FLOOD RISK ASSESSMENT & SURFACE WATER DRAINAGE STRATEGY

Didcot Park, Didcot

Engineering, Design and
Surveying Consultants

from inception to completion

Prepared for: Reef Estates
Ref: TR8130727/SH/DW/050
Issue 3: 30 April 2020

Document History

Issue	Date	Description	Prepared By	Checked By
1	7 Oct 16	Draft issue	L McGregor	
2	8 Nov 16	For consultation	L McGregor	K Rayner
3	30 Apr 20	Report updated to suit revised masterplan	S Haque/L McGregor	K Rayner

Glanville

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Contents

Appendices

1.0 Introduction

1.1 This Flood Risk Assessment and Surface Water Drainage Strategy has been prepared by Glanville Consultants (Glanville) on behalf of Reef Estates to support a Local Development Order (LDO) submission to Vale of White Horse District Council for a commercial development on land north of Didcot, Oxfordshire.

1.2 The site in question was identified for the land use proposed in the Local Plan.

1.3 This report assesses flood risk associated specifically with developing this site, in accordance with the National Planning Policy Framework (February 2019) and Planning Practice Guidance, issued by the Department for Communities and Local Government.

1.4 This report defines the principles for the management of surface water run-off generated by the proposed development and demonstrates how Sustainable Drainage Systems (SuDS) can be incorporated.

1.5 Information used to prepare this report includes:

- Ordnance Survey (OS) Map Data (OS, 2020).
- British Geological Society (BGS) Map Data (BGS, 2020).
- Environment Agency (EA) Flood Maps (EA, 2020).
- Vale of White Horse District Council and South Oxfordshire District Council Strategic Flood Risk Assessment (SFRA) (JBA Consulting, 2013).
- Thames Water Sewer Records (Thames Water, 2016).

2.0 Flood Risk Policy and Guidance

2.1 A summary of the national and local policy, legislation and guidance relating to flood risk and surface water drainage relevant to the development proposals is outlined below.

National Planning Policy Framework (March 2012) / Planning Practice Guidance (March 2014)

2.2 The National Planning Policy Framework (NPPF) and associated Planning Practice Guidance (PPG) provide national guidance to planning authorities, developers, the public and the Environment Agency (EA), to ensure flood risk is taken into account at all stages of the planning process.

2.3 The PPG establishes Flood Zones as the starting point for the sequential approach identified in the NPPF. The aim of the approach is to steer new development to areas with the lowest probability of flooding. The Flood Zones are defined as follows:

- Flood Zone 1 (Low Probability) comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 (Medium Probability) comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
- Flood Zone 3 (High Probability) comprises land comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3 is further subdivided into Flood Zones 3a and 3b, where Flood Zone 3b is 'The Functional Floodplain' typically considered to have an annual probability of flooding of 1 in 20 or greater (>5%) in any year.

2.4 The sequential approach steers new development to Flood Zone 1. Where there is no reasonably available land in Flood Zone 1, local planning authorities allocating Local Plans or determining planning applications for development at a particular location should take into account the flood risk vulnerability of land uses (refer to Table 2 of the PPG) and consider reasonably available land in Flood Zone 2, applying the Exception Test if required (refer to Table 3 of the PPG). Only where there is no reasonably available land in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required. The sequential approach should also be considered when assigning land uses within a site that includes land located within different Flood Zones.

2.5 The PPG categorises different types of development divided into five flood risk vulnerability classifications:

- Essential Infrastructure
- Highly Vulnerable
- More Vulnerable
- Less Vulnerable
- Water Compatible Development

2.6 Subject to the application of the Sequential Test, the PPG specifies which of these types of development are suitable within each zone:

- Flood Zone 1: All land uses are appropriate in this zone.
- Flood Zone 2: Water Compatible, Less Vulnerable, More Vulnerable and Essential Infrastructure are appropriate in this zone. Highly Vulnerable uses are only appropriate in this zone if the Exception Test is passed.
- Flood Zone 3a: Water Compatible and Less Vulnerable land uses are appropriate in this zone. Highly Vulnerable uses should not be permitted in this zone. More Vulnerable and Essential Infrastructure uses should only be permitted in this zone if the Exception Test is passed.
- Flood Zone 3b: Only Water Compatible uses and Essential Infrastructure should be permitted in this zone. Essential Infrastructure in this zone should pass the Exception Test and be designed and constructed to meet a number of flood risk related targets. Less Vulnerable, More Vulnerable and Highly Vulnerable uses should not be permitted in this zone.

2.7 Buildings used for shops, financial, professional and other services, restaurants and cafes, offices, industry, storage and distribution, and assembly and leisure, are all classified as 'Less Vulnerable'.

The Flood and Water Management Act (2010)

2.8 The Flood and Water Management Act (2010) places duties on the Environment Agency, Local Authorities, developers, and other bodies to manage flood risk. The Act requires the approval and adoption of SuDS by the Lead Local Authority.

3.0 The Existing Site

Site Description

3.1 The site is located to the north of the town of Didcot in Oxfordshire, with an approximate National Grid Reference of SU 52240 91980 and co-ordinates 452240E, 191980N. A site location plan is given in Appendix A.

3.2 An aerial photograph showing the site is given in Figure 1.

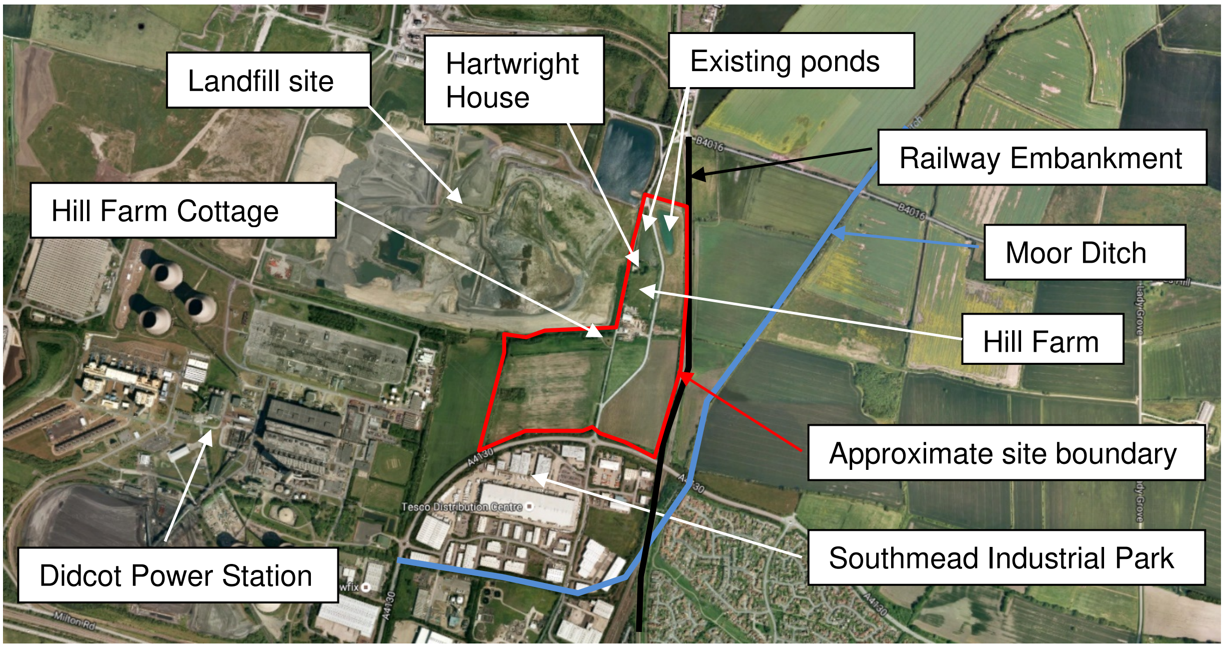


Figure 1: Site aerial photo (Google, 2016)

3.3 The site is roughly "L" shaped, with the main land area at the southern end just north of the A4130 Didcot ring road and a narrower strip extending to the north at the eastern side. It is approximately 23ha in size.

3.4 To the south of the site is the A4130, with the Southmead Industrial Park beyond. To the west lies Didcot Power Station. To the north is a landfill site in a former quarry/gravel pit. On the east the site is bounded by the main London-Oxford railway line, with green fields that have been allocated for mixed residential development beyond.

3.5 The site is mostly undeveloped, but there is an access road running from south to north through the site which serves the quarries beyond and a small number of properties within the northern strip of the site, where there is a farmhouse, Hill Farm, currently used as a small commercial wood yard, and two residential properties known as Hill Farm Cottage and Hartwright House. Additionally, there is a second, wider quarry access track passing to the east of the residential properties, which provides a preferential access to the quarries for heavy vehicles.

