Barracks Farm

Environmental Permit Application

Hydrogeological Risk Assessment

Oaks Land Management Limited

July 2021

Prepared on Behalf of Tetra Tech Environment Planning Transport Limited.

Registered in England number: 03050297

Tetra Tech Cardiff, 5th Floor, Longcross Court, 47 Newport Road, Cardiff, United Kingdom, CF24 0AD

Tetra Tech Environment Planning Transport Limited, Registered in England number 03050297

Registered Office: 3 Sovereign Square, Sovereign Street, Leeds, United Kingdom, LS1 4ER

Document Control

Document:	Hydrogeological Risk Assessment
Project:	Barracks Farm
Client:	Oaks Land Management Limited
Job Number:	A115247
File Origin:	N:\Projects\Oaks Land Management Ltd\A115247 (Barracks Farm)\Reports

Revision:	-	**Status:**	Final – Submission to the Environment Agency
Date:	July 2021		
Prepared by: Neil Dickson		**Checked by:** Adam James	**Approved by:** Conor Lydon
Description of revision:			

Revision:		**Status:**	
Date:			
Prepared by:		**Checked by:**	**Approved By:**
Description of revision:			

Revision:		**Status:**	
Date:			
Prepared by:		**Checked by:**	**Approved By:**
Description of revision:			

TABLE OF CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

1.1 REPORT CONTEXT

1.1.1 Tetra Tech have been commissioned by Oaks Land Management (hereafter referred to as 'the client') to undertake a Hydrogeological Risk Assessment (HRA) in support of their application for a recovery permit at Barracks Farm, Emerton Road, Fetcham, Leatherhead, KT22 9TP (hereafter referred to as 'the site').

1.1.2 Barracks Farm is owned by F Conisbee and Son who are an independent family run business who specialise in producing high quality, environmentally sustainable agricultural produce for local consumption. The farm is currently used by the business for the rearing of cows, sheep and turkeys.

1.1.3 The site is located approximately 1.4km north from the village of Fetcham and is centred at approximate National Grid Reference (NGR) TQ14277 57075. Access to the site is achieved off Emerton Road located to the south of the site.

1.1.4 In July of 2017, planning permission (reference MO/2017/1198) was granted by Mole Valley District Council to permit the erection of two livestock buildings at Barracks Farm, construction of a bunded manure store and a wetlands drainage scheme comprising of reed beds. In addition, the permission allowed the importation of 30,000m^3 of inert materials in order to raise to ground levels up to the existing plateau upon which the farmyard has been built on (See Figure 1 - Drawing Number BKP042017/BRK/004).

1.1.5 The proposed development seeks to utilise imported inert waste materials rather than using 'virgin' inert construction fill materials for the restoration.

1.1.6 A HRA is required to demonstrate that the proposed restoration of the site, as a Recovery Operation, with inert material, will be compliant with Environment Agency (EA) Groundwater Protection Positions Statement 'E1', Landfill Location Policy as well as the Environmental Permitting Regulations 2016 (as amended) and Groundwater (England and Wales) Regulations 2009. These Regulations require that certain substances (Hazardous Substances) are not discharged to groundwater such that they are discernible, and that the discharge of other substances (Non-Hazardous Pollutants) is limited to prevent pollution of the water environment in accordance with the Water Framework Directive (2000/EC/60).

1.2 OBJECTIVES

1.2.1 The HRA has been prepared in accordance with the EA guidance on Landfill developments:

groundwater risk assessment for leachate[1] which replaced the EA guidance document Horizontal guidance Note H1 - Annex J3: Additional guidance for hydrogeological risk assessment for landfills and the derivation of groundwater control levels and compliance limits v 2.1 (2011)[2] on the 1st February 2016; and, EA guidance on 'Waste recovery plans and permits' (2016)[3].

1.2.2 The principal objectives of this study are to:

- Determine baseline conditions in relation to the water environment at Barracks Farm and in the wider surrounding area;
- Establish compliance with the Water Framework Directive, Groundwater Daughter Directive (GWDD) and the Environment Agency's Groundwater Protection Policy Landfill positional statement F1;
- Develop a hydrogeological conceptual model for the site including source term, pathway receptor relationship and to define groundwater levels and direction beneath the site; and,
- Identify the likely risk to identified groundwater dependant receptors due to the proposed waste recovery activity at the site.

1.2.3 A hydrogeological Conceptual Site Model (CSM) has been developed and is presented for the site and surrounding area (presented on Figure 2).

1.2.4 The CSM has been used to inform a qualitative risk assessment (Section 4) which considers whether the proposed restoration represents a hazard to controlled waters. The risk screening exercise assess whether potential discharge from the proposed development is acceptable and whether further, more detailed risk assessment is required. The Conceptual Site Model (CSM) presented as part of this report is limited to publicly available data.

1.3 REGULATORY CONTEXT

1.3.1 The Water Framework Directive (WFD) (2000/EC/60) came into force in December 2000. The Water Framework Directive establishes an integrated approach to the protection, improvement and sustainable use of Europe's surface waters and groundwater.

1.3.2 The WFD and Groundwater Daughter Directive (GWDD) superseded the former Groundwater Directive (80/68/EEC) in December 2013 with European Union (EU) member states ensuring an equal

[1] Department for Environment, Food & Rural Affairs and Environment Agency, 'Landfill developments: groundwater risk assessment for leachate', 1 February 2016 - https://www.gov.uk/guidance/landfill-developments-groundwater-risk-assessment-for-leachate [Accessed 12 October 2020]

[2] Environment Agency, 'Horizontal guidance Note H1 – Annex J 3. Additional guidance for hydrogeological risk assessments for landfills and the derivation of groundwater control levels and compliance limits v 2.1, December 2011, www.gov.uk/government/publications/h1-annex-j3-hydrogeological-risk-assessment-for-landfills-and-derivation-of-groundwater-levels-and-compliance

[3] Environment Agency, 'Waste recovery plans and permits - How to apply for a waste recovery environmental permit to permanently deposit waste on land. 18th October 2016, https://www.gov.uk/guidance/waste-recovery-plans-and-permits

level of protection is afforded to groundwater quality under the WFD. The two main objectives of the WFD are that there is 'No deterioration in status' and 'Good quantitative status' of groundwater bodies by 2027 (WFD Cycle 2). Objectives for groundwater quality are subject to a more detailed description and criteria under the Groundwater Daughter Directive (GWDD).

1.3.3 The Waste Framework Directive (2008/98/EC) requires member states to ensure that waste is recovered or disposed of without endangering human health and without using processes and methods which could harm the environment. One of the key aims of the Directive is to promote the better use of resources by encouraging the use of waste for beneficial purposes. To this end, recovery operations which result in waste being used in place of primary resources are to be encouraged over disposal operations which are intended to simply get rid of the waste safely.

