CLOCKHOUSE QUARRY RESTORATION

Technical Appendix 9/1

Flood Risk Assessment and Surface Water Drainage Strategy

Prepared for: Suez Recycling & Recovery

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1.0 Introduction

SLR Consulting Limited (SLR) has been appointed by SUEZ Recycling & Recovery (SUEZ) to prepare a Flood Risk Assessment (FRA) and outline Surface Water Drainage Strategy (SWDS) in support of a planning application for the restoration, with inert material and soils (waste or non-waste), of Clockhouse Quarry, Horsham Road, near Capel, Surrey, RH5 5JL.

The FRA and SWDS has been prepared under the direction of a Technical Director of SLR who specialises in flood risk, drainage and associated planning matters. It has been prepared in support of a planning application and in particular, it forms a technical appendix to the Water Chapter (Chapter 9) in the Environmental Statement (ES) accompanying the planning application. The FRA and SWDS has been completed in accordance with guidance presented within the National Planning Policy Framework[1] (NPPF) and its associated Planning Practice Guidance[2] (PPG). Current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[3] have also been taken into account.

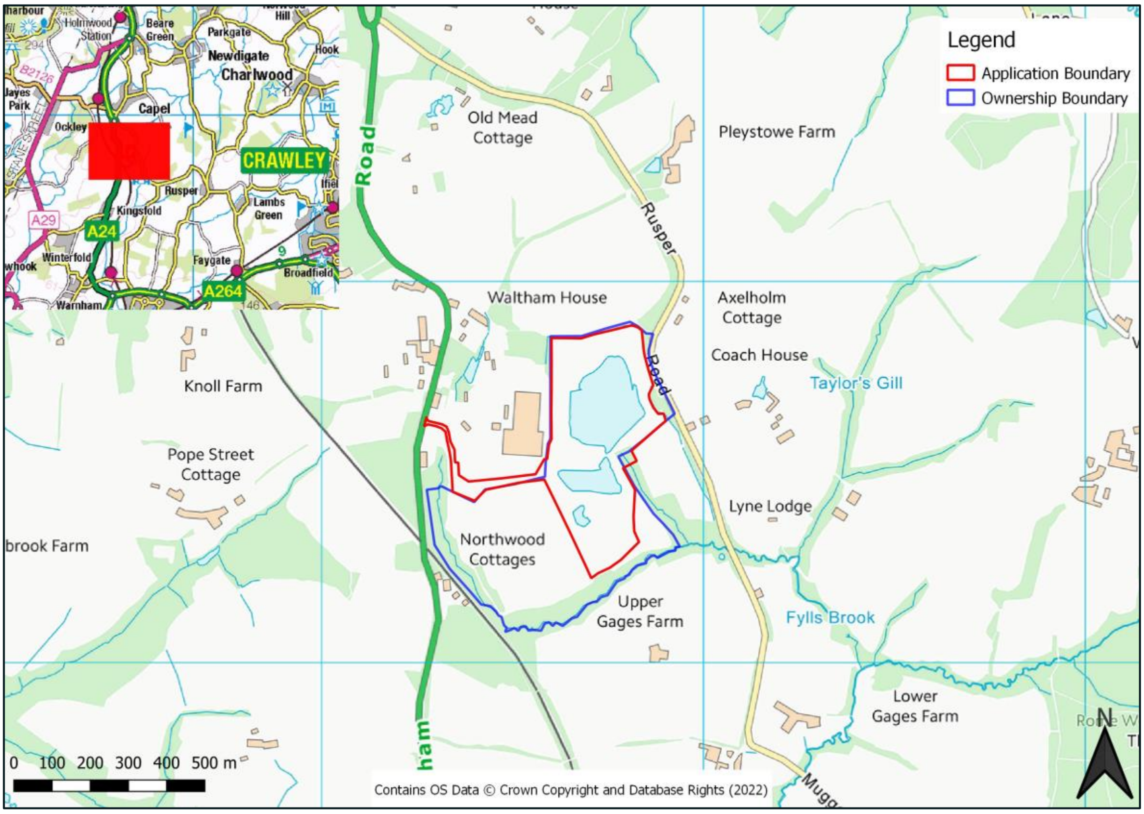
This version of the report has been updated in November 2023, to reflect changes in the proposed drainage strategy. Whilst these have not altered the overarching strategy, this report and the drawings supersede the previous versions. There are no updates undertaken to the Flood Risk Assessment, which was completed in December 2022.