3.6 Existing site access to the site is via the north-south access road in the centre of the site. Approximately at the centre of the southern site boundary is a 4-way roundabout with the A4130 east and west, the site access road north and Collett (the access road into the commercial development at Southmead Industrial Park) south.

Topography

3.7 The site is generally flat, with a shallow slope downwards to the north east. Levels range from approximately 53mAOD in the south west to approximately 50.20mAOD in the north east.

Surface Water Bodies

3.8 The site is located in a low-lying and historically marshy area, with a number of surrounding surface water features both on and offsite.

3.9 The River Thames is located just over 2km to the north of the site, flowing from west to east. A main river, Moor Ditch, loops round the site approximately 500m to the south, then passes approximately 100m beyond the western site boundary as it flows north towards the Thames. There are also a large number of undesignated drainage ditches and streams in the surrounding area.

3.10 At the extreme northern end of the site there are two ponds which may be the result of former quarrying activity, one either side of the existing quarry access track. A larger water body lies outside the site boundary a little further to the north west. These ponds drain via a drain on the northern site boundary which is marked on local maps as crossing the railway embankment to the east and outfalling to Moor Ditch.

3.11 There are ditches on site, draining east towards the railway embankment and Moor Ditch beyond. Two were observed on a site visit, located in the centre of the site, east of Hill Farm and running east, and further ditches on other field boundaries are marked on the topographical survey. All accessible ditches were dry when the site was visited in August 2016, and clearly function as drainage run-off channels rather than active watercourses.

3.12 To reach Moor Ditch, drainage from the site must pass the railway embankment on the site's eastern boundary. It is believed from map evidence that the drain just north of the site boundary is culverted beneath the railway embankment and then continues to the east; the other ditches on the site turn north and run along the site side of the embankment to this point. This is thought to be the only existing point in or adjacent to the site where surface water can cross the railway embankment.

Geology and Hydrogeology

3.13 BGS mapping indicates that the bedrock geology at the site is the Gault Clay Formation.

3.14 Superficial deposits over the majority of the site are recorded as being comprised of the Wolvercote Sand and Gravel Member. Towards the northern extent of the site superficial deposits of the Northmoor Sand and Gravel Member are recorded. Both these geological formations are river plain deposits that typically support sandy or gravelly soils, and are the formations supporting current and previous quarrying and gravel pit operations at the site.

3.15 In March 2014, an intrusive site investigation for the purpose of minerals assessment was carried out by Greenfield Associates covering an area that overlaps with the western part of the site. Although this assessment was for a different purpose and does not cover the full site area, the borehole logs can be used to give a general idea of ground conditions in the area. These logs have been included in Appendix B.

3.16 The boreholes from the neighbouring site investigation encountered dark brown soil to a depth of 0.2m – 1.1m below ground level (bgl). Beneath the soil, pale yellow to orangey brown gravelly clay was present to a depth ranging from 0.6m to 1.7m bgl. Below was found pale yellowish brown, medium to coarse sand and fine to medium gravel, ranging from 0.2m to 1.1m thickness. All boreholes were terminated in light or dark grey/blue clay that is considered to be of the Gault Clay Formation.

3.17 Groundwater was encountered in all boreholes between 0.8 and 1.9m below ground level and typically rose to approximately 0.7m below ground level on completion of the borehole. This places the standing groundwater level at the time of the site investigation in March 2014 between 51.92mAOD and 52.77mAOD.

3.18 According to Met Office records, the winter of 2013/2014 was the wettest year on record, with rainfall exceeding 200% of the seasonal average in south east and central south England. Therefore around the mid-end of March 2014 (when the survey was undertaken), it would be expected that the groundwater levels observed at the site represent a peak high water level.

3.19 Environment Agency mapping confirms that the superficial deposits at the site are classified as a Secondary A aquifer, a "permeable layer capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers", which is defined as being of Intermediate Vulnerability.

3.20 The site is not within a Source Protection Zone, meaning that groundwater at the site is not considered to be directly feeding a potable source.

<u>Sewers and Drains</u>

3.21 Sewer records obtained from Thames Water indicate that the closest public surface water sewer is in Collett and falls south to an outfall to the southern loop of Moor Ditch.

3.22 There appear to be no public sewers serving the existing site.

4.0 Development Proposals

4.1 The LDO application is for 885,000 sq ft of office, R&D, and industrial accommodation provided in units ranging in height from one to three storeys.

4.2 Car parking will be provided individually to each unit as required by the demand of the unit type as the plots come forwards.

4.3 Access will be from the existing site access road, with the road and junctions updated as necessary to suit the predicted traffic and loading conditions. The other existing quarry access track will be removed and a new network of internal site access roads provided to serve the individual units.

4.4 The proposed development is subject to change as plots and units will be assigned as appropriate to interested parties following the parameters agreed in the LDO. However, an illustrative layout showing a suitable plan for the development is given in Appendix C.

5.0 Flood Risk Assessment

5.1 This section of the report assesses flood risk at the site from all sources and includes an appropriate allowance for climate change as required by relevant national and local planning policy.

Tidal / Coastal

5.2 The site is located inland and so is not at risk of flooding from coastal sources.

Fluvial

5.3 The EA's Flood Map for Planning indicates that the site is within Flood Zone 1, at very low risk of fluvial flooding, as the railway embankment to the east of the site restricts flooding from Moor Ditch from reaching the site.

5.4 This is supported by more detailed mapping in the SFRA and modelling for the local area.

Groundwater

5.5 The SFRA contains a map showing the Areas Susceptible to Groundwater Flooding dataset, which was provided to local councils by the EA as an initial high level review of groundwater flood risk while the EA work on more detailed modelling. This map shows that the site is at a high (>75%) risk of groundwater emergence. The relevant figure from the SFRA is included in Appendix D.

5.6 The Areas Susceptible to Groundwater Flooding dataset is a very basic analysis and does not represent the actual risk of groundwater flooding at the site level. However it is a useful guide as to which sites may potentially be at risk and require a more detailed site specific analysis.

5.7 The site topographical levels range between 50 – 53mAOD. Site investigation recorded peak high groundwater levels nearby up to 52.77mAOD, which was approximately 0.6 – 0.7 mbgl due to the slightly higher ground levels in the neighbouring site where the investigation was undertaken.

5.8 The drain at the northern side of the site provides a control on the groundwater levels. The emergence level into the drain is at approximately 50mAOD, and it would therefore be expected that groundwater above this level would draw down towards the drain, which will act to reduce groundwater levels at the site in a high groundwater event.

5.9 The site is large and generally flat, and overland flow paths are present which drain water from the site surface. Therefore if groundwater were to emerge at the site surface, it is reasonable to conclude that it would drain away via surface water flow paths. The site topography does not indicate that there is a risk of significant depth of water pooling on site.

5.10 However, there may be some risk of groundwater emergence and surface waterlogging at the site.

5.11 Mitigation measures to manage this risk will be required within the site masterplan and drainage strategy design. Measures could include:

- Land drainage to locally drawdown groundwater levels and prevent emergence and waterlogging at the site surface;
- Design of site levels such that low points that could support pools of water are minimised;
- Raising of buildings or design of site levels such that buildings are raised above the majority of the site area;
- Removal of any basements or below ground elements of the design; and/or
- Flood resilience measures to the ground floor of buildings, such as services to be located at raised levels and materials used to be water resistant and easy to clean and restore.

5.12 Overall, groundwater flooding is assessed as having a low to medium probability and a low hazard rating, which leads to an overall assessment of low risk, with mitigation measures advised.