1.3.4 In general, non-landfill waste operations pose fewer hazards to groundwater than landfill operations. With the exception of 'deposit for recovery' activities, these hazards can – unlike landfill – be removed if necessary if groundwater pollution is expected to occur.

1.3.5 The EA framework for the regulation, protection and management of groundwater is set out in their approach to groundwater protection guidance document[4] which replaces 'Groundwater Protection: Policy and Practice (GP3)' which was withdrawn in March 2017. The guidance documents detail the technical framework and the EA's approach to the management and protection of groundwater, the tools used in the assessment of groundwater, the policy and legislation.

1.3.6 Groundwater can be at serious risk of pollution unless recovery operations are located in the right place and subject to the right operational controls. When submitting a proposal for a waste facility, the operator must include sufficient evidence to demonstrate that the risk to groundwater can be satisfactorily managed. Where a proposed development would present an unacceptable risk to groundwater that could not be managed by planning conditions, an environmental permit or registered exemption, the EA will object to the development.

1.3.7 The EA will apply the F1 Non-Landfill Waste Activities Positional Statement in its consultee role under the Town & Country Planning Act 1990 and in its permitting role. This approach complements the EA's role in promoting the government's waste hierarchy of prevention, preparing for re-use, recycling, other recovery and finally disposal, so as to reduce the need for landfill.

1.3.8 The EA positional statement F is as follows:

(i) *Inside SPZ1 the Environment Agency will only object to proposals for new development of non-landfill waste operations where it believes the operation poses an intrinsic hazard to*

[4] Environment Agency, 'The Environment Agency's approach to groundwater protection' Version 1.2. February 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf [Accessed 12 October 2020]

groundwater. For example, deposit of waste for recovery activities. The Environment Agency will oppose such new developments via the development planning system.

(ii) For any other non-landfill waste operations that are proposed in SPZ1, when considering any environmental permit application, the Environment Agency will usually require a detailed risk assessment, and mitigation measures to be put in place to manage all risks to groundwater. Accordingly, the Environment Agency will raise concerns when responding to any planning application consultation, as to whether a permit could be granted. In sensitive groundwater locations, the Environment Agency will therefore strongly encourage parallel tracked environmental permit applications with planning applications.

(iii) Outside SPZ1 the Environment Agency will agree to proposals for new developments of non-landfill waste operations where risks can be appropriately controlled by an environmental permit or a relevant waste exemption.

1.3.9 The controls to protect groundwater quality formerly dealt with under the transitory Groundwater Regulations 2009 (which superseded the Groundwater Regulations 1998) came within phase 2 of environmental permitting regime via the Environmental Permitting (England & Wales) Regulations (EPR) 2016 (as amended). The EPR regulations implements the requirements for the control of discharges to groundwater imposed by the WFD and GWDD.

1.4 REPORT STRUCTURE

1.4.1 The remainder of this report is structured as follows:

- Section 2 – Environmental Site Setting;
- Section 3 – Hydrogeological Conceptual Site Model;
- Section 4 – Risk Screening Assessment;
- Section 5 – Requisite Surveillance; and,
- Section 6 – Conclusions.

1.4.2 The report and content within are subject to the conditions presented at Appendix A.

2 ENVIRONMENTAL SETTING

2.1 INTRODUCTION

2.1.1 This section of the report summarises available information collated as part of the desk study.

2.1.2 Details on the current scheme, proposed restoration and the environmental setting of the site are set out in the following reports which have been referenced during the preparation of this HRA:

- Bill Kear Plant and Agricultural Contractors Ltd drawing number BKP042017-BPK-001, dated 01 July 2017, which details the Existing Site Layout at Barracks Farm;
- Bill Kear Plant and Agricultural Contractors Ltd drawing number BKP042017-BPK-003, dated 01 July 2017, which details the Proposed Site Layout at Barracks Farm;
- Bill Kear Plant and Agricultural Contractors Ltd drawing number BKP042017-BPK-004, dated 04 July 2017, which details the Proposed Sections at Barracks Farm;
- Bill Kear Plant and Agricultural Contractors Ltd drawing number BKP042017-BPK-006, dated 26 July 2017, which details the Reinstated Pond Cross Sections at Barracks Farm;
- Groundsure Enviro & GeoInsight report, GS-7160913 dated 14 October 2020.

2.2 SITE LOCATION

2.2.1 Barracks Farm is located c. 1.4km to the north of the rural village of Fetcham approximately 1.9km northwest of Leatherhead.

2.2.2 The site is bound to the north and west by agricultural lands. To the south is agricultural lands, with Cobham Road and further agricultural lands beyond. To the east, the site is bound by the existing farmyard with agricultural lands beyond. The existing planning permission (reference MO/2017/1198) allowed for the importation of 30,000m^3 of inert materials to raise ground levels. The total site covers an area of c. 4.59 hectares (ha) and is centred at National Grid Reference (NGR) TQ 14277 57075.

2.2.3 The topography of the general vicinity slopes downwards from west to east and south to north broadly towards River Mole, c. 380m east of the site.

2.3 SITE SETTING

2.3.1 Barracks Farm is owned and operated by F. Conisbee and Son who will be responsible for all future restoration to topographical levels shown on Drawing BKP042017-BRK-003 by Bill Kear Plant and Agricultural Contractors Ltd, dated 4 July 2017.

2.3.2 At present, the lands form a steeply sloping landscaping, sloping downwards to the north and west: the site slopes from c. 51.2 metres Above Ordnance Datum (mAOD) to c. 39mAOD along the northern boundary and from c. 51.2mAOD to c. 45mAOD along the western boundary. The site is on an elevated position in the context of the immediate vicinity.

2.3.3 A lagoon is located immediately north of the primary site buildings, within the permit boundary. A mature tree is annotated to the northwest of the primary site buildings.

