REVISED STAGE E	WRA	PAB

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CLIENT

THE NEW LMB BUILDING
MRC LABORATORY

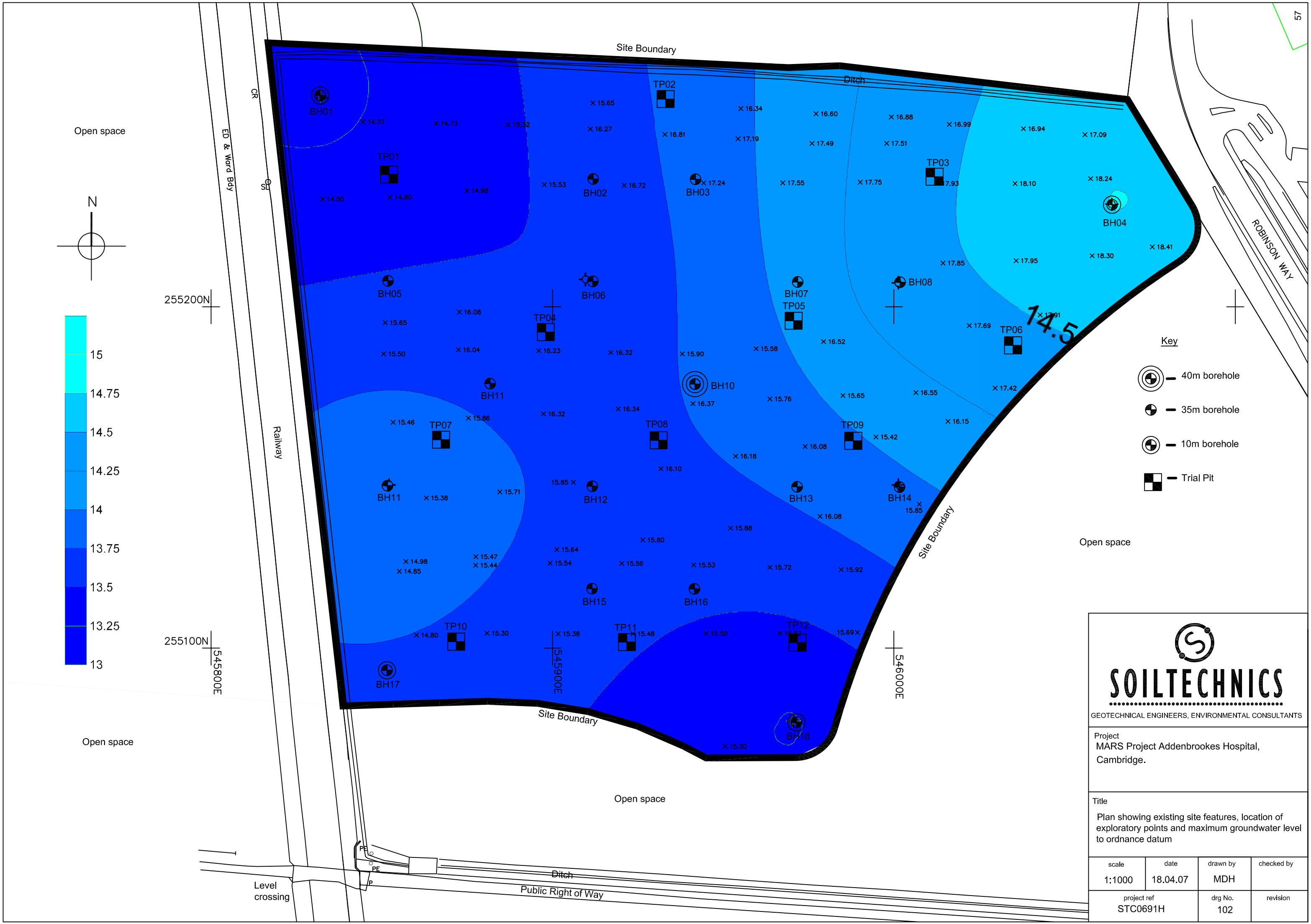
PROJECT

OVERLAND FLOW ROUTING PLAN

TITLE

DRAWN	WRA	SCALE	NTS @ A0	CAD FILENAME	
DATE	04/03/2008	CHECKED	PAB	STATUS	FOR TENDER

PROJECT No.	DRAWING No.	REVISION
2525	C-081	T1



SOILTECHNICS

GEOTECHNICAL ENGINEERS, ENVIRONMENTAL CONSULTANTS

Project
MARS Project Addenbrookes Hospital, Cambridge.

