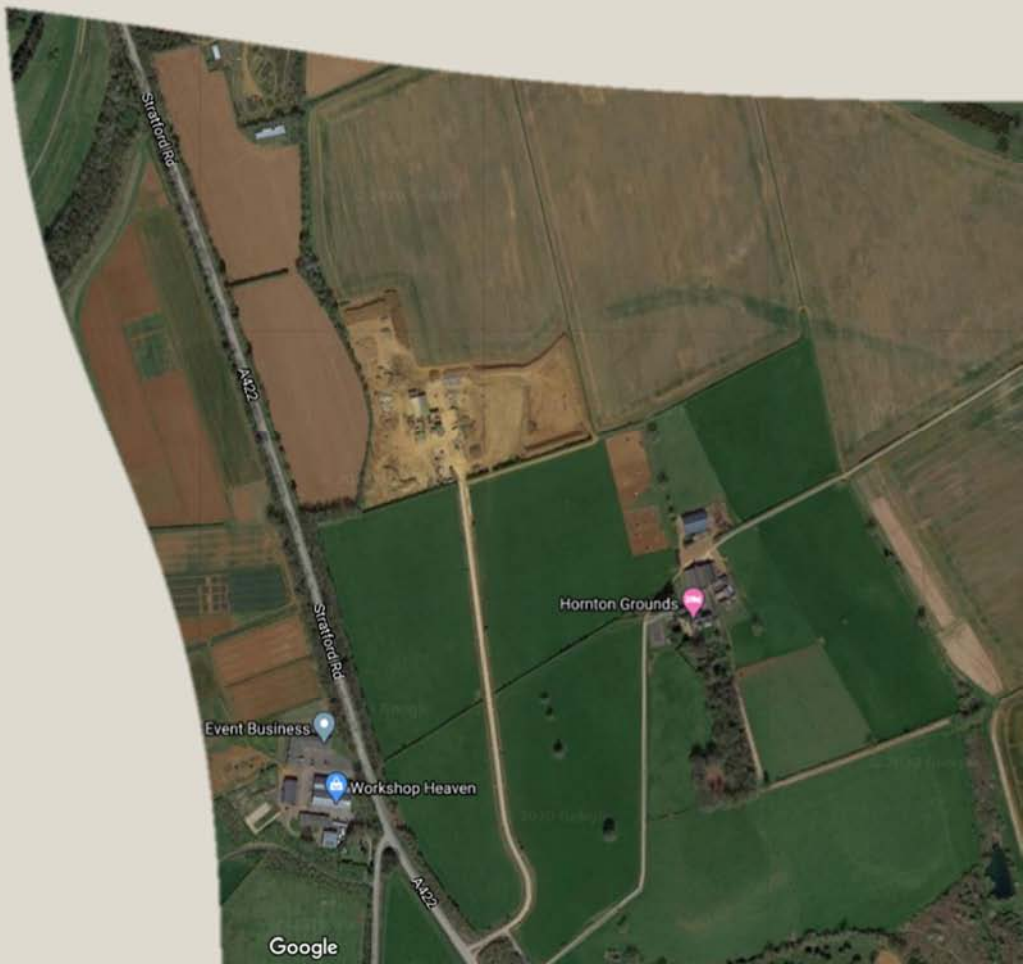
Wormald Burrows Partnership Limited
Civil Engineering Consultants

PROPOSED ENERGY HUB
HORNTON GROUNDS QUARRY, HORNTON, OXFORDSHIRE
FLOOD RISK ASSESSMENT

July 2020

E4040-FRA Report-Rev 0



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FLOOD RISK ASSESSMENT

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Status: Draft

REGISTRATION OF AMENDMENTS

Revision	Date	Amendment Details	Prepared by	Checked by
Rev 0	Jul 20	First issue	Nick Kohli	
Rev 1	Oct 20	Site investigation results inserted at Appendix D. Amendments to Sections 2.3, 2.4, 6 and 8. Appendices Q and R updated.	Nick Kohli	

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 Wormald Burrows Partnership Limited (WBPL) has been commissioned by Finsco Property Company on behalf of Certas Energy to provide a Flood Risk Assessment (FRA) relating to the proposed to development of a land adjacent to the Hornton Grounds Quarry to provide a new fuel storage and distribution depot east of the A422 in Oxfordshire.

1.2 This FRA has been prepared in accordance with The National Planning Policy Framework (NPPF) 2018 (revised 2019) and Planning Policy Guidance - Flood Risk and Coastal Change (PPG) 2014.

1.3 This report is also based on a review of desktop data including Environment Agency mapping, the Oxfordshire County Council Local Flood Risk Management Strategy (LFRMS) and the Preliminary Flood Risk Assessment Report (PFRA) by Oxford County Council dated June 2011. Reference is also made to the Surface Water Management Plan (SWMP) by Oxford County Council dated May 2012 and the Cherwell Level 1 Strategic Flood Risk Assessment Update (SFRA) dated May 2017.

1.4 The Environment Agency's (EA) indicative flood mapping shows the site to be within Flood Zone 1 i.e. little or no risk and assessed as having less than a 1 in 1000 (<0.1%) annual probability of flooding from fluvial sources. The SFRA also shows the same level of flood risk.

1.5 The greatest residual flood risk arises from increased post development flows however, the report outlines the principles of a drainage strategy which will manage surface water flows and ensure there will be no increase in flood risk to the site or land downstream of the site. All drainage measures will be designed to cope with the 1 in 100 year storm event including a 40% allowance to cater for the predicted effects of climate change.

2 EXISTING SITE CONDITIONS

2.1 Site Description

2.1.1 The application site is situated in northern Oxfordshire on the boundary with Warwickshire in Hornton, which falls under the Cherwell District Council. Drawing PF/8930.03, which is provided in **Appendix A**, shows the location of the proposed development site.

2.1.2 The site comprises of the worked land of the Hornton Grounds Quarry, which is located approximately 1.2 kilometres south east of the village of Hornton and approximately 8 kilometres west of the town of Banbury. The existing buildings and yard of the quarry borders the western boundary of the site with arable land to the north, east and south.

2.1.3 The village of Hornton lies approximately 1.2 kilometres north-east of the application site while Shenington lies approximately 2.0 kilometres south of the site. Upton House is located approximately 1.0 kilometre north of the site.

2.1.4 Sor Brook flows approximately 3.35km east of the site and a tributary from the brook is located approximately 0.75km to the south.

Figure 1 – Aerial View of Site

2.2 Topography

2.2.1 A topographical survey of the site was carried out by Interlocks Surveys Limited in November 2017 to provide a better understanding of levels and existing features and the immediate surrounding area (see **Appendix B**).

2.2.2 The survey shows a high point of c 187,0 at the north west corner of the site where levels then fall gradually in an south-easterly direction to the approximate mod pint of the site where there is a north-south step in levels from c 185,6m AOD to 188.0 m AOD. At this point there is then a step in levels along the site's southern boundary from c 188m AOD to c 192m AOD.

2.2.3 To the east of the north-south step, levels are relatively flat with a slight increase to the site's eastern boundary to a level of c 180m AOD.

2.2.4 There is a 1m high bund along the length of the eastern boundary and along the southern boundary a 2m high bund.

2.2.5 Levels fall southwards from the site along the access road towards it junction with Stratford Road (A422).

2.3 Geological ground conditions

2.3.1 British Geological Survey (BGS) show the site to be underlain by the Marlstone rock formation which comprises sandy, shell-fragmental and ooidal ferruginous limestone interbedded with ferruginous calcareous sandstone, and generally a subordinate ferruginous mudstone bed (**Appendix C**).

2.3.2 The use of soakaways has therefore been considered, as such soils potentially have good infiltration however, issues of shallow groundwater are discussed below.

2.3.3 On-site soakage testing has been undertaken as part of a combined Phase 1/2 Geo-environmental assessment by OHES Environmental (ref: R001 – 6114) dated 30 September 2020, and a copy of their findings is included in **Appendix D**.

2.3.4 Four soakaway pits were excavated in the quarry (SA1 – SA4) and these were progressed to depths of between 1 – 3m bgl. Water seepage was entering the pits at around 0.55 – 0.65m bgl and therefore the pits filled with water and the soakaway tests were unable to be conducted on-site. An additional two soakaway pits were progressed down towards the outfall (SA5 and SA6) in the ditch beside the access road and there was water in these pits deeper at depths of between

1.1m and 1.7m bgl respectively.

2.3.5 The report concludes 'Based on the shallow seepage of groundwater, it is not advisable that soakaways are used on site for drainage. Deeper soakaways are also unlikely given the underlying strata.'

2.4 Existing surface water management

2.4.1 Details of an existing land drainage system have been provided and are included in **Appendix E**. This show a pipe passing along the northern site boundary before turning southwards and being directed to an existing ditch, which runs southwards adjacent to the site access road.

2.4.2 It is understood that this intercepts groundwater which was evident on site prior to the quarry works commencing. The recent site investigation works referred to above confirms the presence of shallow groundwater.

2.4.3 This drainage system is reported to work well and there have been no reports of any flooding since it was installed. Despite reports of a steady flow of water to the ditch, it is understood that water infiltrates along its length and even following prolonged heavy rainfall, there is no water evident in the ditch further south. It is therefore anticipated that this runoff infiltrates into the ground at relatively shallow depths.

3 POLICY CONTEXT FOR PROPOSED DEVELOPMENT

3.1 The National Planning Policy Framework (NPPF) 2019 & Planning Policy Guidance - Flood Risk and Coastal Change (PPG) 2014

3.1.1 Vulnerability Classification

3.1.2 The proposed redevelopment complies with the following principles:

- EA maps show that the site is located in Flood Zone 1 (see **Appendix F**) with a less than 1 in 1000 annual probability of fluvial flooding.
- The proposed development is classified as 'less vulnerable' with reference to Table 2 of the PPG (extract reproduced below).

Vulnerability	Site Elements
More Vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels • Buildings used for dwelling houses; student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place).
Notes	

Vulnerability	Site Elements
1) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)21 and also on the need of some uses to keep functior during flooding. 2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity. 3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.	

Extract of Table 2 of the PPG - Flood Risk Vulnerability Classification

Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less vulnerable
Flood Zone	Zone 1	√	√	√	√	√
	Zone 2	√	√	Exception Test	√	√
	Zone 3	Exception Test	√	X	Exception Test	√
	Zone 3b	Exception Test	√	X	X	√
Key √ Development is appropriate X Development should not be permitted						

Extract of Table 3 of the PPG - Flood Risk Vulnerability and Flood Zone Compatibility

3.1.3 The proposed development is appropriate in accordance with Table 3 of the PPG, reproduced above.

3.1.4 Sequential Test

3.1.5 The NPPF requires that at all stages of planning, a Sequential Test is completed with the aim of steering new development to areas at the lowest probability of flooding (Flood Zone 1). The Sequential Test would normally be completed by the Local Planning Authority (LPA) to inform the preparation of the Local Development Framework (LDF), where one exists. However, where this process has not yet been completed, the onus for the provision of evidence demonstrating successful application of the Sequential Test falls to the developer, or promoter of the site.

3.1.1 In this instance, as the site is located in Flood Zone 1, the Sequential Test can be

deemed to be passed. Notwithstanding the above, the NPPF also requires the layout of the site to be sequentially tested however, the site is located entirely within Flood Zone 1. It is therefore not necessary to sequentially test the development layout.

3.1.2 Exception Test

3.1.1 Table 3 of the NPPF indicates when the Exception Test is required and reference to this table outlines that 'less vulnerable' uses in Flood Zone 1 do not require the application of the Exception Test.

3.2 Strategic Flood Risk Assessment (SFRA)

3.2.1 The Cherwell Level 1 Strategic Flood Risk Assessment Update (SFRA) was prepared on behalf of Cherwell District Council by Aecom, in May 2017 and the appendices to this document include a number of maps of flood risk form different sources.

3.2.2 Appendix B6A shows that the application site is not affected by fluvial flooding (see **Appendix G**).

3.2.3 Appendix B7A shows that the application site is not affected by flooding from surface water (see **Appendix H**).

3.2.4 Appendix B8 shows that the application site is not affected by flooding from groundwater (see **Appendix I**).

3.2.5 Appendix B9 shows that the application site overlies a minor aquifer of medium vulnerability (see **Appendix J**). It is therefore important that suitable pollution control measures are included in the surface water drainage systems and this is outlined in Chapter 6 below.

3.2.6 Appendix B10 is a map of historic sewer flooding incidents and whilst the application site in an area that has had 0 – 5 properties affected by historic flooding from sewers, the application site has not had any such incidents (see **Appendix K**).

3.3 Local Flood Risk Management Strategy (LFRMS)

3.3.1 The Oxfordshire County Council LFRMS sets out how in their role as the Lead Local Flood Authority, they will manage flood risk and it includes details of the

following objectives; -

- Sets a long term programme for the reduction of flood risk.
- Sets procedures for identifying the relative priorities of measures for reducing flood risk.
- Establishes how to identify areas where a holistic approach to flood risk management will achieve multiple benefits.
- Establishes how to identify affordable measures for implementation to agreed time frames.
- Will facilitate engagement and consultation with the community and all our partners.
- Encourages public awareness and self-help where appropriate.

3.4 Preliminary Flood Risk Assessment (PFRA)

3.4.1 This report was produced on behalf of Oxfordshire County Council by JBA dated June 2011.

3.4.2 The PFRA is aimed at providing a high-level overview of flood risk from local flood sources and includes flooding from surface water, groundwater, ordinary watercourses and canals.

3.4.3 Whilst the PFRA assesses the different forms of flood risk outlined above and includes the Cherwell District, no reference is made to Hornton.

3.5 Cherwell District Council Local Plan 2011 – 2031

3.5.1 The Cherwell District Council (CDC) Local Plan 2011 – 2031 was adopted by CDC on 19 December 2016. Policies relevant to flood risk and drainage include: -

3.5.2 Policy ESD6: Sustainable Flood Risk Management

3.5.3 This policy comments that CDC will manage and reduce flood risk in the District through using a sequential approach to development locating vulnerable developments in areas at lower risk of flooding. The site complies in this regard, as it is located in Flood Zone 1.

3.5.4 This policy requires development proposals to be supported by an FRA which shows that there will be no increase in surface water discharge rates or volumes for storms up to and including the 1 in 100 year plus climate change event. Also, there should be no flooding in rainfall events up to the 1 in 30 year storm and any flooding in excess of this event should be safely contained within the site's boundaries. These criteria are met by the proposed drainage strategy outlined in Chapter 6 below.

3.5.5 The policy also states that developments should be safe and remain operational (where necessary) and proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding. Chapter 6 below outlines how the surface water management proposals will meet these criteria.

3.5.6 Policy ESD7: Sustainable Drainage Systems (SuDS)

3.5.7 This policy emphasises that all development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off. It can be seen from Chapter 6 below that surface water flows will be managed by the use of infiltration systems and thus this policy objective will be met.

3.5.8 The policy also points out that the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features. The drainage proposals include the use of appropriate petrol interceptors and permeable paving, prior to discharges to the ground. These proposals together with a management strategy will be submitted to the LLFA for approval.

3.5.9 Policy ESD8: Water Resources

3.5.10 This policy aims to ensure that water quality is maintained and enhanced by avoiding adverse effects of development on the water environment. As outlined above, the drainage proposals included in Chapter 6 below include pollution control measures to maintain water quality.

4 DEVELOPMENT PROPOSALS

4.1 Development Layout

4.1.1 A proposed layout has been prepared by Trident Engineering Consultants and is included in **Appendix L**.

4.1.2 The proposed layout comprises mainly hard standing areas split in to two areas. An area comprising of an office building and car parking for staff and visitor parking and an oil fuelling and storage area with lorry circulation and parking areas.

4.1.3 The oil fuelling area includes a tank farm with six above ground tanks, with the ability to provide a further tank at a later date. There are also areas for the loading and unloading of fuel. This is discussed further in Section 6.3 below.

4.1.4 Vehicle access is to be taken from the existing access to the quarry from Stratford Road (A422).

5 PROBABILITY OF FLOODING

5.1 Sources of Flooding

5.1.1 The PPG points out that for the purposes of applying the National Planning Policy Framework, "flood risk" is a combination of the probability and the potential consequences of flooding from all sources including: -

- Rivers (fluvial flooding) and the sea (tidal flooding);
- Rainfall on the ground surface;
- Rising groundwater
- Overwhelmed sewers and drainage systems; and
- Reservoirs, canals and lakes and other artificial sources.

5.2 How Flooding May Occur

5.2.1 Rivers (fluvial flooding) and the sea (tidal flooding)

5.2.2 As outlined in paragraph 3.2.2 above, the map in Appendix B6A of the Level 1 SFRA shows that the site is not affected by flooding from rivers and the sea. The EA map of flooding from rivers and the sea is included in **Appendix F** and also shows the site to be located in Flood Zone 1 and thus at a low risk of flooding from these sources.

5.2.3 Surface Water Flooding

5.2.1 As outlined in paragraph 3.2.3 above, the map in Appendix B7A of Level 1 SFRA shows that the site is not affected by flooding from surface water. The EA map of flooding from surface water is included in **Appendix M** and also shows that the site is not affected by flooding from surface water.

5.2.2 Groundwater Flooding

5.2.3 As outlined in paragraph 3.2.4 above, the map in Appendix B8 of the Level 1 SFRA shows that the site is not affected by flooding from groundwater. A copy of this map is included in **Appendix I.**

5.2.4 It should be noted that records of perched water have previously been noted however, these have been addressed by a land drainage system that will be maintained and adjusted as necessary to suit the development layout. In addition

to this, the development proposals include for paving the site and providing a positive drainage system.

5.2.5 Overwhelmed sewers and drainage systems

5.2.6 As outlined in paragraph 3.2.5, the map in Appendix B10 of the Level 1 SFRA shows that the Cherwell area has had 0 – 5 properties affected by historic flooding from sewers however, the application site has not had any such incidents

5.2.7 Reservoirs, canals and lakes and other artificial sources

5.2.8 A review of the EA's map of the extent of flood risk from Reservoirs (**Appendix N**) shows that the site is not affected by flooding from reservoirs.

5.2.9 There is also no known risk of flooding from other artificial sources.

6 SURFACE WATER MANAGEMENT

6.1 Surface Water Drainage

6.1.1 The total site area is approximately 0.8ha and is currently undeveloped. Once developed, the site will become impermeable comprising offices, car parking, tanker parking and the fuelling area.

6.1.2 An estimation of the greenfield runoff rate for the development area has been calculated using the ICP SuDS method on MicroDrainage. The calculations are included in **Appendix O**. This generates a Qbar rate of 3.5 l/s for the site.

6.1.3 As stated in Section 2.3 above, soakage testing was undertaken and concluded that due to the presence of shallow groundwater, it is not advisable that soakaways are used on site for drainage. Deeper soakaways are also unlikely given the underlying strata (See **Appendix D**).

6.1.4 Consequently, a drainage scheme has been developed which includes attenuation with a restricted discharge to the existing ditch adjacent to the access road.

6.1.5 Porous paving is provided to the office car park area and this be lined and with an outfall to the downstream drainage system.

6.1.6 Porous paving is not considered a suitable method of managing surface water runoff in areas trafficked by HGV vehicles and where oils will be handled. These areas will need to be hard paved and an appropriate Class 1 full retention separator used before being attenuated and directed to the existing ditch.

6.1.7 It is proposed to separate the site in to 2 areas: -

- Office and car park area – porous paving discharging to the existing ditch.
- Tanker parking, circulation and fuelling areas - Impermeable surface with runoff directed through an appropriately sized Class 1 full retention separator to the existing ditch.

Different methods of pollution control can be used for each area, as required.

6.1.8 The attenuation required for the tanker parking and fuelling areas is 597m^3 - 833m^3 and a copy of the calculations is included in **Appendix P**.

6.1.9 An Indicative Drainage Strategy Plan drawing number E4040-501, has been

prepared and is included in **Appendix Q**. The plan shows cellular storage soakaways under the tanker parking and fuelling areas and the permeable paving within the office car park area. The cellular storage provided will need to be able to withstand the weight of HGV's and Wavin's AquaCell Plus is an example of a product suitable for use under heavily trafficked areas (for vehicles up to 44 tonnes).

6.1.10 The drainage system including cellular storage and permeable paving has been modelled in MicroDrainage and a copy of the results is attached in **Appendix R**.

6.2 The Effect on Flood Risk Elsewhere

6.2.1 The drainage system will be designed to accommodate all rainfall events up to and including a 1 in 100 year event with an additional allowance of 40% for climate change.

6.2.2 Should the drainage design parameters be exceeded, proposed levels will be designed to direct excess flows away from buildings towards the greenfield land around the site.

6.3 Management of Risks

6.3.1 A management company will be appointed to maintain the drainage system including any gullies, ACO drains, pipes and crate storage.

6.3.2 Manufacturers' installation and maintenance specifications should be followed in order to minimise any risk of failure in the system.

6.3.3 The development proposals include a fuel tank farm together with circulation and fuelling areas where fuel is transferred to or from the tanks. The risk of spillage or leakage is considered below.

6.3.4 The tank farm comprises six above ground fuel storage tanks which will be double skinned with a bund of 110% capacity of the fuel tank.

6.3.5 The fuel tanks are integrally bunded, so that any possible leak or failure will be contained within the bunded tank structure.

6.3.6 The tank farm area is paved in reinforced concrete and each tank will be installed on an individual foundation. Furthermore, the concrete joints to this area will have PVC water bars installed in them, which will decrease the risk of leak paths in the

event of a potential spillage.

6.3.7 The tank farm will be surrounded by a reinforced concrete upstand 150mm high around its perimeter and there are no penetrations through the upstand or concrete floor (see **Appendix S**). Therefore, in the highly unlikely event that there is a spill or leak inside the tertiary containment area, there will be no leak paths from this area through the floor or bund.

6.3.8 In the event of a spillage or leak, this area will drain via a pump sump, so that there would be a controlled release of fuel. This can be drained when required by a site operative using an electrical switch button.

6.3.9 The fuelling areas are surrounded by channel drains (Aco or similar), so that any leaks or spillages are intercepted.

6.3.10 The channel drains from the fuelling areas are directed to an appropriately sized Class 1 full retention separator with an auto closure device and a high-level alarm. Similarly, the tank farm sump pump is also directed to the full retention separator, so that any runoff, leaks or spillages are fully contained and appropriately treated prior to release into the drainage system.

6.1 Climate Change

Climate change will result in more intense storm events over time. This will be allowed for in the design by including an allowance of 40% increase in rainfall for the design 1 in 100 year storm event.

7 FOUL WATER MANAGEMENT

7.1 It is proposed that an on-site package sewage treatment system will be installed with a discharge to the ground via a drainage field in accordance with manufacturer's and EA guidelines. Consent will be sought from the EA for this arrangement.

7.2 The proposed foul water drainage system will be maintained by a suitable management company.

8 CONCLUSIONS

8.1 The site is located within Flood Zone 1, according to EA flood maps and the NPPF confirms that a site within Flood Zone 1 is suitable for industrial development.

8.2 BGS records indicate that the site is underlain by the Marlstone Rock formation which has good soakage potential and thus consideration was given to the use of infiltration methods for the management of surface water runoff.

8.3 Site investigation works have concluded that due to the presence of shallow groundwater, it is not advisable that soakaways are used on site for drainage.

8.4 Consequently, it is proposed that surface water runoff be attenuated and discharged at a controlled greenfield rate to the existing ditch adjacent to the site access road.

8.5 All surface water runoff from areas trafficked by HGV vehicles, and where oils will be handled, will pass through an appropriately sized Class 1 full retention separator to remove any oils that may be present in the surface water run-off.

8.6 The surface water drainage system will be designed to cater for storms up to the 1 in 100 year storm event plus 40% for climate change and proposed levels will be set such that exceedance flows will be directed away from any development.