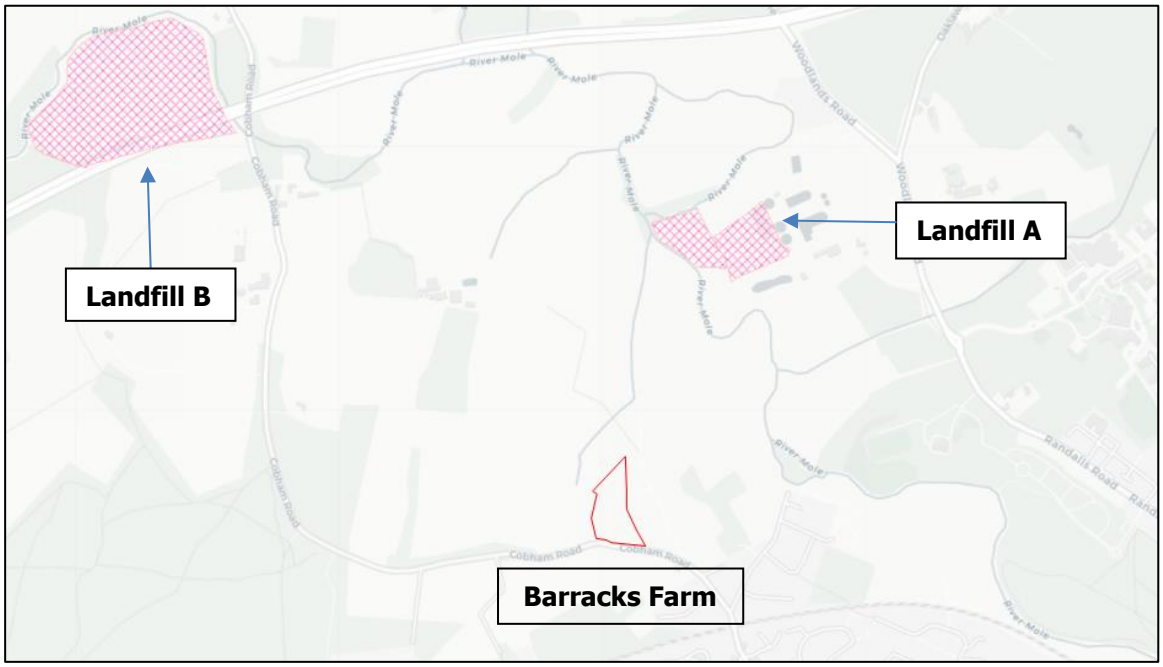
2.3.4 The proposed raising of current topography levels is to be focused to the north of the existing buildings of the site. The main features associated with works are depicted on Drawing BKP042017-BRK-003, dated July 2017 and include:

- A continued downward slope to the north but after an initial continuation of the concrete plateau. Following the extension of a level surface, the site will slope at a slightly steeper ration than current back to the existing topographical elevation;
- Within the plateau will be a central dished concrete channel placed between two barns with three 1m^3 concrete catch pits which will divert run-off to the pre-existing lagoon. From the lagoon, a 150mm drainage outlet will be laid to a new reed bed system;
- An earth bund will be created to ensure surface water run-off does not directly flow into the neighbouring lagoon;
- A retaining wall will be placed between the existing primary buildings and the proposed buildings with associated earthworks;
- Three areas of proposed native trees are proposed to the northeast, west and south-southwest of the proposed works area. The proposed recovery operation will not extend as far as the pre-existing mature trees located on the lands.

2.3.5 Two historic EA landfills exist in the surrounding area as shown on Insert 1 below[5]. No authorised EA landfills are recorded to exist.

[5] Basemap for insert obtained from Groundsure Enviro Data - http://groundsure.io/

Insert 1 – Environment Agency Licensed and Historic Landfill Sites



2.3.6 As shown in Insert 1 above, there are no areas of historic or authorised permitted landfilling within the site boundary. There are no active landfills located within or adjacent to the site.

2.3.7 Within the wider vicinity, to the northeast of the site, there are 2 No. historic landfills. Landfill A is related to Leatherhead Landfill (reference MO/63, 023) which closed on 31/12/1974. Landfill B is related to Cobham Road (reference 8/358, MO/14, MO/12/LCC, S247), which was operated by Fairclough Civil Engineering Limited until cessation of work in 31/12/1995.

2.4 RECOVERY OPERATION

2.4.1 There are currently no extraction or recovery operations on going at the proposed site. It is proposed that the site is enhanced under a bespoke permit for a Recovery Operation.

2.4.2 The Restoration Plan (Drawing reference Drawing BKP042017-BRK-003, dated July 2017) details how the site is to be restored in one stage and is limited to the area, north of the existing buildings. Existing environmental features such as trees and a lagoon are to be retained and enhanced.

2.5 SITE HISTORY

2.5.1 Based on historical mapping provided within the Groundsure Enviro and GeoInsight report, in 1868 the site is depicted as agricultural lands which extend to the north, south, east and west. Barracks Farm is annotated to the east of the site, adjacent to an unnamed access road / track. To the south,

Cobham Road is annotated and a single residential dwelling is noted at the southern boundary. The residential dwelling remains present on historical maps up to present day.

2.5.2 The site and surrounding lands remain relatively unchanged between 1868 and 1972. In 1972, Barracks Farm is shown to have expanded and has extended westwards, towards the eastern boundary of the site. Further expansion has occurred at the farm between this period and present-day mapping.

2.5.3 No features of worth are noted within the surrounding vicinity in historical mapping.

2.6 SITE GEOLOGY

2.6.1 Geology information for the site and the surrounding area has been reviewed using the British Geological Survey (BGS) Geological Map Reigate (1978), Sheet 286 (England & Wales) and the BGS Onshore viewer[6].

2.6.2 **Made Ground**

2.6.3 There are no Made Ground deposits shown on site. Immediately to the east is the infrastructure associated with Barracks Farm and it is assumed there is a portion of made ground associated with its construction.

2.6.4 **Superficial Deposits**

2.6.5 There are no Superficial Deposits shown to be present across the site.

2.6.6 Superficial deposits are annotated c. 160m northeast of this and are noted as River Terrace Deposits and Alluvium.

2.6.7 The BGS describe the River Terrace Deposits as "*sand and gravel, locally with lenses of silt, clay or peat*"**.** However, this is likely to be underlaying Alluvium deposits. Alluvium is described by the BGS as **"***soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel***"**.

2.6.8 Sheet 286, Reigate Drift, Scale 1:50,000 published in 1978 indicates there is no drift material across the site.

2.6.9 **Solid Geology**

2.6.10 The solid geology shown to be present beneath the site feature in this region's solid geology is the

[6] British Geology Survey GeoIndex Onshore Viewer - http://www.bgs.ac.uk/data/mapViewers [Accessed 12 October 2020]

London Clay Formation, which the BGS describe as “mainly comprises bioturbed or poorly laminated, blue-grey or grey-brown, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay”. The London Clay Formation formed in the Ypresian Age, 56 to 47.8 million years ago. It thins to c. 20m in Dorset.

2.6.11 According to Sheet 286, Reigate Drift, Scale 1:50,000 published in 1978, the site is underlain by the London Clays and noted to be 99-120m in thickness.

2.6.12 Underlying the London Clays is the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation which are all components of the White Chalk Supergroup. The BGS describes the White Chalk Subgroup as “c*halk with flints, with discrete marl seams, nodular chalk, sponge-rich and flint seams throughout*” and it formed between the Cenomanian Age (100.5 – 93.9 million years ago) and the Maastrichtian Age (72.1 – 66 million years ago).

2.6.13 Borehole Records

2.6.14 No borehole records are shown to be present within the site. However, six borehole records are shown to be present within a 1km area; the closest of which is c. 220m from site (TQ15NW49). All boreholes are shallow and installed into stiff, fissured clay. A summary of all boreholes is provided below in Table 2.1.