Title
Plan showing existing site features, location of exploratory points and maximum groundwater level to ordnance datum

scale	date	drawn by	checked by
1:1000	18.04.07	MDH	

project ref	drg No.	revision
STC0691H	102	

2.2 North-Western Soakaway

2.2.1 Refer to AKT drawing number 2525-C-012 for layout and details of the storm drainage.

2.2.2 The following design parameters were used during the design of the soakaway system

- Plan area = 650m^2
- Infiltration Rate = 1.2 x 10^{-5} m/s – taken from the lowest infiltration rate calculated by Soiltechnics (TP01)
- Maximum Ground Water Level = 13.500m – taken from the Soiltechnics Report.
- Drained Area = 7470m^2

2.2.3 The soakaway required shall be permeable paving as follows

Lowest finished pavement level	= 15.500m
Lowest level to top of subbase	= 15.400m
Formation level of subbase	= 14.500m
Plan area	= 650m^2

2.2.4 Perforated distribution pipes shall be provided to in order to convey the storm water throughout the permeable subbase.

2.2.5 The flooding check calculations have indicated flooding in pipe number 12.000. For ease of modelling during the design a 225mm diameter pipe laid at 1:167 has been used. Drawing 2525-C-012 shows this pipe as a filter drain. Therefore any flood water shown in the calculations will be accommodated within the filter drain construction.

2.2.6 North-western soakaway calculations are presented below

North-Western Soakaway

Plan Showing Pipe Numbers

2.4 South Soakaway

2.4.1 Refer to AKT drawing number 2525-C-012 for layout and details of the storm drainage.

2.4.2 The following design parameters were used during the design of the soakaway system

- Plan area = 2017m^2
- Infiltration Rate = 1.16 x 10^{-5} m/s – Taken as lowest of the infiltration rates calculated by Soiltechnics (TP10 and TP11)
- Ground Water Level = 14.000m – taken from the Soiltechnics Report.
- Drained Area = 13930m^2

2.4.3 The soakaway required shall be permeable paving as follows

Lowest finished pavement level	= 15.600m
Formation level of subbase	= 15.000m
Plan area	= 2017m^2

2.4.4 Perforated distribution pipes shall be provided to in order to convey the storm water throughout the permeable subbase.

2.4.5 The flooding check calculations have indicated flooding in pipe number 31.000 and 32.000. For ease of modelling during the design a 225mm diameter pipe laid at 1:167 has been used. Drawing 2525-C-012-T5 shows these pipes as a filter drain. Therefore any flood water shown in the calculations will be accommodated within the filter drain construction.

2.4.6 South soakaway calculations are presented below

South Soakaway

Plan Showing Pipe Numbers

2.5 Flooding

2.5.1 In the event that any part of the storm water network fails or in the event of a storm event rarer than a 1 in 100 year plus 20% allowance for climate change, it is likely that flooding will occur, principally at manhole locations

2.5.2 In the event that this occurs, external levels shall be designed to allow storm water to be conveyed across the site, overland, and diverted towards the ditches that surround the site.

2.5.3 Site levels shall be designed to prevent water from causing flooding to the on site buildings or neighbouring properties, including the proposed access road to the east of the site.