Flooding from Overland Sources and Pluvial Flooding

5.13 An extract from the EA's Flood Map for Risk of Flooding from Surface Water is given as Figure 2.

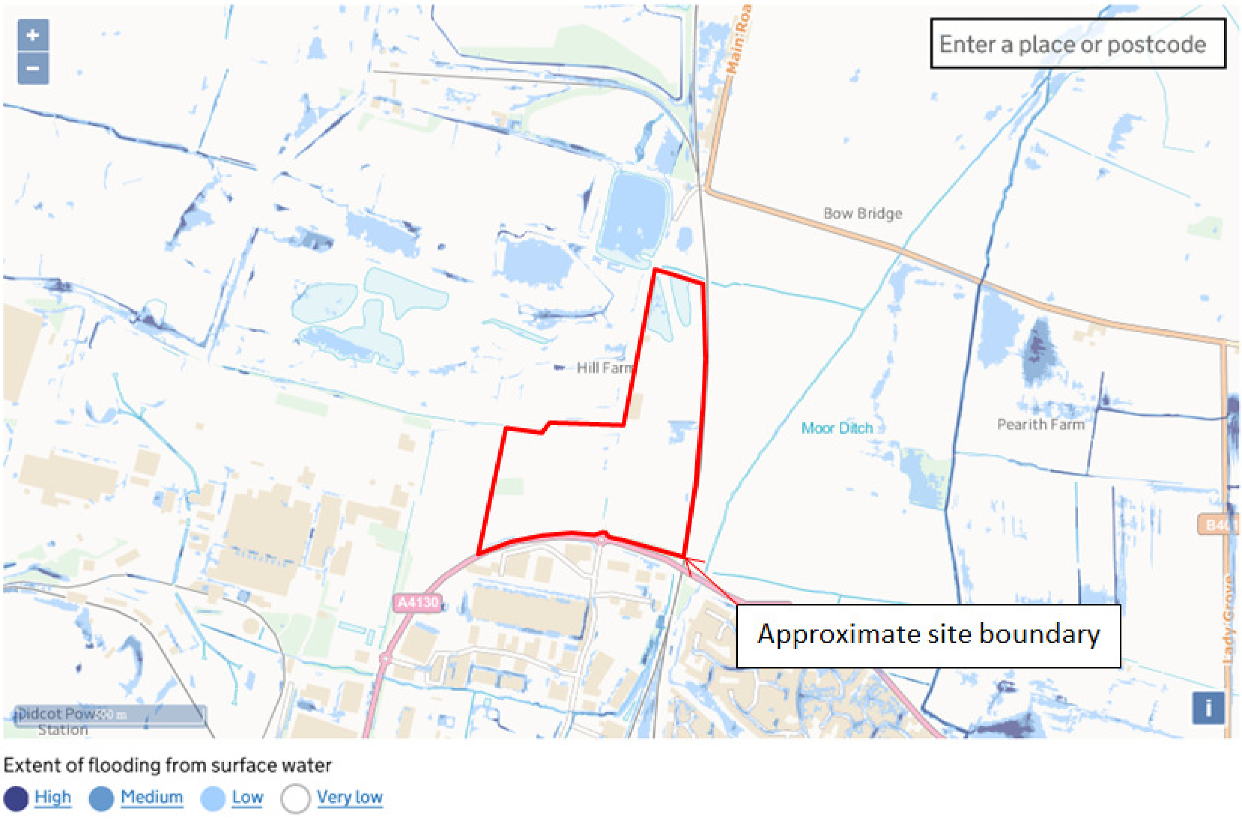


Figure 2: Extract from the EA's Flood Map for Risk of Flooding from Surface Water (EA, 2020)

5.14 It can be seen that some small areas of low risk are present on site along the access road and in the centre of the eastern side of the site.

5.15 The site lies generally in the flow path for rainfall/run-off travelling towards the River Thames. However, the topographical fall of the site and the immediately surrounding areas is slight, and furthermore the upstream areas to the south are recently developed and have modern drainage networks designed to manage their own surface water run-off generation. Therefore the risk of overland flows from offsite causing flooding at the site is thought to be negligible.

5.16 When the site is developed impermeable areas at the site will increase, and there is then a potential for overland run-off flows to become more significant. A surface water drainage network will be required at the site to prevent run-off flows generated by the new development from causing flood risk at the site or elsewhere.

5.17 Therefore overall the site is assessed having a low risk of flooding from this source and a robust surface water drainage network will be required to manage this risk.

5.18 The surface water drainage strategy is outlined in section 6.

Flooding from Sewers

5.19 The only known existing sewer at the site is the Thames Water foul rising main passing south across the site. As a rising main it is subject to a controlled flow rate and therefore flooding is unlikely. Therefore there is thought to be no significant flood risk from existing sewers at the site.

5.20 Following development a surface water drainage system will be implemented at the site.

5.21 The proposed surface water drainage system will be designed to accommodate flows from all events up to and including the 1 in 100 year event, including a suitable allowance for climate change.

5.22 This means that the chance of a storm event occurring that exceeds the capacity of the drainage system and causes a flood event is very low.

Flooding from Artificial Sources

5.23 There are no raised artificial waterbodies in the vicinity of the site.

5.24 The EA's map Risk of Flooding from Reservoirs does not show a known reservoir flood risk to the site.

5.25 Therefore the flood risk from this flooding mechanism is assessed as negligible.

Historic Flooding

5.26 There are no available records of historic flooding at the site.

5.27 As described in the section on Groundwater Flooding, above, the SFRA contains a small number of historic groundwater flooding records from the surrounding villages.

5.28 Thames Water records collated for the SFRA record 1 historic sewer flooding event in the district.

5.29 The SFRA contains records of internal flooding to properties in all of the nearby villages (Sutton Courtenay, Milton, Drayton, and Steventon) in the 2007 floods. However, these villages are in general known to be at higher flood risk than the site.

5.30 In general it can be seen that there has historically been some flood risk in the general area of the site, but there is no evidence of a specific risk to the site additional to those already assessed in this report.

Flood Flow Conveyance and Floodplain Storage

5.31 The site is wholly located in Flood Zone 1 so floodplain conveyance and storage will not be affected.

Safe Access

5.32 The site is wholly located in an area at low risk of flooding, and residual risks relate only to very shallow predicted flood depths. Therefore safe access is maintained at all times.

6.0 Surface Water Drainage Strategy

6.1 This section of the report presents the outline surface water drainage strategy for the proposed development.

6.2 At this stage of the development process detailed proposals for the various phases of the development are unavailable. This outline strategy therefore provides the framework for more refined information to be provided as individual units within the site are developed.

Sustainable Urban Drainage Systems

6.3 All developments present opportunities to incorporate Sustainable Drainage Systems (SuDS), which might include infiltration drainage or attenuation of flows to protect watercourses. The choice of system is dependent upon the ground conditions and site specific characteristics.

6.4 The use of SuDS attempts to mimic the existing flow regime of the undeveloped Greenfield site, thus reducing the impact of the proposed development on the hydrology of the undeveloped catchment.

6.5 All SuDS will be designed in accordance with CIRIA Report C753 'The SuDS Manual' (2015) or subsequent revisions.

6.6 In accordance with best practice, a SuDS "management train" approach will be followed to ensure that the proposed drainage strategy mimics the surface water drainage regime of the undeveloped Greenfield site as closely as possible.

6.7 Source control techniques will be incorporated into the drainage strategy to ensure that surface water run-off is managed as close to source as possible.

Surface Water Drainage Constraints

6.8 Part H of the Building Regulations outlines a hierarchy for the disposal of surface water drainage from new development. Firstly, the guidance recommends that surface water run-off should discharge to soakaway or other infiltration system where practical. Where infiltration is not feasible then regulations state that disposal to a local watercourse should be investigated. It is only when these other means of discharge are not practicable, that discharge should be made to a sewer.

6.9 No infiltration testing has been undertaken at the site. However boreholes drilled in the western part of the site and the neighbouring site indicated the presence of clay topsoils and clay bedrock, with only a narrow sand and gravel layer. Additionally a high groundwater level was observed. The combination of these factors means that it is not thought that a significant infiltration rate can be achieved across the site.

6.10 As the site soils are variable, it is possible that there are some areas of the site where the clay topsoils are thinner and the sand and gravel layer thicker, making some infiltration available locally. When developing detailed drainage design for individual units at the site, developers should consider the plot-specific ground conditions and if appropriate commission soakage testing to establish if infiltration could form a part of the unit drainage design.

6.11 In the existing site drainage regime, Greenfield run-off from the site travels to the low point of the site, the north east corner, to join the surface drain that passes eastwards under the railway embankment to Moor Ditch. This drain would be a suitable outfall point for surface water drainage from the site.

6.12 The surface water drainage will therefore be designed to discharge surface water to the existing drain at the northern site boundary.

6.13 The existing site is mainly Greenfield, and is considered to generate surface water run-off at Greenfield rates.

6.14 In February 2016 updated guidance on climate change allowances for flood risk assessment and drainage design was published as part of the PPG. The new guidance states that predicted rainfall intensities should be assessed including both a “central” climate change value and an “upper end” climate change value in order to understand the sensitivity of the site and decide on the appropriate design of the surface water drainage network. The “central” value represents the average climate change prediction for the development and there is a 50% chance that this value will be exceeded. The “upper end” value is a conservative estimate with a 90% chance of not being exceeded.

6.15 For a site with a design life of greater than approximately 50 years (with a proposed end of use date in or beyond the year 2070), the “central” climate change allowance is 20% and the “upper end” allowance is 40%.

SuDS Options

6.16 As the proposed disposal method for surface water run-off at the site is a controlled discharge to a local watercourse, SuDS features that attenuate discharge rates and provide water quality benefits will be required at this site. This includes pervious pavements, swales, and detention/retention ponds or basins.

Pervious Pavements

6.17 Pervious pavements allow rainwater to infiltrate through the surface and underlying layers where run-off is temporarily stored before being discharged to the ground or downstream SuDS components at controlled rates. Pervious pavements are identified in the SuDS manual as improving water quality and providing treatment as run-off percolates through the layers of the system.