8.7 A drainage strategy has been prepared to demonstrate that the development can accommodate the proposed surface water runoff.

8.8 Foul water from the office block will be disposed of via an on-site package sewage treatment system with a discharge to the ground via a drainage field. EA consent for this arrangement will be obtained.

8.9 In the highly unlikely event of a leak or spillage of fuel from the fuelling areas, fuel would be directed to an appropriately sized Class 1 full retention separator with an auto closure device and a high-level alarm.

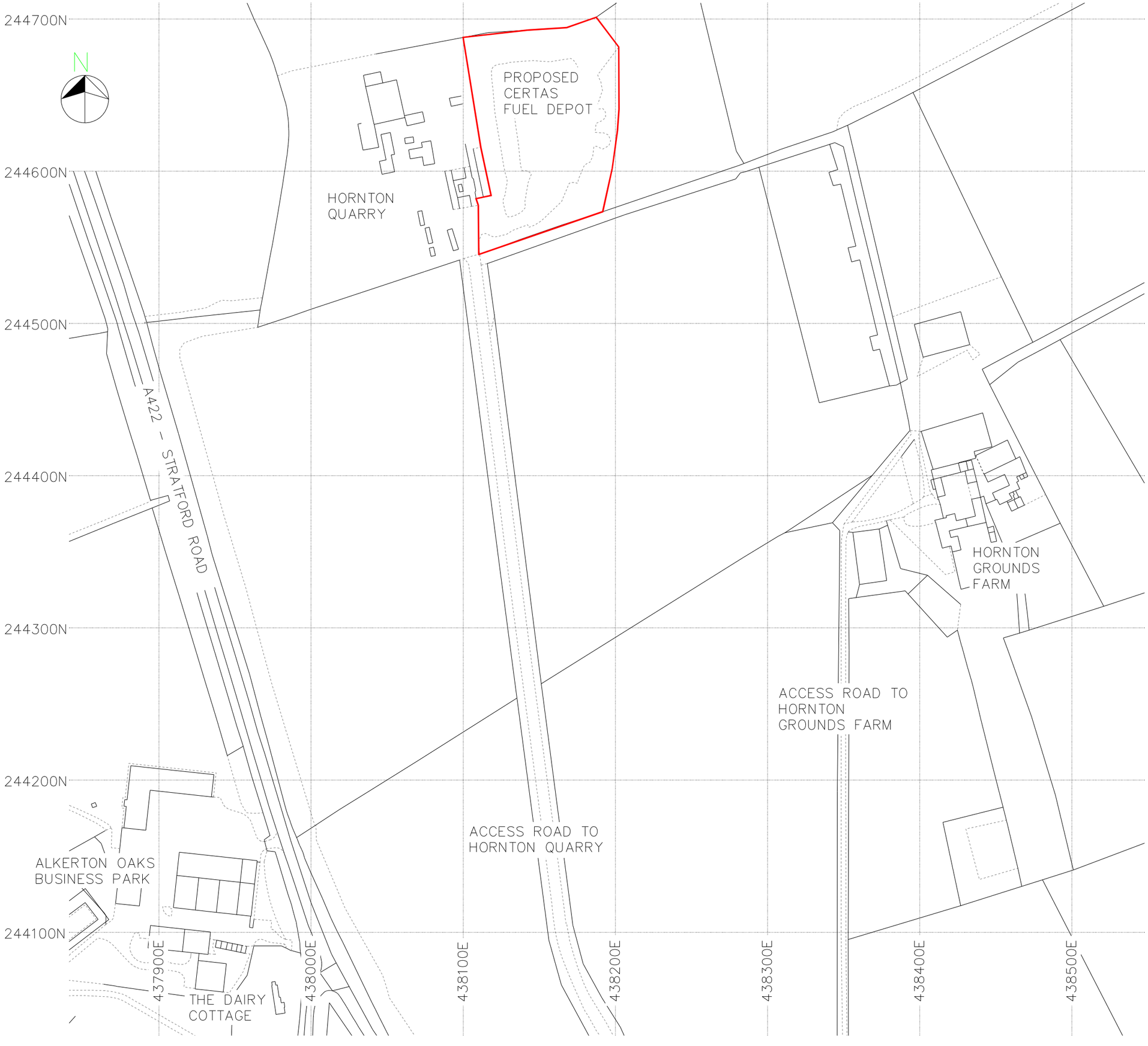
8.10 The storage tanks are integrally bunded and they are housed in fully bunded reinforced concrete area. Any potential leaks or spillages would therefore be fully contained and a sump pump provided to direct flows in a controlled manner to the full retention separator. Thus, such flows would be retained and appropriately

treated prior to release into the drainage system.

8.11 A management company will be appointed to maintain both the foul and surface water drainage systems on the site. The management company will be qualified and experienced to ensure the long-term performance will be maintained in accordance with the design.

APPENDICES

APPENDIX A



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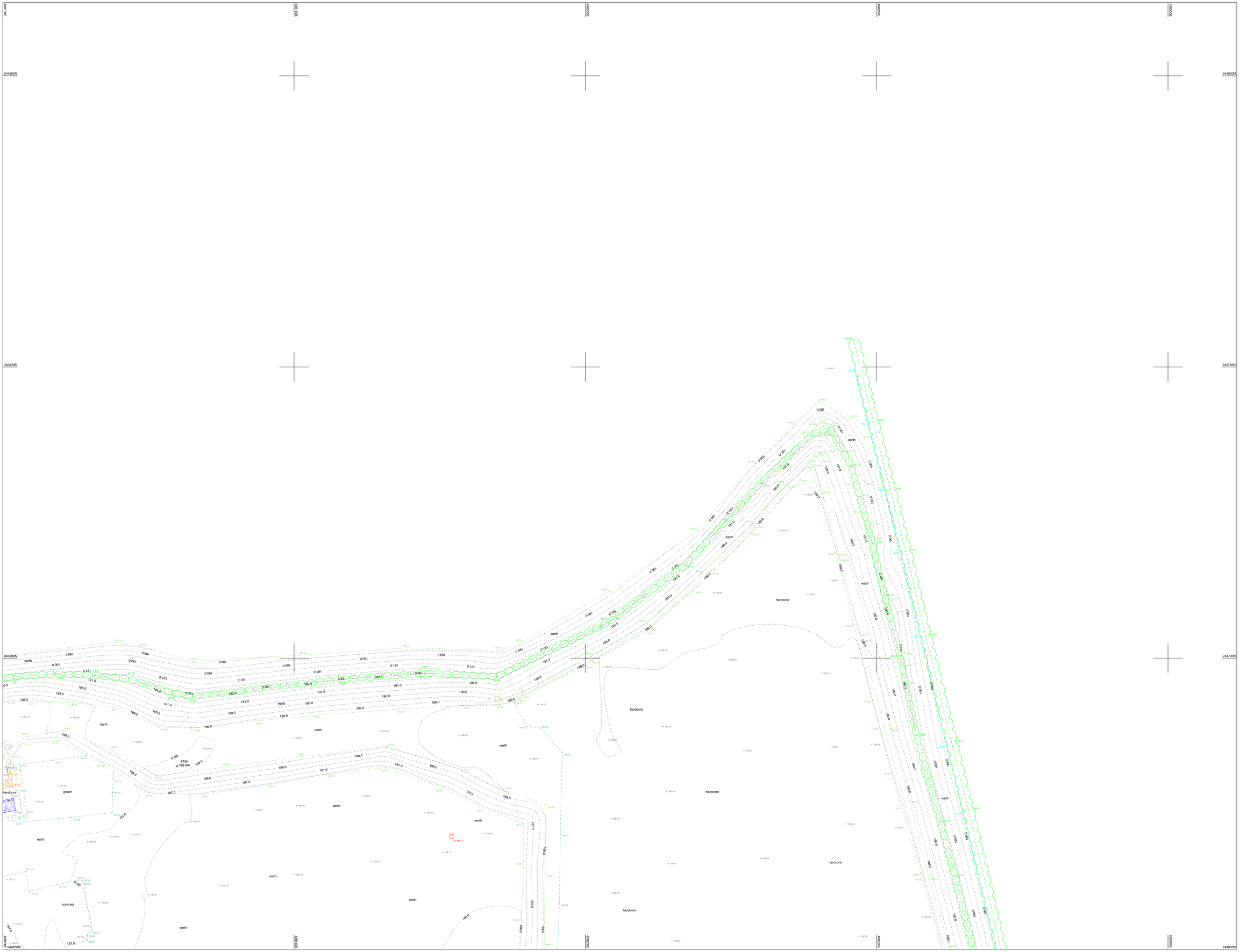
Site: BANBURY – HORNTON QUARRY

Title: LOCATION PLAN

Dwg By:	Checked:	Approved:
SMont	CH	NM
Date: 14.11.19	Date: 14.11.19	Date: 14.11.19

Scale:	Drawing No:	Rev:
1:2500 @ A3	6289–803	A

APPENDIX B



Symbol & Abbreviation Key.

- BARBED WIRE FENCE
- POST & RAIL FENCE
- CLOSE BOARD FENCE
- RAILINGS
- CHAIN LINK FENCE
- OTHER FENCE
- KERB
- DROPPED KERB
- GULLY CHANNEL
- TOP / BOTTOM OF BANK
- FOLIAGE
- DITCH
- VERGE
- OVERHEAD CABLES
- GATE
- HEDGE
- TREE - BROAD LEAVED
- TREE - CONIFEROUS
- BUSH
- BUILDING
- BOREHOLE
- SURVEY STATION
- ORDNANCE SURVEY BENCH MARK

A/C	AIR CONDITIONING UNIT	KO	KERB OFFLET
AV	AIR VALVE	LC	LIGHTING COLUMN
BOL	BOLLARD	LP	LAMP POST
BH	BOREHOLE	NP	NAME PLATE
BL	BED LEVEL	NB	NOTICE BOARD
BM	BENCH MARK	PR	PIPE RISER
BT	BRITISH TELECOM	RP	RODDING POINT
CTV	CABLE TV	RS	ROAD SIGN
CL	COVER LEVEL	SP	SIGN POST
CR	CABLE RISER	SV	STOP VALVE
DP	DOWN PIPE	TL	TRAFFIC LIGHT
ER	EARTH ROD	TP	TELEGRAPH POLE
EP	ELECTRICITY POLE	TOF	TOP OF FENCE
EM	ELECTRICITY MARKER	TOH	TOP OF HEDGE
FB	FUSE BOX	TOR	TOP OF RAILINGS
FH	FIRE HYDRANT	TOS	SERVICE LEVEL
FP	FENCE POST	TOW	TOP OF WALL
FL	FLOOR LEVEL	UTL	UNABLE TO LIFT
GV	GAS VALVE	VM	VALVE MARKER
GM	GAS MARKER	VP	VENT PIPE
GU	GULLY	WL	WATER LEVEL
HM	HYDRANT MARKER	WM	WATER MARKER
IL	INVERT LEVEL	WO	WASH OUT

General.

This survey has been prepared with a scaling accuracy for a plot at a scale of 1:200.

All tree heights and spreads are approximate. We have tried to identify tree types, however if tree species are critical specialist advice should be gained.

Drainage pipe sizes have been measured from the surface. Chamber access has not been gained for safety reasons, therefore sizes should be regarded as approximate.

Some detail may have been omitted due to parked vehicles.

Notes.

Coordinates related to OS National Grid from ST03 by GPS (No scale factor added). Levels related to GPS.

INDICATIVE ONLY

Rev	Details of Revision	Drawn	Date

Surveyed	Drawn	Date	Checked	Date	Approved	Date
SE	MS	27/11/17	APK	27/11/17	APK	27/11/17

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Client.

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ORIEL HOUSE
42 NORTH BAR, BANBURY
OXFORDSHIRE
OX16 0TH

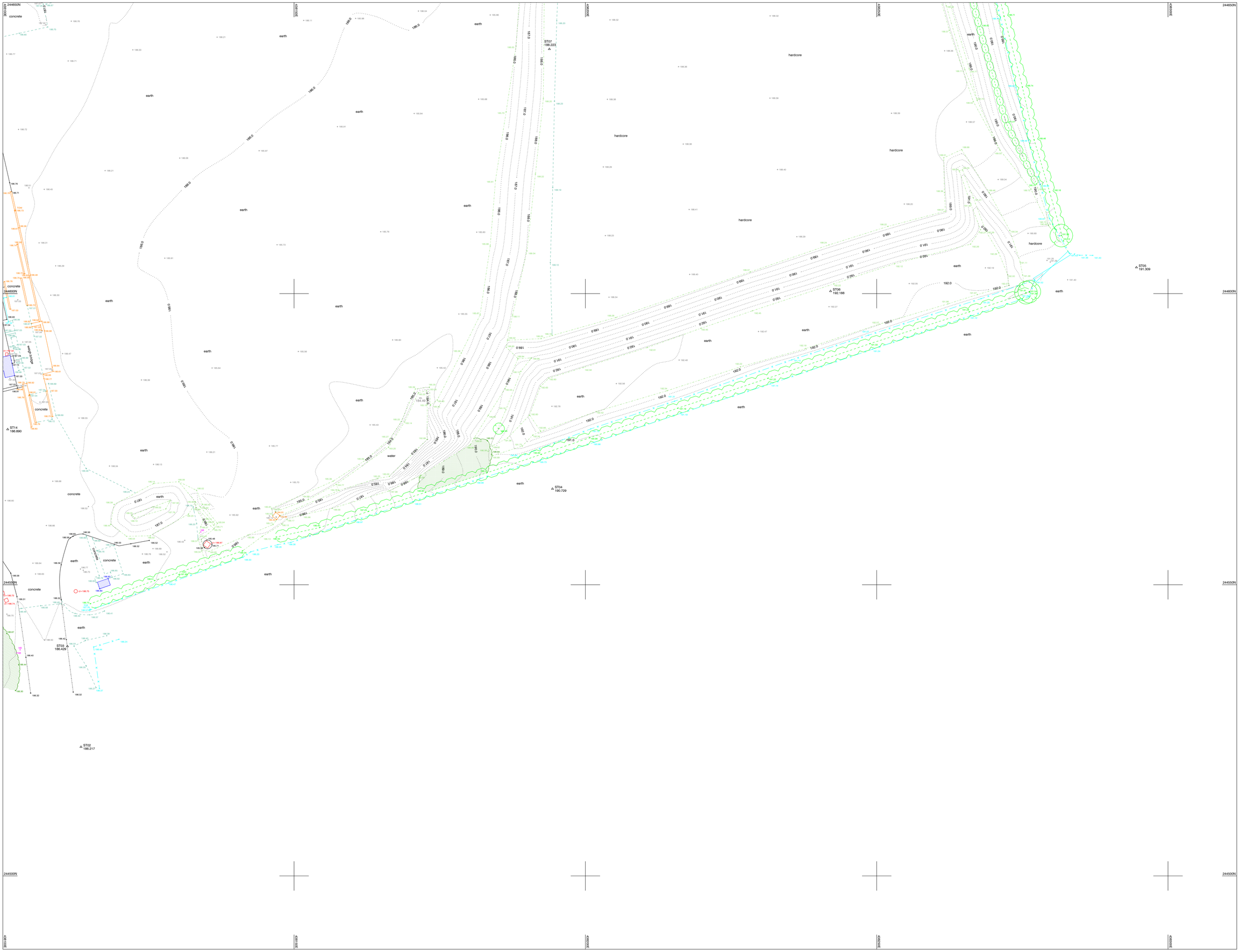
Title.

TOPOGRAPHICAL SURVEY

HORNTON QUARRY
BANBURY

Dwg No. **170907** Sheet **2 of 4**

Scale 1:200 A0 Sheet Rev. -



Symbol & Abbreviation Key.

- BARBED WIRE FENCE
- POST & RAIL FENCE
- CLOSE BOARD FENCE
- RAILINGS
- CHAIN LINK FENCE
- OTHER FENCE
- KERB
- DROPPED KERB
- GULLY CHANNEL
- TOP / BOTTOM OF BANK
- FOLIAGE
- DITCH
- VERGE
- OVERHEAD CABLES
- GATE
- HEDGE
- TREE - BROAD LEAVED
- TREE - CONIFEROUS
- BUSH
- BUILDING
- BOREHOLE
- SURVEY STATION
- ORDNANCE SURVEY BENCH MARK

A/C	AIR CONDITIONING UNIT	KO	KERB OFFLET
AV	AIR VALVE	LC	LIGHTING COLUMN
BOL	BOLLARD	LP	LAMP POST
BH	BOREHOLE	NP	NAME PLATE
BL	BED LEVEL	NB	NOTICE BOARD
BM	BENCH MARK	PR	PIPE RISER
BT	BRITISH TELECOM	RP	RODDING POINT
CTV	CABLE TV	RS	ROAD SIGN
CL	COVER LEVEL	SP	SIGN POST
CR	CABLE RISER	SV	STOP VALVE
DP	DOWN PIPE	TL	TRAFFIC LIGHT
ER	EARTH ROD	TP	TELEGRAPH POLE
EP	ELECTRICITY POLE	TOF	TOP OF FENCE
EM	ELECTRICITY MARKER	TOH	TOP OF HEDGE
FB	FUSE BOX	TOR	TOP OF RAILINGS
FH	FIRE HYDRANT	TOS	SERVICE LEVEL
FP	FENCE POST	TOW	TOP OF WALL
FL	FLOOR LEVEL	UTL	UNABLE TO LIFT
GV	GAS VALVE	VM	VALVE MARKER
GM	GAS MARKER	VP	VENT PIPE
GU	GULLY	WL	WATER LEVEL
HM	HYDRANT MARKER	WM	WATER MARKER
IL	INVERT LEVEL	WO	WASH OUT

General.

This survey has been prepared with a scaling accuracy for a plot at a scale of 1:200.

All tree heights and spreads are approximate. We have tried to identify tree types, however if tree species are critical specialist advice should be gained.

Drainage pipe sizes have been measured from the surface. Chamber access has not been gained for safety reasons, therefore sizes should be regarded as approximate.

Some detail may have been omitted due to parked vehicles.

Notes.

Coordinates related to OS National Grid from ST03 by GPS (No scale factor added). Levels related to GPS.

INDICATIVE ONLY

Rev.	Details of Revision	Drawn	Date

Surveyed	Drawn	Date	Checked	Date	Approved	Date
SE	MS	27/11/17	APK	27/11/17	APK	27/11/17

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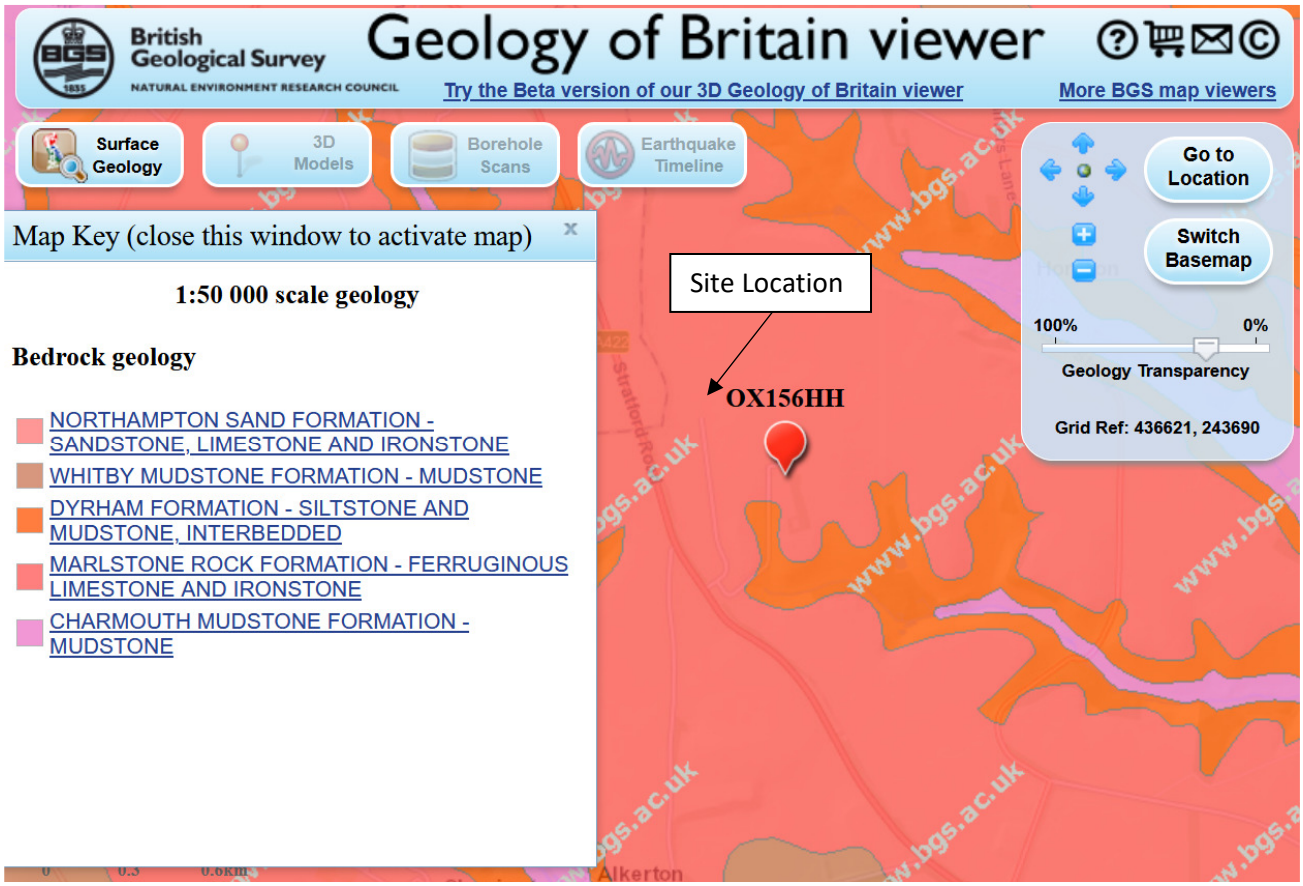
Dwg No. **170907** Sheet **4 of 4**

Scale 1:200 A0 Sheet Rev. -

APPENDIX C

British Geological Survey Geology Map



APPENDIX D

PHASE 2 GEO-ENVIRONMENTAL SITE ASSESSMENT

SITE NAME	Hornton Quarry
CLIENT	Finsco Property Company
CLIENT REFERENCE	Certasapp1
DATE	30th September 2020
REPORT REFERENCE	R001 - 6114
WRITTEN BY	Stacey Higgs Environmental Consultant
QA/QC BY	Samantha Yarnold Senior Environmental Consultant

This report has been prepared for Finsco Property Company only, in accordance with their instruction dated 21st August 2020. The report is intended to the specific purpose detailed in Section 1.0 of this report. OHES Environmental Ltd (OHES) cannot accept any responsibility for any use of, or reliance on the contents of this report by any third party

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REVIEWS AND REVISIONS

REVISION NUMBER	DATE	DETAILS	OHES CONULTANT

EXECUTIVE SUMMARY

CONTEXT AND OBJECTIVES

OHES Environmental Ltd (OHES) was instructed by Finsco Property Company on 21st August 2020 to complete a combined Phase 1/2 Geo-Environmental Site Assessment (GESA) for the site, in the context of the proposed change in usage from a former quarry land into a fuel depot.

The objective of the assessment is to determine the likely presence, extent and severity of any contamination and geotechnical hazards and risks through completion of a suitable desk study, site inspection, intrusive investigation and generic quantitative risk assessment (GQRA). The results of the assessment have been used to design any further assessment or remediation that may be required in the context of the proposed site use.

SITE DETAILS

The site, known as 'Hornton Quarry', is located 1km south-west of the village of Hornton, off the A422 Stratford Road, Hornton, near Banbury OX15 6HH.

The land under assessment is situated on relatively level ground on the eastern side of a pre-existing quarry. Current land use comprises former quarried land.