2.5.6 AKT drawing 2525-C-081 shows the likely flow paths for the flooded storm water.

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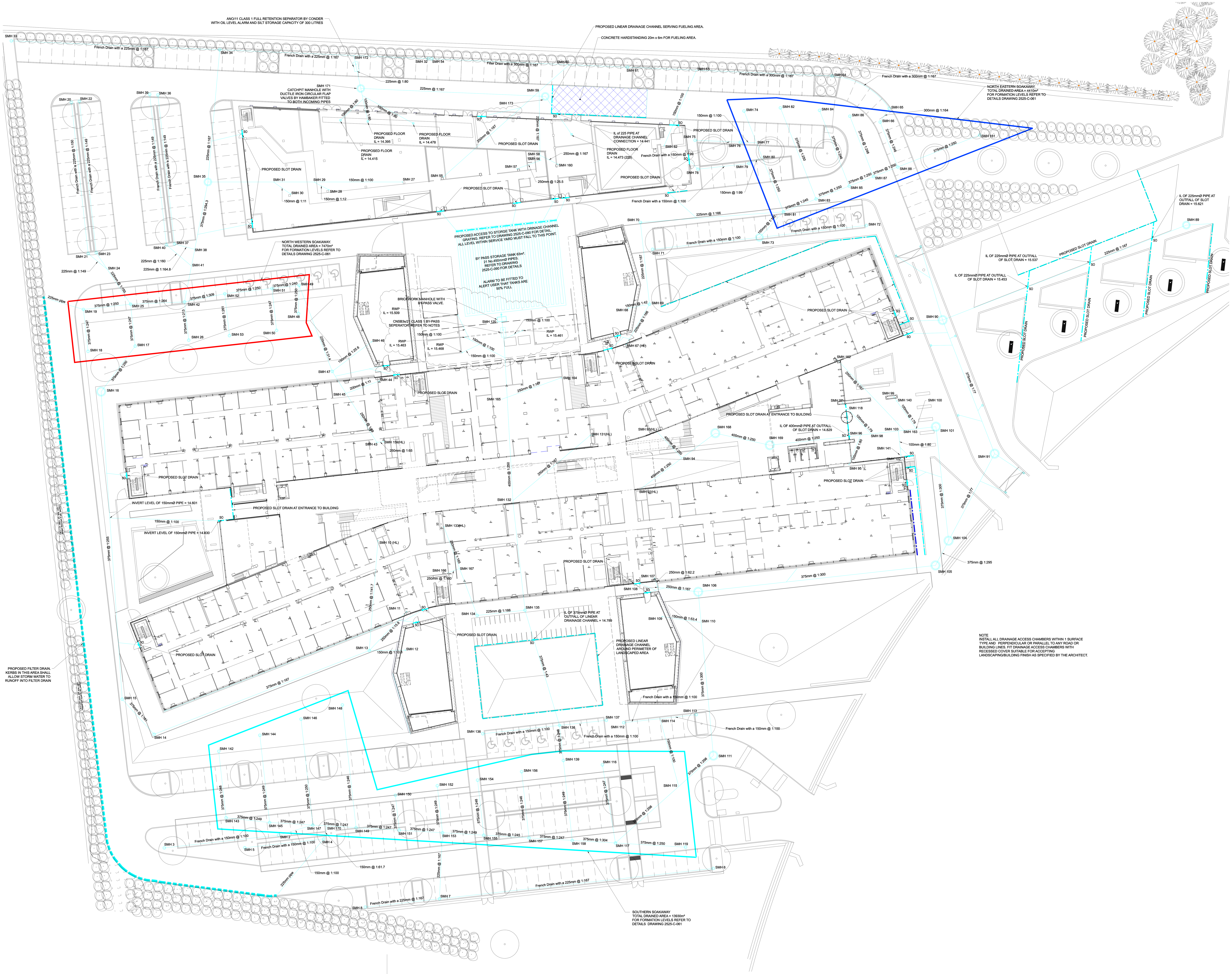
For JPP Consulting

PHILLIP A BROWN B.Eng. (Hons), C.Eng., M.I.C.E., M.I.H.T., M.C.I.W.E.M
Associate Director for JPP Consulting



NOTES

G GENERAL

G1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS, SPECIFICATIONS AND DETAILS.

G2. ALL DIMENSIONS AND LEVELS SHOWN ARE IN METRES UNLESS INDICATED OTHERWISE.

G3. THIS SCHEME HAS BEEN DESIGNED USING THE SURVEY INFORMATION AVAILABLE; IN PARTICULAR DRAWING NUMBER 4626M/RE/80002 PRODUCED ON THE 07/10/2005 BY AUKETT LIMITED. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL LEVELS, BOUNDARIES, FEATURES ETC PRIOR TO COMMENCING WORKS ON SITE. AKT SHALL NOT ACCEPT ANY RESPONSIBILITY FOR ERRORS RESULTING FROM THE SURVEY.