6.18 Large, flat car parking areas are very suitable for the use of permeable paving, and this permits water storage close to the site surface which will assist in achieving a suitable outfall level at the north east corner of the site, so it is recommended that this SuDS component is considered by plot designers for use on any units that require relatively high parking provision.

Swales

6.19 The SuDS Manual (C753) describes swales as linear vegetated drainage features in which water can be stored or conveyed. Swale channels are broad and shallow features considered effective at removing urban pollutants.

6.20 The SuDS Manual identifies different types of swale each with different surface water management capability. Dry swales are considered to be the most appropriate in the upstream (south and west) parts of the site as these present a larger attenuation capacity, fit well into landscaped areas, and are often dry and accessible when it is not raining. The features comprise a vegetated channel with a filter bed of prepared soil that overlays an underdrain system.

6.21 Wet swales or linear ponds may be more appropriate in the lower parts of the site due to the proximity to the outfall level. These features are similar in construction to dry swales but are specifically designed to deliver wet or marshy conditions at the base and therefore do not require an underdrain unless higher conveyance is required.

6.22 Swales will be used in combination with to conventional piped drains to collect run-off from the site development units and convey it downstream towards the outfall point at the north east corner of the site.

Detention/Retention Ponds/Basins

6.23 These terms are used to refer to a family of SuDS features which use landscape areas to store large volumes of run-off at surface level. They have good water quality/pollution control properties (depending on the specific design selected) and also contribute towards the landscape and amenity value of the development in which they are placed. However, they require a relatively large land allocation and are therefore often not practical on smaller sites. The feasibility of incorporating these features is often dictated by the topography of the site.

6.24 Dry detention basins are dry flat areas with shallow depressions used for temporary storage of excess surface water run-off. In a rainfall event run-off accumulates in the depression before flowing out downstream at a controlled rate. These types of basins are often able to provide public open space areas as they are dry for the majority of the year and can therefore support landscaping and planting etc.

6.25 Wet retention ponds are basins which have their outfall above the invert of the basin, leading to the formation of a permanent water body below the outfall level. In a rainfall event, run-off accumulates in the freeboard space between the normal water level and the top of bank level, before draining down to the normal outfall level once the storm event passes. These types of basins cannot be used as public open space, but have a higher water quality benefit and support a wider variety of biodiversity than a dry basin.

6.26 There are already two significantly sized pond at the north east corner of the site which have an existing recreational/amenity use as fishing lakes. It is therefore suggested that the most natural way to incorporate detention of rainfall run-off from the site would be to make use of any freeboard to the existing seasonally high water level in the ponds and/or to extend and reshape the ponds in order to incorporate attenuation storage while maintaining or increasing the amenity value of this feature.

Geocellular Storage

6.27 The SuDS manual (2015) identifies geocellular storage tanks as being able to provide online / offline storage.

6.28 These systems provide very high storage volume capacity capable of managing high flow events. They can be installed beneath landscaping or trafficked areas providing that structural performance is proven to be sufficient (this is of particular importance in heavy clay soils where excessive depths need to be avoided).

6.29 The main disadvantage of these features is that they provide limited water quality treatment and should therefore only be used in conjunction with other SuDS features.

6.30 Therefore geocellular storage crates present an option for unit drainage developers to incorporate if additional attenuation storage is required that cannot be achieved by the preferred SuDS features.

Drainage Strategy

6.31 Surface water drainage at the Didcot Park site will be split between strategic drainage that serves the development as a whole and individual drainage networks to service the separate units proposed at the site.

6.32 The strategic drainage network will collect surface water run-off from individual developer units as well as from shared assets like the site access road, and convey this run-off to the outfall point in the site north east corner. This shared network will include a flow control prior to the outfall which will restrict the total discharge from the site to the Greenfield QBAR rate.

6.33 A calculation for the whole site Greenfield run-off rate was undertaken using the MicroDrainage WinDes software and is included in Appendix E. The Greenfield run-off rates for various return period storms are calculated as:

- 1-in-1 year = 71.9 l/s
- 1-in-30 year = 191.6 l/s
- 1-in-100 year = 269.7 l/s

- QBAR = 84.6 l/s

6.34 The strategic drainage network will make use of the existing pond at the north east corner of the site for attenuation storage. The existing invert level of the drain at the north east corner of the site is approximately 49.50mAOD, and allowing for some fall, the outlet of an outfall pipe form the pond can be set at 49.609mAOD. However, the top of bank level in the pond is consistently 50mAOD. Therefore there exists approximately 0.39m existing freeboard to the pond which will be utilised as attenuation storage by the site drainage strategy.

6.35 A freeboard value of at least 150mm should be maintained during the use of the pond, meaning that the design of the site should ensue that the pond water level remains at or below 49.85mAOD. This leaves approximately 245mm of depth available for attenuation storage. Over the large surface area of the pond (approximately 5790m^2) this equates to a storage volume of 1420m^3.

6.36 The outlet from the pond will need to be flow controlled to maintain run-off from the site at no more than the site Greenfield QBAR rate of 84.6 l/s. As this rate is relatively high compared to the storage flow head of 0.35m, a vortex flow control with suitable performance parameters cannot readily be determined.

6.37 It is therefore proposed to limit the outlet from the pond using a pipe to limit the flow. A 300mm diameter pipe laid at 1:300 typically has a pipe full flow capacity of approximately 64.7 l/s, well below the Greenfield rate, but a larger pipe would allow flows that exceed the rate. Therefore a 300mm diameter pipe laid at 1:300 is proposed as the outfall pipe from the pond into the drain, and will naturally limit the outflow from the site to below the Greenfield rate. This will provide approximately a 23.5% betterment compared to the existing QBAR rate.

6.38 The shared infrastructure at the site, mainly consisting of the access roads and roundabouts, has an approximate impermeable area of 0.864 ha. The existing available attenuation in the pond of 1420m^3 is more than enough to accommodate this impermeable area.

6.39 A hydraulic model of the site for the 1-in-100 year + 40% climate change allowance design storm, with the shared impermeable area, is included in Appendix F. It can be seen that the pond attenuation is only around 46% utilised, and the predicted run-off flows are only approximately 17.2 l/s, a fraction of the allowable rate.

6.40 However, as the site is developed additional impermeable area will be added and the required attenuation will increase beyond the existing available capacity of the pond.

6.41 There will be options in the future to increase the attenuation storage available in the strategic network by increasing the size of the north-eastern pond, and also by connecting to the north-western pond to utilise this additional area for storage.

6.42 It will also be possible to provide additional storage within the development plots themselves and restrict the run-off rate from the plots to the strategic drainage network.

6.43 As the individual plots will be decided based on the needs of individual developers and are not yet fixed in location, size, or design, plot-specific drainage design cannot currently be fixed. Plot-specific drainage design will be the responsibility of each plot developer.

6.44 As each plot comes forward, the plot drainage designer will be required to demonstrate that their development does not, individually or in combination with existing and future developments at the site, cause the total run-off from the site to exceed the Greenfield rate.

6.45 As demonstrated by the calculations in Appendix F, the run-off from the shared strategic road network is approximately 17.2 l/s.

6.46 Compared to the total run-off rate from the site of 84.6 l/s, it can be seen that the available additional flow from development plots totals to 67.4 l/s. Compared to the site area of 23ha it can be seen that 2.9l/s/ha is a suitable additional run-off rate from each plot to achieve an appropriate total run-off rate once the site is completely developed.

6.45 Attenuation storage to reduce run-off to these rates may be provided by utilising some of the existing spare attenuation capacity; expanding the strategic network ponds to provide additional capacity; providing attenuation and flow controls within the development plots; or some combination of these measures.

6.46 Compliance with this flow rate restriction could be demonstrated either by placing a flow control at the plot that restricts discharge directly to 2.9l/s/ha, or by demonstrating that the overall run-off from the development does not increase by more than this value.

6.47 As a typical example, should the first development plot be 6ha in area, it would be suitable for the developer to design a drainage system that incorporated storage volume on site and left the plot at a rate of no greater than 17.4 l/s into the strategic drainage network. However, it would also be suitable for the developer to design a system that increased the volume of storage in the strategic network such that the total run-off from the whole site following their development was no greater than 34.6 l/s – incorporating 17.2 l/s from the strategic network and an additional 17.4 l/s from the new plot.

6.48 Plot-specific drainage design, including storage volumes and flow controls, will be the responsibility of each plot developer.

6.49 An indicative surface water strategy drawing showing the strategic drainage assets is included in Appendix G.

Pollution Control

6.50 The use of SuDS on the site would help to remove urban pollutants from run-off before discharge to the local water environment. Drainage from lightly trafficked roads and car parks does not present a high pollution risk, but there is a possibility of hydrocarbons or lightly contaminated sediments washing off the site roads.