INITIAL CONCEPTUAL SITE MODEL AND PRELIMINARY RISK ASSESSMENT

Based on the results of the desk study and site inspection, the following key risks have been identified:

Preliminary Environmental Assessment

- Groundwater- **Low** risk;
- Surface water-**Very low** risk;
- Human health- On site ground and construction workers- **Low** risk;
- Human health – On site post construction staff and operatives-**Low** risk; and
- Human Health – Offsite-**Low** risk.

Based on this assessment, intrusive investigation was required to further assess risks associated with the pollutant linkages identified above.

Preliminary Geotechnical Assessment

- The site is within a worked rock quarry therefore bedrock will be shallow; and
- The absence of superficial deposits may impede the use of soak away drainage.

Based on this assessment, intrusive investigation was required to further assess ground conditions for foundation design and drainage proposals.

SITE INVESTIGATION WORKS COMPLETED

Ground investigations commenced on the 26th August 2020 and included:

- Four trial pits were advanced to between 1.00m and 1.50m bgl;
- The drilling method used was rotary sampling, chosen based on a preliminary site assessment at the time of initial enquiry;
- Two boreholes were drilled to 6.00m depth;
- Monitoring wells were installed in both locations (BH1 and BH2) designed to target groundwater;

CONTAMINATION FINDINGS

- No visual or olfactory evidence for contamination was recorded in soil, rock or groundwater encountered;
- Volatile Organic Compounds measured by the PID readings were all below detection;
- Laboratory analysis of soil samples returned concentrations for petroleum hydrocarbons below detection or at concentrations which are not considered significant, none of the concentrations of contaminants of concern in soil samples analysed exceeded Tier 1 screening criteria protective of human health for proposed commercial land use;
- Groundwater was recorded at both locations during monitoring, groundwater samples submitted for analysis returned concentrations below detection for all determinants analysed; and
- One soil sample was submitted for asbestos screening, there were no detections of asbestos fibres within the sample analysed.

GEOTECHNICAL FINDINGS

- The site is situated within a quarry within Marlstone Rock. The depth of quarry and the increasing mudstone content suggests that the Dyrham Formation is within close proximity of the surface.
- Shallow reworked natural soils (brown gravelly clays with cobbles and boulders) covers the bedrock surface in some areas of site to a maximum depth of 0.85m, but generally the depth is <0.3m.
- Shallow groundwater seepages entered trial pits at generally 0.5m depth. Groundwater strikes were encountered in boreholes at approximately 1.3m depth, resting levels after 1 week were approximately 1.0m suggesting poor drainage throughout the upper 6.0m of strata.
- Infiltration testing for soak away design could not be completed due to the presence of shallow groundwater.
- It appears the current site level is just above a spring line.
- Observed ground conditions confirm that the underlying bedrock is not a continuous slab of thickly bedded limestone or sandstone but instead comprises of an interbedded sequence of limestone and mudstones/siltstones/sandstones in places weathered to clay/silt.
- Based on observation and laboratory testing the strata will provide adequate bearing capacity for the tank farm foundations (assumed 50kpa required) and office block foundations. However a shallow 300mm thick band of soft to firm clay at between 0.5 and 0.85 depth beneath the upper bedrock beds will be compressible potentially resulting in settlements estimated to be in excess of 50mm.
- For soils, water soluble sulphate concentrations range from 29.8 to 25.1mg/l (mean 27.45mg/l) with a pH of 8. Groundwater sulphates ranging between 43.4 and 54.4mg/l with a pH values of 7.5. The shallow ground is not deemed to be pyritic.
- Surrounding slopes and earthworks appear to be stable.

UPDATED CSM AND RISK ASSESSMENT

Based on the results of the site investigations the following key risks have been identified:

Revised Environmental Assessment

- Human health- On site ground and construction workers-**Very Low** risk
- Human health – On site post construction staff and operatives- **Very Low** risk

Following site investigations, no sources of contamination relevant to surface/groundwater were identified and therefore the revised assessment is based on viable source-pathway-receptor relationships. In this case there are very lows risks relating to human health and the identified risks can be managed by appropriate risk assessments and adequate PPE.

RECOMMENDATIONS

Environmental Assessment

The Environmental Site Assessment (ESA) has determined viable pollutant linkages from soils onsite with detections of metals and PAH and low-level heavy end hydrocarbons, though these have been deemed very low risk to human health.

The ESA is in its nature limited to the areas investigated and therefore a conservative approach should be taken to adopt appropriate mitigations to supress soil dust and prevent inhalation/contact with site workers during any redevelopment of the site.

Geotechnical

General

The site formation level comprises of strong limestone bedrock with reprofiled slopes and banks defining the edges. Although the ground conditions appear favourable for construction care should be taken when completing earthworks excavations adjacent to these slopes, as detailed within, slope instability can be an issue in this region especially with shallow groundwater levels at the site.

At one location (TP4) the upper 0.85m of ground comprised of reworked soil and rock (Made Ground). It is possible these conditions are replicated elsewhere on site.

Foundations

Tank Farm

Shallow groundwater presents a problem for bedding the tank farm tank base into the upper strata. Any excavation would need to be progressed to at least 1.2m depth to encounter the competent mudstone beyond the clay/silt (weathered mudstone). Given the general situation with shallow groundwater and drainage it maybe instead beneficial to raise site levels using imported stone engineered on the existing limestone bed to form a suitable formation level.

As the clay layer appears to be continuous across the site differential settlements are unlikely, however to further mitigate this, in addition to the extra loading afforded by the placement of engineered fill the tanks could be pre-loaded with water prior to filling with fuel to induce settlement prior to commissioning.

A cost benefit analysis should be undertaken to compare the two options above.

Further sampling and geotechnical testing of the clay or In-situ plate loading tests of the surface limestone would be recommended to assist in the above options appraisal to ascertain the potential settlement.

Office Block

Any shallow strip or pad foundation will need to be bearing on the underlying mudstone at circa 1.0m bgl to ensure adequate and consistent bearing beyond the clay bed. Foundations will need to be dewatered prior to the placement of concrete.

Office block floor slabs may consist of ground bearing reinforced concrete which should include a radon barrier.

For the purposes of designing the appropriate concrete mix for shallow foundations and floor slabs, the ACEC classification for the site is DS-1 - AC-1.

Pavements

Although no CBR testing was undertaken the existing quarry floor will have CBR values >3%.

Drainage

Based on the shallow seepage of groundwater it is not advisable that soakaways are used on-site for drainage. Deeper borehole soakaways are also unlikely given the underlying strata.

Other Considerations

To enable groundworks sumps or trenches could be utilised upgradient of groundworks to intercept groundwater seeping through the limestone bed to improve working conditions.

OHES have not been provided with proposed finished ground levels, however it is assumed that some reprofiling of the site will take place during construction. It may be possible to reuse some of the materials generated to build up site levels etc. if required. This would be subject to an evaluation of site levels and a proven requirement for the re-use of these materials on-site. The re-use of any site won materials will need to be undertaken in accordance with a site-specific Materials Management Plan (MMP). Considerable volumes of waste materials (soils etc.) are likely to be generated by the excavation of new foundations and service trenches. Allowance should be made for the disposal of these materials in accordance with current UK waste disposal regulations.

1.0 INTRODUCTION

1.1 Context and Purpose

OHES Environmental Ltd (OHES) was instructed by Finsco Property Company (the 'client') on 21st August 2020 to complete a Combined Phase 1/2 Geo-Environmental Site Assessment (GESA) at Hornton Quarry, off the A422 Stratford Road, Hornton, near Banbury OX15 6HH (hereafter referred to as the 'site'). The assessment is required in the context of the proposed development of the site into a fuel oil storage and distribution depot.

This assessment has been designed on order to meet the requirements for such assessment as detailed within '*Model Procedures for the Management of Land Contamination*' (CLR11) and '*Guidance for the Safe Development of Housing on Land Affected by Contamination*' (R&D Publication 66: 2008). The latter guidance is particularly focussed on the development of housing on land affected by contamination. However, the advice is generally applicable to other forms of development and to sites where no developments is proposed.

1.2 Objectives

The objectives of the assessment are:

- Determine the potential for contamination to be present based on the current and historical site use of the site and surrounding area;
- Determine the sites Environmental Sensitivity;
- Produce an initial conceptual site model (CSM) and preliminary risk assessment (PRA);
- Further determine the presence, extent and severity of any contamination present;
- Update the CSM and risk assessment;
- Assess geotechnical hazards and risks present based on the identified ground conditions; and
- Inform the need for and scope of further assessment and/or remediation works.

1.3 Guidance and Standards

In order to achieve the objectives, set out in Section 1.2, OHES has designed and delivered a suitable level and method of investigation and assessment in accordance with industry best practice, the documents referenced in Section 1.0 and the following technical guidelines:

- BS10175:2011 '*Investigation of Potentially Contaminated Sites Code of Practice*';
- BS 5930:2015+A1:2020, '*Code of practice for ground investigations*';
- Technical Report P5-065/TR, '*Technical Aspects of Site Investigation*';
- BS EN 1997-2:2007, '*Eurocode 7. Geotechnical design. Ground investigation and testing*';
- CIRIA C665, '*Assessing Risks Posed by hazardous Ground Gases*'; and
- BS8485:2015, *'Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments'*.

The scope and methodology completed as part of this assessment has been designed to meet the requirements of the above documents.

1.4 Project Information and Limitations

This report has been produced solely for Finsco Property Company based upon the instruction received from Finlay Scott on 21st August 2020. This assessment has been completed in the context of the agreed scope of works as detailed in OHES proposal dated 30th June 2020. The geotechnical aspect of the proposal was instructed on the 25th August the day prior to commencement on site. This led to a reduced level of data retrieved from site as the drillers had already mobilised to an adjacent site therefore SPT Insitu testing equipment had not been mobilised.

For details relating to general assessment limitations and its use by other parties please refer to the details provided in Appendix 1. Specific limitations to the site investigation are summarised in Section 4.

2.0 DESK STUDY AND SITE INSPECTION

2.1 Methodology

As part of this assessment a desk study was been completed in advance of the intrusive works which broadly comprised the following:

Site Details	Details of the site and surrounding area were obtained through a review of information provided by the client, information from a variety of internet resources and through the completion of a site inspection on 26th August 2020.
Environmental Setting	The environmental setting has been assessed through a review of available Ordnance Survey (OS), British Geological Survey (BGS) and UK Government mapping, information obtained from the site inspection and information provided in an Envirocheck Report obtained from the Landmark Group Limited.
Site History	The history of the site was determined based upon a review of historical mapping obtained from Landmark Group Limited, internet resources, Zetica Limited, local authority information (including planning records) and anecdotal information.
Regulatory Data	Regulatory data was obtained from an Envirocheck Report obtained from Landmark Group Limited and online public register information.
Geotechnical Hazard Identification	Potential geotechnical hazards and considerations have been assessed following a review of geological mapping, hazard information listed within Envirocheck Reports and with reference to data presented on BGS Engineering Geology Map Viewer. Publicly available online satellite imagery and aerial photography provided by Landmark Group Limited has been viewed to assess the geomorphology of the site and surrounding area to identify potential ground hazards. Published LiDAR imagery for the specific site location was not available.
Previous Reports	No previous reports are available for this site.
Initial CSM and Preliminary Risk Assessment	The results of the desk study and site inspection have been used to identify potential pollutant linkages and produce an initial conceptual site model (CSM). Upon completion of the CSM, a preliminary risk assessment has been completed in accordance with the methodology detailed within Section 6.3 of CIRIA Report 552 *'Contaminated Land Risk Assessment: A Guide to Good Practice'* and pages 33 to 35 of R&D 66:2008 publication. This is summarised in the Risk Assessment Methodology in Appendix 2.

2.2 General Site Information

SITE INFORMATION	
Name	Hornton Quarry
Address	Hornton Quarry, off the A422 Stratford Road, Hornton, near Banbury OX15 6HH.
Location	The site is located 1km south-west of the village of Hornton and 7km north-west of Banbury (Figure 1).
Grid Reference	SP381446.
Current Land Use	The site is an approximately rectangular area of former quarried land. The proposed depot location is shown on the accompanying site plan (Figure 2).
Site Ownership	The site is owned by Finlay Scott from Finsco Property Company.

Site Occupation	The site area is currently unoccupied former quarry land, the access road to the site is located to the south-west , to the west of this is a cabin and welfare facilities which are associated with Building Stone Ltd located to the west of the site.
Site Size	The site area is approximately 10,500 m^2.
Proposed Development / End Use	It is understood that it is Certas Energy's intention is to develop and operate the site as a fuel depot. The southern part of the site is proposed to contain an office building along the southern boundary with car parking spaces to the south of this section. The mid-section of the site is proposed to contain a central bund containing six tanks. Two loading gantries are proposed to be located to the west of the bund with one offloading header to the south east. One Glomax tank and one Derv tank are proposed to be located to the north east of the bund. The eastern boundary of site is proposed to be a tanker parking area. The proposed traffic flow on and off site is anti-clockwise. Ingress and egress on and off site is proposed to be from an electrical automatic sliding gate to the south-west of the site, leading from the concrete access road to the south of the quarry. Pedestrian access to the yard from the car park is proposed through a gate in the southern area of site.

A map showing the location of the site is presented as Figure 1. A copy of the proposed development drawings is provided in Figure 3.

2.3 Site Description

The description of the site has been produced based upon a review of desk-based information and a site inspection completed on 26th August 2020. A plan showing the current layout of the site is presented in Figure 2. Key site photographs from the site inspection are presented in Appendix 3.

2.3.1 Site Layout

SITE DETAILS	
General Site Layout	The site is set in cut ground (quarry) and is broadly rectangular in shape, the northern and eastern edges of the site are bounded by cut slopes covered in vegetation.
Site Access	The site can be accessed via a gated track access road from the south west of the site off the A422.
Buildings and Structures	There are no structures present on site.
Retaining Structures	No retaining structures have been identified.
Evidence of Buried Structures / Basements	No evidence of buried structures was immediately apparent from the walkover/site inspection or during the intrusive investigation.
Structural Damage	No structural damage has been identified.
Ground Cover / Surfacing	The ground cover is gravelly bedrock with weeds.
Boundary Fencing / Definition	The northern and eastern edges of the site are bounded by cut slopes covered in vegetation. The southern boundary is designated by an area of water and a tree line beyond this.

	The western boundary is designated by concrete hardstanding associated with Building Stone Ltd.
Site Vegetation	There are weeds across the quarry floor, and also vegetation growing on the slopes to the north and east of the site.
Trees	A mix of newly planted trees mark the eastern and northern boundary of the quarry area.
Fuel / Chemical Storage	No fuel or chemical storage has been identified.
Presence of Interceptors / Septic Tanks	No interceptor or septic tanks have been identified.
Quality of Housekeeping	Housekeeping was noted to be moderate to good.
Indicators of Former Structures	No indication of former structures were present on site.
Indicators of Site History	No further indications of previous site usage.

2.3.2 Description of Surrounding Area

SURROUNDING AREA		
General Land Use	The area surrounding site generally consists of arable agricultural land with Building Stone Ltd to the west of the site.	
Land Use Details	North	The area to the north of site consists of arable agricultural land.
	East	The area to the east of site consists of arable agricultural land.
	South	The area to the south of the site consists of arable agricultural land. The access road to the site is to the south-west. Hornton Grounds farm and a hotel are located 0.25km south east of the site.
	West	The area to the west of the site is occupied by Building Stone Ltd.
Likely / known Future Land Use change	Subject to completion and findings of the assessments reported herein, Certas propose to develop the site into a fuel depot. Proposed future layout is shown on Figure 3.	

2.3.3 Evidence of Contamination

EVIDENCE OF CONTAMINATION	
Surface Staining	No surface staining was noted.
Distressed Vegetation	No distressed vegetation was noted during the site walkover.
Invasive Weeds	No invasive weeds were noted during the site walkover.
Regulatory Involvement	No known regulatory involvement.
Asbestos Containing Materials	No asbestos containing materials (ACMs) were encountered during the site works.
Evidence of Artificial Levelling / Infilling	The quarry has been worked to a relatively level working platform corresponding with the bedrock bedding. No evidence of localised infilling on site were observed.
Waste Disposal Activities	No evidence of waste disposal on site was noted.

Known Pollution Incidents	No known recorded pollution incidents on site or within 1km.
Groundwater Monitoring	No historic groundwater monitoring wells were noted during the site visit.
Ongoing Remediation / Mitigation	No ongoing remediation or mitigation.
Other Evidence	No evidence of contamination was identified.

2.3.4 Topography

TOPOGRAPHY	
Site Elevation	Site lies at approximately 185m AOD, the surrounding ground to the north is approximately 188m to 190AOD.
Site Topography	The ground surface across the site is relatively flat, the levels are slightly lower to the south along the access road. The topography is interspersed with local changes in topography due to earth mounds on site. Northern and eastern edges of the site are bounded by cut slopes.
Surrounding Area	The surrounding area is predominately flat land.

2.4 Environmental Setting

OHES has assessed the sites environmental setting based upon information held on published mapping, internet resources and information held within ''Envirocheck Reports' published by Landmark Group. Copies of these reports are presented in Appendix 4 for reference.

2.4.1 Geology

GEOLOGICAL INFORMATION	
Made Ground	There is no made ground recorded on site. Significant artificial ground 500m south is however shown on BGS mapping.
Drift Deposits	According to British Geological Survey data the site is not underlain by superficial deposits.
Bedrock	The site is underlain by the Marlstone Rock Formation (MRB) – Sandy Ferruginous Limestone and Ironstone and Calcareous Sandstones. This rock has been quarried as building stone and is known as 'Hornton/Wroxton' Stone. The MRB is relatively thin in the region (1.2 to 7.5m thick) therefore the existing quarry floor level may represent the interface with the Dyrham Formation (DYS) interbedded siltstones and mudstones.
Radon	The site is located in a Higher probability radon area (more than 30% of homes are estimated to be at or above the Action Level). Full radon protective measures are necessary in the construction of new office block.
Other Information	No other pertinent information.
Shrinking / Swelling Clay	Published data suggests the Dyrham Formation has a medium shrink swell rating. No published data for the Marlstone Rock was identified.
Landslip Hazards	Slope instability is well documented at the interface between the Marlstone Rock and Dyrham formation. Cambering is particularly common resulting in subsurface voids.

	The BGS documents a landslide feature (the Hornton landslide) 1km south east of site.
Ground Dissolution Hazards	Envirocheck data states no known hazard.
Compressible Deposit Hazards	Envirocheck data states no known hazard.
Collapsible Deposit Hazards	Envirocheck data states very low hazard potential.
Running Sand Hazards	Envirocheck data states no known hazard.
Mining Hazards	Opencast quarrying has taken place at the site, the potential for deeper/discrete mine hazards such as shafts etc is unlikely.

2.4.2 Geomorphology

Aerial photography was utilised to assess the morphology of the site and local area to identify any features of interest that may reflect the underlying geology, which in turn may influence the geotechnical assessment of the site.

Utilising the Historical Aerial Photograph (dated 1999) published by Envirocheck (Appendix 5) and freely available online satellite imagery, linear features are recognised aligned north to south running towards and through the site. Given the relatively level terrain these features are unlikely to represent evidence of potential ground hazards i.e. cambered/disrupted blocks of bedrock. These morphological features may instead represent denuded drainage channels which are northward extensions of valley features further south and/or are morphological benches formed by the Marlstone rock bedrock.

Other features confirm former roadways leading out from the north east corner of the site and potential areas of infilling off site to the east.

2.4.3 Groundwater

GROUNDWATER INFORMATION		
Aquifer Classification	Drift	The site is not recorded to be underlain by a superficial deposit.
	Bedrock	Bedrock aquifer is designated as a 'Secondary A' Aquifer.
Source Protection Zone (SPZ)	The site is not located within a SPZ Zone.	
Groundwater Abstractions	There are 22 known abstractions within 1.5km of the site. The closest of these is located 820m west of site and relates to general farming and domestic abstraction for Upton Farm, under the authority of EA.	
Private Water Supplies	The nearest private household abstraction is located 1.4km west of site and relates to the Upton Estate, under the authority of EA.	
Discharges to Groundwater	No discharge consents to groundwater are listed within 2km of site.	
Evidence of Springs	There are a number of springs located within 2km of site. The closest of these relates to a spring 600m north-west, there are also springs 800m west and 1000m south-east of site shown on the historical mapping.	
Groundwater Quality	No information on groundwater quality is available.	
Other Groundwater Information	Soils are classified as having freely draining slightly acid but base-rich soils. The MAGIC website indicates that the site is located within a high groundwater	

	vulnerability area. The BGS website states the Marlstone Rock Bed is fissured and yields small supplies of groundwater. BGS borehole records show that there are sixteen boreholes within 2kmthe site, the majority of which are private records relating to old landfill sites, the others relate to private abstractions for farming.

2.4.4 Surface Water

SURFACE WATER INFORMATION	
Nearest Watercourse	Unnamed inland river located 424m south-west of the site.
Other surface water features	There is an unnamed ditch located 603m north-east and a pond marked 610m south-east of the site. There is a surface water feature 690m downslope south of the site, it is assumed that this is in continuity with the land drain from the drainage ditch beside the access road to the site. Hornton Stream is located 767m east of the site.
Surface Water Abstractions	There are no surface water abstractions listed with 2km of the site.
River Quality	The Hornton Stream is designated with River Quality B.
Flood Zones	The site is not located within a Flood Zone.
Discharges to Surface Water	No discharge consents to surface water are listed within 2km.
Other surface water information	The site is located with a Drinking Water Safeguard Zone for surface waters.

2.4.5 Ecology

ECOLOGICAL INFORMATION	
Environmentally Sensitive Areas	There are no environmentally sensitive areas within 2km of the site.
On-Site Habitats / Species	No evidence of on-site habitats or species were noted.
Off-Site Habitats / Species	No evidence of off-site habitats or species were noted.

2.4.6 Historically Sensitive Features

HISTORICALLY SENSITIVE FEATURES	
Designated Historically Important Features	There are no designated historically important features located on-site, there is a grade two listed building 0.25km south-east of the site located at Hornton Grounds Farm.

2.5 Site History

2.5.1 Historical Map Review

A summary of the key historical uses of the site and surrounding area from a review of available historical maps is presented in the following section. Copies of the historical maps are presented in Appendix 5.

HISTORICAL LAND USE – THE SITE		
Description	***Dates From***	***Date To***
Agricultural Land	1885	1999
Quarried Land	Circa 1999	Present Day

HISTORICAL LAND USE – SURROUNDING AREA			
Description	***Distance and Direction***	***Dates From***	***Date To***
Agricultural land	Surrounding areas	1885	Present day
Woodville Barn Hornton Grounds Farm	200m N 320m SE.	1885	1978 Present Day
Springs	600m NW 800m W 1000m SE	1999 1923 1900	Present day
Reservoir	800m W	1886	Present day
Old Quarries	600m N 700m N 1000m N 800m S 1200m SE	1900 1900 1900 1923 1955	2006 2006 2006 1971 1978
Motor test track	800m SE	1999	Present day
Building Stone Ltd	10m W	Circa 1998	Present day

2.5.2 Local Authority Information

A search of Cherwell District Council planning portal did not reveal any historical records relevant to site.

2.6 Regulatory Data

2.6.1 Regulatory Data Review

As part of this assessment OHES has purchased and reviewed an 'Envirocheck' report from Landmark Group. A copy of this report is presented in Appendix 4. A summary of the key findings relating to the site and surrounding area is presented in the following table.

REGULATORY DATA REVIEW	
Historical Land Use Records	The site has not been subjected to potentially contaminating activates associated with its current or previous use. The wider surrounding area does not contain potentially contaminating activities.
Environmental Permitting	The Envirocheck report lists no permits or Part A (1) Authorised processes within 1km of the site.