1.1 Site Location

The application site (to which the planning application relates, see Chapter 2 in the ES) is located about 1.3km south of the village of Capel in Surrey and is centred on National Grid Reference (NGR) TQ (51) 17712, 38558. A site location plan is provided in Figure 1-1.

1 Ministry of Housing, Communities & Local Government, National Planning Policy Framework, March 2012, updated September 2023
2 Planning Practice Guidance for Flood Risk and Coastal Change: Communities and Local Government, March 2014, updated August 2022
3 BS8533:2017, Assessing and managing flood risk in development. Code of practice, December 2017

Figure 1-1
Site Location Plan



Access to the application site is from the A24 (Horsham Road) which is located to the west of the site. The access is shared by the Brickworks site (currently not used) which bounds the northern half of the site to the west. The southern half of the application site is bounded by an area of already restored landfill to the west that falls within the ownership of SUEZ. To the north is arable agricultural land and Rusper Road forms the eastern boundary of the northern part of the site. In the southern half of the application site the eastern boundary is formed by ancient woodland which contains an unnamed watercourse (a tributary of Fylls Brook). Between this and Rusper Road is another arable field. The southern ownership boundary is formed by more woodland which includes the course of Fylls Brook. Additionally there is a railway line parallel to the southwest ownership boundary.

The Surrey County Council are both the Waste Planning Authority and the Lead Local Flood Authority (LLFA), who are responsible for managing the flood risk from surface water locally.

2.0 Baseline Conditions

2.1 Existing Site

As can be seen in Figure 2-1, the existing site has previously been quarried and there is a large, flooded void within the northern area of the application site. In the south of the application site there are a number of pond features; this section of the site is covered in poor quality scrub and includes piles of overburden.

Figure 2-1
Aerial Imagery of the Site

2.2 Topography

Topographic data, gathered using Light Detection and Ranging (LiDAR) aerial photogrammetric techniques, has been downloaded from the Environment Agency (EA) open data website[4] (Figure 2-2 and Figure 2-3) and provides information on the topography of the application site and locale. Additionally a survey of the worked out levels is provided in Appendix 01.

The valley of Fylls Brook, which borders the application site to the south is the dominant topographical feature in the area. There is an area of higher elevation land located to the north of the application site, which has an elevation of up to about 110m above Ordnance Datum (AOD). Prior to quarrying the natural slope in the vicinity

4 Environment Agency open data website, http://environment.data.gov.uk

of the application site was from this higher land toward Fylls Brook to the south that has an elevation of about 74.4mAOD within the valley.

There is a railway line located to the southwest of the ownership boundary and maintains a levels of about 86mAOD.