6.51 The shared strategic drainage infrastructure proposed for the site incorporates a SuDS management train where run-off is conveyed through dry swales, and then held in a wet basin prior to discharge into a local watercourse. This management train provides a high degree of water quality treatment and is more than sufficient to treat the low risk run-off from access roads and car parks.

6.52 As a result, the risk of pollution from the site is considered low, and no further pollution control measures are considered necessary.

6.53 However following the principles of source control and the SuDS hierarchy, plot developers should look for opportunities to incorporate SuDS features close to the point of generation where possible.

6.54 In the event that any unit at the site is proposed for occupation by a high pollution risk industry, the operator of the facility causing the risk would need to examine the risks for that unit specifically and implement any further pollution control or water quality treatment measures as may be required to reduce and manage the risk of pollution to the local water environment.

Maintenance and Adoption

6.55 SuDS serving single properties, for example permeable paving in the car parking areas of individual units, will be owned and maintained by the owner of that property.

6.56 SuDS serving more than one property, including the shared strategic swales and ponds, would be the responsibility of the local authority or private management company as appropriate. The maintenance outlets, underlying pipework and any underground storage would be maintained by private management company.

6.57 Suitable adoption and maintenance regimes for SuDS will be submitted in support of individual development drainage designs.

7.0 Summary and Conclusions

7.1 This report has been prepared to support a Local Development Order (LDO) submission to Vale of White Horse District Council regarding a commercial development on land north of Didcot, Oxfordshire.

7.2 This site-specific Flood Risk Assessment has been prepared in accordance with the requirements of National and Local Planning Policy and concludes that the site can be developed safely without increasing flood risk elsewhere. This report has undertaken an assessment considering flood risk from all sources, including an allowance for climate change.

7.3 This report demonstrates that the site is at the lowest possible risk of flooding from fluvial, tidal and artificial sources. There is a low risk of flooding from groundwater and surface water sources, which will require management through suitable drainage design and implementation of mitigation measures. The detailed design for each plot will have to consider what specific mitigation measures are suitable for use for in that plot.

7.4 A surface water drainage strategy is proposed based on the principles of SuDS surface water management train outlined in the document produced by CIRIA C753 'The SuDS Manual' (2015).

7.5 Geological reports for the site are not complete and show some variation across the site; however, it is not thought that a significant infiltration rate will be achievable in general. Therefore the strategy proposed is discharge surface water run-off from the site to the existing drain on the northern boundary at the existing Greenfield QBAR run-off rate. If some infiltration is available locally, individual unit developers may be able to make use of this discharge mechanism.

7.6 A strategic drainage system is proposed using the existing pond at the north eastern corner of the site. Considering the size of this pond and the site Greenfield run-off rates, allowable discharge rates from the development plots have been proposed.

7.7 Plot-specific drainage design, including restricting surface water run-off to the appropriate discharge rates, will be the responsibility of each plot developer. All surface water drainage systems for individual development plots should be designed to collect, store and attenuate surface water run-off for all events up to and including the 1-in-100 year event including an allowance for a 40% increase in rainfall intensities as a result of climate change.

7.8 This report demonstrates that sufficient space for the strategic site drainage has been provided within the indicative masterplan, and the sustainable and appropriate development of the plots is feasible.

7.9 No constraints have been identified that would prevent the successful development of the site for its intended end use.

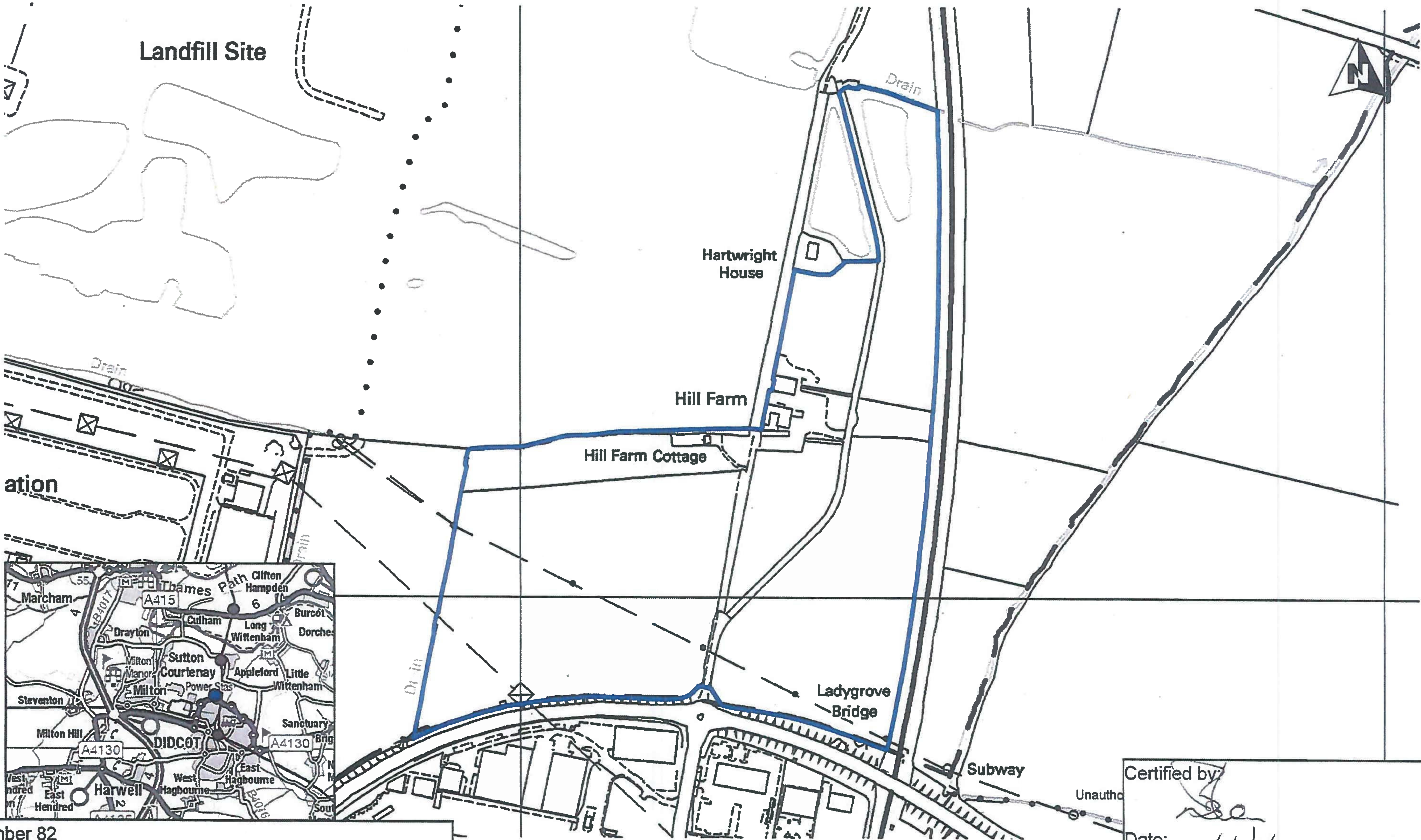
Appendices

Appendix A

Site Location Plan

Boundary for business rate retention

Didcot Growth Accelerator Enterprise Zone: Didcot Park



Map Number 82
Didcot Growth Accelerator - Didcot Park
Maps referred to in Schedule 1 to the Non-Domestic Rating (Designated Areas) Regulations 2016