Pollution Incidents	The Envirocheck report lists no known pollution incidents within 1km of site.
Landfill Records	There are three historical landfill sites located with 1km of the site, the closest is 573m north of the site, waste deposited was inert waste. The other two landfills are located 652m south and 731m north of the site. There is one licensed waste management facility within 1km of the site, this is located 993m south of the site which is run by the Environmental Agency and accepts Household, Commercial and Industrial Waste. There is a registered landfill site 768m north of the site, the authorised waste is; hardcore and rubble, high-density Asbestos, Inert construction and industrial waste, plaster, soil and subsoil. There are five records of potentially infilled land within 1km of site. These all related to unknown infill of pits/quarries, the closest is 409m north-west of the site.
Current Land Use Records	The Envirocheck report lists 6 industrial land uses/contemporary Trade Directory entries within 1km radius of site.
Known Regulatory Action	No known regulatory action relating to the site.
UXO Assessment	Mapping from Zetica Limited indicates the site is located in a low risk UXB zone.

2.6.2 Local Authority Information

A search of Cherwell District Council Planning portal identified a number of planning records relating to the site and the wider area;

- **Display of free standing business sign at entrance to Hornton Grounds Farm adjacent to Hornton Grounds Quarry access -** 98/00332/ADV**.** Hornton Grounds Farm Hornton Banbury Oxon OX15 6HH. Validated: 18 Feb 1998 | Status: Permitted.
- **Erection of gable extension to existing building to house stone cutting saw.** Hornton Grounds Quarry North Of Hornton Grounds Farm Hornton Banbury Oxon. Ref. No: 00/01017/F Validated: 1 June 2000 | Status: Permitted.
- **Importation of 6757 cubic metres of clay from Hennef Way highway improvements to Hornton Grounds Quarry to assist with site restoration.** Hornton Grounds Quarry Hornton Banbury Oxon**.** Ref. No: 02/01797/CM | Received: 21 Aug 2002| Status: Permitted.
- **Variation of condition 79 of 97/00430/CM to allow the temporary retention of existing Saw Shed and ancillary facilities.** Hornton Grounds Quarry Hornton Banbury Oxon. Ref. No: 02/02485/CM | Received: 21 Nov 2002 | Status: Permitted.
- **Extension to Saw Shed and importation of block stone.** Hornton Grounds Quarry Hornton Banbury Oxon. Ref. No: 02/02488/CM | Received: 21 Nov 2002 | Status: Permitted.
- **Change of use from agriculture to provide an extension to the area associated with the processing of stone, to provide additional space for stone and product storage; part retrospective.** Hornton Grounds Quarry Stratford Road Wroxton Oxfordshire. Ref. No: 06/01116/CM | Received: 05 Jun 2006 | Status: Objections.
- **To develop land without complying with condition 5 of permission 02/02488/CM to allow the importation of up to 4,000 tonnes of stone per year.** Hornton Grounds Quarry Stratford Road Wroxton Oxfordshire. Ref. No: 06/01117/CM | Received: 05 Jun 2006 | Status: Objections.
- **Retrospective permission for additional structures and proposed replacement building.** Hornton Grounds Quarry Hornton Oxfordshire. Ref. No: 08/01431/CM | Received: 09 Jun 2008 | Status: Permitted.

2.6.3 Other Information

No other pertinent information was found related to the site.

2.7 Previous Report Review

No previous reports were available relating to the site for OHES to review.

3.0 INITIAL CONCEPTUAL SITE MODEL AND PRELIMINARY RISK ASSESSMENT

3.1 Summary of Contaminant Sources

Based on the results of the assessment, the following key contaminative sources have been identified. The likely contaminants of concern from each source have also been assessed based upon experience of similar sites, a review of appropriate DoE industrial profiles (where relevant and applicable to historical land-use) and tables provided in Annex 3 of the R&D66:2008 document.

SOURCE DESCRIPTION	LOCATION	POTENTIAL CONTAMINANTS OF CONCERN
ON-SITE		
Agricultural Land	On-Site	Pesticides and Herbicides.
Quarry use – fuel storage from plant during quarry operations and potentially infilled land.	On-site	Hydrocarbons
OFF-SITE		
Agricultural Land	Surrounding	Pesticides and Herbicides.
Building Stone Ltd	10m W	Petroleum hydrocarbons.
Motor Test Track	800m SE	Petroleum hydrocarbons.
Landfills	573m N 652m S 731m N 768m N	Volatile vapours.

3.2 Receptors and Sensitivity

The key receptors likely to be at risk from site sourced contamination are detailed in the following table along with an assessment of the sensitivity of each receptor. The sensitivity assessment is based broadly on definitions provided in the R&D66: 2008 document (water environment only) and adapted to reflect other sensitive receptors types.

KEY RECEPTORS	DETAIL	SENSITIVITY
Groundwater	The site is underlain by a 'Secondary A' Aquifer comprising of Marlstone Rock Formation – Ferruginous Limestone and Ironstone. There are a number of springs located in the vicinity of site which in this region are likely to be associated with the boundary between permeable limestones and underlying mudstones of the Dyrham Formation which is a Secondary Undifferentiated aquifer.	Moderate
Surface Water	The nearest surface water feature is an unnamed inland river 424m south-west and surface water feature 690m S of site, it is assumed that this is in continuity with the land drain from the drainage ditch beside the access road to the site.	Moderate/Low
Human Health – On-Site	It is understood that there are no planned soft landscaping areas and the site will have concrete hard standing across the entire footprint.	Very Low

	There is considered to be a very low risk from on-site sources of contamination given historic usage as an arable field.	
Human Health- Future Groundworkers	Future excavation and construction works are expected to take place on site during the change of site usage. Groundworkers may be exposure to low levels of potential contaminates of concern within soils.	Moderate
Human Health – Off-Site	The environmental sensitivity of off-site human health is considered to be very low from current site sourced potential contaminates of concern given the historic usage as an arable field.	Very Low
Historical Features	The designated status of the Grade 2 listed building at Hornton Grounds is unlikely to be affected.	Very Low

3.3 Initial Conceptual Site Model (CSM)

For a risk from ground contamination to exist, a contaminant source, pathway for migration and viable receptor must exist. The presence of all three of these elements is known as a 'pollutant linkage'.

The likely potential pollutant linkages identified as a result of this assessment and specific for the site have been provided in the initial CSM overleaf. The model has been based upon the site setting at the time of the assessment, the land use (current and reasonably foreseen future use) of the surrounding area and the proposed future use of the site as a fuel depot.

As well as identifying the potential pollutant linkages the model includes a preliminary assessment of risk based upon the probability of impact and the likely severity of impact in the context of the site setting and proposed future site use.

The criteria used for the risk assessment classifications as detailed in the CSM table are based on those presented in CIRIA Report 552 and pages 33 to 35 of R&D66:2008 publication. Further details of the risk assessment methodology and classifications can be found in Appendix 2.

IDENTIFIED POLLUTANT LINKAGES			PRELIMINARY RISK ASSESSMENT		
SOURCE	**PATHWAY**	**RECEPTOR**	**PROBABILITY**	**SEVERITY**	**RISK ASSESSMENT AND JUSTIFICATION**
On site; possible contamination in shallow soils from previous use as a quarry i.e. fuel storage from plant during quarry operations and potentially infilled land.	Leaching of contaminants and vertical migration into groundwater.	Groundwater within the bedrock deposits ('Secondary A' Aquifer).	Unlikely	Medium	**Low Risk:** If present, potential mobile contamination could impact the groundwater with the underlying bedrock deposits via percolation and lateral migration pathways, especially given the lack of superficial deposits. Risk assessed as low due to the absence of historically contaminative activities identified on site.
	Lateral migration in shallow groundwater.	Surface water (Unnamed inland river 424m SW of site, surface water feature 690m S of site).	Likely	Mild	**Moderate/Low Risk:** The surface water feature 690m downslope of site could be a diverted land drain associated with the drainage ditch along the access road, therefore any on-site contamination could likely migrate into this surface water feature. It is a mild severity given the lack of historically contaminative activities on site.
		Human Health- Off site Users	Unlikely	Medium	**Low Risk:** There is limited potential for mobile contamination in the soils on site and realisation of volatilisation to indoor/outdoor air pathways. Risk assessed as low due to the distance to offsite residents and absence of historically contaminative activities on site.
	Inhalation of volatile vapours (soil and groundwater-based contamination via volatilisation to indoor air pathways)	Human Health – Future Site Users	Unlikely	Medium	**Low Risk:** There is limited potential for Made Ground present on-site due to it being a quarry base therefore it's unlikely any harmful gases are present that could impact future users via volatilisation to indoor air pathways. Risk assessed as low due to the commercial/industrial offsite use and absence of historically contaminative activities on site.
		Human Health- Off site users	Unlikely	Medium	**Low Risk:** There is limited potential for Made Ground present on-site due to it being a quarry base so therefore its unlikely any harmful gases are present that could impact future users via volatilisation to indoor air pathways. Risk assessed as low due to the commercial/industrial offsite use and absence of historically contaminative activities on site.
	Direct contact, ingestion, dust inhalation	Human Health – Future Site Users	Unlikely	Medium	**Low Risk:** There is limited potential for contamination to be present that could impact future users via direct contact, ingestion and inhalation pathways. Risk assessed as low due to the proposed commercial/industrial end land use which is unlikely to have 'green' areas to realise this pathway.
		Human Health – Future Groundworkers	Unlikely	Medium	**Low Risk:** There is limited potential for contamination to be present that could impact future groundworkers.

On-site: possible contamination in shallow soils from previous use for agriculture.	Direct contact, ingestion, dust inhalation	Human Health – Future Site Users	Unlikely	Medium	**Low Risk:** Due to the land on-site previously being a quarry and having been worked to a relatively level working platform corresponding with the bedrock bedding and there being no evidence of localised infilling on site observed, it is unlikely that any contamination from previous agricultural activities still remains on-site.
		Human Health – Future Groundworkers	Unlikely	Medium	**Low Risk:** Due to the land on-site previously being a quarry and having been worked to a relatively level working platform corresponding with the bedrock bedding and there being no evidence of localised infilling on site observed, it is unlikely that any contamination from previous agricultural activities still remains on-site.
Off site; Contamination associated with the neighbouring Building Stone Company and the Motor Test Track	Lateral migration through shallow groundwater	Human Health- Future Site Users	Unlikely	Medium	**Low Risk:** There is limited potential for migration of off-site contamination sources such as fuel oils and PAHs from surrounding land usages, given the distance between them and site.
Off site: Ground gases from historical and current landfill sites.	Inhalation of volatile vapours and accumulation of explosive/toxic gases (soil and groundwater-based contamination via volatilisation to indoor air pathways)	Human Health- Future Site Users	Low Likelihood	Medium	**Moderate/Low Risk:** There is potential for migration of off-site gases associated with landfill sites to build-up within the buildings on-site.

3.4 Risk Assessment Discussion

As detailed within the CSM table, a number of pollutant linkages have been identified at the site. A preliminary assessment of risk has been completed and appropriate risk ratings have been applied based upon the likelihood of impact and the severity, if impact does occur. Further discussion of the risk assessment is presented in the following sections.

3.4.1 Preliminary Controlled Waters Risk Assessment

Groundwater

The review of the site's environmental setting in relation to controlled water receptors has identified that the bedrock directly underlying the site (Marlstone Formation) is designated a Secondary A Aquifer. The site does not lie within an SPZ however, there are 22 known abstractions within 1.5km of the site. The closest of these is located 820m west of site and relates to general farming and domestic abstraction for Upton Farm, under the authority of EA.

There are no superficial deposits indicated to be present to protect the underlying groundwater within bedrock from potential surface derived contaminants, however further assessment would be required to confirm this. Despite the lack of superficial geology, the risks to groundwater have been identified as low at this stage based upon the absence of historic potentially contaminative uses of the site.

Based on this information the groundwater beneath site has been assigned as **low** risk.

Surface Waters

The desk-based assessment has identified that the nearest surface water features are an Unnamed river 424m SW of site and a surface water feature 690m S of site. Based on the distance involved and the slope direction of the site it is considered unlikely that the unnamed river is at risk of impact from site sourced contamination via percolation and lateral migration pathways. The surface water feature 690m downslope of site could be in continuity with the diverted land drain associated with the drainage ditch along the access road, therefore any on-site contamination could likely migrate into this surface water feature. It is a mild severity given the lack of historically contaminative activities on site.

On this basis the risks to the river are considered to be **moderate/low** and further assessment is considered necessary prior to the purchase of the site in this regard.

3.4.2 Preliminary Human Health Risk Assessment

Future Site Users

Low risks have been identified following the desk-based assessment to human health of potential future site users based on the proposed commercial/industrial end land use of the site. There is no evidence that Made Ground is present on site and based upon on the proposed end use, the site is unlikely to have 'green' areas to enable pathways through direct contact or soil ingestion. Human health risk from volatilisation of contaminants is considered **low** based upon the absences of historic potentially contaminative uses of the site and the unlikely realisation of this pathway due to the proposed hard-standing surfacing of the entire site.

Future Groundworkers

Low risks have been identified following the desk-based assessment to human health of potential future groundworkers based upon the limited potential for contamination to be present that could impact future groundworkers.

Offsite Users

Low risks have been identified to on-site human health due to the limited potential for migration of off-site sourced contamination such as fuel oils and PAHs from surrounding land usages given the distance between them and site.

3.5 Preliminary Geotechnical Assessment

3.5.1 Foundation and Floorslab Constraints

The review of geological mapping has identified that the site is likely to be underlain by the Marlstone Rock Formation however given the site appears to have been worked to at least 4.0m beneath surrounding ground level the underlying Dyrham Formation may be present at relatively shallow depth beneath the site level. Superficial deposits are not listed on the BGS map and are understood to be absent. Bedrock could provide suitable founding strata for the support of conventional shallow foundations. However, consideration must be made with regards to the potential for uneven rock head, and the degree of weathering. Other hazards such as voids as a result of cambering would be visible given the site is cut into rock.

As there is no evidence of historical development on the site, significant Made Ground is not anticipated therefore reinforced ground bearing slabs would be permissible.

Given the slight topographic slope towards the west cut and fill or up-filling may be required to provide a suitable level formation for constructing the tank farm and trafficable pavements. Imported material for this purpose should be inert and suitable for use as engineering fill and should be handled and compacted to provide a suitable formation. Material on site that maybe considered for use as engineering fill should be assessed for its suitability to act as subgrade.

3.5.2 Infiltration

Based on published ground conditions, the use of soakaway drainage systems may not be viable. Consideration therefore should be given to contacting the local sewerage operator at an early stage to discuss potential options for connecting to the local network.

3.5.3 Other Considerations

It is recommended that a suitably scoped site investigation is undertaken to assess the nature of underlying ground conditions and depths to suitable founding strata in order to enable preliminary foundation / floorslab recommendations to be provided.

3.6 Recommendations for Further Assessment

The desk study and subsequent preliminary risk assessment has identified potentially unacceptable (moderate/low) risks to surface waters as a result of site sourced contamination specifically from leaching of contaminants through lateral migration in shallow groundwater to surface water features. Risks to future site-users through inhalation of volatile vapours (soil and groundwater-based contamination via volatilisation to indoor air pathways) from landfill gases were also identified.

In addition, further information is required in order to provide suitable geotechnical information to aid foundation, floorslab and drainage design.

On this basis, a site investigation was considered to be required in order to further assess potential environmental risks and to provide further geotechnical data. Details of the works completed and the findings are presented in the following sections.

4.0 SITE INVESTIGATION

4.1 Site Investigation

<table>
<tr><td>Investigation Strategy</td><td colspan="2">The investigation was designed to deliver targeted assessment of contamination and geotechnical hazards based on risks identified in the PRA. Non-targeted locations were also advanced to provide general site coverage and aid the reliability of interpretation.</td></tr>
<tr><td>Preparatory Work</td><td colspan="2">Prior to commencement of the works, a specialist sub-contractor (Geotechnical Limited) was appointed to undertake a utility survey of the site area and specifically clear all locations for buried services and obstructions. This work was required as part of OHES standard health and safety precautions and in order to identify potential below ground pathways, contamination sources and/or receptors.

At the time of these works, a relative height survey was completed in order to obtain ground levels were collected for each proposed intrusive location.

The utility survey was completed on 25th August 2020 under supervision by an OHES consultant.</td></tr>
<tr><td rowspan="6">Investigation Methodology</td><td>Date of Works</td><td>The drilling works and trial pits were undertaken on 26th August 2020. Soakaway pits were excavated the week prior to this, week commencing the 17th August. These were positioned by the client's engineer.</td></tr>
<tr><td>Methodology</td><td>The drilling method used was rotary drilling chosen based on a preliminary site assessment and known geology.</td></tr>
<tr><td>Number of Locations</td><td>Two boreholes were drilled up to 6.00m bgl. Four trial pits were advanced up to 1.00m to 1.50m bgl. The approximate location of the boreholes was determined by the clients engineer.</td></tr>
<tr><td>Monitoring Well Installations</td><td>Monitoring wells were installed in both locations (BH1 and BH2) to enable groundwater monitoring and sampling to be completed.</td></tr>
<tr><td>Contractor</td><td>The drilling works were completed by Geotechnical Engineering Ltd, an OHES approved supplier under supervision by an OHES consultant.</td></tr>
<tr><td>Re-instatement</td><td>All trial pit locations were backfilled with arisings in the order removed and nominally compacted.</td></tr>
<tr><td>Investigation Locations</td><td colspan="2">The site investigation locations were positioned for the following purpose:
<table>
<tr><th>LOCATION</th><th>JUSTIFICATION FOR POSITION</th></tr>
<tr><td>BH1</td><td>Located in the east of site. Positioned beneath the proposed tanker parking area to identify any existing potential contamination and to target groundwater levels for drainage design.</td></tr>
<tr><td>BH02</td><td>Located in the centre and north of the site in the location of the proposed roadway. Positioned to laterally cover the site and to identify changes in ground condition and potential contamination.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>TP1</td><td>Located near the centre of the site. Positioned to the south of the proposed tank farm.</td></tr>
<tr><td>TP2</td><td>Located in the west of site. Underneath the proposed bottom loading skids.</td></tr>
<tr><td>TP3</td><td>Located near the centre of the site. Positioned to the north of the proposed tank farm.</td></tr>
<tr><td>TP4</td><td>Located in the east of the site. Positioned underneath the roadway.</td></tr>
</table>
All locations were selected with the aim to achieve a good spread laterally across the site to delineate any possible areas of contamination.

Trial pits SA1 to SA6 were not logged as these trial pits were excavated the week prior. Groundwater flooded the trial pits so no observations could be made during the OHES attendance. The arisings were however inspected and found to reflect the ground conditions in the OHES trial pits.

The position of the intrusive locations and soakaway trial pits is presented in Figure 2.</td></tr>
<tr><td>Soil Logging and Sampling</td><td>Logging and sampling of soil was undertaken by a qualified OHES Geo-Environmental Consultant in general accordance with BS5930:2015+A1:2020.

During the investigation, representative soil samples were collected and placed into small plastic bags to allow accurate screening for volatile vapours using a photo-ionisation detector (PID). Following initial screening and logging, selected soil samples were placed into suitable glass jars for submission to Element Materials Technology laboratory for chemical analysis.

Selected small and bulk disturbed samples were collected from selected investigation locations for geotechnical testing by i2 Analytical Laboratories.</td></tr>
<tr><td>Water Monitoring and Sampling</td><td><u>Groundwater</u>
Groundwater monitoring was undertaken on 1 no. monitoring event following the investigation (2nd September 2020) using an oil/water interface probe with the aim of confirming the following:

• Depth and thickness of any Light Non-Aqueous Phase Liquids (LNAPL) and/or Dense Non-Aqueous Phase Liquids (DNAPL);
• Groundwater depth; and
• Borehole depth.

Upon completion of monitoring representative samples were collected from each accessible well (where sufficient water was present). Prior to sampling, each well was purged of three well volumes using a bailer. Once three well volumes had been removed from the well a representative sample was collected and placed directly into appropriate glass bottles for the analysis required.

Additional bottles were also filled to allow headspace readings for volatile organic compounds (VOC) using a PID and assessment of visual or olfactory evidence of impact.</td></tr>
</table>

<table>
<tr><td></td><td><u>Sample Handling</u>
Once collected, the samples from the site were transferred in chilled cool boxes to Element Materials Technology Laboratories with an appropriate chain of custody.</td></tr>
<tr><td>Vapour Monitoring</td><td>Volatile vapour monitoring was completed at the time of the groundwater monitoring on 2nd September 2020.

VOC readings were collected using a suitably calibrated hand-held PID.</td></tr>
<tr><td>Soil and Water Sample Analysis</td><td>Selected soil and water samples collected from the site were scheduled for chemical testing to allow an assessment of the severity and vertical/lateral extent of contamination present.

The scope of testing scheduled was based on contaminants of concern likely to be present as identified in the PRA. The extent of testing undertaken was as follows:
<table>
<tr><th rowspan="2">CONTAMINANTS</th><th colspan="2">NUMBER OF SAMPLES ANALYSED</th></tr>
<tr><th>SOIL</th><th>WATER</th></tr>
<tr><td>TPH CWG</td><td>2</td><td>2</td></tr>
<tr><td>Banded EPH</td><td>4</td><td>0</td></tr>
<tr><td>SVOCs</td><td>2</td><td>0</td></tr>
<tr><td>VOCs</td><td>2</td><td>0</td></tr>
<tr><td>Metals</td><td>2</td><td>0</td></tr>
<tr><td>pH</td><td>2</td><td>0</td></tr>
<tr><td>SOM</td><td>2</td><td>N/A</td></tr>
<tr><td>Asbestos</td><td>1</td><td>N/A</td></tr>
</table></td></tr>
<tr><td>Geotechnical Sample Analysis</td><td>Selected soil samples collected from the investigation were submitted to i2 Analytical Laboratories (an OHES approved supplier) for suitable and representative geotechnical testing to allow foundation design. The testing undertaken was as follows:
<table>
<tr><th>TEST</th><th>NUMBER OF SAMPLES TESTING</th></tr>
<tr><td>BRE SD1 classification</td><td>2</td></tr>
<tr><td>Atterberg Limits</td><td>2</td></tr>
<tr><td>Point Load Index Pair</td><td>9</td></tr>
</table></td></tr>
</table>

4.2 Ground Conditions Encountered

A summary of the ground conditions encountered during the investigation is presented in the following table. Further details on ground conditions can be found on the investigation logs presented in Appendix 6.

GEOLOGICAL TYPE	DEPTHS ENCOUNTERED	THICKNESS	DESCRIPTION	LOCATION
Made Ground	0.0m bgl	0.2 - 0.84m	Brown gravelly CLAY with limestone cobbles and boulders (reworked natural)	All locations, deepest at TP4

Bedrock	0.2m to 0.3m bgl	Base not defined. Maximum thickness 5.8m (BH1)	Blueish/grey LIMESTONE with fossils of with belemnites and brachiopods (*Lobothyris* and *Tetrarhynchia*). Orangey grey MUDSTONE with iron staining.	All locations.

In addition to the above the bedrock surface at the site was found to be dipping gently south. The bedrock jointing was found to be moderately to widely spaced and of medium persistence (3-10m), joints were infilled with silt/clay and were generally vegetated.

4.3 Groundwater Information

4.3.1 Groundwater Strikes

Groundwater strikes were encountered at 1.3m bgl in BH1 and 1.4m bgl in BH2. Groundwater strikes were encountered at approximately 0.55m in the trial pits.

4.3.2 Groundwater Monitoring

The results of groundwater monitoring are presented in Appendix 7. In summary, groundwater was encountered at depths ranging between 1.020m (BH2) and 1.050m (BH1) bgl.

4.3.3 Permeability

During groundwater sampling the recharge from both boreholes was noted to be good.

4.4 Ground Gas Information

The site is located in a Higher probability radon area (more than 30% of homes are estimated to be at or above the Action Level). Full radon protective measures are necessary in the construction of new dwellings or extensions.