Figure 2-2
Digital Terrain Model – Regional Scale

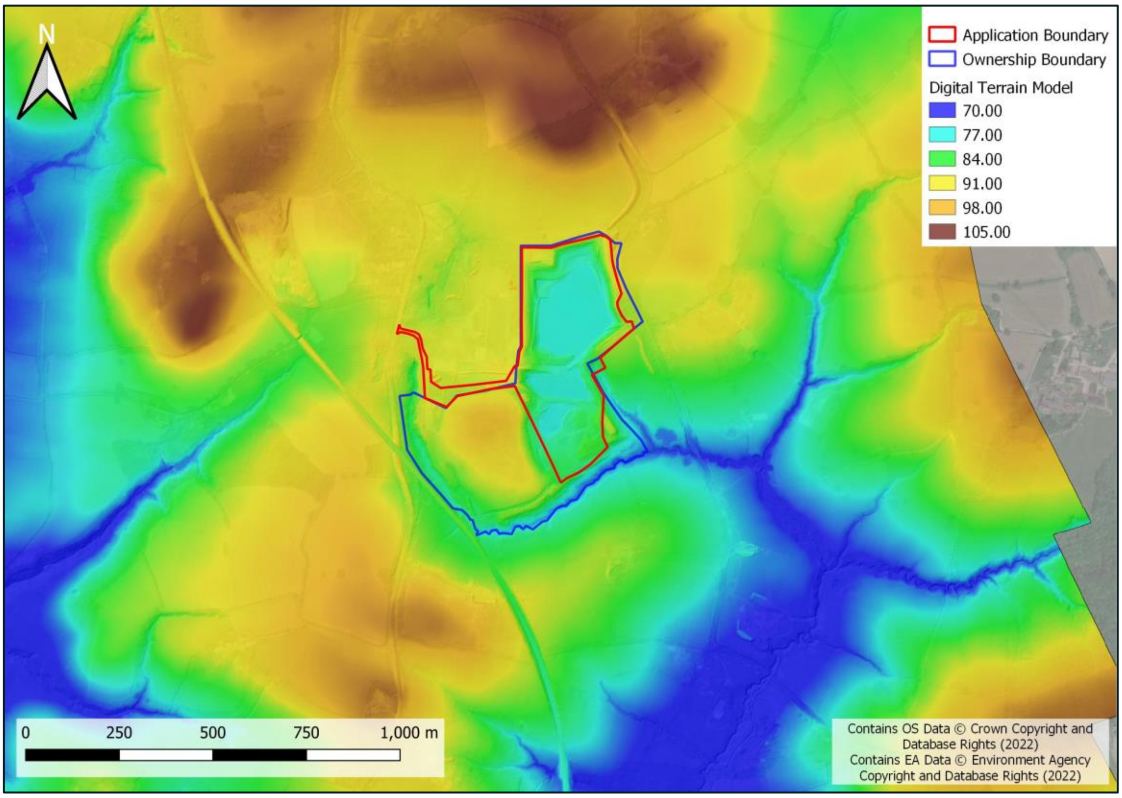
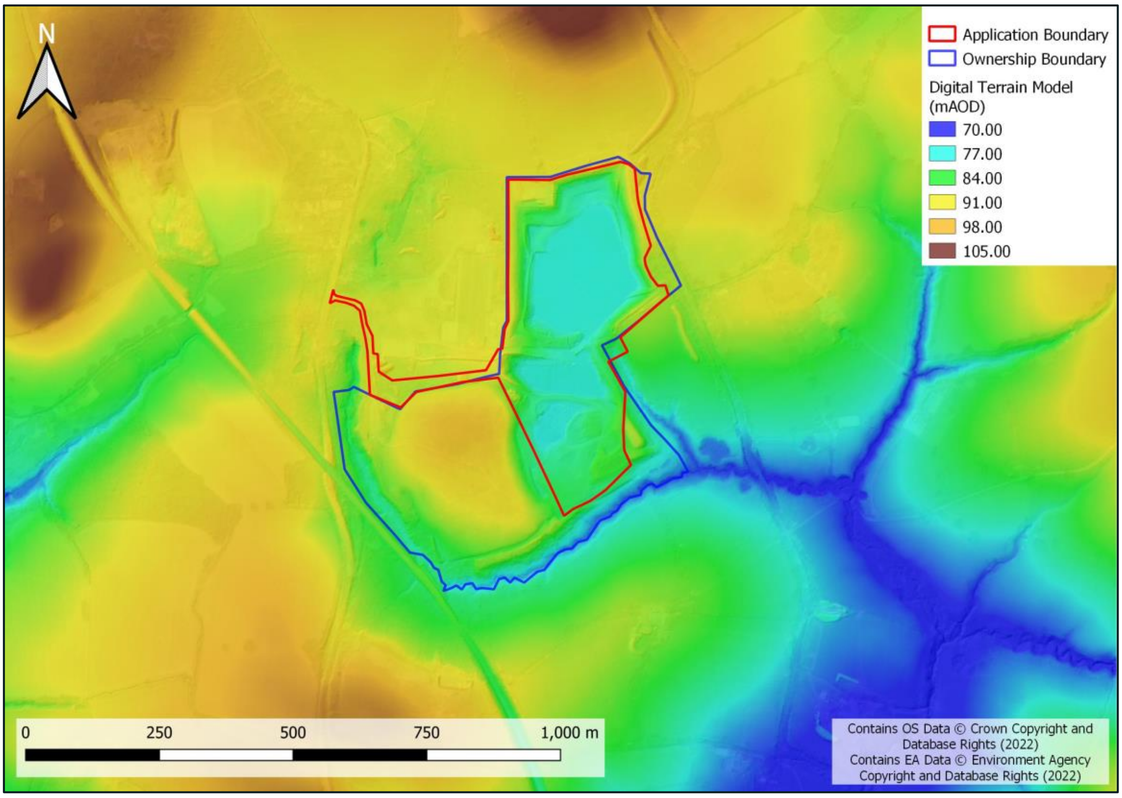