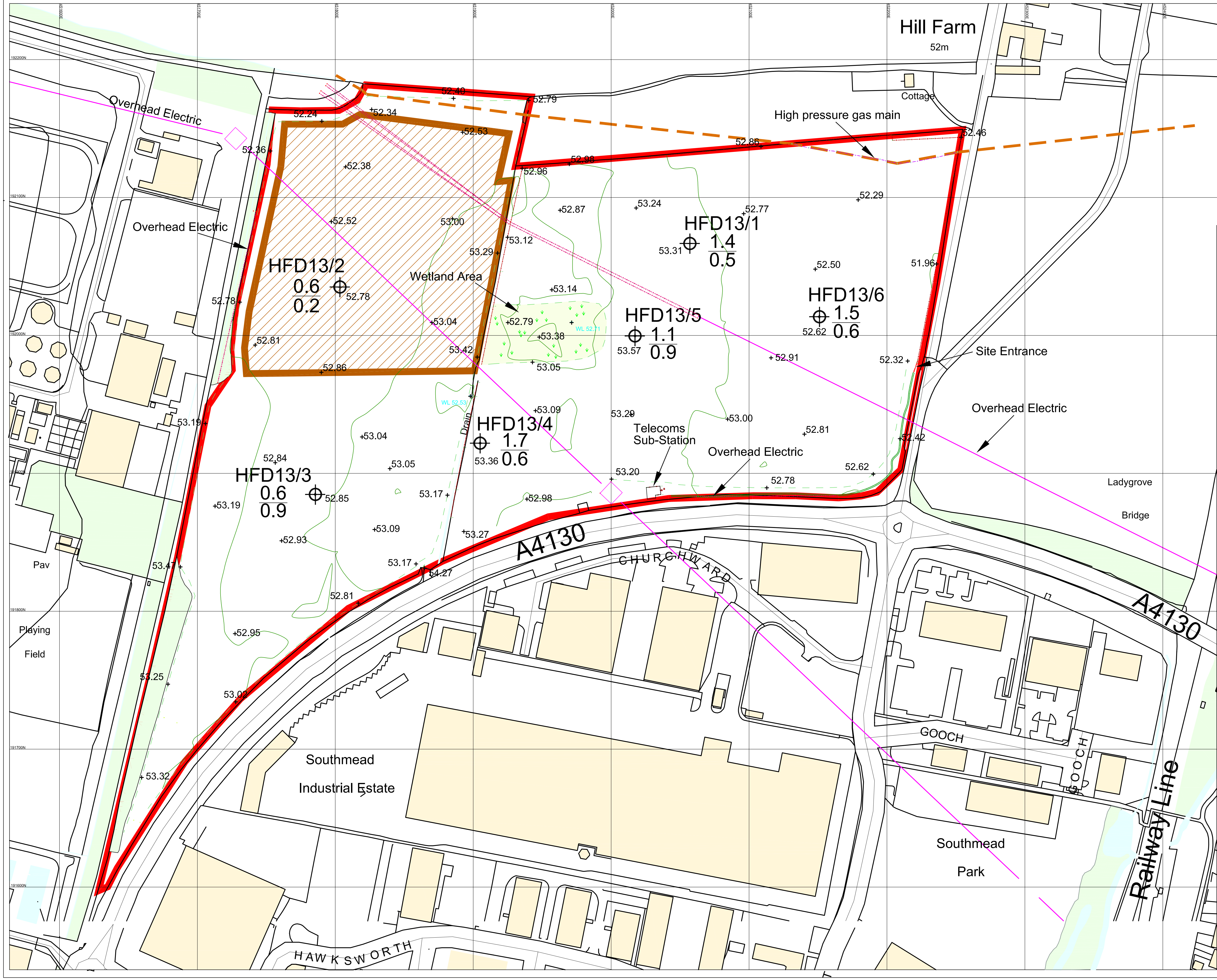
Certified by:

Date: 16/1/16

Senior Civil Servant in the Department for Communities and Local Government

Appendix B

Borehole Logs from 2014 Minerals Assessment



Key

- Land at Didcot (Approx area 16.1ha)
- Borehole Location
- HFD13/1
  - 1.5 Overburden Thickness
  - 0.6 Mineral Thickness
- Barren Area

Notes

Site surveyed by Greenfield Associates on 18th March 2014 using Trimble GPS VRS now system.
Approximate location of high pressure gas main was picked up using C.A.T scanner. Locations of services are indicative only.

Scale
0m 50m 100m

Site
Hill Farm, Didcot

Project
Minerals Assessment

Title
Site Plan & Borehole Locations

File:	Didcot Site Plan 2014.dwg
Project No.	SMT/LAD/101
Scale:	1:2500@A3
Drawn by:	DJR
Date:	19th March 2014

reef ESTATES

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GREENFIELD ASSOCIATES
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Keyworth, Nottingham
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BOREHOLE LOG

Project			BOREHOLE No
Didcot Minerals Assessment			**HFD 13-1**
Job No	Dates: start 17-03-14, finish 17-03-14	Ground Level (m): 53.31	
Client: **Reef Estates**		Co-Ordinates (): E 452,057.0 N 192,066.0	Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				52.91		(0.40) 0.40	Dark brown slightly sandy slightly gravelly silty soft to firm clay	
			1 (▽)	52.21		(0.70) 1.10	Dark brown gravelly silty firm clay	
			1 (▼)	51.91		(0.30) 1.40	Dark orange to yellowish brown slightly sandy gravelly clay	
1.40-1.90	B1			51.41		(0.50) 1.90	Pale yellow brown slightly silty medium to coarse sand and fine to medium angular to rounded gravel of flint quartzite and vein quartz with some limestone.	
1.90-2.50	B2			50.81		(0.60) 2.50	Dark blue stiff clay	

Boring Progress and Water Observations					Chiselling			Water Added		Remarks
Date	Time	Depth	Casing Depth	Water Depth & Remarks	From	To	Hours	From	To	Groundwater encountered at 1.4m bgl rising to 0.7m bgl

All dimensions in metres Scale 1:25	Engineer **Greenfield Associates**	Method/ Plant Used: Cable Percussion	Logged By: DJR

Greenfield associates
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1 Commercial Road
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BOREHOLE LOG

Project			BOREHOLE No
Didcot Minerals Assessment			**HFD 13-2**
Job No	Dates: start 17-03-14, finish 17-03-14	Ground Level (m): 52.78	
Client: **Reef Estates**		Co-Ordinates (): E 451,803.0 N 192,034.0	Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				52.38		(0.40) 0.40	Dark grey gravelly sandy silt	
			1 ▽	52.18		(0.20) 0.60	Orange brown slightly gravelly clay	
				51.98		(0.20) 0.80	Light orange brown silty medium to coarse sand and fine to medium gravel with occasional clay lumps.	
0.80-2.00	B1		1 ▼	50.78		(1.20) 2.00	Light blue grey and light brown mottled fine to medium rounded to sub rounded gravelly firm to stiff clay	

Boring Progress and Water Observations					Chiselling			Water Added		Remarks
Date	Time	Depth	Casing Depth	Water Depth & Remarks	From	To	Hours	From	To	Groundwater encountered at 1.0m bgl rising to 0.6m bgl

All dimensions in metres Scale 1:25	Engineer **Greenfield Associates**	Method/ Plant Used: Cable Percussion	Logged By: DJR

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BOREHOLE LOG

Project			BOREHOLE No
Didcot Minerals Assessment			**HFD 13-3**
Job No	Dates: start 17-03-14, finish 17-03-14	Ground Level (m): 52.85	
Client: **Reef Estates**		Co-Ordinates (): E 451,785.0 N 191,884.0	Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				52.65		(0.20) 0.20	Grey brown gravelly silt	
				52.25		(0.40) 0.60	Light yellow brown slightly gravelly silty clay becoming light yellowish brown clayey sand	
0.60-1.50	B1		1 (struck), 1 (rose)				Yellowy brown silty medium to coarse sand and sub angular to rounded fine gravel of flint quartzite vein quartz and limestone. Gravel beoming fine to course from 1.5m	
1.50-1.70	B2			51.15		(1.10) 1.70		
1.70-2.00	B3			50.85		(0.30) 2.00	Light blue grey and pale brown mottled slightly gravelly firm to stiff clay	

Boring Progress and Water Observations					Chiselling			Water Added		Remarks
Date	Time	Depth	Casing Depth	Water Depth & Remarks	From	To	Hours	From	To	Groundwater encountered at 1.0m bgl rising to 0.7m bgl

All dimensions in metres Scale 1:25	Engineer **Greenfield Associates**	Method/ Plant Used: Cable Percussion	Logged By: DJR

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BOREHOLE LOG

Project			BOREHOLE No
Didcot Minerals Assessment			**HFD 13-4**
Job No	Dates: start 17-03-14, finish 17-03-14	Ground Level (m): 53.36	
Client: **Reef Estates**		Co-Ordinates (): E 451,905.0 N 191,921.0	Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				52.66		(0.70) 0.70	Dark brown slightly sandy slightly gravelly silty soft to firm clay	
			1 (rest level)	51.66		(1.00) 1.70	White sandy slightly gravelly soft clay becoming pale brown to light yellowy brown	
1.90-2.30	B1		1 (strike)	51.06		(0.60) 2.30	Pale yellowy brown silty medium to coarse sand and fine to medium sub angular to rounded gravel	
2.30-3.00	B2			50.36		(0.70) 3.00	Dark blue firm clay	

Boring Progress and Water Observations					Chiselling			Water Added		Remarks
Date	Time	Depth	Casing Depth	Water Depth & Remarks	From	To	Hours	From	To	Groundwater encountered at 1.9m bgl rising to 0.75m bgl

All dimensions in metres Scale 1:25	Engineer **Greenfield Associates**	Method/ Plant Used: Cable Percussion	Logged By: DJR

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BOREHOLE LOG

Project				BOREHOLE No
Didcot Minerals Assessment				**HFD 13-5**
Job No	Dates: start 17-03-14, finish 17-03-14	Ground Level (m): 53.57		
Client: **Reef Estates**			Co-Ordinates (): E 452,017.0 N 191,999.0	Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				53.07		(0.50) 0.50	Dark brown slightly sandy slightly gravelly silty soft to firm clay	
			1 (0.8m)	52.47		(0.60) 1.10	Yellow to orange brown sandy slightly gravelly clay	
1.10-2.00	B1			51.57		(0.90) 2.00	Yellowy brown slightly silty medium to coarse sand and fine to medium angular to sub rounded gravel. Gravel becoming fine to coarse from 1.6m	
2.00-2.50	B2			51.07		(0.50) 2.50	Light grey gravelly firm to stiff clay	