G4. ALL PROPOSED COVER LEVELS HAVE BEEN CLARIFIED BY INTERPOLATION FROM THE PROPOSED LEVELS DRAWING PRODUCED BY RMJM DRAWING NO. 2053(90)LP0006.

D DRAINAGE

D1. THE STORM WATER DRAINAGE SYSTEM HAS GENERALLY BEEN DESIGNED NOT TO SURCHARG FOR A 1 IN 2 YEAR RAINFALL EVENT AND NOT TO FLOOD FOR A 1 IN 100 YEAR EVENT PLUS AN ALLOWANCE OF 20% FOR CLIMATE CHANGE. REFERENCE SHALL BE MADE TO THE FLOOD RISK ASSESSMENT PRODUCED BY ENVIRON.

D2. DRAIN AND SEWER SYSTEMS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DESIGN AND WITH PARTICULAR CONSIDERATION OF THE FOLLOWING:
A) HEALTH, SAFETY AND WELFARE OF CONSTRUCTION PERSONNEL AND OTHER PEOPLE.
B) METHODS OF DEALING WITH EXISTING FLOWS IN PART COMPLETED SYSTEMS OR WHEN CARRY OUT WORKS IN EXISTING DRAINS AND SEWERS.
C) PROTECTION OF THE ENVIRONMENT.

D3. THE CONSTRUCTION AND TESTING OF DRAINS AND SEWERS SHALL BE CARRIED OUT IN ACCORDANCE WITH BS EN 1610.

D4.

MAINTENANCE SCHEDULE	**REQUIRED ACTION**	**RECORDED FREQUENCY**
REGULAR MAINTENANCE	INSPECT AND IDENTIFY AREAS THAT ARE NOT OPERATING CORRECTLY. IF REQUIRED, TAKE REMEDIAL ACTION	MONTHLY FOR FIRST 3 MONTHS THEN SIX MONTHLY
REMEDIAL ACTION.	DEBRIS REMOVAL FROM CATCHMENT SURFACE (WHERE MAY CAUSE RISKS TO PERFORMANCE)	MONTHLY
	REMOVE SEDIMENT FROM PRE-TREATMENT STRUCTURE E.G. GULLIES	ANNUALLY OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR/REHABILITATION OF INLETS, OUTLETS, OVERFLOW AND VENTS	AS REQUIRED
MONITORING	INSPECT/CHECK ALL INLETS, VENTS, OVERFLOWS TO ENSURE THEY ARE IN GOOD CONDITION AND OPERATING AS DESIGNED	ANNUALLY AND AFTER LARGE STORMS

D5. FOUL DRAINAGE SHALL NOT BE MADE LIVE UNTIL THE APPROPRIATE APPROVALS FROM ANGLIAN WATER ARE IN PLACE.

D6. ALL WASTE ARISING FROM THE MAINTENANCE OF THE DRAINS AND SEWERS SHALL BE HANDLED, STORED AND DISPOSED OF CORRECTLY TO AVOID POLLUTION. WASTE MAY BE DESIGNATED AS HAZARDOUS/SPECIAL WASTE AND AS SUCH THE END USER SHALL ENSURE THAT THEY COMPLY WITH THE HAZARDOUS WASTE (ENGLAND AND WALES) REGULATION 2005 THE END USER SHALL FOLLOW THE, 'WASTE MANAGEMENT, THE DUTY OF CARE, A CODE OF PRACTICE (REVISED 1996)'. THE END USER SHALL ENSURE THEIR WASTE DOES NOT ESCAPE FROM THEIR CONTROL, IS TRANSFERRED ONLY TO A REGISTERED WASTE CARRIER TO BE SE FOR RECYCLING OR DISPOSAL AT A SUITABLY LICENSED FACILITY,

D7 SLOT DRAINS TO BE ACO M100D No. 0.0 CHANNEL BODY WITH EITHER BRICKSLOT 23465 GALVANISED) OR 23475 (STAINLESS) GRATING - ARCHITECT TO CONFIRM PREFERRED FINISH. ALL END CAPS, SUMP UNITS AND OUTLETS TO BE STANDARD ACO UNITS. INVERT LEVEL AT OUTLETS TO BE 460mm BELOW GROUND LEVEL (I.E. THE "350mm" SIDE OUTLET FROM THE SUI UNIT.).