Figure 2-3
Digital Terrain Model – Local Scale



Elevations across the land within the ownership boundary have been significantly reworked as a result of the quarrying operations at the site. The southwest corner of the ownership boundary has already been restored by infilling with non-hazardous wastes to form a raised mound with a crest elevation of approximately 97.2m AOD. This is the highest area within the ownership boundary.

Currently there are several voids across the application site which have lower levels than surrounding areas. The water level in the three main voids was approximately 77.4m AOD when the survey was taken (2019). The southeast corner of the application site is raised with an elevation of 84.6m AOD. There is a small pond towards the top of this higher area that has a water level of 84.7mAOD. The highest elevation within the application site is located within the north west corner, which has an elevation of about 90.7mAOD.

2.3 Hydrology

Locally mapped surface water features are shown in Figure 2-4.

Along the south western ownership boundary is an *Ordinary Watercourse* called Clock House Gill. Adjacent to the site access, this has an upstream catchment[5] of 0.68km^2 and includes the brickworks site to the northwest of the application site, the A24 and agricultural land. Although it could not be observed during a site walkover survey this is assumed to be culverted between the mapped locations shown in Figure 2-4 starting about 70m north of the access road.

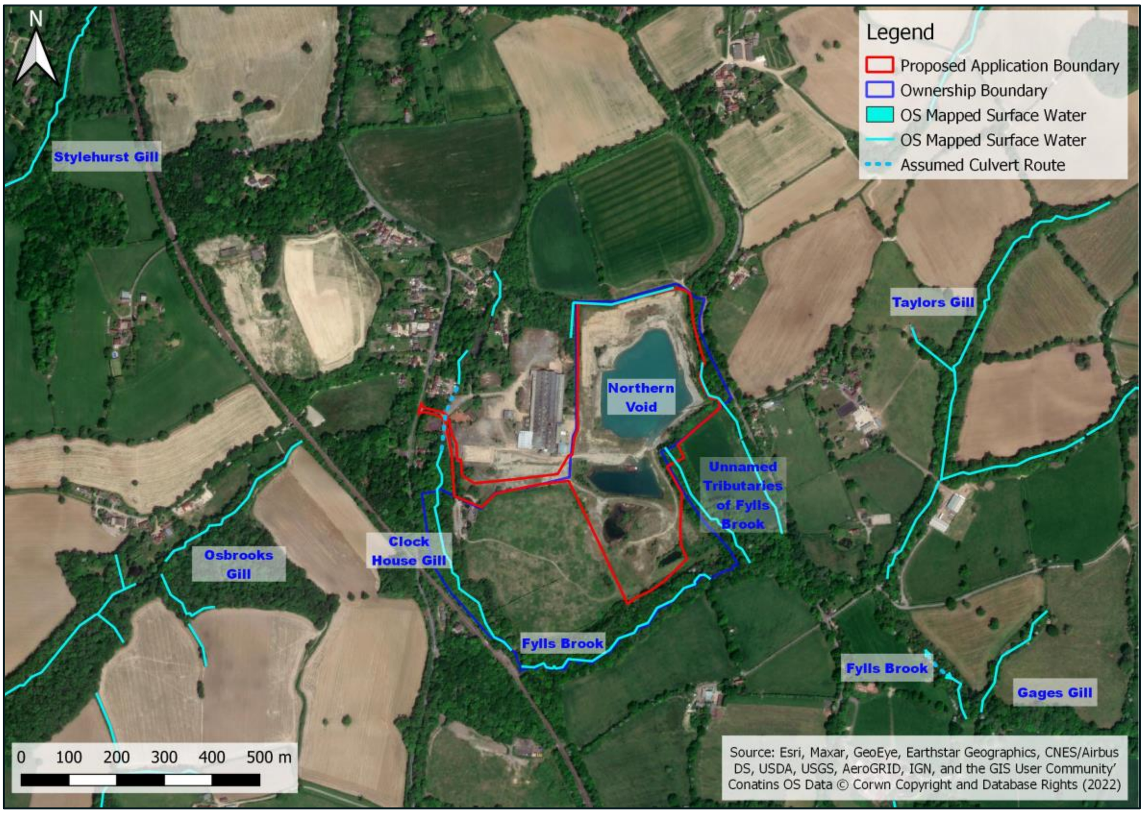
Clock House Gill flows south and becomes Fylls Brook in the southwestern corner of the ownership boundary. There are no reports indicating whether this watercourse is ephemeral or perennial. However, during a site visit