Boring Progress and Water Observations

Date	Time	Depth	Casing Depth	Water Depth & Remarks

Chiselling

From	To	Hours

Water Added

From	To

Remarks

Groundwater encountered at 0.8m bgl

All dimensions in metres Scale 1:25	Engineer **Greenfield Associates**	Method/ Plant Used: Cable Percussion	Logged By: DJR

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BOREHOLE LOG

Project			BOREHOLE No
Didcot Minerals Assessment			**HFD 13-6**
Job No	Dates: start 18-03-14, finish 18-03-14	Ground Level (m): 52.62	
Client: **Reef Estates**		Co-Ordinates (): E 452,150.0 N 192,013.0	Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				51.92		(0.70) 0.70	Dark brown slightly sandy slightly gravelly silty soft to firm clay	
0.70-1.50	B1		1 (0.70)	51.12		(0.80) 1.50	Yellow to orange brown sandy slightly gravelly clay	
1.50-2.10	B2			50.52		(0.60) 2.10	Pale yellow brown silty fine to coarse sand and fine to medium angular to rounded gravel of flint quartzite and vein quartz with some limestone.	
2.10-2.60	B3			50.02		(0.50) 2.60	Dark blue stiff clay	

Boring Progress and Water Observations					Chiselling			Water Added		Remarks
Date	Time	Depth	Casing Depth	Water Depth & Remarks	From	To	Hours	From	To	Groundwater encountered at 0.7m bgl

All dimensions in metres Scale 1:25	Engineer **Greenfield Associates**	Method/ Plant Used: Cable Percussion	Logged By: DJR

AGS3 UK BH DIDCOT LOGS.GPJ AGS 3_1.GDT 28/3/14

Appendix C

Proposed Development Masterplan

AUTOMATED SHUTTLE BUS STOP (INDICATIVE)

5M WIDE FOOTPATH AND CYCLE ROUTE

PROPOSED ELECTRIC CAR CHARGING STATIONS, CAR SHARING PARKING

PROPOSED E-BIKE CHARGING STATIONS, COVERED BIKE PARKING FACILITIES

BUILDING HEIGHTS

- ■ SINGLE STOREY
- ■■ TWO STOREYS
- ■■■ THREE STOREYS
- ■■■■ FOUR STOREYS

BUILDING USE CLASSES

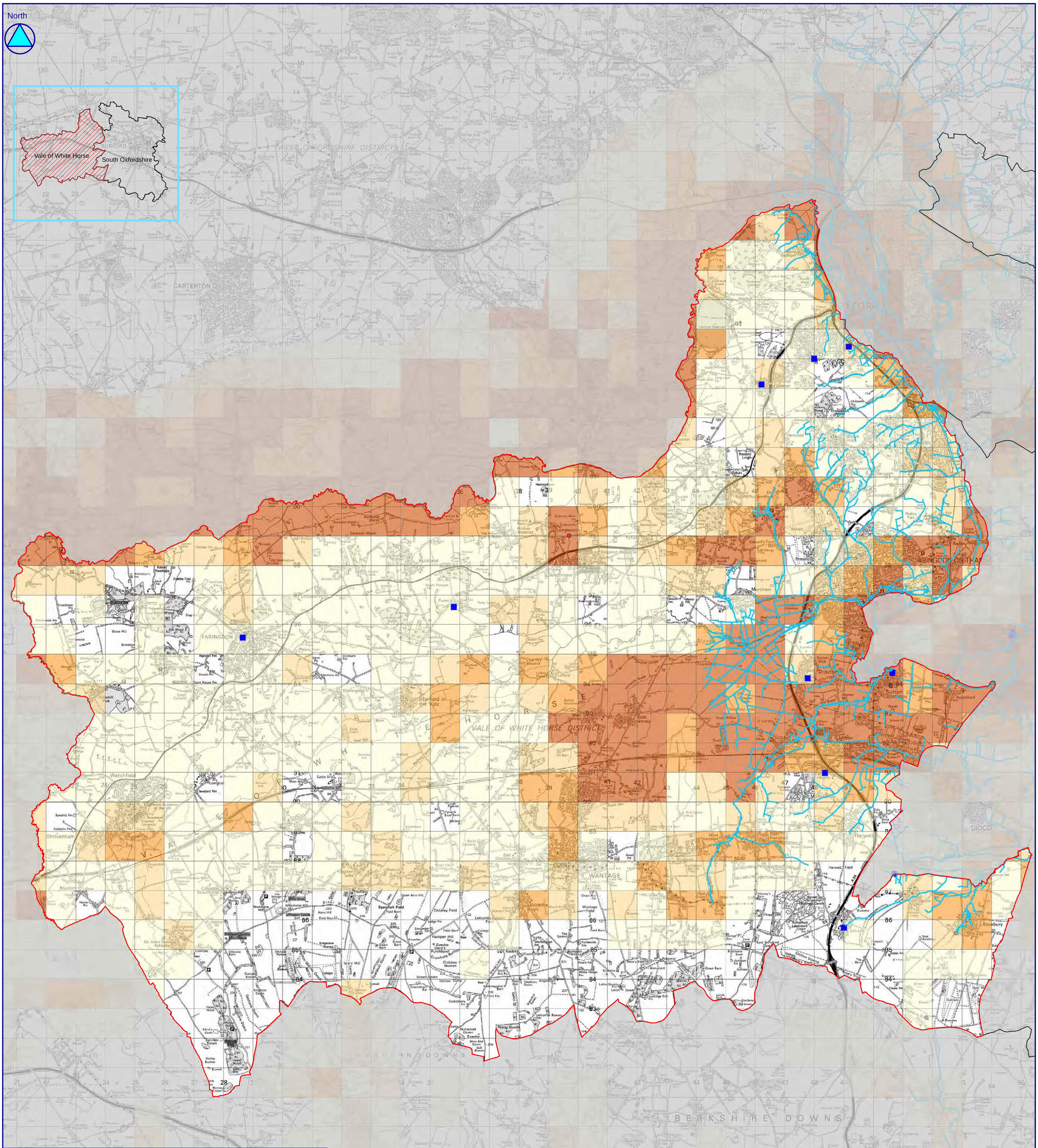
- INDUSTRIAL (B2)
- DATA (B8)
- OTHER (BATTERY)

For illustrative purposes only

Rev	Date	Description	
REEF GROUP		Job Title **Didcot Technology Park** Hill Farm Appleford, Abingdon OX14 4PJ	Drawing Name **INDICATIVE PROPOSED MASTERPLAN**
51 Welbeck Street, London, W1G 9HL T: 020 7637 0601 W: www.reefestates.co.uk		Drawing Status **Preliminary**	Drawing Scale **1:2000, 1:200 @A2**
URBAN REEF | DESIGN AND CONSTRUCTION		Date first Issued **02.03.20**	Layout ID **01** Revision

Appendix D

SFRA Map of Areas Susceptible to Groundwater Flooding



LEGEND

- Vale of White Horse
- South Oxfordshire
- Main Rivers
- Watercourses reported as being affected by groundwater flooding in 2001
- Reported Groundwater Flooding

Risk of Groundwater Emergence

- >= 75%
- >= 50% <75%
- >= 25% <50%
- < 25%

Reported Groundwater flooding incidents 2000-2013

Year

- 2000
- 2001
- 2002
- 2003
- 2006
- 2007
- 2008
- 2009
- 2011
- 2013

Area classification:
Proportion of each 1 km square that is susceptible to groundwater flood emergence.

SOUTH OXFORDSHIRE DISTRICT COUNCIL & VALE OF WHITE HORSE DISTRICT COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT MAP 6.2: AREAS SUSCEPTIBLE TO GROUNDWATER FLOODING (VOWH)

JBA consulting

Information regarding modelled and historical flood risk is constantly changing. Users should consult the Environment Agency for the latest flood risk information relating to specific planning applications.