Table 2.1 – BGS Borehole Records

BGS Reference	Name	NGR	London Clay Formation Thickness (m)
TQ15NW45	M25 S Orbital Rd Wisley Leatherhead 734	513290, 157120	>10.5
TQ15NW64	M25 S Orbital Rd Wisley Leatherhead 848	513670, 157000	>7.05
TQ15NW49	M25 S Orbital Rd Wisley Leatherhead 778	514000, 156820	>12
TQ15NW50	M25 S Orbital Rd Wisley Leatherhead 779	514170, 156530	>12
TQ15NW51	M25 S Orbital Rd Wisley Leatherhead 780	514190, 156390	>6
TQ15NW52	M25 S Orbital Rd Wisley Leatherhead 781	514310, 156150	>6

2.7 HYDROGEOLOGY

2.7.1 Aquifer Classification

2.7.2 According to the Hydrogeological Map of England and Wales (1;625,000), the site is underlain by the London Clay which is classified as a Concealed aquifer or aquifer with limited or local potential. The

EA further classify the Clays as an up-productive aquifer. The clays are reported as being up to 150m thick across the region, with cement-stone nodule bands at rare intervals. The clays confine waters in underlying beds.

2.7.3 The EA classify the London Clays as relatively impermeable and would have negligible significance for water supply and river baseflow.

2.7.4 The White Chalk Supergroup which underlies the London Clays is classified as a principal aquifer which are layers of rock or drift deposits that have high intergranular and / or fracture permeability.

2.7.5 **Groundwater Source Protection Zones**

2.7.6 It is widely recognised that in some instances new developments can pose a risk to the quality and availability of groundwater. In such instances land-use planning policies and groundwater regulations play a vital role in the protection of groundwater. Source Protection Zones (SPZ's) are used by the EA to focus pollution prevention activities and inform planning decisions.

2.7.7 The Environment Agency uses SPZ's as a risk screening tool and they act as a first step to assessing the potential risk of a development and its impact on groundwater resources or abstraction sources.

2.7.8 According to the Environment Agency, the site is located in the Outer Protection Area (Zone 2) of a groundwater Source Protection Zone (SPZ). This is defined as:

2.7.9 *"…400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken"*. The groundwater abstraction which is the focus of the SPZ is located c. 1,800m southeast of the site (down-hydraulic gradient).

2.7.10 **Aquifer Properties**

2.7.11 The London Clay has rapid lateral and vertical variations in the sand and clay content. This has a commensurate effect on aquifer properties. The presence of clay acts as a barrier to groundwater flow direction, primarily preventing vertical movement and subsequently forming aquitards and perched groundwater levels. In regions where sandy beds are well developed, boreholes of up to 200mm diameter may yield up to 200m^3/d. This can increase to 1,800m^3/d in sandier strata and larger boreholes. Water from these aquifers may be ferruginous (i.e. high in iron content).

2.7.12 **Aquifer Recharge**

2.7.13 The 'Unproductive' Aquifer (London Clays) is unconfined and water bearing, sand layers (if present) within the unit will be subject to direct recharge from rainfall falling into the open area of restoration. However, the majority of rainfall falling at the site is anticipated to run-off rather than infiltrate (effective

rainfall) due to the low permeability nature of the clay which will serve to retard recharge. In its current condition, the site slopes steeply to the north and west, away from the farm buildings and there is an anticipated high volume of run-off.

2.7.14 **Groundwater Occurrence and Levels**

2.7.15 There are no groundwater monitoring boreholes currently installed at the site, and no groundwater monitoring data for the local area is currently available.

2.7.16 There are a number of publicly available drill logs for the local area which generally did not record groundwater within the London Clay Formation. One identification of a groundwater seepage at a depth of 16mbgl is noted from TQ15NW63, located c. 1.2km west-northwest of the site.

2.7.17 There are currently no time series groundwater elevation data available for the site and surrounding area.

2.7.18 Due to the lack of recorded groundwater strikes within the wider vicinity available within the historical boreholes logs there is insufficient data to estimate groundwater elevations across the site with a reasonable degree of confidence.

2.7.19 On a regional scale, groundwater elevations in the underlying bedrock are assumed to fall broadly east with the occasional northern influence.

2.8 HYDROLOGY

2.8.1 The presence of surface water features, including streams, rivers, drainage ditches and ponds have been determined from the Ordnance Survey (OS) Maps. Existing surface water features (labelled in red), and surface water collection ponds (labelled in blue) identified within the site area are depicted below in Insert 2.

2.8.2 Several surface water features are shown to be present on site and the immediate surrounding area. A pre-existing lagoon is shown to the north of the existing buildings. This lagoon area is approximated on Insert 2 and is shown as an existing feature on the restoration proposal drawings (see Figure 1).

2.8.3 SW1 and SW2 lie outside of the site and relate to the primary river, River Mole and a feeding tributary respectively. The River is expected to be relatively shallow and fed via shallow groundwaters within the alluvium and sand and gravel deposits in the wider area. They are not anticipated to receive groundwater baseflow from the London Clay or any further underlying unit.

Insert 2 – Barracks Farm Surface Water Features

2.8.4 P1 – 6 are outside of the immediate site area and are less at risk of contamination. They are isolated and have no apparent connection to nearby watercourses. As they are located on the London Clays, they are anticipated to be maintained by rainwater only i.e. do not receive groundwater baseflow.

2.9 REGULATORY CONSULTATION

2.9.1 Tetra Tech accessed publicly available EA records on 12 October 2020 in order to gain an understanding of the current site setting. Information was also sourced from a Groundsure Report (Appendix B). Details on surface water and groundwater abstractions, discharge consents and pollution incidents within proximity of the site were accessed.

2.9.2 Discharge Consents

The consultation response indicates 3No. discharge consents recorded within 500m of the site. A further 5No. discharge consents are present within 1km of the site[7]. The details of the consents are summarised in Table 2..

Table 2.2 - Licenced Discharges within 2km of Site

Permit No.	Location		Status	Type
CTCR.1644 v1	340m E	River Lane Pumping Station	Revoked [28/11/2018]	Sewage - water company
CTCR.1644 v2	340m E	River Lane Pumping Station	Active	Sewage - water company
CTCR.1755	371m NE	Bookham STW	Revoked [31/07/1986]	Sewage – not water company
TEMP.1685 v1	600m SW	Penrose Road	Revoked [02/09/2010]	Sewage - water company
TEMP.1685 v2	600m SW	Penrose Road	Revoked [19/08/2014]	Sewage - water company
TEMP.1320 v1	600m NE	Leatherhead River Lane	Revoked [01/11/1989]	Sewage - water company
TEMP.1320 v2	600m NE	Leatherhead River Lane	Revoked [03/09/2010]	Sewage - water company
TEMP.0602 v1	750m SE	Cannon Way (1) (Foul)	Revoked [25/11/1997]	Sewage - water company

2.9.3 Pollution Incidents

The consultation indicates 2No. water pollution incidents within 500m of the site. A summary of the pollution incidents, both of which are outside of the site boundary, are detailed below in Table 2.3.