5.0 GEOTECHNICAL RESULTS AND ASSESSMENT

5.1 Underground Obstructions

No underground obstructions were noted during the intrusive site investigation.

5.2 In-Situ Test Results

5.2.1 Infiltration Test for Soak Away Design

Four soakaway pits were excavated within the site boundary (SA1-SA4) and two additional soakaway pits were excavated along the ditch down the access road (SA5-SA6). It was noted whilst excavating the trial pits that water seepage was coming in at around 0.55m and 0.65m bgl, on the day of the site investigation all of the soakaway pits contained significant amounts of water, therefore no soakaway tests could be completed on-site.

5.3 Laboratory Test Results

Geotechnical Laboratory Test results can be found in Appendix 10.

5.3.1 BRE Sulphate Testing for Concrete Aggressivity

Moisture content in the two samples analysed for BRE Sulphates was 21.4% at 0.55m and at 0.9m bgl. Soil pH values ranged from 8.17 to 8.29 (slightly alkaline).

Results of the water-soluble sulphate soil analysis for TP1 (0.55m) and TP3 (0.9m) are summarised below. As is shown below water soluble sulphate concentrations range from 29.8 to 25.1mg/l (mean 27.45mg/l).

Analysis (SOIL)	Units	Trial Pit reference and depth (m)	
		TP1 (0.55m)	TP3 (0.9m)
Water Soluble SO4 (2:1 Leachate Equivalent)	mg/l	29.8	25.1
pH	n/a	8.17	8.29
Magnesium	mg/l	1.5	0.8
Total Sulphur	%	0.02	0.01
Total Sulphate	%	0.03	0.03

Groundwater samples from BH1 and BH2 analysed following the monitoring were shown as containing sulphates ranging between 43.4 and 54.4mg/l with a pH values of 7.5.

5.3.2 Atterberg Limits

One bulk disturbed sample of soil was submitted to i2 Analytical Laboratories for Atterberg's and divide into sub samples for 1-Point Analysis, the results of which are enclosed. In summary moisture contents in the soils sampled at 0.5m were found to range between 22 and 28% (mean 25%).

LOCATION AND DEPTH	PLASTICITY INDEX (%)	INTERPRETATION
SA2 (0.5m)	25	High plasticity silt
SA2 (0.5m)	22	High plasticity silt

Plasticity indices ranged between 22 and 25% with both soils being described as high plasticity silt.

These materials represent weathered rock and weather rock interbeds which have weathered to clay/silt soil.

5.3.3 Point Load Index Testing

Suitably sized rock fragments were sampled from two bulk bags (SA2 and TP3) which represented rock/soil recovered from the top 1m of ground at those locations. Samples were subjected to point load testing by i2 Laboratories to ascertain the point load strength index Is(50) of the sampled rock.

These results are enclosed, however in summary samples of sandstone recovered from SA2 were found to have a mean Is(50) of 1.3. Limestone fragments from TP3 were found to have a mean Is(50) of 3.34.

5.4 Interpretation and Assessment

5.4.1 In-Situ Test Results

No Insitu ground strength testing was undertaken due to the shallow bedrock.

5.4.2 Infiltration Testing for Soak Away Design

Due to the presence of shallow water within all trial pits (SA1 – SA6 and TP1 – TP4) the completion of soak away testing was not possible. Groundwater levels observed in the boreholes during monitoring were approximately 1.0m bgl and ingress of water was good confirming that the observed water levels were associated with a continuous groundwater level.

Deeper borehole soakaways are also not deemed to be viable based on ground conditions encountered in the top 6m (no extensively fractured rock). In addition, water levels within the wells were similar to water strike levels a week after installation indicating poor drainage. It is likely that the site level is approximately at the spring line where the Marlstone Rock meets the less permeable underlying Dyrham Formation.

5.4.3 Laboratory Test Results

5.4.4 BRE Sulphate Testing for concrete aggressivity

Based upon the BRE Sulphate analysis of soils and groundwater the Aggressive Chemical Environment for Concrete (ACEC), the design Class for buried concrete DS1 – AC1 is derived including for Total Potential Sulphate (0.06%) and Oxidisable sulphate (0.03%) within a natural environment setting (non-brownfield).

5.4.5 Atterberg Limits

This data once modified for particles <425µm results in the clay/silt material within the bedrock being classified as having a modified plasticity index of 14, and low volume change potential (between 10 and 20%). It should be noted however that these silt soils are likely to be compressible and susceptible to the effects of frost.

5.4.6 Point Load Index Testing

Using the mean Is(50) value for the sandstone this has been converted into an approximate compressive strength of 25MPa. For the limestone an approximate derived compressive strength of 60MPa has been derived (ISRM 2007). The rocks did not contain laminations or other planes of weakness therefore these values are valid.

The sandstone tested can be described as a weak to medium strong rock and the limestone can be described as strong rock.

6.0 LAND CONTAMINATION ASSESSMENT

6.1 Evidence of Contamination Encountered

6.1.1 Soils

No evidence of soil contamination was observed during ground investigations, PID readings were taken at 0.5m intervals and all readings were recorded as <0.1ppm.

6.1.2 Groundwater

Details of contamination observations and volatile vapour readings are presented in the groundwater monitoring sheets presented in Appendix 7.

No free product was encountered in the boreholes during either visit. This is consistent with the absence of olfactory or visual signs of contamination during the site investigation and absence of historic contaminative land uses on site.

VOC readings from both boreholes were <0.1ppm.

The groundwater samples obtained from BH1 and BH2 were not noted to have olfactory or visual signs of contamination.

6.2 Chemical Analysis – Soils

The laboratory test results are presented in the laboratory analysis certificates in Appendix 8.

Where possible the soil results have been compared to the respective Human Health guidance criteria for a commercial end use including LQM/CIEH S4ULs, Tier 1 Generic Assessment Criteria (VOC/SVOC) produced by CL:AIRE/AGS and Soil Guideline Values (SGV). These are considered the most suitable given the proposed development of this site into a fuel depot.

Guideline values for 2.5% SOM, where available, have been used in this assessment to assess risks to Human Health as they are considered the most suitably conservative.

The results of the tier 1 screening are presented in Appendix 9. A discussion of the results is presented in the following sections.

6.2.1 Hydrocarbons

There were no detections of TPHCWG, BTEX and MTBE within four of the six soil samples submitted for analysis. TP1 (0.55m) and TP4 (0.2m) had minor detections of EPH banding C21-C40 at concentrations of 44mg/kg and 78mg/kg respectively.

All of the results were compared against Tier 1 screening values protective of human health for commercial land used and no exceedances of these values occurred.

6.2.2 Volatile and Semi-Volatile Organic Compounds

SVOCs (mainly PAH's: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(bk)fluoranthene, Benzo(a)pyrene, Benzo(ghi)perylene, and Benzo(b)fluoranthene) were detected at minor concentrations in one of the two soil samples analysed (TP4 at 0.2m bgl). These concentrations do not exceed the Tier 1 Screening criteria. There were no detections of VOCs within soil samples analysed.

6.2.3 Metals

There were detections of metals in the two of the soil samples submitted for analysis, though concentrations did not exceed the Tier 1 screening levels protective of human health receptors for commercial land use. Concentrations of metals within soil samples analysed were typical of background concentrations available for review within the Envirocheck report in Appendix 4.

6.2.4 Asbestos

No asbestos containing materials (ACMs) were encountered during the intrusive works. Asbestos fibres were not identified in the soil sample analysed (TP4 at 0.20m bgl).

6.3 Chemical Analysis – Groundwater

The laboratory analysis results are presented in the laboratory certificates in Appendix 8.

For the purpose of assessing risks to controlled waters, the results have been compared against the following Tier 1 Criteria:

- Guideline values for the protection of surface water for potable abstraction (1996);
- UK Drinking Water Standards (DWS) for the protection of groundwater or the Water Supply Regulations (1989);
- Statutory and Non-Statutory Environmental Quality Standards (EQS); and
- Sum of 5 PAH - EA Surface-water Pollution RA for Environmental Permitting.

The results of the Tier 1 screening are presented in Appendix 9. A discussion of the results is presented in the following sections.

6.3.1 Hydrocarbon Contamination

There were no detections of TPHCWG, BTEX or MTBE in groundwater samples analysed from BH1 or BH2.

7.0 ENVIRONMENTAL RISK ASSESSMENT

7.1 Identified Contamination

Soils

No visual and olfactory evidence was identified in soils across the site or during ground investigations.

The results assessment has not identified any elevated concentrations of TPH (Aliphatics and Aromatics), SVOC or VOC (including BTEX) at concentrations in exceedances of Tier 1 screening levels protective of on-site human health receptors for industrial/commercial end use of site. On this basis, no further assessment or remedial action is considered necessary in this regard.

There were no detections of metals recorded in exceedances of Tier 1 screening levels protective of on-site human health receptors for industrial/commercial end use of site. Elevated detections of metals have been identified, though considered a very low risk, a conservative approach would be to adopt the use of PPE and construction management practices during redevelopment of the site.

No asbestos fibres were detected in the soils submitted for the analysis. Although no asbestos fibres were identified within these samples, the possible presence of further asbestos contamination within the Made Ground in other locations across the site can't be ruled out at this stage.

Waters

No visual and olfactory evidence was identified during groundwater monitoring and sampling visits.

There were no detections of determinants within groundwater samples analysed (BH1 and BH2), there is no evidence of impact to groundwater, soil is not indicated to be significantly impacted and therefore is not considered as a likely source to groundwater.

7.2 Identified Receptors

- Future site users; and
- Future ground workers.

7.3 Identified Pathways

- Inhalation, ingestion and direct contact by humans (groundworker receptors).
- Inhalation of volatile vapours (soil and groundwater-based contamination via volatilisation to indoor air pathways).

7.4 Updated Conceptual Site Model

The table overleaf presents an updated conceptual site model following completion of the intrusive investigation. The table includes details of the potential pollutant linkages considered to present and an associated risk assessment completed in accordance with the same methodology as the preliminary risk assessment as detailed in Section 4.3 and as detailed in Appendix 2.

IDENTIFIED POLLUTANT LINKAGES			UPDATED RISK ASSESSMENT		
SOURCE	**PATHWAY**	**RECEPTOR**	**PROBABILITY**	**SEVERITY**	**RISK ASSESSMENT AND JUSTIFICATION**
Site soils - natural background heavy metal concentrations	Direct contact, ingestion, dust inhalation	Human Health – Future Site Users	Unlikely	Mild	**Very Low Risk:** There were detections of Metals in soil samples, however these are in line with published background soil concentrations. The risk is assessed as very low due to the proposed commercial/industrial end use of the site which is unlikely to have 'green' areas to realise this pathway.
		Human Health – Future Groundworkers	Unlikely	Mild	**Very Low Risk:** There were detections of Metals in soil samples, however these are in line with published background soil concentrations. This could impact future groundworkers via direct contact and via duct inhalation during earthworks however it is considered to be of very low risk.
Site soils - agriculture pesticides	Direct contact, ingestion, dust inhalation	Human Health – Future Site Users	Unlikely	Mild	**Very Low Risk:** No shallow soils from agriculture exist on-site. Due to the land on-site previously being a quarry and having been worked to a relatively level working platform corresponding with the bedrock bedding and there being no evidence of localised infilling on site observed, it is unlikely that any contamination from previous agricultural activities still remains on-site.
		Human Health – Future Groundworkers	Unlikely	Mild	**Very Low Risk:** No shallow soils from agriculture exist on-site. Due to the land on-site previously being a quarry and having been worked to a relatively level working platform corresponding with the bedrock bedding and there being no evidence of localised infilling on site observed, it is unlikely that any contamination from previous agricultural activities still remains on-site**.**
Off-site Ground gases from historical and current landfill sites	Inhalation of volatile vapours and accumulation of explosive/toxic gases (soil and groundwater-based contamination via volatilisation to indoor air pathways)	Human Health – Future Site Users	Unlikely	Mild	**Very Low Risk:** The site investigation identified that the geology below the site is impermeable, also the shallow groundwater will reduce the likelihood of the gases building up. The large distance to the landfill sites also reduces the likelihood of migration from these gases. It has been recommended that the office building is fitted with a radon barrier.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions Geotechnical

General

The site formation level comprises of strong limestone bedrock with reprofiled slopes and banks defining the edges. Although the ground conditions appear favourable for construction care should be taken when completing earthworks excavations adjacent to these slopes, as detailed within slope instability can be an issue especially with shallow groundwater levels at the site.

At one location (TP4) the upper 0.85m of ground comprised of reworked soil and rock (Made Ground). It is possible these conditions are replicated elsewhere on site.

Foundations

Tank Farm

Based on observed ground conditions and laboratory testing the underlying bedrock is not a continuous slab of thickly bedded limestone or sandstone but instead comprises of an interbedded sequence of limestone and mudstones/siltstones in places weathered to clay/silt. The shallowest clay/silt band was identified at most exploratory locations varying in depth from 0.5 to 0.85m bgl.

Groundwater seepages were encountered at circa 0.5 to 0.75m depth coinciding with the aforementioned strata. Inflows were moderate, with levels rising to rest at approximately 0.5m bgl.

Although there is vertical variability in the ground conditions the overall bearing capacities are more than adequate for typical tank farm loadings (circa 50kpa). The clay/silt bands are not thick (generally <300mm) however total settlements maybe more than 50mm.

Office Block

Any shallow foundation will need to be bearing on the underlying mudstone at circa 1.0m bgl to ensure adequate and consistent bearing beyond the clay bed. Foundations will need to be dewatered prior to the placement of concrete.

Office block floor slabs may consist of ground bearing reinforced concrete which should include a radon barrier.

For the purposes of designing the appropriate concrete mix for shallow foundations and floor slabs, the ACEC classification for the site is DS-1 - AC-1.

Pavements

Although no CBR testing was undertaken the existing quarry floor will have CBR values >3%.

Drainage

Based on the shallow seepage of groundwater it is not advisable that soakaways are used on-site for drainage.

Other Considerations

To enable groundworks sumps or trenches could be utilised upgradient of groundworks to intercept groundwater seeping through the limestone bed to improve working conditions.

OHES have not been provided with proposed finished ground levels, however it is assumed that some reprofiling of the site will take place during construction. It may be possible to reuse some of the

materials generated to build up site levels etc. if required. This would be subject to an evaluation of site levels and a proven requirement for the re-use of these materials on-site. The re-use of any site won materials will need to be undertaken in accordance with a site-specific Materials Management Plan (MMP). Considerable volumes of waste materials (soils etc.) are likely to be generated by the excavation of new foundations and service trenches. Allowance should be made for the disposal of these materials in accordance with current UK waste disposal regulations.

8.2 Conclusions Environmental

Human Health – Future Site Users

The screening of the soil analysis results against conservative Tier 1 screening criteria protective of onsite commercial/industrial users has not identified any exceedances for any of the potential Contaminants of Concern (CoCs) analysed for including TPH (Aliphatics and Aromatics), EPH, SVOC, VOC, Heavy Metals, and BTEX.

No shallow soils from agriculture exist on-site. Due to the land on-site previously being a quarry and having been worked to a relatively level working platform corresponding with the bedrock bedding and there being no evidence of localised infilling on site observed, it is unlikely that any contamination from previous agricultural activities still remains on-site.

On this basis, no potential risks to human health receptors associated with a future industrial/commercial use of the site from soil sourced contamination have been identified. No further assessment or remedial action is considered necessary in this regard.

Human Health - Groundworkers

It is likely that groundworks may need to be conducted on site, therefore groundworkers have the potential to come into contact with soils with elevated concentrations of heavy metals principally via dermal contact, inhalation, and ingestion pathways. There were however no exceedances of the relevant criteria and therefore, the risk associated with the above pollutant linkages has been assessed as being **very low.** However, appropriate RAMS in accordance with CDM regulations and correct the use of appropriate PPE and good hygiene practice should mitigate any limited risk to construction workers at the site.

Asbestos was not identified in soil samples submitted for analysis. The potential for soil sourced Asbestos contamination is not likely to be present beneath the site due to the absence of Made Ground and therefore does not need to be considered as part of any future development works.

Human Health – Offsite staff/public

There were no analysis results in exceedance of the Tier 1 screening values protective of human health and given the distance to offsite receptors on the nearby Horton Grounds Farm site the risks are deemed to be **very low.**

8.3 Recommendations

8.3.1 Geotechnical Assessment

Shallow groundwater presents a problem for bedding the tank farm tank base into the upper strata. Any excavation would need to be progressed to at least 1.2m depth to encounter the competent mudstone beyond the clay/silt (weathered mudstone). Given the general situation with shallow groundwater and drainage it maybe instead beneficial to raise site levels using imported stone engineered on the existing limestone bed to form a suitable formation level.

As the clay layer appears to be continuous across the site differential settlements are unlikely, however to further mitigate this, in addition to the extra loading afforded by the placement of engineered fill the tanks could be pre-loaded with water prior to filling with fuel to induce settlement prior to commissioning.

A cost benefit analysis should be undertaken to compare 1) excavation of the tank base footprint and reinstatement with engineered fill (including the management of groundwater) with 2) the upfilling of site and pre-loading the underlying strata.

Further sampling and geotechnical testing of the clay or Insitu plate loading tests of the surface limestone would be recommended to assist in the above options appraisal to ascertain the potential settlement.

8.3.2 Environmental Assessment

As a result of this environmental assessment, only risks to future site ground workers are considered to be of limited concern, this regards to the presence of naturally occurring metals in soils (although below the Tier 1 values).

Appropriate RAMS in accordance with CDM regulations and correct the use of appropriate PPE and good hygiene practice should mitigate any limited risk to construction workers at the site. The investigation was limited to the data collected and does not negate the risk of unexpected contaminants, In the event of encountering unexpected contaminants, OHES should be contacted.

8.3.3 Other recommendations

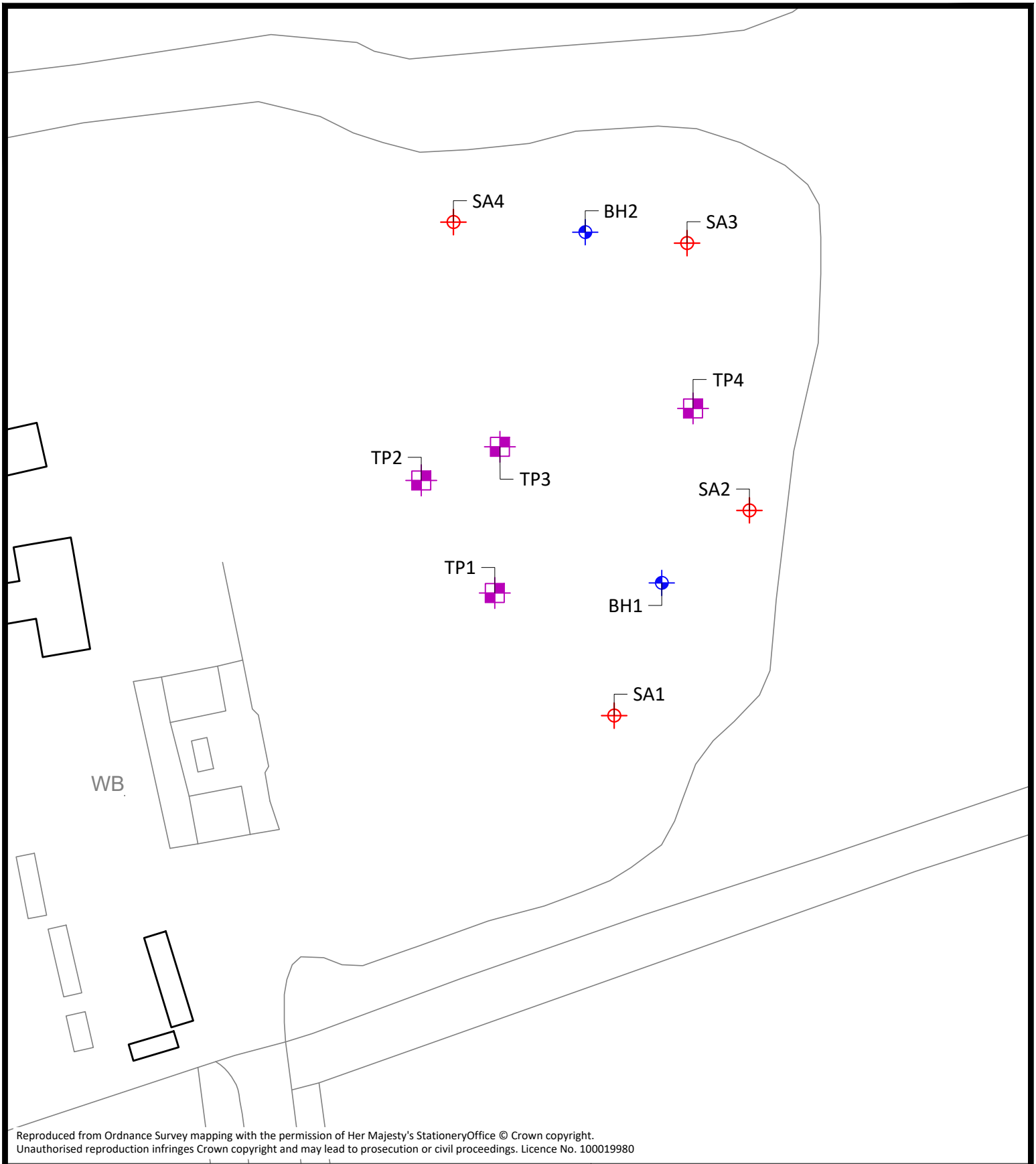
There is a potential pollutant linkage from site to a surface water feature which may be connected to a diverted land drain from the site. On-site construction activities that could cause development of sediment could impact surface waters, appropriate mitigation measures. OHES also recommends that the groundwater monitoring wells on-site are retained to allow for future monitoring.

8.3 Statement on Objectives

OHES considers that this assessment provides a suitable and accurate assessment of all known contamination and geotechnical hazards and associated risks and provides recommendations for further works, where necessary. Therefore, it is considered that this assessment fully meets the objectives set out in Section 1.2 of this report.