5 UK Centre for Ecology & Hydrology, Flood Estimation Handbook Web Service, https://fehweb.ceh.ac.uk/Map, Accessed August 2022

in mid-September 2022 following a relatively dry period, flow was observed within these watercourses. Given the local geology, this baseflow will be relatively low with a significant proportion of flow coming during rainfall events. Fylls Brook flows east past the application site before meandering around to the south. It joins with a number of other tributaries becoming a designated Main River circa 1.5km south of the application site as Boldings Brook.

There is an unnamed tributary of Fylls Brook which rises in the centre of the eastern boundary of the application site. While the original catchment of this tributary has now all been quarried, pumped flows from the existing quarry are discharged intermittantly to this channel under consent number P.12567/S/05. There is a second unnamed tributary of Fylls Brook that starts from the south east corner of the northern area of the application site. During the site walkover, no significant flow was observed in the upstream end of this watercourse.

Figure 2-4
Local Hydrological Features



There are other tributaries of Fylls Brook in the vicinity, but downstream, of the application site. These include:

- Taylors Gill about 300m east of the application site; and
- Gages Gill about 585m south east of the application site.

There are two other watercourses close to the application site, which rise on the west side of the railway line and flow away from the application site (Osbrooks Gill and Stylehurst Gill). No flow from the application site would enter these watercourses.