Table 2.3 – Pollution Incidents within 500m

Incident ID	Distance and Direction from site	Date	Pollutant	Impact
133345	441m E	26/01/2003	Sewage Materials	Minor impact to land and water
1308222	464m E	21/01/2015	Inert Materials and Wastes	Significant impact to land

2.9.4 Surface Water Abstractions

The Groundsure report (Appendix B) states that there are 3No. surface water abstractions within 2km of the site. The closest is located approximately 1,087m east of the site boundary (licence 28/39/32/0014 detailed below).

[7] Environmental Permitting Regulations – Discharges to water and groundwater: https://environment.data.gov.uk/public-register/view/search-water-discharge-consents [accessed 12 October 2020]

Table 2.4 - Licenced Surface Water Abstractions within 2km of Site

Licence No.	Location	Status	Source	Volume
28/39/32/0014	515400, 156800	Historical	River Mole at Cannon Grove Nursery	159.06m^3/day (Direct Spray irrigation)
28/39/32/0014	515400, 156800	Historical	River Mole at Cannon Grove Nursery	159.06m^3/day (Spray irrigation Definition order)
28/39/32/0030	515700, 156200	Active	Fetcham Pumping Station Point B	Potable Water Supply

2.9.5 Groundwater Abstractions

There are 6No. active groundwater abstraction wells within 2km of the site. Two abstractions are historical; 1No. relates to a pumping station at Fetcham and a further 3No. relate to a pumping station at Leatherhead. The latter are governed by one licence. All 3No. of these wells operate under a single abstraction licence (Ref: 28/39/32/0032) by Sutton and East Surrey Water Plc. The annual water volume abstracted from these wells is 15,390,483m³, with a daily licensed volume of 57,961m³ permitted. The remaining boreholes are all located at Fetcham Pumping Station, also licensed to Sutton and East Surrey Water Plc. Two of the three licenses are historical. The current licence allows the abstraction of 412,900m^3/year with a daily licensed volume of 1,136m^3 permitted. It is considered that the licences are permitting the abstraction from the White Chalk Supergroup aquifer unit. A summary of the abstraction licence details is shown in Table 2..

Table 2.5 - Potable Supply Abstraction Licences

Licence No.	Name	Location	Distance from Site	Details
Historical License *(28/39/32/0031)*	Fetcham Pumping Station Point A	515700, 156200	1560m SE	Start date: 09/01/1967
Historical License *(28/39/32/0031)*	Stream at Fetcham Pumping Station Point A	515700, 156200	1560m SE	Start date: 09/01/1967
Active (28/39/32/0031)	Fetcham Pumping Station Point A	515700, 156200	1560m SE	Annual Vol: 4.129x10^5 m³ Max Daily Vol: 1,136 m³ Start Date: 09/07/2014 Expiry Date: -
Active (28/39/32/0032)	Leatherhead Pumping Station Point A1	516180, 156270	1976m E	Annual Vol: 1.539x10^7 m³ Max Daily Vol: 57,961 m³ Start Date: 15/06/2018 Expiry Date: -
	Leatherhead Pumping Station Point A3	516200, 156280	1991m E	
	Leatherhead Pumping Station Point A2	516200, 156260	1998m E	

3 HYDROGEOLOGICAL CONCEPTUAL SITE MODEL

3.1 CSM OVERVIEW

3.1.1 This section sets out our Hydrogeological Conceptual Site Model (CSM), which qualitatively describes the potential contaminant sources / ground conditions associated with the proposed Waste Recovery Operation, receptors upon which contaminants could potentially have an impact and also pathways that may exist to allow contaminants to impact upon the identified receptors.

3.1.2 The CSM development has focussed on characterising the Hydrogeological Model for groundwater beneath the site, both in its current condition and post restoration of the site following infilling with inert waste. A conceptual understanding of the hydrogeological regime in the vicinity of Barracks Farm and the proposed restoration has been derived from an assessment of published and site-specific information.

3.1.3 To assess the potential impact of any contamination identified at the site on groundwater receptors, a risk assessment has been progressed. For a risk to be present at the site, three components must exist:

- Contaminant(s) must be present at concentrations capable of causing adverse effects on groundwater (Source);
- There must be exposure migration pathway by which the receptor encounters the contaminant (Pathway); and
- A groundwater dependent receptor must be present, (Receptor).

3.1.4 The source-pathway-receptor scenario is a used to generate a conceptual site model (CSM), which can be used to identify potentially significant pollutant linkages to inform the decision whether a more detailed quantitative analysis of risk is required. The first stage of the process is to determine the presence or absence of any contaminant(s) of concern (source) at the site, followed by the most likely pathways that these contaminants would take in the environment and finally the potential receptors of concern.

3.1.5 A graphical depiction of the CSM in its current condition is presented on Figure 2 while a CSM of the post restoration phase is depicted on Figure 3. The current condition CSM is presented on a regional scale to provide context of underlying geology across a relatively small site.

3.2 SOURCE TERM CHARACTERISTICS

3.2.1 Waste Types

3.2.2 It is proposed to restore the site with inert material as defined in Article 2 of the Landfill Directive 1999/31/EC as follows:

'Inert waste' means waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. The total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water and/or groundwater. Table 2 lists those wastes that may be accepted at the site which do not require Waste Acceptance Criteria (WAC) testing under Council Decision (2003/33/EC), provided that they are inert and from a single source only (mixed loads from more than one site cannot be accepted without testing).'

3.2.3 Permitted wastes accepted at the site will be strictly inert as classified under the Landfill Directive (1999/31/EC) and Council Decision (2003/33/EC) of 19th December 2002 'establishing criteria and procedures for the acceptance of waste landfills…' and are set out in Table 3.1.

Table 3.1 – Permitted Waste Types

EWC Code	Description
01	**WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS**
01 01	**Wastes from mineral excavation**
01 01 02	Wastes from mineral non-metalliferous excavation
01 04	**Wastes from physical and chemical processing of non-metalliferous minerals**
01 04 08	Waste gravel and crushed rocks other than those containing dangerous substances
01 04 09	Waste sand and clays
10	**WASTES FROM THERMAL PROCESSES**
10 12	**Waste from manufacture of ceramic goods, bricks, tiles and construction products**
10 12 08	Waste ceramics, bricks, toles and construction products (after thermal processing)
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	**Concrete, bricks, tiles and ceramics**
17 01 01	Concrete
17 01 02	Bricks
17 01 03	Tiles and ceramics
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 05	**Soil (including excavated soil from contaminated sites), stones and dredging spoil**

17 05 04	Soil and stones not containing dangerous substances
17 05 06	Dredging spoil (unless it contains dangerous substances)
07 05 08	Track ballast, soil and stones other than those containing dangerous substances
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTEWATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 12	**Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 09	Mineral (for example sand, stones)
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 02	**Garden and park wastes (including cemetery waste)**
20 02 02	Soil and stones

3.2.4 Any suspected non-compliant material will not be accepted onto site and will be dealt with in accordance with the Sites Waste Acceptance Procedures. Further detail on the acceptance procedures is provided in report, 'A115247 Operating Techniques' completed by Tetra Tech in December 2020.