D8 CHANNEL DRAINS TO BE ACO M100D No. 0.0 CHANNEL BODY WITH D400 LOAD CLASS GRATING ARCHITECT TO CONFIRM PREFERRED FINISH. ALL END CAPS, SUMP UNITS AND OUTLETS TO I STANDARD ACO UNITS. INVERT LEVEL AT OUTLETS TO BE 460mm BELOW GROUND LEVEL (I.E. THE "350mm" SIDE OUTLET FROM THE SUMP UNIT.).

FD FRENCH DRAINS

FD1. IT IS ESSENTIAL THAT CONSTRUCTION SEDIMENTS ARE PREVENTED FROM ENTERING THE FRENCH DRAINS AND THE CONTRACTOR SHALL PROVIDE ADEQUATE PROTECTION TO PREVEI THIS

FD2.

MAINTENANCE SCHEDULE	**REQUIRED ACTION**	**FREQUENCY**
REGULAR MAINTENANCE	LITTER AND DEBRIS REMOVAL	MONTHLY OR AS REQUIRED
	MANAGE OTHER VEGETATION AND REMOVE NUISANCE PLANTS	MONTHLY AT START THEN AS REQUIRED
OCCASIONAL MAINTENANCE	CUT BACK ADJACENT VEGETATION WHERE POSSIBLE	ANNUALLY
REMEDIAL ACTIONS	REMOVE BUILD UP OF SEDIMENT ON GROUND TRENCH	AS REQUIRED
MONITORING	INSPECT INLETS AND OUTLETS FOR BLOCKAGES, CLEAR AS NECESSARY	MONTHLY
	INSPECT INFILTRATION SURFACES FOR PONDING COMPACTION, SILT ACCUMULATION. RECORD AREAS WHERE WATER IS PONDING FOR >48 HOURS	MONTHLY OR WHEN REQUIRE
	INSPECT INLETS AND FACILITY FOR SILT ACCUMULATION. ESTABLISH APPROPRIATE SILT REMOVAL FREQUENCIES	HALF YEARLY

FD3. REFERENCE SHALL BE MADE TO CIRIA C697. THE SUDS MANUAL AND CIRIA C698. SITE BOOK FOR THE CONSTRUCTION OF SUDS BY THE CONTRACTOR AND END USER. IT IS RECOMMEND THAT A MAINTENANCE SCHEDULE IS DEVELOPED, MAINTAINED AND FOLLOWED.

S1. SEPARATOR NOTES

S4. THE SEPARATOR AND TANK SHALL MEET THE CURRENT ENVIRONMENT AGENCY POLLUTION PREVENTION GUIDELINES, IN PARTICULAR 'USE AND DESIGN OF OIL SEPARATORS IN SURFACE WATER DRAINAGE SYSTEMS: PPG3'. THE CHOICE OF SEPARATOR SHALL BE DETERMINED BY THE SPECIALIST SUPPLIER.

S5. THE CONTRACTOR SHALL PROVIDE EVIDENCE THAT THE SEPARATOR HAS BEEN DECLARED COMPLIED WITH THE CONSTRUCTION PRODUCTS REGULATIONS 1991 AND THAT THE DECLARATION HAS BEEN CHECKED FOR VALIDITY BY THE APPROPRIATE TRADING STANDARDS AUTHORITY.

S6. THE SEPARATOR AND TANK SHALL BE BEDDED AND SURROUNDED IN A MINIMUM OF 150MM THICK CONCRETE WHERE GROUND WATER LEVELS ARE HIGHER THAN THE BASE OF THE EXCAVATIONS THEN ADDITIONAL THICKNESS OF THE CONCRETE SURROUND MAY BE NECESSARY TO AVOID FLOTATION. THE ENGINEER SHALL BE ADVISED OF WATER LEVELS HIGHER THEN THE DEPTH OF THE EXCAVATION TO RECEIVE THE SEPARATOR TO ALLOW CALCULATIONS TO BE EFFECTED TO ENSURE FLOTATION OF THE SEPARATOR DOES NOT OCCUR EITHER DURING CONSTRUCTION OR WHILST IN SERVICE.