Scale:1:60,000

0 0.65 1.3 km

Appendix E

Greenfield Run-off Rate Calculations

ICP SUDS Mean Annual Flood

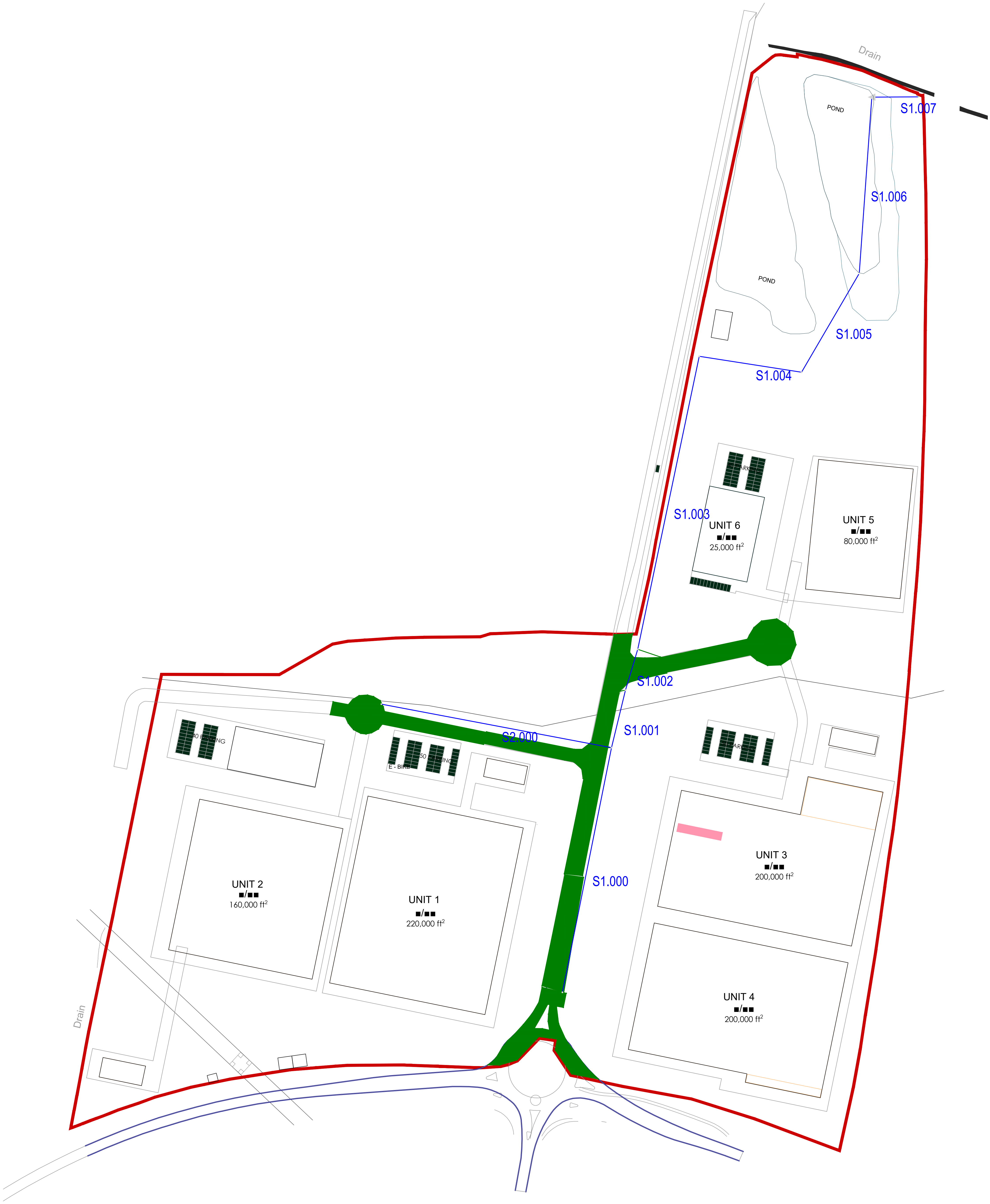
Input

Return Period (years)	100	Soil	0.450
Area (ha)	23.050	Urban	0.000
SAAR (mm)	600	Region Number	Region 6

Results	**l/s**
QBAR Rural	84.6
QBAR Urban	84.6
Q100 years	269.7
Q1 year	71.9
Q30 years	191.6
Q100 years	269.7

Appendix F

Initial Site Model Results



Drain
POND
POND
S1.007
S1.006
S1.005
S1.004
S1.003
S1.002
S1.001
S1.000
S2.000
UNIT 6
25,000 ft^2
UNIT 5
80,000 ft^2
UNIT 2
160,000 ft^2
UNIT 1
220,000 ft^2
UNIT 3
200,000 ft^2
UNIT 4
200,000 ft^2
E - BIKE
Drain

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	176.025	0.587	299.9	0.249	5.00	0.0	0.600		o	300	Pipe/Conduit	
S2.000	165.187	0.551	299.8	0.134	5.00	0.0	0.600		o	300	Pipe/Conduit	
S1.001	41.736	0.139	300.3	0.186	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.002	30.148	0.100	301.5	0.140	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.003	211.243	0.704	300.1	0.155	0.00	0.0		0.045	3 \=/	300	1:3 Swale	
S1.004	72.974	0.243	300.3	0.000	0.00	0.0		0.045	3 \=/	300	1:3 Swale	
S1.005	80.791	0.269	300.3	0.000	0.00	0.0		0.045	3 \=/	300	1:3 Swale	
S1.006	124.650	0.001	124650.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.007	32.794	0.109	300.9	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	8.25	51.552	0.249	0.0	0.0	0.0	0.90	63.8	33.8
S2.000	50.00	8.05	51.516	0.134	0.0	0.0	0.0	0.90	63.8	18.1
S1.001	50.00	9.02	50.965	0.569	0.0	0.0	0.0	0.90	63.8«	77.1
S1.002	50.00	9.58	50.926	0.709	0.0	0.0	0.0	0.90	63.6«	96.1
S1.003	50.00	23.23	50.826	0.864	0.0	0.0	0.0	0.26	29.0«	117.0
S1.004	50.00	27.95	50.122	0.864	0.0	0.0	0.0	0.26	29.0«	117.0
S1.005	50.00	30.00	49.879	0.864	0.0	0.0	0.0	0.26	29.0«	117.0
S1.006	50.00	30.00	49.610	0.864	0.0	0.0	0.0	0.04	2.7«	117.0
S1.007	50.00	30.00	49.609	0.864	0.0	0.0	0.0	0.90	63.7«	117.0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.050	0.050	0.050
	User	-	100	0.062	0.062	0.112
	User	-	100	0.019	0.019	0.131
	User	-	100	0.119	0.119	0.249
2.000	User	-	100	0.134	0.134	0.134
1.001	User	-	100	0.069	0.069	0.069
	User	-	100	0.117	0.117	0.186
1.002	User	-	100	0.140	0.140	0.140
1.003	User	-	100	0.155	0.155	0.155
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.864	0.864	0.864

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	S8	50.730	49.500	49.950	0	0

Storage Structures for Storm

Tank or Pond Manhole: S7, DS/PN: S1.007

Invert Level (m) 49.609

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4925.2	0.391	5791.8

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.900
M5-60 (mm) 20.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	120 Winter	100	+40%					51.852
S2.000	S2	120 Winter	100	+40%					51.816
S1.001	S3	30 Winter	100	+40%					51.265
S1.002	S4	120 Winter	100	+40%					51.226
S1.003	S5	15 Winter	100	+40%					51.250
S1.004	S6	30 Winter	100	+40%					50.499
S1.005	S7	30 Winter	100	+40%					50.253
S1.006	S7	480 Winter	100	+40%			100/15 Summer	18	49.721
S1.007	S7	480 Winter	100	+40%					49.720

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.000	0.80		50.8	SURCHARGED*	
S2.000	S2	0.000	0.000	0.43		27.4	SURCHARGED*	
S1.001	S3	0.000	0.000	2.94		187.2	SURCHARGED*	
S1.002	S4	0.000	0.000	2.26		143.6	SURCHARGED*	
S1.003	S5	-0.550	0.000	0.10		239.1	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.004	S6	-0.001	0.000	0.99		235.4	FLOOD RISK*	
S1.005	S7	-0.047	0.000	0.76		233.7	FLOOD RISK*	
S1.006	S7	-0.189	0.000	0.03	65.1	1.2	FLOOD RISK*	
S1.007	S7	-0.189	0.000	0.29		17.2	FLOOD RISK	

Appendix G

SuDS Strategy Plan

NOTES

1. This drawing is to be read in conjunction with all other relevant documents and specifications.
2. Dimensions not to be scaled.

KEY

- Swales incorporated into access road corridor to transfer flows at ground level and provide amenity and water quality benefits.
- Development plot drainage to be designed by individual plot developers. Paving areas with potential for permeable paving shown.
- Proposed extension to existing pond to incorporate attenuation storage. Precise geometry of pond to be determined at detailed design once further details of existing pond are available.

Rev.	Description	Date	Chkd
P1	Preliminary Issue.	- MLM	LM

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Client : Reef Estates

Project : Didcot Park Hill Farm

Title : SUDS Strategy

Project Engineer : L. McGregor Scale : 1:500 @ A1

Project Director : K. Rayner Date : August 2016

Status : PRELIMINARY

Drawing No. 8130727/002 Rev P1

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- BIM