3.2.5 **Leachate Generation**

3.2.6 Due to the inert nature of the material to be used to restore the quarry, it is considered highly unlikely that water coming into contact with the material at the restored site will generate high concentrations of pollutants. This can be ensured due to the restricted source of waste materials allowed on to the site and stringent Waste Acceptance Procedures to be put in place. It is therefore considered that hazardous substances are not expected to be present and non-hazardous substances are expected to be low with respect to the background groundwater quality.

3.2.7 The decline in leachate concentrations is controlled by water inputs to the fill material at the site. The site is to be restored progressively and therefore will be open to rainfall infiltration for a relatively short period of time. Rainfall falling on the inert materials will either run-off over the waste and be subject to evapotranspiration and / or infiltration through waste mass as effective rainfall.

3.2.8 The annual average rainfall (1981 to 2010) has been obtained from a weather station located at Wisley[8] c. 7.5km northwest of the site and is reported at a value of 656.6mm/year. This annual rainfall value has been compared against the Centre for Ecology & Hydrology (CEH) and BGS UK Hydrological Review report for Anglian catchment in 2010[9]. The annual rainfall for the Anglian area was 744mm/year in 2009 into 2010. The average annual rainfall for Thames between 1971 and 2000 is 607mm/year. Therefore, the annual rainfall reported by the nearby weather station is within the annual rainfall range recorded for the region.

[8] Wisley Weather Station: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcpevmgzn
[9] UK Hydrological Review, 2010: http://nora.nerc.ac.uk/id/eprint/15942/1/Hydrological_Rev2010.pdf

3.2.9 During rainfall events, rainwater will fall onto the ground where a proportion will infiltrate through the top of soils and the balance will run off. The remaining water will seep into the underlying restoration soils (upon restoration of the site) where it will be subject to evaporation and use by plants (transpiration). These two processes are known as evapotranspiration. The CEH & BGS UK Hydrological Review report for 2009[10] provides actual evapotranspiration rates for that year and totals for 1971 to 2000 as a percentage. The actual evapotranspiration totals for the Anglian area in 2009 are shown to be between 530-569 mm/year, with the average between 1971 to 2000 shown to be as much as 10% higher than this.

3.2.10 The approximate area of the site is approximately 45,900m^2 and the estimated effective rainfall to the site is anticipated to be 87.6 to 126.6mm/year which is based on the average annual rainfall minus (656.6mm/year) annual evapotranspiration rate, recorded at the Wisley rainfall station. Based on this, the current infiltration is estimated to be c. 4,020.84 to 5,810.94m^3/year.

3.2.11 Effective rainwater which does infiltrate through the recovered waste soils will migrate vertically through the inert waste materials. Leachate generated will be subject to attenuation and retardation processes. Furthermore, the plateau area of recovery is to be covered with hardstanding and barns constructed. This end use will further limit the potential for infiltration. A concrete channel and concrete catch-pits are also to be installed to catch surface water run-off on the proposed hardstanding and direct it to the nearby lagoon and ultimately a reed bed.

3.2.12 Given the inert nature of the imported materials and reference to EA guidance 'Standards and Measures for the Deposit of Inert Waste on Land'[11], it is not necessary to manage and monitor leachate at sites which comprise the recovery or disposal of inert waste. The site will fall outside the scope of the EPR 2016 (as amended) and therefore, no leachate management and monitoring are proposed for the site.

3.3 PROPOSED LANDFILL ENGINEERING

3.3.1 It is proposed that the site should be restored in line with the wider proposals for the site utilizing imported inert waste materials. The ground levels will be raised up to the plateau that the existing farm sits on as shown on the cross sections (Drawing Number BKP042017-BRK-004) approved under planning permission MO/2017/1198. It is envisaged that a bunding system will be utilised to create the outer edge of the new landform up to the desired level.

3.3.2 Though some native infill material is available in the form of stripped overburdens, the desired landform cannot be attained without the deposition of imported infill material. The proposed

[10] UK Hydrological Review, 2009: http://nora.nerc.ac.uk/id/eprint/13677/1/Hydrological_Rev2009.pdf

[11] Environment Agency, 'Environmental Permitting Regulations: Inert Waste Guidance. Standards and Measures for the Deposit of Inert Waste on Land' https://webarchive.nationalarchives.gov.uk/20140328160310/http://cdn.environment-agency.gov.uk/geho0509bpwj-e-e.pdf [Accessed 08th July 2019]

development would require a volume of 30,000m^3 of imported inert material to achieve the final profiles provided on the Proposed Site Plan (BKP042017-BRK-003) approved under planning permission MO/2017/1198. When using a bulk conversion factor of 2No. tonnes/m^3 this equates to 60,000 tonnes. Native overburdens will be placed upon the base of the proposed development area over which the inert material will be placed in a single phase via mobile plant. Stripped and stored soils will then be spread over the infill to allow a level surface to facilitate the laying of hardstanding.

3.3.3 All imported infill materials will be subject to strict Waste Classification (WM3) and will be stored on Site whilst recyclable materials are removed and processed.

Geological Barrier

3.3.4 No geological barrier is required to be constructed. This is the case across the whole permitted site due to the presence of a natural geological barrier in the form of the London Clay Formation at the base. The London Clay is reported to extent up to 150m beneath the region in which the site lies. The London Clays are reported[12] to have a vertical hydraulic conductivity (permeability) of approximately 5.8x10^{-11}m/s. Therefore, the geological barrier across the site will be formed by leaving the clays in-situ.

Side Wall Liner

3.3.5 It is considered that an engineered side wall liner is not required due to the presence of a natural geological barrier in the form of the London Clay Formation at the base. The London Clay is reported to extent up to 150m beneath the region in which the site lies. The London Clays are reported to have a vertical hydraulic conductivity (permeability) of approximately 5.8x10^{-11}m/s. Therefore, the side wall liner will be formed by leaving the clays in-situ.

Above Ground Bund

3.3.6 As the recovery operation is primarily above ground, a new artificial boundary will be required along the northern and western edge of the proposed works area. It is proposed that a bund will be constructed above ground level using available soils in essence to create a new side wall for the area of recovery. The bund will be sloped and constructed in a phased manner in line with the infill levels from the inert waste.