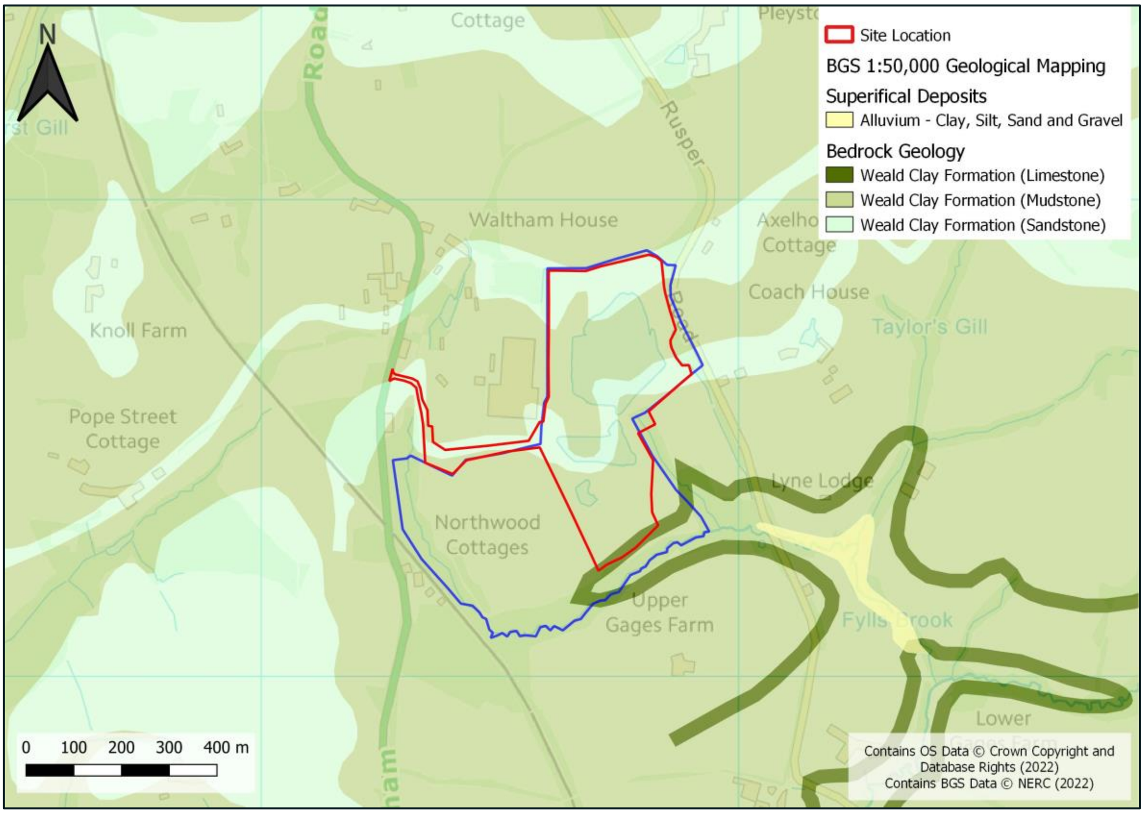
2.4 Geological and Hydrogeological Features

2.4.1 Geology

The application site is a former quarry, supplying mudstone and clays for the adjacent brickworks. The previously restored area in the southwest of the ownership boundary consists of non-hazardous waste material, capped and covered in soils and vegetation.

Mapping published by the British Geological Survey[6] shows that the site is underlain by Weald Clay bedrock predominantly of mudstone type with some bands of sandstone and limestone in the southeast corner of the application site. This is supported by BGS borehole records which indicate clay to a depth of 376 feet (114.6m). There are no superficial deposits indicated at the application site.

Figure 2-5
Local Geology



2.4.2 Hydrogeology

The sandstone and limestone bands of the Weald Clay are indicated to be Secondary A aquifers[7]. These are defined as *"permeable layers that can support local water supplies, and may form an important source of base flow to rivers"*. The mudstone beds that dominate the site, however, are designated as unproductive strata.

6 British Geological Survey, BGS Geology Viewer, https://geologyviewer.bgs.ac.uk/?_ga=2.26580157.1410893641.1659691616-1009770412.1659691616, Accessed August 2022
7 Natural England, Magic Map Application, https://magic.defra.gov.uk/magicmap.aspx, Accessed August 2022

The nearby borehole record recorded a resting water level in June 1931 as 43 ft (13.1m) below ground level. Lateral groundwater flow would be within the limestone and sandstone members however, these typically have a limited extent reducing their potential for abstraction.

The 2001 Hydrogeological Risk Assessment[8], which included further review of the geology of the site states that the site is underlain by up to 120m of Weald Clay. Although the stratigraphic column consists of occasional sandstone and limestone lenses, extensive borehole logs held by SUEZ for the site do not provide any evidence of sandstone or limestone being present.

The application site does not fall with any source protection zones (SPZ)[7].