S7. THE SEPARATOR SHALL BE PROVIDED WITH A ROBUST DEVICE TO PROVIDE VISUAL AND AUDIBLE WARNING TO AN APPROPRIATE LOCATION WHEN THE LEVEL OF OIL REACHES 90% OI THE OIL STRONG VOLUME (V) UNDER STATIC LIQUID LEVEL CONDITION. APPROPRIATE MAINTENANCE SHALL THEN BE CARRIED OUT.

S8.

MAINTENANCE SCHEDULE	**REQUIRED ACTION**	**RECORDED FREQUENCY**
REGULAR MAINTENANCE	FOLLOW THE MANUFACTURERS RECOMMENDATIONS	AS RECOMMENDED BY MANUFACTURER
	REMOVE SEDIMENT/ OIL FROM SEPARATOR	EVERY SIX MONTHS OR IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTI
	SERVE ALL ELECTRICAL EQUIPMENT	IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTI
	INSPECT INTEGRITY OF SEPARATOR AND ALL MECHANICAL PARTS	EVERY SIX MONTHS OR IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTI

S9. SEPARATOR VENT PIPES SHALL BE AS SHORT AS PRACTICABLE AND SHALL TERMINATE NOT LESS THAN 2M ABOVE THE FINISHED PAVEMENT LEVEL NOR LESS THAN 1M ABOVE AN OPENABLE WINDOW OR OTHER OPENING IN A BUILDING WITHIN A HORIZONTAL DISTANCE OR OR AS SHOWN ON THE DRAINAGE DRAWING

REV	DATE	DESCRIPTION	BY	CHECKED
C9	08/07/2010	SUMP OUTLET POSITIONS ADDED. INTERCEPTOR REFERENCES ADDED. CHANNEL AND SLOT DRAIN REFERENCES ADDED.	DS	MD
C8	11/11/2009	SERVICE YARD DRAINAGE AMENDED	WRA	PAB
C7	21/10/2009	SERVICE YARD DRAINAGE AMENDED	WRA	PAB
C6	01/10/2009	RODDING EYES ADDED AT BUILDING ENTRANCE	WRA	PAB
C5	16/09/2009	SMH 164 AMENDED	WRA	PAB
C4	24/07/2009	SOUTH SOAKAWAY LAYOUT AMENDED	WRA	PAB
C3	22/07/2009	DESIGN ABEYANCE NOTES ADDED	WRA	PAB
C2	17/07/2009	FULL RENTENTION SEPERATOR RELOCATED SMH 42 RELOCATED TO AVIOD TREE PIT SMH 164 AMENDED	WRA	PAB
C1	02/07/2009	CONSTRUCTION ISSUE	WRA	PAB

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CLIENT

THE NEW LMB BUILDING MRC LABORATORY

PROJECT

STORM DRAINAGE LAYOUT

TITLE

DRAWN WRA	SCALE 1:250 @ A0	CAD FILENAME
DATE 19/09/2008	CHECKED PAB	STATUS CONSTRUCTION
PROJECT No. 2525	DRAWING No. C-012	REVISION C9

APPENDIX A6 – FOUL WATER CALCULATIONS SUMMARY AND DRAWINGS – LMB DESIGN PACKAGE

JPP
CONSULTING
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

Foul Water Drainage Calculations
New LMB Building
Cambridge

Foul Water Drainage Calculations Report

REVISION 0
22th October 2008

Cedar Barn, White Lodge, Walgrave, Northampton
Telephone: 01604 781811 Fax: 01604 781999 E-mail: mail@jppuk.net

FOUL WATER DRAINAGE CALCULATIONS REPORT

CONTENTS

Drawings Included In This Report

2525-C-001- Foul Drainage Layout
2525-C-002-009 – Foul Connections Layouts

FOUL WATER DRAINAGE CALCULATIONS REPORT

1.0 INTRODUCTION AND BRIEF

1.1 This report presents the drainage calculations for the proposed drainage works for the new LMB building at Cambridge

1.2 The development will comprise the construction of a new purpose built laboratory and associated infrastructure for use by the MRC/LMB