3.3.7 The construction of the bund is proposed to be in accordance with the Highways Agency Specification for Highways Series 600 which provides specification for the construction of earthwork environmental bunds. The bund will comprise a restoration soils layer of 0.45 to 1.00m topsoil/subsoil in order to enable planting of broad land shrubs and trees. The compaction of the bund in layers coupled with the overlying low permeability restoration soils will encourage surface water run-off towards the edge of

[12] Environment Agency and ESI (2010) London Basin Aquifer Conceptual Model. ESI Report Reference 60121R1 (June 2010).

the site. Therefore, infiltration into the bund is anticipated to be within the top 200/300mm within the restoration soils layer with negligible amount of infiltration into the inert waste.

Capping

3.3.8 In accordance with the requirements of the Landfill Directive, an engineered cap (clay or plastic) is not required. Therefore, on completion of infilling, the sloping side of the site will be restored with c. 1m of previously stripped low permeability restoration soils and no less than 0.30m of topsoil. On the plateau area, a layer of hardstanding (concrete) will be installed to allow for the construction of barns

Restoration and Aftercare

3.3.9 The land surrounding the Farm slopes downwards to the north and east. Upon completion of the restoration works, it is envisaged that the final topographical contours will compliment that of the surrounding lands.

3.3.10 In accordance with planning permission MO/2017/1198 the raised land will be intended to allow the development of the following:

- Two parallel livestock buildings would then be erected on the raised land each measuring 49m long, 15.25m wide with a height of 5.5m and a 4m separation between the two buildings;
- Construction of a bunded hardstanding measuring 70m x 30m for the storage or manure;
- Construction of a sustainable farm wetlands drainage scheme and the raising of ground levels to the minimum required to accommodate a reed bed system.

3.3.11 As detailed in the restoration scheme (Drawing Number BKP042017-BRK-003, dated July 2017) the edge of the site is to be restored back to grasslands with additional arboriculture features that will enhance the biodiversity of the site.

3.3.12 It is proposed to restore Barracks Farm with inert material as defined in Article 2 of the Landfill Directive 1999/31/EC.

3.3.13 The operator will undertake a topographical survey of the site referenced to ordnance datum on completion of the recovery activity. An existing topographical survey has already been completed.

3.3.14 In order to minimise potential pollution from surface water the proposals include the construction of a reed bed drainage system. The raised ground level would raise the ground levels to the minimum required in order to accommodate the wetland. The wetland would enable the purification of the runoff from the bunded hardstanding used to store manure generated in the livestock buildings.

3.3.15 Clean surface water from development platform will be collected by the central dished concrete channel within the concrete handling area. This clean surface water will be directed to the existing

surface water lagoon which will in turn discharge to the proposed new reed bed as shown on Drawing Number BKP042017-BRK-003.

3.4 PATHWAYS

3.4.1 A conceptual understanding of the hydrogeological regime in the vicinity of Barracks Farm and the proposed restoration has been derived from an assessment of both published and site-specific information.

3.4.2 The site is mapped as being underlain by clays of the London Clays. The London Clays are classified by the Environment Agency as an 'Unproductive' aquifer and restricts the vertical movement of groundwater as the permeability is anticipated to be relatively low.

3.4.3 The regional watercourse network is assumed to be shallow and restricted to localised alluvium or other sand and gravel deposits, i.e. River terrace Deposits which are mapped in the region.

3.4.4 There exists the potential for leachate generation, where rainfall comes into contact with the inert material. The resultant quality of the leachate will be directly dependant on the nature of the waste material. The sole water input is expected to be effective rainfall (infiltration) into the bund following a period of rainfall.

3.4.5 Rainwater that does infiltrate through the waste has the potential to generate small quantities of leachate which would migrate vertically towards the base. Leachate generated will permeate vertically through the underlying low permeability London Clays where contaminant concentrations will be subject to attenuation (reduction in concentration) by retardation processes such as sorption, chemisorption, absorption and cation exchange. Leachate concentrations will be further subject to retardation and attenuation (of contaminant mass) as leachate vertically migrates through the un-saturated portion of the underlying inert waste materials.

3.4.6 Rainwater which does not infiltrate through the waste will be captured within a central concrete channel within the plateau hardstanding area and will be directed to the existing lagoon which in turn will discharge to the new reed bed system. Site levels are to be engineered to facilitate gravity flow to the lagoon and reed bed.

3.4.7 The underlying deep White Chalk Supergroup aquifer is protected by a significant thickness of the London Clay Formation.

Groundwater Levels

3.4.8 Groundwater levels at the site cannot be confirmed due to the lack of installed boreholes or piezometers. Borehole records held by BGS surrounding the site generally did not report groundwater within the clay aquifer. The closest borehole record to report water seepage (at 16mbgl) is located c.

1.2 km west-northwest of the site. No time series groundwater elevation data is available for the site or surrounding area.

3.4.9 Due to the lack of recorded groundwater strikes within the wider vicinity available within the historical boreholes logs there is insufficient data to estimate groundwater elevations across the Site with a reasonable degree of confidence.

3.4.10 On a regional scale, groundwater elevations in the underlying bedrock are assumed to fall broadly east with the occasional northern influence.

Baseline Groundwater Quality

3.4.11 As no borehole installations are located within the boundary of the site, no representative groundwater samples have been obtained. Generally, water from these aquifers can be ferruginous.

3.5 RECEPTORS

3.5.1 The following are considered to represent potential receptors for any leachate generated from the proposed infilling Barracks Farm:

- River Mole; breakouts from the infilled material (particularly during infilling) have the potential of becoming surface run-off feeding into the river downgradient of the site.

3.5.2 Based on the lack of historical groundwater levels available in borehole logs surrounding the site, the site is unlikely to be in continuous hydraulic connection with perched groundwater within the underlying London Clay Formation. As such, groundwater on site is not considered to be connected to the nearby surface water bodies or rivers.

3.5.3 The majority of precipitation is anticipated to leave the site as surface water run-off and will be collected in designated channels for discharge to the existing lagoon and ultimately the reed bed system. As the lagoon and reed bed system are outside of the proposed recovery footprint and are artificially maintained, they are not considered to be hydraulically connected with any perched groundwater within the London Clay Formation.

3.5.4 The 2No. active consented groundwater abstractions in the wider vicinity (up to 2km away) are not considered to be receiving groundwater from below the site. It is assumed that these bodies receive their groundwater from the underlying Upper White Chalk Formation which is confined at the site below an estimated 45m thickness of the London Clay Formation (based on the graphical CSM created).

3.5.5 Any vertical movement of groundwater will be retarded by the London Clays. Therefore, the site is not considered an active area of recharge for the Upper White Chalk Subgroup which is the Principal Aquifer unit within the wider area.