FIGURE 2

CURRENT SITE LAYOUT AND INTRUSIVE LOCATION PLAN



Legend

- BH = Borehole
- TP = Trial Pit
- SA = Soakaway

Figure:

Intrusive Location Plan

Site:

Hornton Quarry

Job No:

FJ6114

OHES Environmental Ltd
Unit 3 Forest Court,
Oaklands Business Park
Wokingham | Berkshire
RG41 2FD

Date: 14/09/2020

Drawn by: AMP

Checked by: Stacey Higgs

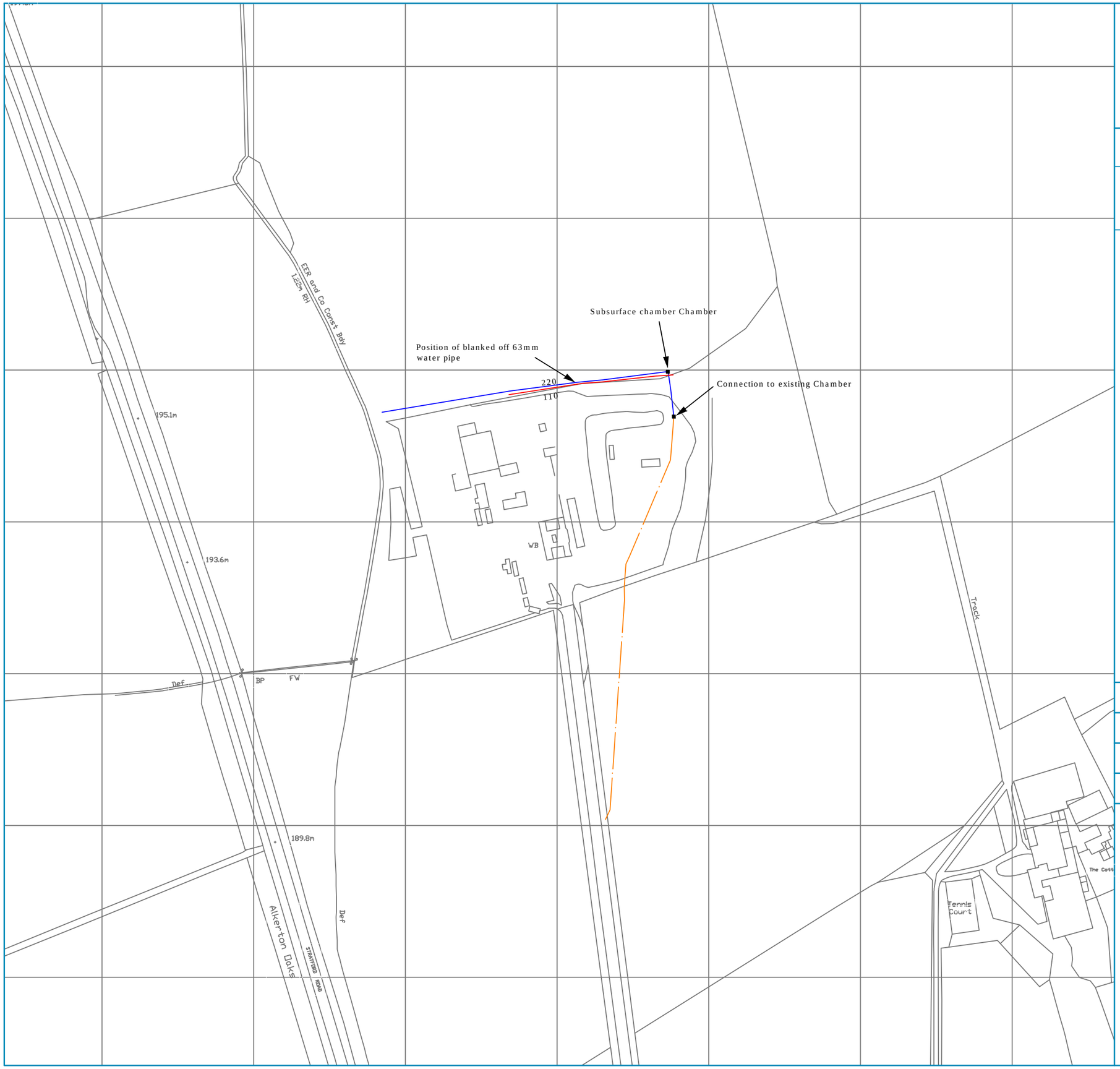
Drawing Ref: FJ6114_Hornton Quarry_01

Not to Scale

Revision: A

N

APPENDIX E



Client: F. Scott
The Limes, The Green
Kernhill Road,
Shenington, Oxfordshire
OX15 6NH

Location: Manor Farm, Hornton, Oxfordshire

AS LAID LAND DRAINAGE

I hereby certify that this is a true record of the scheme as laid by Farm Services Ltd. Signed: [redacted]

Date: March 2016

Legend:

160 mm Diameter Twinwall Pipe Thus Shown

Existing 225mm Diameter Twinwall Pipe laid in February 2016 Thus Shown

Electric duct with marker tape Thus Shown

Scale - 1:2500 @ A3

Zero 50m 100m

This Plan has been reproduced using a GPS device. All points have a recorded O.S Grid Reference.

Job No. 3730

Revision No. 1

O.S. Sheet No. SP 3843 & 3844

Drawing Date : 31.03.16

FarmServices limited
Chesterton Estate Yard Banbury Road
Lighthorne Warwick CV35 0AF
Tel: 01926 651540 Web: www.farmservicesltd.co.uk

Subject: RE: Hornton
From: "Rob Burtonshaw" <rob@farmservicesltd.co.uk>
Date: 14/08/2020, 10:04
To: "'James Martindale'" <james@cuvette.uk>, "'Nick Kohli'" <nick@wormburp.com>
CC: "'Finlay'" <finlay@finscoproperty.com>

James,

The attached plans show the works we carried out on the quarry. I'm happy to forward the .dwg plans as well if you need GPS coordinates. The pipe depth is dependent upon the grade and is between 1.5m and 1.0m deep. The pipe sizes are 225mm dia smooth bore twinwall and 160mm corrugated plastic land drainage pipe

Happy to talk further if required

Regards

Rob

Rob Burtonshaw
BA(Hons) Nsch P.Agric MIAgrE

FarmServices limited
www.farmservicesltd.co.uk
Chesterton Estate Yard, Banbury Road,
Lighthorne, Warwick, CV35 0AF
01926 651540

Twitter: @FarmservicesLtd

APPENDIX F

Flood map for planning

Your reference	Location (easting/northing)	Created
Hornton EA	**438074/244626**	**14 Jul 2020 17:39**

Your selected location is in flood zone 1, an area with a low probability of flooding.

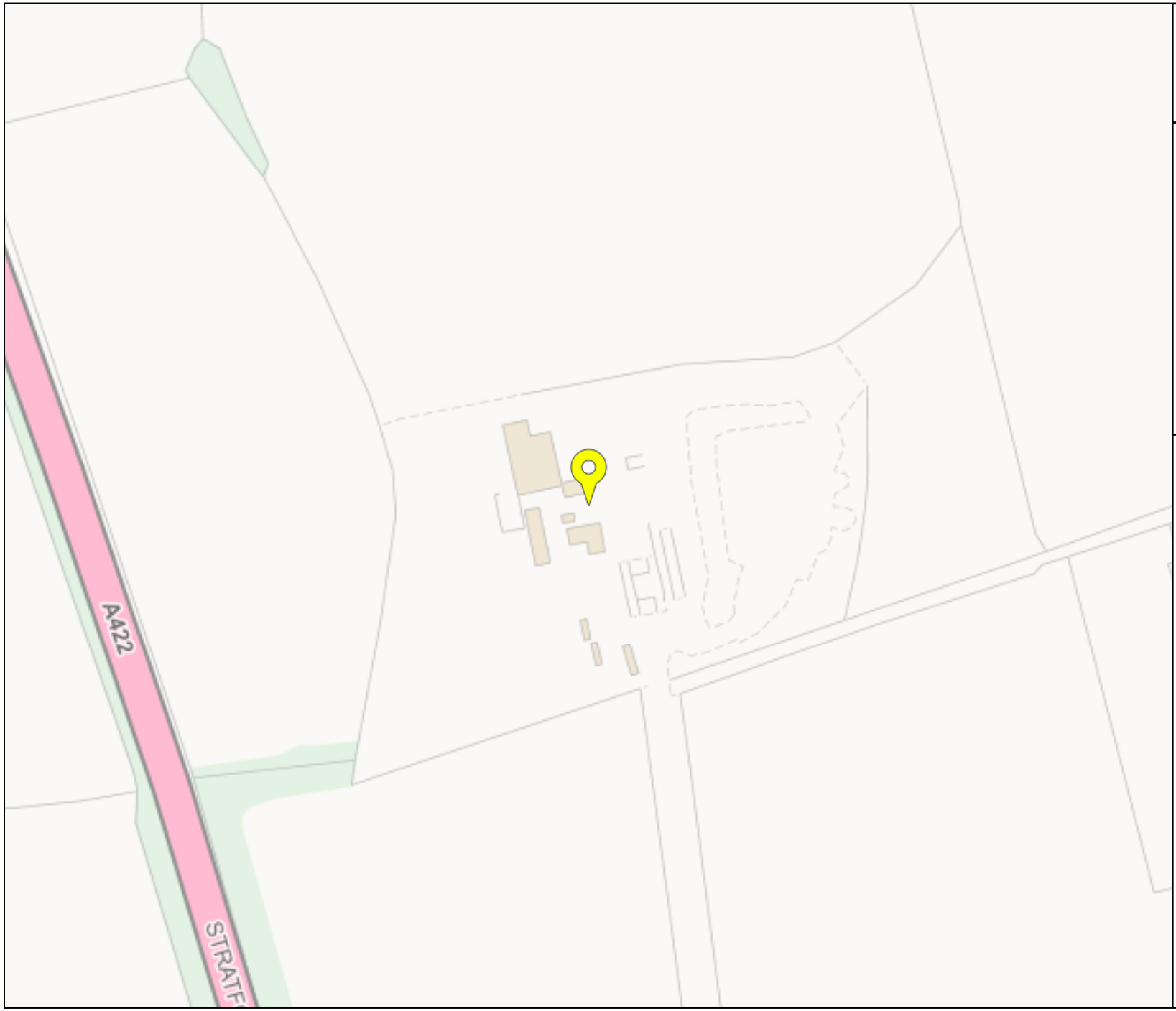
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Hornton EA

Location (easting/northing)
438074/244626

Scale
1:2500

Created
14 Jul 2020 17:39

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

APPENDIX G

Main Rivers are designated by Defra on a 'Main River Map'. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only. However, overall responsibility for maintenance lies with the riparian owner.

The Environment Agency Flood Map for Planning (Rivers and Sea) is available on the Environment Agency website (www.gov.uk/environment-agency) and displays the risk of flooding based on probability.
- Flood Zone 1: Land assessed, ignoring the presence of flood defences, as having a less than 0.1% annual probability of fluvial or tidal flooding.
- Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.
- Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding in any year.

INSET OVERVIEW

Hornton

Horley

Wroxton

Balscote

Shennington

Alkerton

North Newington

Cotswold Hills

HORNTON CP

HORLEY CP

WROXTON CP

SHENNINGTON WITH ALKERTON CP

SHUTFORD CP

NORTH NEWINGTON CP

BROUGHTON CP

0 1 KILOMETRES

N

Legend

Environment Agency Flood Map for Planning (Rivers and the Sea)

- Flood Zone 3b (High Probability - Functional Floodplain)
- Flood Zone 3 (High Probability)
- Flood Zone 3 plus 20 percent for Climate Change (High Probability)
- Flood Zone 2 (Medium Probability)
- Flood Zone 1 (Low Probability)

Legend

- Cherwell District Council
- Inset Maps
- Level 1 SFRA Sites

Detailed River Network
- Main River
- Ordinary Watercourse
- Offline Waterbody

Environment Agency Flood Defence Database (Raised Defences)
- Embankment
- Wall
- Areas Benefitting from Defences (ABDs)

Client: Cherwell DISTRICT COUNCIL NORTH OXFORDSHIRE

Drawing Status: FINAL

Job Title: CHERWELL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT UPDATE

Drawing Title: ENVIRONMENT AGENCY FLUVIAL FLOOD ZONES - INSET A

Scale at A3: AS SHOWN (1:25,000)

Drawn: RS | Approved: MT | Date: 02-2017

Notes: THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

AECOM Infrastructure & Environment UK Ltd
Royal Court, Basil Close, Chesterfield, Derbyshire, S41 7SL
www.aecom.com
Tel 01246 209 221 Fax 01246 209 229

Drawing Number: FIGURE B6-A Rev

Plot Date: 03/02/2017
Filepath: \\Ch-wip-001\CH_Water\Projects\60494538 - Cherwell L1 SFRA Update\0000 GIS_Data\01-WIP\01_02-Data_Working\WOR\Fig B7 - Flood Zones & Defences.wor

APPENDIX H

1. This map illustrates the predicted likelihood of surface water flooding as defined by the Environment Agency's updated Flood Map for Surface Water (uFMfSW) data, which may be subject to further analysis in the future. Further information is provided on the Environment Agency website (www.gov.uk/environment-agency).
2. The Risk from Surface Water Flooding is divided into categories:
- High: each year, the chance of flooding is greater than 1 in 30 (3.3%).
- Medium: each year, the chance of flooding is between 1 in 100 (1%) and 1 in 30 (3.3%).
- Low: each year, the chance of flooding is between 1 in 1000 (0.1%) and 1 in 100 (1%).
- Very Low: each year, the chance of flooding is less than 1 in 1000 (0.1%).
3. The potential impact of surface water flooding can vary according to the depth of the water, and its velocity (speed and direction that it is flowing in).
4. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. This type of flooding can be difficult to predict as it is hard to forecast exactly where or how much rain will fall in any storm.
5. This map is intended to provide a strategic overview of surface water flood risk and should not be used to assess flood risk for individual properties.

INSET OVERVIEW

Cotswold Hills

HORNTON CP

Hornton

HORLEY CP

Horley

SHENNINGTON WITH ALKERTON CP

Shennington

Alkerton

WROXTON CP

Wroxton

Balscote

SHUTFORD CP

Shutford

NORTH NEWINGTON CP

North Newington

BROUGHTON CP

0 1 KILOMETRES N

Legend

- Cherwell District Council
- Inset Maps
- Level 1 SFRA Sites

Detailed River Network

- Main River
- Ordinary Watercourse
- Offline Waterbody

Risk of Flooding from Surface Water

- High (3.3 percent AEP)
- Medium (1 percent AEP)
- Low (0.1 percent AEP)

Client: Cherwell DISTRICT COUNCIL NORTH OXFORDSHIRE

Drawing Status: FINAL

Job Title: CHERWELL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT UPDATE

Drawing Title: RISK OF FLOODING FROM SURFACE WATER (uFMfSW) INSET A

Scale at A3: AS SHOWN (1:25,000)

Drawn RS | Approved MT | Date 02-2017

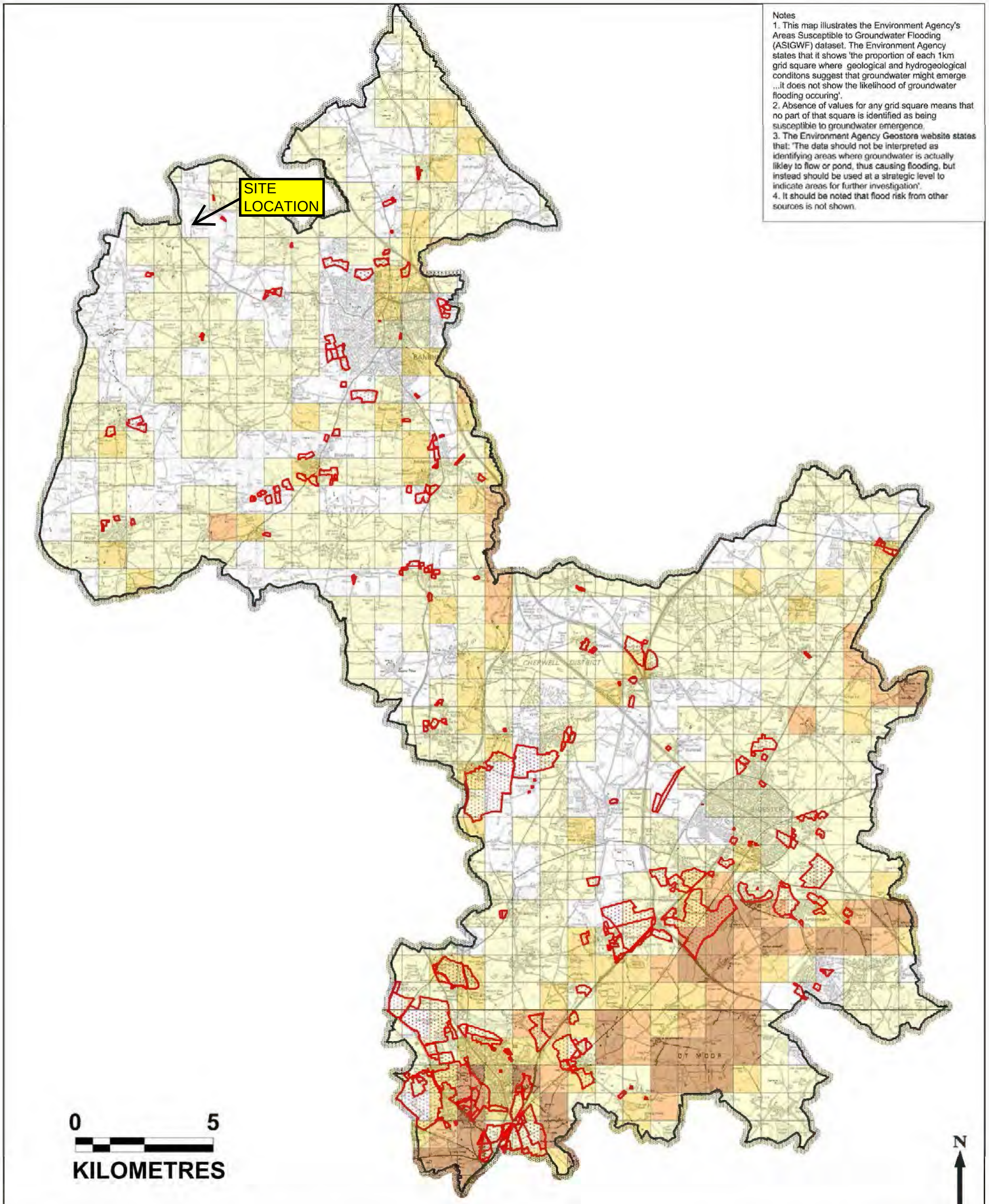
Notes: THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

AECOM Infrastructure & Environment UK Ltd
Royal Court, Basil Close, Chesterfield, Derbyshire, S41 7SL
www.aecom.com
Tel 01246 209 221 Fax 01246 209 229

Drawing Number: FIGURE B7-A Rev

Plot Date: 03/02/2017
Filepath: \\Ch-wlp-001\CH_Water\Projects\60494538 - Cherwell L1 SFRA Update\0000 GIS_Data\01-WIP\01_02-Data_Working\WOR\Fig B7 - uFMfSW.wor

APPENDIX I



Notes
1. This map illustrates the Environment Agency's Areas Susceptible to Groundwater Flooding (ASIGWF) dataset. The Environment Agency states that it shows 'the proportion of each 1km grid square where geological and hydrogeological conditons suggest that groundwater might emerge ...it does not show the likelihood of groundwater flooding occuring'.
2. Absence of values for any grid square means that no part of that square is identified as being susceptible to groundwater emergence.
3. The Environment Agency Geostore website states that: 'The data should not be interpreted as identifying areas where groundwater is actually likley to flow or pond, thus causing flooding, but instead should be used at a strategic level to indicate areas for further investigation'.
4. It should be noted that flood risk from other sources is not shown.

Legend
- Cherwell District Boundary
- Level 1 SFRA Sites

Areas Susceptible to Groundwater Flooding
- <25 percent
- >=25 percent <50 percent
- >=50 percent<75 percent
- >=75 percent

Client: Cherwell District Council, North Oxfordshire

Drawing Status: FINAL

Revision Details | By / Check | Date | Suffix

AECOM Infrastructure & Environment UK Ltd
Royal Court, Basil Close, Chesterfield, Derbyshire, S41 7SL
www.aecom.com
Tel 01246 209 221 Fax 01246 209 229

Job Title: CHERWELL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT UPDATE

Drawing Title: AREAS SUSCEPTIBLE TO GROUNDWATER FOODING (ASTGWF)

Scale at A3: AS SHOWN

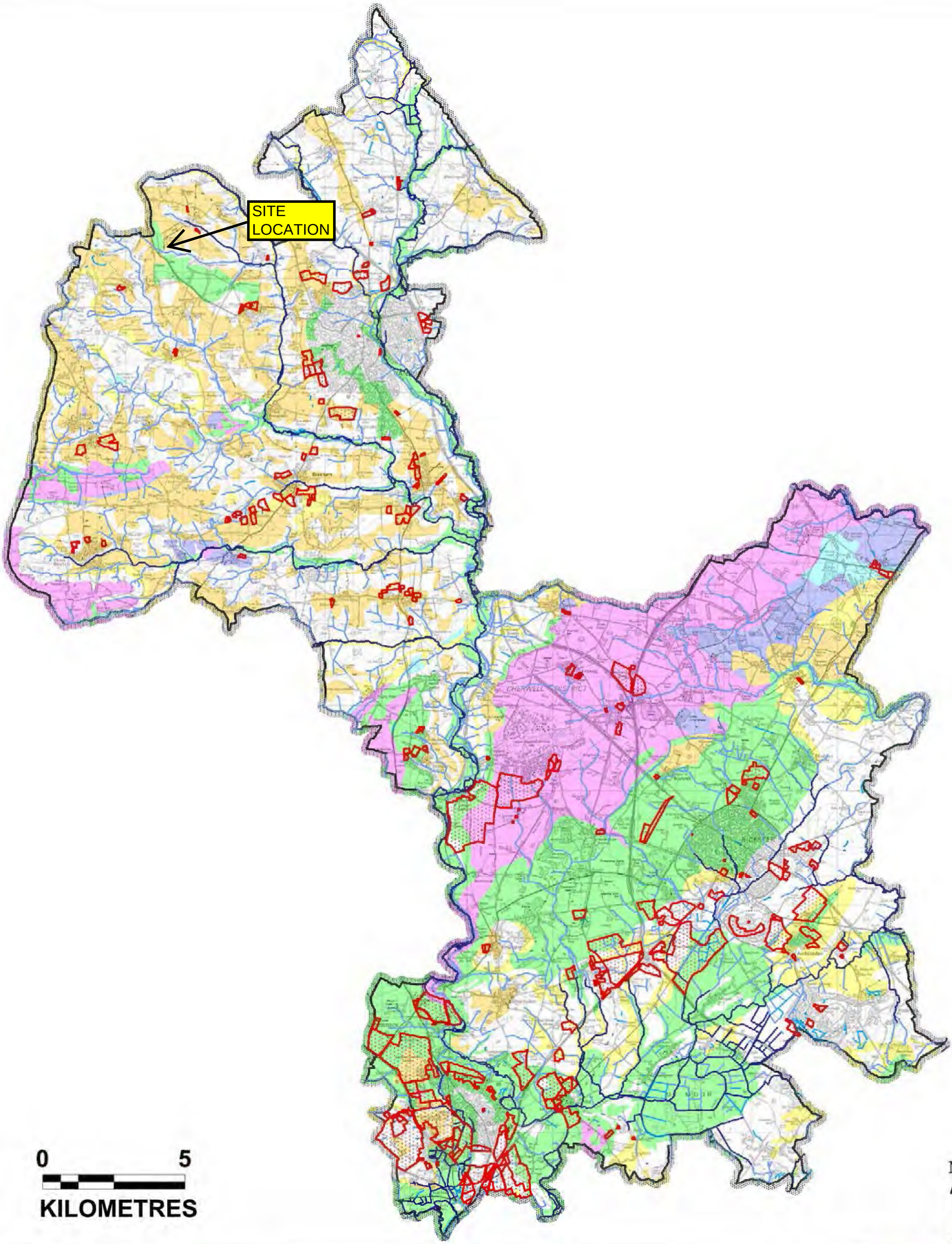
Drawn RS | Approved MT | Date 05-2017

Notes: THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Drawing Number: FIGURE B8 | Rev

Plot Date: 17/05/2017
Filepath: \\Ch-wip-001\CH_Water\Projects\60494538 - Cherwell L1 SFRA Update\0000 GIS_Data\01-WIP\01_02-Data_Working\WOR\Fig B8 - ASIGWF.wor

APPENDIX J



Legend

- Cherwell District Boundary
- Level 1 SFRA Sites

Detailed River Network

- Main River
- Offline Waterbody
- Ordinary Watercourse

Groundwater Vulnerability

- Major Aquifer - High
- Major Aquifer - Intermediate
- Major Aquifer - Low
- Minor Aquifer - High
- Minor Aquifer - Intermediate
- Minor Aquifer - Low

Revision Details	By / Check	Date	Suffix

Client: Cherwell District Council, North Oxfordshire

Drawing Status: FINAL

AECOM Infrastructure & Environment UK Ltd
Royal Court, Basil Close, Chesterfield, Derbyshire, S41 7SL
www.aecom.com
Tel 01246 209 221 Fax 01246 209 229