1.3 The following calculations demonstrate design compliance with 'The Building Regulations 2000 – Approved Document H', BS EN 752 and the flood risk assessment produced by Environ. Submitted as part of the planning application for the development

1.4 Definitions of terminology used in this report are as follows

Windes	Computer design programme for drainage. Current version W.11.3
Pipe Number (PN)	Each pipe has been numbered for identification. Pipe numbers are presented in the relevant sections of this report.
Manhole Number	Each manhole has been numbered for identification. Manhole numbers are presented on each drawing.
Cover Level	Level of the manhole cover, in metres, relative to local datum.
Invert Level	Level of the pipe invert, in meters, relative to local datum.
Depth	Distance, in metres, between the cover level and invert level.
Pipe Length	Horizontal length of each pipe, in metres, between the centres of each manhole.
Slope	Slope of the pipe based on pipe length and difference in invert levels between upstream and downstream manholes.
Pipe Diameter	Internal pipe diameters.
Pipe Capacity (CAP)	Using the information determined above the capacity of the pipes has been assessed using WinDes using a pipe roughness, k=0.6mm for storm and k=1.5mm for foul.

FOUL WATER DRAINAGE CALCULATIONS REPORT

Area (Ha)	The drained area to each pipe.
T.E	Time of entry.
Vel. (m/s)	Pipe full velocity
k (mm)	Pipe roughness.
Flow (l/s)	Calculated flow rate based in the above.
Units	Total Discharge Units for each pipe.
P.Vel (m/s)	Proportional pipe velocity.

FOUL WATER DRAINAGE CALCULATIONS REPORT

2.0 Foul Water Drainage

2.1 Our assessment has been limited to checking that the foul drainage is capable of carrying foul water collected from the new laboratory.

2.2 The design parameters considered in this assessment have been based on the Approved Document H and BS EN 752:2008.

Paragraph 2.34 and table 6 of the Approved Document H recommends that the minimum gradients of foul drains are as follows:

100mm diameter laid no flatter than 1 in 40
100mm diameter laid no flatter than 1in 80 – minimum of 1 WC's
150mm diameter laid no flatter than 1 in 150 – minimum of 5 WC's

BS EN 752 recommends that a self cleansing velocity of at least 0.7 m/s occurs daily. Where the calculations show a self cleansing velocity of less than 0.7 m/s, then the pipe has been checked to ensure that it complies with the above minimum gradients.

In accordance with BS EN 752:2008 NA.3.1.2 a hydraulic pipeline roughness value (k) of 1.5 shall be used.

2.3 The foul water drainage has been split into 2 networks. Network 1 drains the eastern side of the new building and Network 2 drains the western side. All discharge units are taken from RMF Engineering Inc. drawings.

2.4 The two networks connect into separate outfalls. These outfalls are as shown on Faber Maunsell drawing No. 53337/K/02/P7. Network 1 will outfall to F2 at an invert level of 11.930m. Network 2 shall outfall to F1 at an invert level of 12.450m.

2.5 From the drawings produced by RMF Engineering Inc. it has been noted that the lab waste riser discharge units have been calculated based on intermittent use and foul waste riser discharge units have been calculated based on use. Therefore both networks calculations have been checked against Congested and Intermittent use. In accordance with BS EN 752 12056-2:2000 paragraph 6.3.2., a typical frequency factor (K) of 1.2 has been used for congested use to check for pipe capacity. For intermittent use a frequency factor (K) of 0.5 has been used to check for minimum self cleansing velocity.

2.6 Foul water calculations are presented below.

FOUL WATER DRAINAGE CALCULATIONS REPORT

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For JPP Consulting

PHILLIP A BROWN B.Eng. (Hons), C.Eng., M.I.C.E., M.I.H.T., M.C.I.W.E.M
Associate Director for JPP Consulting

FOUL WATER DRAINAGE CALCULATIONS REPORT

Foul Network 1 Calculations

Frequency Factor 1.2

NOTES

G GENERAL

G1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS, SPECIFICATIONS AND DETAILS.

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D1. DRAIN AND SEWER SYSTEMS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DESIGN AND WITH PARTICULAR CONSIDERATION OF THE FOLLOWING:
A) HEALTH, SAFETY AND WELFARE OF CONSTRUCTION PERSONNEL AND OTHER PEOPLE.
B) METHODS OF DEALING WITH EXISTING FLOWS IN PART COMPLETED SYSTEMS OR WHEN CARRY OUT WORKS IN EXISTING DRAINS AND SEWERS.
C) PROTECTION OF THE ENVIRONMENT.