4 HYDROGEOLOGICAL RISK ASSESSMENT

4.1 THE NATURE OF THE HYDROGEOLOGICAL RISK ASSESSMENT

4.1.1 The EA guidance[13] proposes a tiered approach to risk assessment such that the degree of effort and complexity reflects the potential risk posed by a particular site. The risk assessment starts with risk screening, which is the process used to determine whether a waste operation represents, or potentially represents, a risk to groundwater and surface water resources, and at the planning stage whether the site complies with the EA approach to groundwater protection[14]. The qualitative risk screening should assess whether the potential discharge from your activity is acceptable and whether it will require further assessment as outlined in the guidance[15].

4.1.2 Key aspects of the qualitative risk screening for the site are summarised below:

- The site will accept inert waste only for use in the restoration scheme;
- The site is underlain by the London Clay Formation, a low permeability unproductive aquifer;
- The Upper Chalk formation is classified by the EA as a Principal Aquifer but is overlain by a significant thickness (c. 45 m beneath the site as determined by CSM) of London Clays (unproductive Strata);
- There are 2.No licensed potable drinking water abstractions within 2km of the application site. Due to their location and high abstraction rate these are considered to be abstracting from the Upper Chalk formation and not the London Clay Formation;
- The site is shown to be situated within the Outer Protection Area (Zone 2) of a groundwater Source Protection Zone (SPZ) defined by the EA relating to the potable groundwater abstraction located c.1,800 m southeast of the site, abstracting from the Upper Chalk formation;
- The entire site is to be restored using inert material only which will be subject to a robust Waste Acceptance procedure during the entire operation minimising the risk of producing contaminated runoff during the open phase of restauration;
- Upon completion of infilling of the whole site, infiltration will be limited into the site by the construction of a c. 1m ‘capping’ layer using stripped low permeability clay soils and 0.30m thick topsoil layer;
- The plateau of the site will be developed through the construction of a bunded hardstanding for the storage of manure and erection of two parallel livestock buildings;

[13] Landfill developments: groundwater risk assessment for leachate. DEFRA/EA. 1st February 2016;
[14] The Environment Agency’s approach to groundwater protection. Environment Agency. Version 1.2. February 2018;
[15] Groundwater risk assessment for your environmental permit. DEFRA/EA. Published 1st February 2018. Updated 3rd April 2018.

- The low permeability nature of the London Clays underlying the whole site will act as a natural geological barrier, providing attenuation and retardation of any low-level contaminants derived from the inert waste.

- Surface water run-off is to be collected in in concrete channels in conjunction with raised elevations to allow the flow towards the existing lagoon and ultimately into a new reed bed system.

4.1.3 Based on the above risk screening and in line with current EA guidance, no further assessment is required. The risk screening has demonstrated that while the site is situated in an Outer Protection Zone of a groundwater SPZ the thickness and low permeability of the London Clay Formation beneath the site will protect the underlying chalk aquifer from any leachate migrating from the base of the site.

4.1.4 The proposed development complies with the Environmental Permitting Regulations (2016) and Groundwater Regulations (2009) as it will not result in hazardous substances entering groundwater or surface water and will is unlikely to result in the introduction of non-hazardous pollutants so as to cause pollution to controlled waters. In addition, the proposed restoration of the site is considered to comply with EA's approach to groundwater positional statement F1.

4.1.5 Accidents and their Consequences

4.1.6 Consideration must be given to accidents and their consequences within the HRA. The main potential environmental accidents that could have a bearing on the water environment would be the acceptance of material which falls outside the classification as 'inert'. The acceptance of material other than inert could result in the generation of leachate which could pose a risk to groundwater quality within the chalk aquifer. It is not possible to quantitatively assess the risks from such an event, but any acceptance of restoration material will be in accordance with procedures set out in the Environmental Permit which are designed to minimise this risk.

4.1.7 Provided only inert material is accepted at the site, the probability of an accident occurring that would result in a risk to groundwater quality is considered to be low due to the following:

- Fuel tanks on site will be maintained and inspected in accordance with the manufacturer's recommendations;

- All vehicles delivering water to the landfill must report to the site office and upon request provide evidence of Registration as Waste Carriers;

- All reasonable precautions will be taken to prevent the unauthorised entry of the general public and the unauthorised depositing of wastes;

- The following three stages of waste acceptance detailed in the council Decision will be followed:
  - Basic Characterisation;
  - Compliance Testing; and

- Onsite Verification

- Any load identified as unacceptable will be isolated whilst the Environment Agency in contacted to agree the most appropriate course of action; and,
- Records of rejected loads will be kept and made available to the environment Agency containing the following details:
  - Time and date of incident;
  - Haulier and vehicle registration number;
  - Customer;
  - Waste type; and,
  - Reason for rejection.

5 REQUISITE SURVEILLANCE

5.1 GROUNDWATER

5.1.1 Due to the inert nature of wastes deposited and significant thickness of the London Clay Formation overlying the Chalk aquifer, no groundwater management system is required at the site.

5.2 LANDFILL GAS MANAGEMENT AND MONITORING

5.2.1 A Landfill Gas Risk Assessment (GRA) has not been prepared for the proposed waste recovery operation, as the Landfill Technical Guidance LFTGN03 would suggest the activity would not pose a landfill gas hazard.

6 CONCLUSIONS

6.1.1 Tetra Tech have been commissioned by Oaks Land Management Ltd to undertake a Hydrogeological Risk Assessment (HRA) in support of a Bespoke Recovery Permit relating to their currently held planning permission, reference MO/2017/1198, which allows the importation of 30,000m^3 of inert materials to raise ground levels.

6.1.2 This HRA has demonstrated that while the site is situated in an Outer Protection Area (Zone 2) of a groundwater Source Protection Zone, groundwater within the source aquifer (Upper Chalk) is not at risk from the waste operation due to the significant thickness (c. 45m) of the unproductive London Clay Formation, which acts to confine and protect the underlying chalk aquifer. Surface water runoff is to be directed to an onsite lagoon and further discharged to a reed bed system. Therefore, the input of hazardous concentrations into groundwater would be unlikely and the discharge of non-hazardous substances would be limited in leachate migrating from the inert waste soils. Therefore, the site complies with the requirements Environmental Permitting Regulations (2016) and Groundwater Regulations (2009).

FIGURES

FIGURE 1 – BILL KEAR PLANT AND AGRICULTURAL CONTRACTORS LTD DRAWING BKP042017-BRK-004. PROPOSED SECTIONS

FIGURE 2 – CONCEPTUAL SITE MODEL – CURRENT CONDITION

FIGURE 3 – CONCEPTUAL SITE MODEL – POST RESTORATION

APPENDICES

APPENDIX A – REPORT CONDITIONS

APPENDIX A - REPORT CONDITIONS

This report is produced solely for the benefit of Oaks Land Management and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Tetra Tech. In time, improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX B – GROUNDSURE ENVIRO + GEOINSIGHT REPORT