Job Title: CHERWELL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT UPDATE

Drawing Title: GROUNDWATER VUNERABILITY MAP

Scale at A3: AS SHOWN

Drawn RS | Approved MT | Date 05-2017

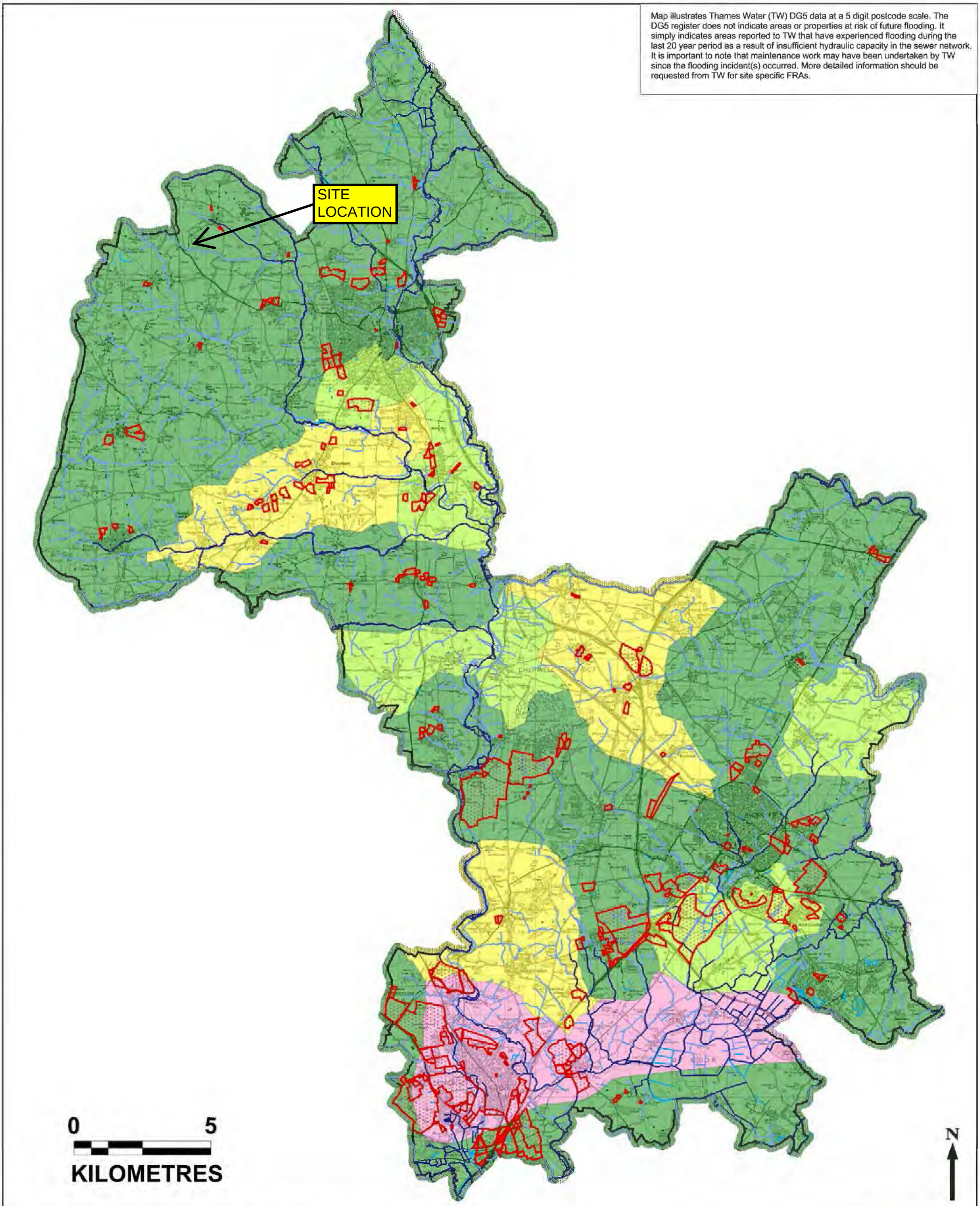
Notes: THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Drawing Number: FIGURE B9 Rev

Plot Date: 17/05/2017
Filepath: \\Ch-wip-001\CH_Water\Projects\60494538 - Cherwell L1 SFRA Update\0000 GIS_Data\01-WIP\01_02-Data_Working\WOR\Fig B9 - EA GWV.wor

APPENDIX K

Map illustrates Thames Water (TW) DG5 data at a 5 digit postcode scale. The DG5 register does not indicate areas or properties at risk of future flooding. It simply indicates areas reported to TW that have experienced flooding during the last 20 year period as a result of insufficient hydraulic capacity in the sewer network. It is important to note that maintenance work may have been undertaken by TW since the flooding incident(s) occurred. More detailed information should be requested from TW for site specific FRAs.



Legend

- Cherwell District Council
- Level 1 SFRA Sites

Detailed River Network

- Main River
- Ordinary Watercourse
- Offline Waterbody

TW DG5 Sewer Flooding Incident Register (reported per postcode region)

- 0 to 5
- 5 to 10
- 10 to 15
- 20 to 25

Revision Details	By / Check	Date	Suffix

Client: Cherwell District Council, North Oxfordshire

Drawing Status: FINAL

Job Title: CHERWELL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT UPDATE

Drawing Title: HISTORICAL SEWER FLOODING INCIDENTS

Scale at A3: AS SHOWN

Drawn RS | Approved MT | Date 05-2017

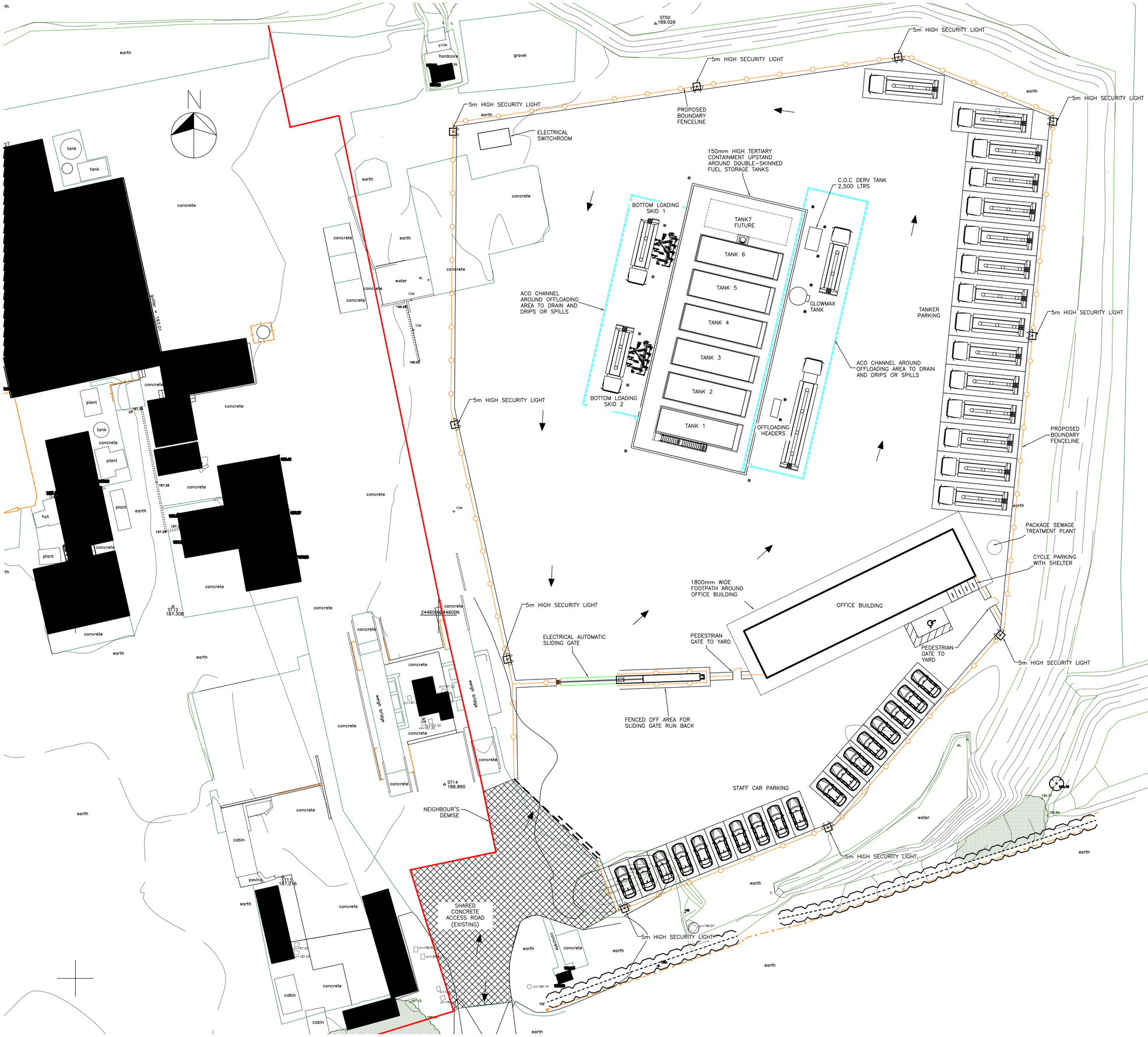
Notes: THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

AECOM Infrastructure & Environment UK Ltd
Royal Court, Basil Close, Chesterfield, Derbyshire, S41 7SL
www.aecom.com
Tel 01246 209 221 Fax 01246 209 229

Drawing Number: FIGURE B10 Rev

Plot Date: 17/05/2017
Filepath: \\Ch-wip-001\CH_Water\Projects\60494538 - Cherwell L1 SFRA Update\0000 GIS_Data\01-WIP\01_02-Data_Working\WOR\Fig B10 - Sewer Flooding.wor

APPENDIX L



Rev:	Date:	Revision Details:	Rev By:	Chk:	Appr:
F	16.07.20	CYCLE PARKING SHOWN	YF	CH	NM
E	12.06.20	BOUNDARY WALL REMOVED	YF	CH	NM
D	04.06.20	FENCE LINE AND KERBKINE ADDED	YF	CH	NM
C	04.06.20	NEIGHBOUR'S DEMISE SHOWN	YF	CH	NM
B	21.05.20	INTERNAL BOUNDARY WALL ADDED SITE DEMISE REVISED LIGHTING COLUMN ADDED	YF	CH	NM
A	02.12.19	FOR COMMENT	YF	CH	NM

Certas Energy UK Ltd
302 Bridgewater Place
Birchwood Park
Warrington
Cheshire WA3 6XG

trident engineering consultants
Consulting Engineers • Design & Project Management • Quantity Surveyors
Cost Control & Analysis
GATEHOUSE OFFICES, WESTWAY, PORTERFIELD ROAD, RENFREW, PA4 8DJ SCOTLAND
Telephone: +44 (0) 141 561 2202 • Fax: +44 (0) 141 561 2259 • E-mail: info@tridenteng.net
www.tridenteng.net

Site: BANBURY HORNTON QUARRY

Title: PROPOSED SITE LAYOUT

Dwg By: SMont **Checked:** CH **Approved:** NM
Date: 08.11.19 **Date:** 08.11.19 **Date:** 08.11.19

Scale: 1:250 @ A1 **Drawing No:** 6289-801 **Rev:** F

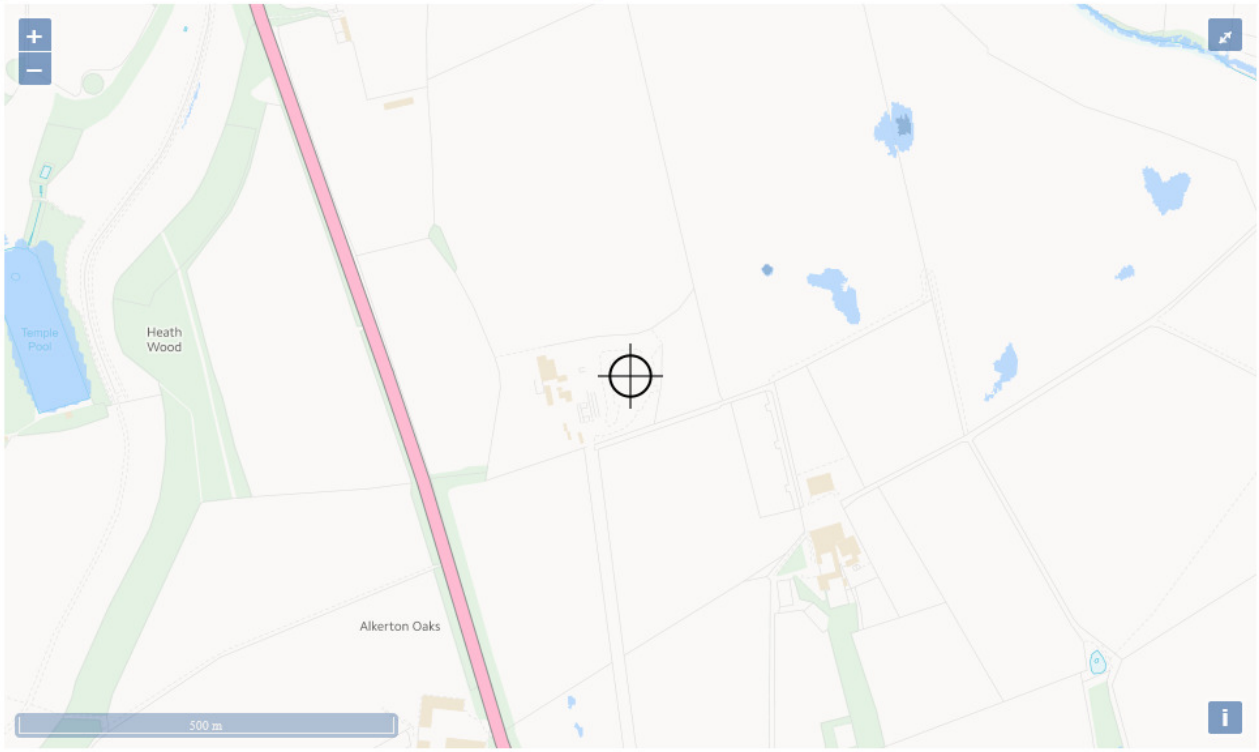
APPENDIX M

EA Map of Flooding from Surface Water

Select the type of flood risk information you're interested in. The map will then update.

Extent of flooding

Enter a place or postcode



Extent of flooding from surface water

High Medium Low Very low Location you selected

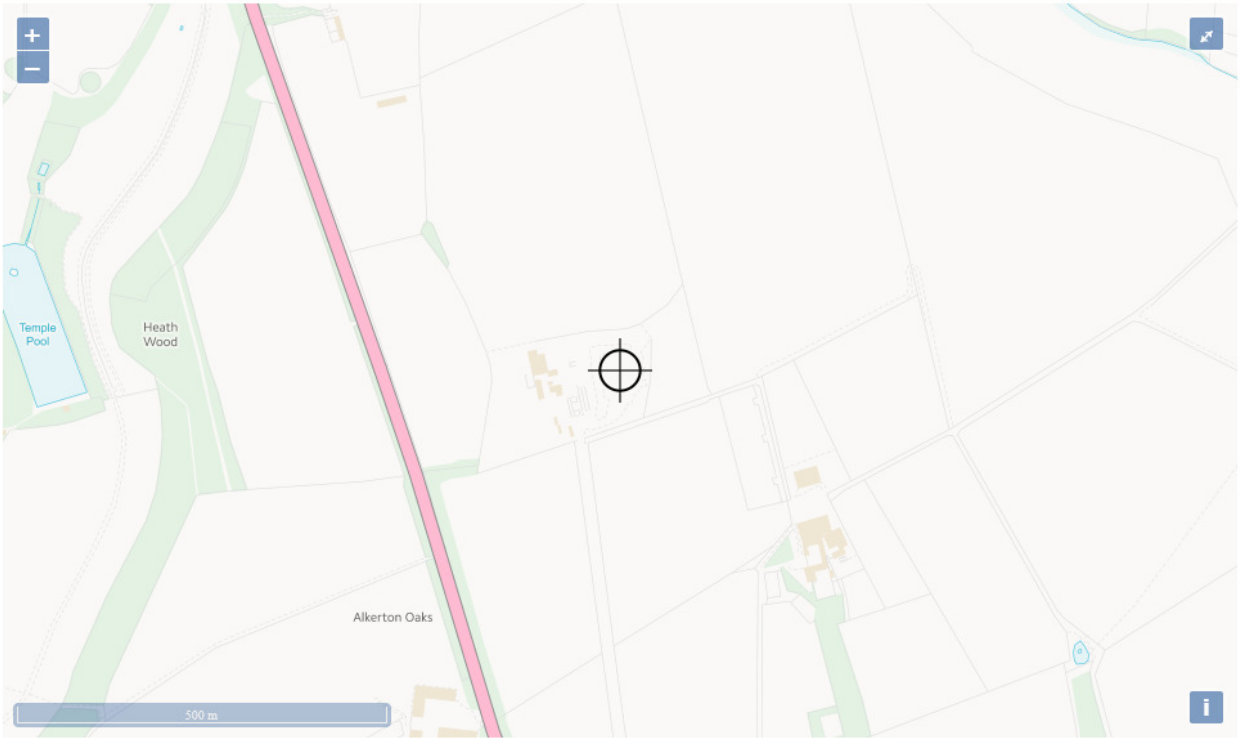
APPENDIX N

EA Map of Flooding from Reservoirs

Select the type of flood risk information you're interested in. The map will then update.

Extent of flooding

Enter a place or postcode



Extent of flooding from reservoirs

Maximum extent of flooding Location you selected

APPENDIX O

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.800	Urban	0.000
SAAR (mm)	700	Region Number	Region 6

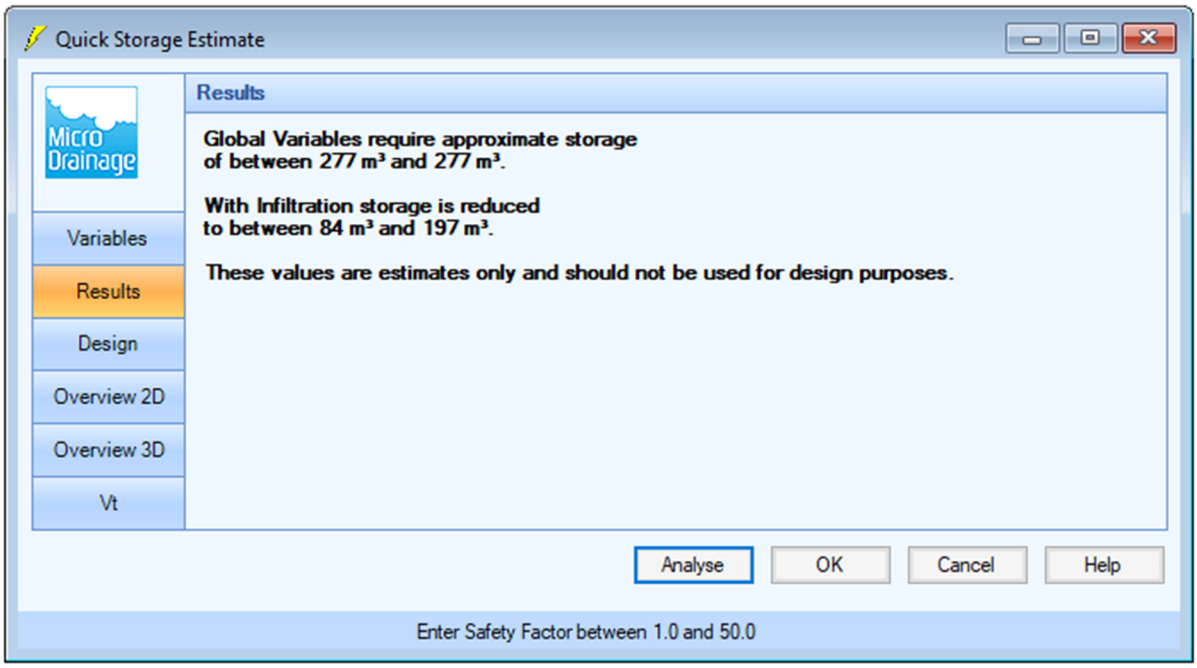
Results l/s

QBAR Rural	3.5
QBAR Urban	3.5
Q100 years	11.2
Q1 year	3.0
Q30 years	8.0
Q100 years	11.2