D2. THE CONSTRUCTION AND TESTING OF DRAINS AND SEWERS SHALL BE CARRIED OUT IN ACCORDANCE WITH BS EN 1610.

D3. **MAINTENANCE SCHEDULE**

	REQUIRED ACTION	**RECORDED FREQUENCY**
REGULAR MAINTENANCE	INSPECT AND IDENTIFY AREAS THAT ARE NOT OPERATING CORRECTLY. IF REQUIRED, TAKE REMEDIAL ACTION.	MONTHLY FOR FIRST 3 MONTHS THEN SIX MONTHLY
	DEBRIS REMOVAL FROM CATCHMENT SURFACE (WHERE MAY CAUSE RISKS TO PERFORMANCE)	MONTHLY
	REMOVE SEDIMENT FROM PRE-TREATMENT STRUCTURE E.G. GULLIES	ANNUALLY OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR/REHABILITATION OF INLETS, OUTLETS, OVERFLOW AND VENTS	AS REQUIRED
MONITORING LARGE	INSPECT/CHECK ALL INLETS, VENTS, OVERFLOWS TO ENSURE THEY ARE IN GOOD CONDITION AND OPERATING AS DESIGNED	ANNUALLY AND AFTER STORMS

D4. FOUL DRAINAGE SHALL NOT BE MADE LIVE UNTIL THE APPROPRIATE APPROVALS FROM ANGLIAN WATER ARE IN PLACE.

D5. ALL WASTE ARISING FROM THE MAINTENANCE OF THE DRAINS AND SEWERS SHALL BE HANDLED, STORED AND DISPOSED OF CORRECTLY TO AVOID POLLUTION. WASTE MAY BE DESIGNATED AS HAZARDOUS/SPECIAL WASTE AND AS SUCH THE END USER SHALL ENSURE THAT THEY COMPLY WITH THE HAZARDOUS WASTE (ENGLAND AND WALES) REGULATION 2005. THE END USER SHALL FOLLOW THE 'WASTE MANAGEMENT; THE DUTY OF CARE, A CODE OF PRACTICE (REVISED 1996)'. THE END USER SHALL ENSURE THEIR WASTE DOES NOT ESCAPE FROM THEIR CONTROL, IS TRANSFERRED ONLY TO A REGISTERED WASTE CARRIER TO BE SENT FOR RECYCLING OR DISPOSAL AT A SUITABLY LICENSED FACILITY.

KEY

- FOUL WASTE INSPECTION CHAMBER 450mmØ
- FOUL WASTE MANHOLE. REFER TO SCHEDULE FOR INTERNAL DIAMETER
- FOUL WASTE RODDING EYE
- FOUL WASTE PIPE. MATERIAL SHALL BE VITRIFIED CLAY TO BS EN 295-1. HEPWORTH PRODUCT REFERENCE SP1, SP2, SP17545 WITH EPDM SEALING RINGS REFERENCE SC2/1, SC2/2, SC2/5 OR SIMILAR APPROVED.
- LAB WASTE PIPE. MATERIAL SHALL BE CAST IRON. SAINT GOBAIN ENSIGN OR SIMILAR APPROVED

REV	DATE	DESCRIPTION	BY	CHECKED
T2	30/10/2006	REVISED STAGE E INCORPORATING ITEMS M009 & M013	WRA	PAB
T1	03/10/2006	REVISED STAGE E	WRA	PAB
P3	19/09/2006	FMH 71 & 72 ADDED	WRA	PAB
P1	12/09/2006	ISSUED FOR COMMENT	WRA	PAB

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CLIENT
THE NEW LMB BUILDING
MRC LABORATORY

PROJECT
FOUL DRAINAGE LAYOUT

TITLE

DRAWN	WRA	SCALE	1:200
DATE	12/09/2006	CHECKED	PAB
CAD FILENAME		STATUS	FOR TENDER
PROJECT NO.	2525	DRAWING NO.	C-001
REVISION	T2		