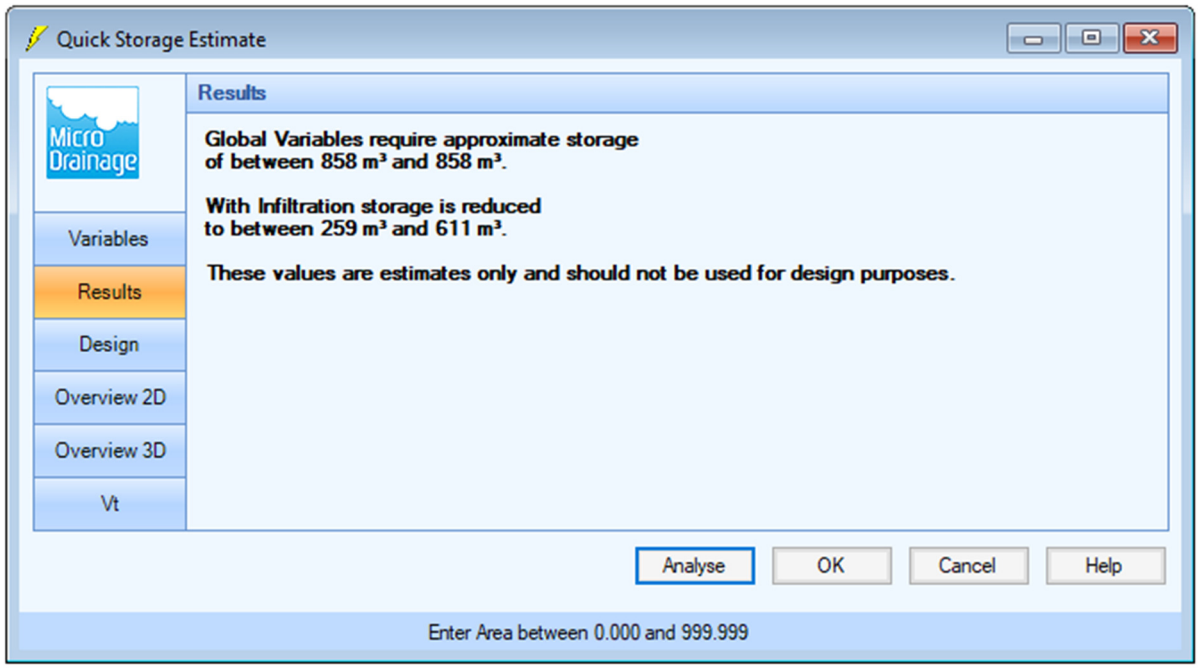
APPENDIX P

OPT 1 - Infiltration storage estimate

Area A – Office and car park area

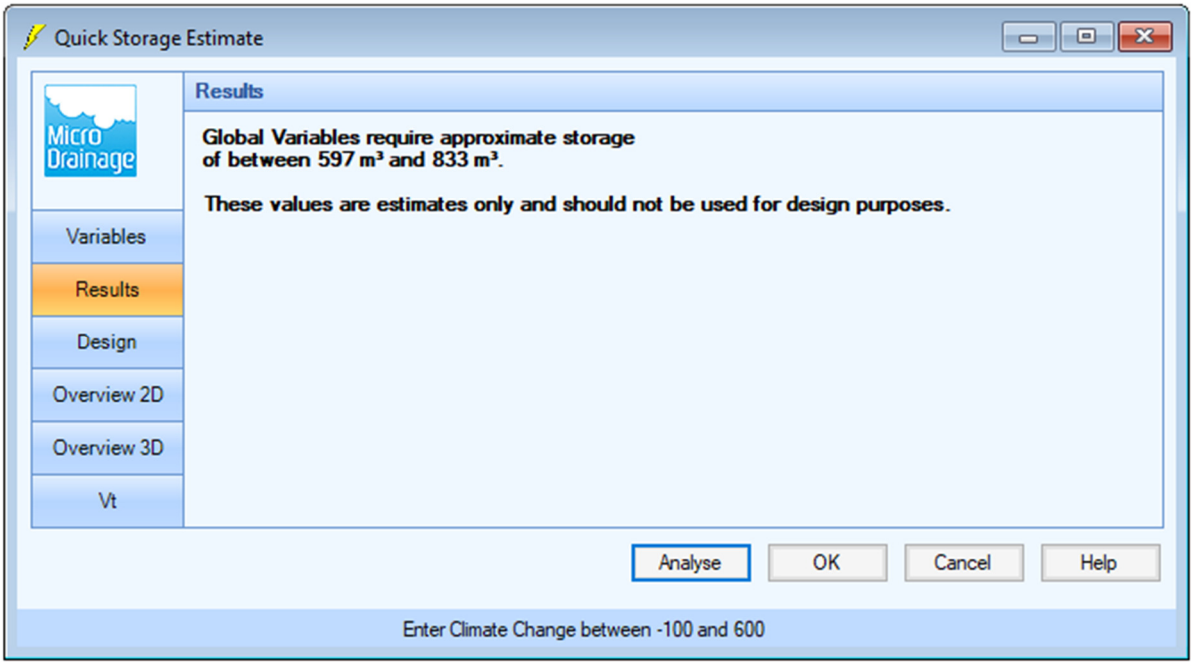


Area B – Tanker park, circulation and fueling area

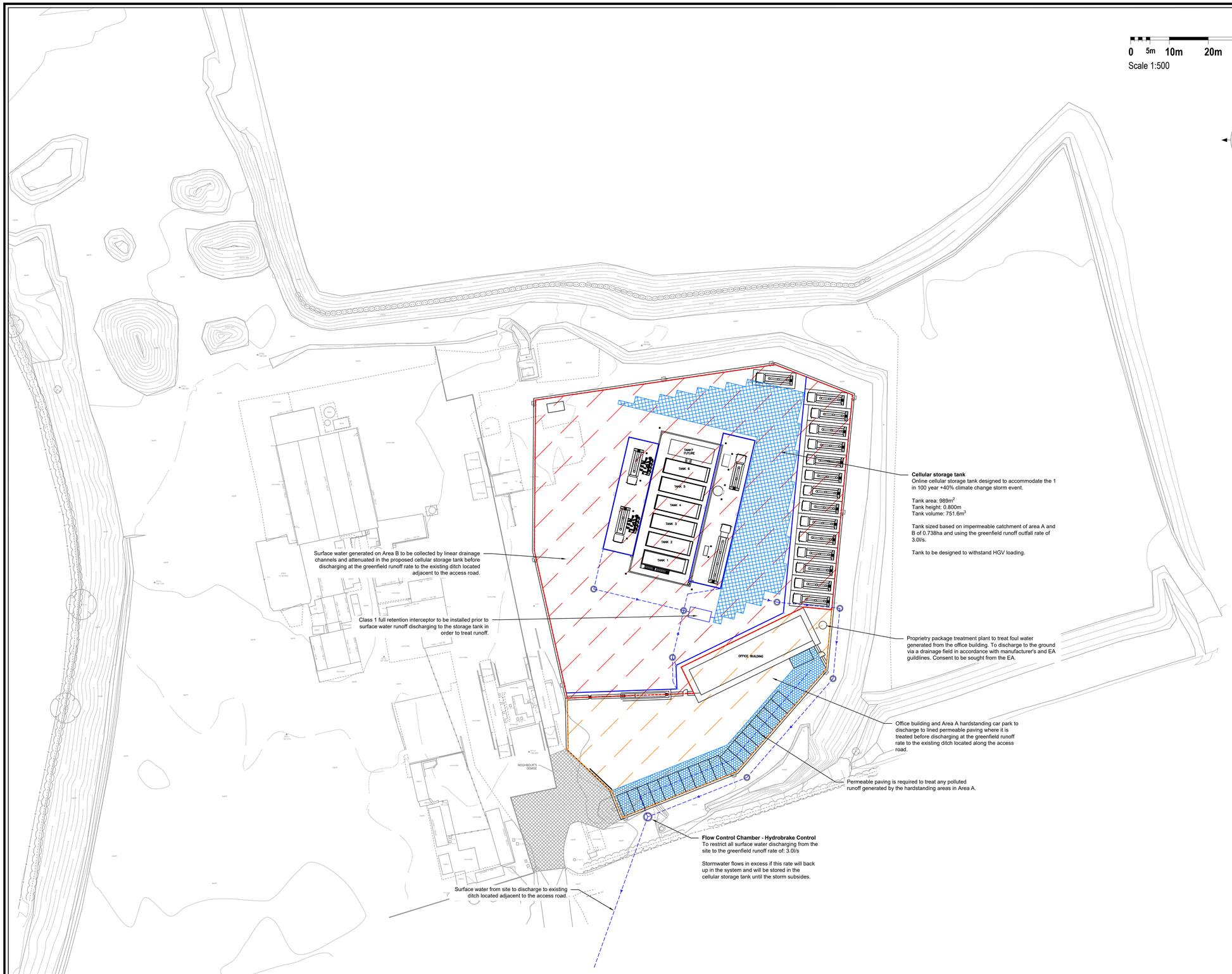


OPT 2 - Ditch outfall storage estimate

Area A and B



APPENDIX Q



Cellular storage tank
Online cellular storage tank designed to accommodate the 1 in 100 year +40% climate change storm event.

Tank area: 989m^2
Tank height: 0.800m
Tank volume: 751.6m^3

Tank sized based on impermeable catchment of area A and B of 0.738ha and using the greenfield runoff outfall rate of 3.0l/s.

Tank to be designed to withstand HGV loading.

Surface water generated on Area B to be collected by linear drainage channels and attenuated in the proposed cellular storage tank before discharging at the greenfield runoff rate to the existing ditch located adjacent to the access road.

Class 1 full retention interceptor to be installed prior to surface water runoff discharging to the storage tank in order to treat runoff.

Proprietry package treatment plant to treat foul water generated from the office building. To discharge to the ground via a drainage field in accordance with manufacturer's and EA guidlines. Consent to be sought from the EA.

Office building and Area A hardstanding car park to discharge to lined permeable paving where it is treated before discharging at the greenfield runoff rate to the existing ditch located along the access road.

Permeable paving is required to treat any polluted runoff generated by the hardstanding areas in Area A.

Flow Control Chamber - Hydrobrake Control
To restrict all surface water discharging from the site to the greenfield runoff rate of: 3.0l/s

Stormwater flows in excess if this rate will back up in the system and will be stored in the cellular storage tank until the storm subsides.

Surface water from site to discharge to existing ditch located adjacent to the access road.

0 5m 10m 20m 30m 40m

Scale 1:500

Drawing Legend

- Area A - Office and car park area - 0.180 ha
- Area B - Tanker park, circulation and fueling area - 0.558 ha
- Proposed surface water sewer
- Proposed foul water sewer
- Proposed linear drainage channel
- Permeable paving
- Cellular storage tank

General Notes

1. All dimensions are in metres unless noted otherwise.
2. Do not scale from this drawing.
3. This drawing is to be read in conjunction with all other relevant drawings.

Rev	Description	Date	Drawn	Checked
A	Drawing title amended	05.10.20	NK	NK

Drawing Approval Status:-

N/A Section 104 N/A Section 38 N/A Section 278

PRELIMINARY

Wormald Burrows Partnership Ltd
Civil Engineering Consultants
12a - 18a Hitchin Street, Biggleswade, SG18 8AX
Tel: (01767) 317244 Fax: (01767) 315434
Web: www.wormburp.com
Email: engineer@wormburp.com

Project:
Proposed Energy Hub
Hornton Quarry Road,
Hornton

Drawing Description:
Drainage Strategy

Client:
Finsco Property Company
The Limes
Shenington
Oxfordshire
OX15 6NH

Drawing Number:
E4040/501A

Client Reference:

Scale:
1:500 @ A1
1:1000 @A3

Designed By:	Drawn By:	Checked By:
MJL	MJL	NK
Date: Aug 2020	Date: Aug 2020	Date: Aug 2020

afaq ISO 9001 Quality — UKAS MANAGEMENT SYSTEMS 022
Certified by Afnor UK

APPENDIX R

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1845 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	98.298	0.298	0.0	3.0	3.0	279.6	O K
30 min Summer	98.343	0.343	0.0	3.0	3.0	322.5	O K
60 min Summer	98.394	0.394	0.0	3.0	3.0	370.6	O K
120 min Summer	98.450	0.450	0.0	3.0	3.0	423.0	O K
180 min Summer	98.484	0.484	0.0	3.0	3.0	454.8	O K
240 min Summer	98.508	0.508	0.0	3.0	3.0	477.2	O K
360 min Summer	98.540	0.540	0.0	3.0	3.0	507.6	O K
480 min Summer	98.561	0.561	0.0	3.0	3.0	527.3	O K
600 min Summer	98.576	0.576	0.0	3.0	3.0	540.7	O K
720 min Summer	98.585	0.585	0.0	3.0	3.0	550.0	O K
960 min Summer	98.600	0.600	0.0	3.0	3.0	563.8	O K
1440 min Summer	98.608	0.608	0.0	3.0	3.0	570.9	O K
2160 min Summer	98.595	0.595	0.0	3.0	3.0	558.8	O K
2880 min Summer	98.578	0.578	0.0	3.0	3.0	543.1	O K
4320 min Summer	98.504	0.504	0.0	3.0	3.0	473.4	O K
5760 min Summer	98.443	0.443	0.0	3.0	3.0	415.9	O K
7200 min Summer	98.390	0.390	0.0	3.0	3.0	366.2	O K
8640 min Summer	98.344	0.344	0.0	3.0	3.0	322.8	O K
10080 min Summer	98.303	0.303	0.0	3.0	3.0	284.9	O K
15 min Winter	98.333	0.333	0.0	3.0	3.0	313.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	203.546	0.0	225.7	19
30 min Summer	117.931	0.0	243.7	34
60 min Summer	68.328	0.0	355.8	64
120 min Summer	39.588	0.0	408.2	124
180 min Summer	28.768	0.0	439.0	184
240 min Summer	22.937	0.0	458.7	244
360 min Summer	16.668	0.0	476.4	362
480 min Summer	13.289	0.0	477.0	482
600 min Summer	11.148	0.0	472.5	602
720 min Summer	9.657	0.0	466.4	722
960 min Summer	7.737	0.0	452.0	962
1440 min Summer	5.662	0.0	424.4	1440
2160 min Summer	4.143	0.0	797.0	1840
2880 min Summer	3.319	0.0	833.2	2192
4320 min Summer	2.314	0.0	808.8	2900
5760 min Summer	1.792	0.0	946.4	3688
7200 min Summer	1.469	0.0	969.3	4464
8640 min Summer	1.249	0.0	987.4	5192
10080 min Summer	1.089	0.0	999.7	5952
15 min Winter	203.546	0.0	241.0	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	98.385	0.385	0.0	3.0	3.0	361.5	O K
60 min Winter	98.442	0.442	0.0	3.0	3.0	415.7	O K
120 min Winter	98.506	0.506	0.0	3.0	3.0	475.4	O K
180 min Winter	98.545	0.545	0.0	3.0	3.0	511.9	O K
240 min Winter	98.573	0.573	0.0	3.0	3.0	538.1	O K
360 min Winter	98.611	0.611	0.0	3.0	3.0	574.3	O K
480 min Winter	98.637	0.637	0.0	3.0	3.0	598.7	O K
600 min Winter	98.655	0.655	0.0	3.0	3.0	615.8	O K
720 min Winter	98.668	0.668	0.0	3.0	3.0	628.1	O K
960 min Winter	98.688	0.688	0.0	3.0	3.0	646.6	O K
1440 min Winter	98.703	0.703	0.0	3.0	3.0	660.7	O K
2160 min Winter	98.696	0.696	0.0	3.0	3.0	653.9	O K
2880 min Winter	98.673	0.673	0.0	3.0	3.0	632.4	O K
4320 min Winter	98.573	0.573	0.0	3.0	3.0	538.5	O K
5760 min Winter	98.483	0.483	0.0	3.0	3.0	453.9	O K
7200 min Winter	98.405	0.405	0.0	3.0	3.0	380.8	O K
8640 min Winter	98.338	0.338	0.0	3.0	3.0	317.7	O K
10080 min Winter	98.281	0.281	0.0	3.0	3.0	264.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	117.931	0.0	250.6	34
60 min Winter	68.328	0.0	396.2	64
120 min Winter	39.588	0.0	449.3	122
180 min Winter	28.768	0.0	474.4	182
240 min Winter	22.937	0.0	483.2	240
360 min Winter	16.668	0.0	479.4	358
480 min Winter	13.289	0.0	469.7	476
600 min Winter	11.148	0.0	460.2	592
720 min Winter	9.657	0.0	451.7	708
960 min Winter	7.737	0.0	436.3	942
1440 min Winter	5.662	0.0	412.3	1396
2160 min Winter	4.143	0.0	865.4	2052
2880 min Winter	3.319	0.0	856.4	2620
4320 min Winter	2.314	0.0	820.5	3200
5760 min Winter	1.792	0.0	1060.0	4032
7200 min Winter	1.469	0.0	1085.8	4824
8640 min Winter	1.249	0.0	1106.6	5544
10080 min Winter	1.089	0.0	1121.6	6256

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 437550 245000 SP 37550 45000
C (1km)	-0.024
D1 (1km)	0.323
D2 (1km)	0.340
D3 (1km)	0.221
E (1km)	0.298
F (1km)	2.517
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.738

Time (mins) From:	To:	Area (ha)
0	4	0.738

Model Details

Storage is Online Cover Level (m) 100.000

Complex Structure

Cellular Storage

Invert Level (m)	98.000
Infiltration Coefficient Base (m/hr)	0.00000
Infiltration Coefficient Side (m/hr)	0.00000
Safety Factor	2.0
Porosity	0.95

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	989.0	989.0	0.801	0.0	1173.0
0.800	989.0	1173.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	98.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0
Flush-Flo™	0.297	3.0
Kick-Flo®	0.623	2.4
Mean Flow over Head Range	-	2.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

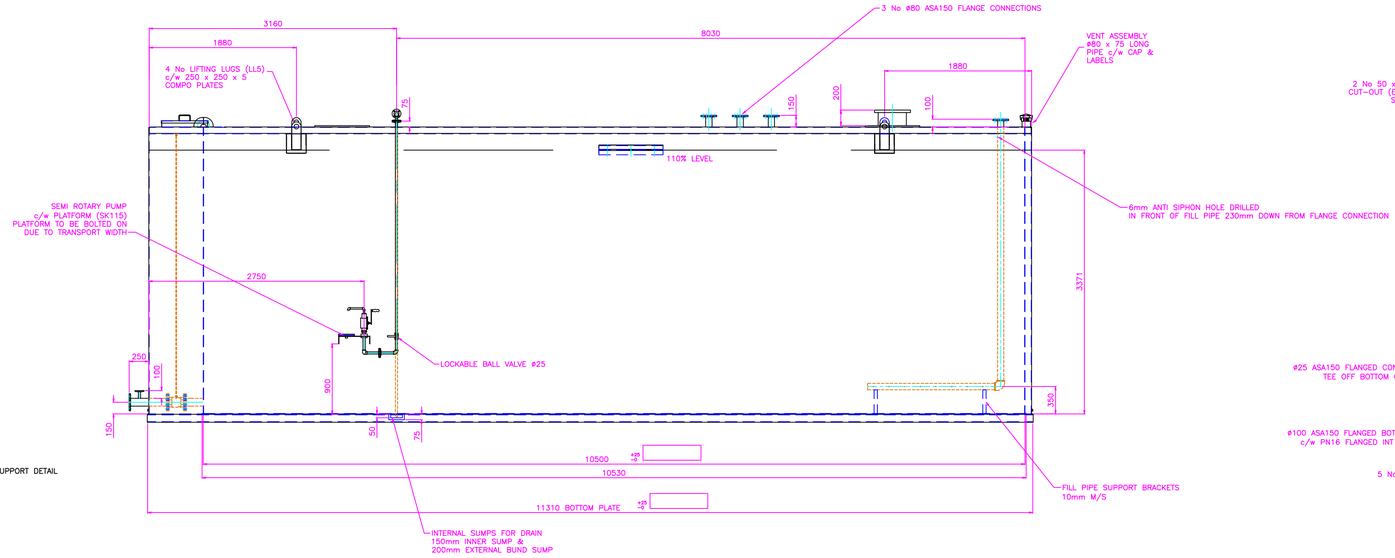
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	0.800	2.7	2.000	4.1	4.000	5.7
0.200	2.9	1.000	3.0	2.200	4.3	4.500	6.0
0.300	3.0	1.200	3.3	2.400	4.5	5.000	6.3
0.400	2.9	1.400	3.5	2.600	4.7	5.500	6.6
0.500	2.8	1.600	3.7	3.000	5.0	6.000	6.9
0.600	2.5	1.800	3.9	3.500	5.4	6.500	7.2

Hydro-Brake® Optimum Outflow Control

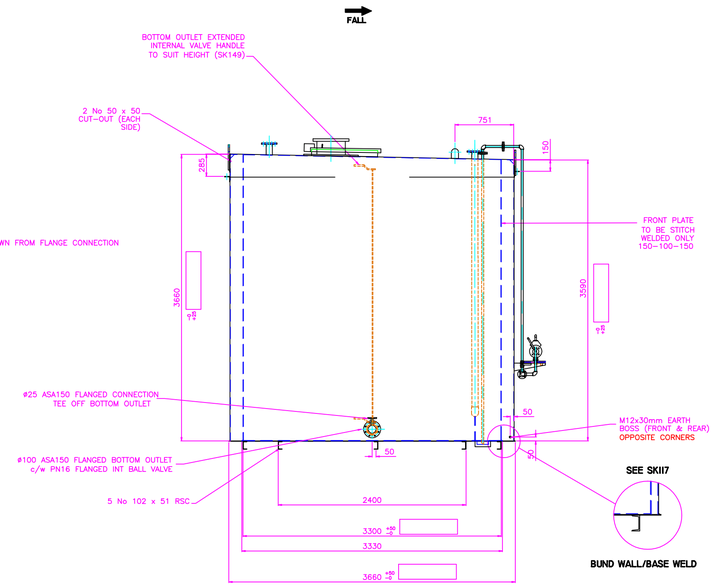
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
7.000	7.4	8.000	7.9	9.000	8.4		
7.500	7.7	8.500	8.2	9.500	8.6		

APPENDIX S

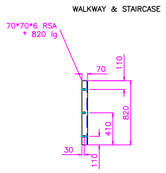
SIDE ELEVATION



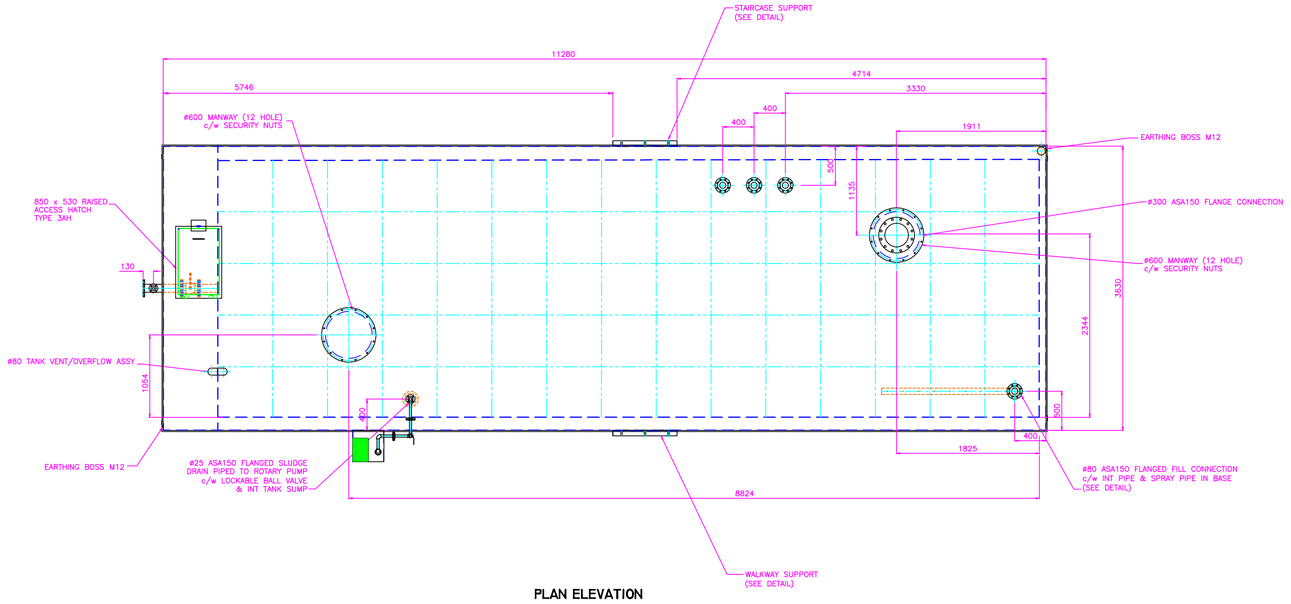
END ELEVATION SLOPING ROOF



WALKWAY & STAIRCASE SUPPORT DETAIL



70*70*6 RSA

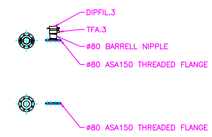


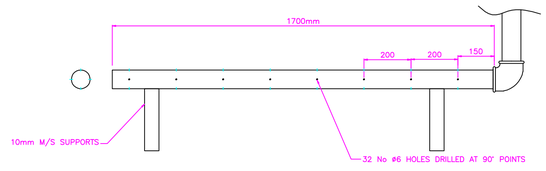
PLAN ELEVATION

LOOSE EQUIPMENT TO BE SUPPLED WITH EACH TANK:

1. 80mm DIP POINT COVER ASSEMBLY – INCLUDES DN80 ASA150 THREADED FLANGE / BARRELL NIPPLE / LOCKABLE DIP COVER

2. DN80mm ASA 150 THREADED FLANGE (FOR GAUGE PROBE)





FILL PIPE DETAIL

SECTION WEIGHTS	
TANK	14.65 TONNES
TOTAL	22.0 TONNES

NOTES.

1. TO BS799 PART 5 TYPE J FULLY INTERNALL WELDED EXCEPT ROOF

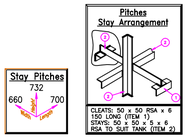
2. BUND MATERIAL:- 6mm MS

3. TANK MATERIAL:- 8mm MS

4. DRAWING TO READ IN CONJUNCTION WITH STANDARD FITTING DRAWING (SK84)

5. UNIT TO BE INSTALLED ON A SUITABLE BASE WITH SLOPE TOWARDS OUTLET.

6. ▭ **DIMENSION ARE ACTUAL.**



NO HARNESS ANCHOR POINTS FITTED

Rev.	Date	Description	By

Drawing Title

TANK & BUND DETAIL FOR 125,000 LITRE TOTALLY ENCLOSED PREMIUM DERV PACK

Colour	ons cost primer		Shade	*	
Drawn	N. Powney	Date	27/7/14	Checked	Date
Customer			Drawing Number		Rev.
Trident Engineering			C12371-1-GA		0

Ledbury Welding & Engineering Ltd.
New Mills Industrial Estate,
Ledbury Way,
Ledbury,
Herefordshire. HR8 2SR
Tel. : 01531 632222
Fax. : 01531 635440
Email : mpowney@talk21.co.uk