8 SITA, Capel Landfill Site, Regulation 15 Hydrogeological Risk Assessment, March 2001

3.0 Policy Status for the Proposed Development

3.1 Development Proposals

The proposed development of the site consists of the restoration of worked-out areas of the Clockhouse Quarry. This would involve the importation of inert material to partially infill the voids on the site and create a naturalised profile that slopes to a series of shallow ponds. A proposed restoration plan is presented in Appendix 02.

3.2 Flood Zone Classification

The definition of EA Flood Zones is provided in PPG *Table 1: Flood Zones*:

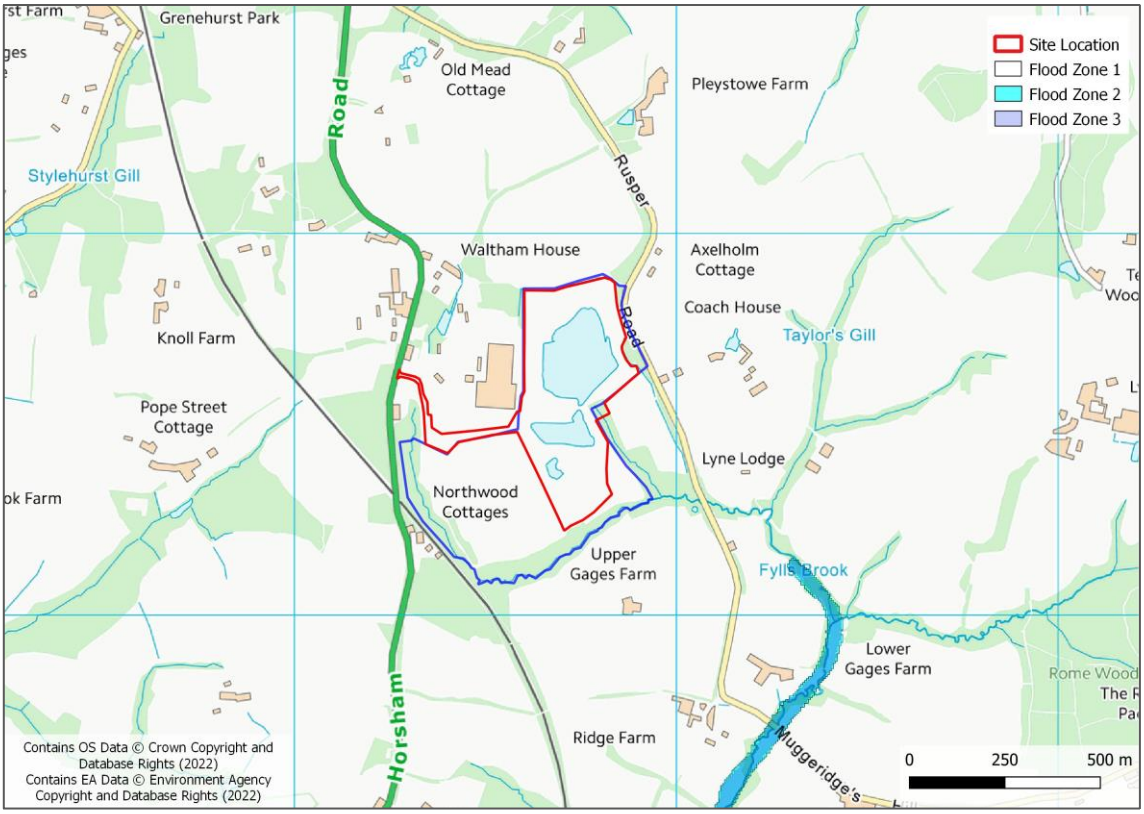
- *Zone 1 - Low Probability* (Flood Zone 1) is defined as land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1% annual probability of occurrence (1:1,000 year) i.e. considered to be at 'low probability' of flooding.
- *Zone 2 - Medium Probability* (Flood Zone 2) is defined as land which could be at risk of flooding with an annual probability of occurrence between 1% (1:100 year) and 0.1% (1:1,000 year) from fluvial sources and between 0.5% (1:200 year) and 0.1% (1:1,000 year) from tidal sources i.e. considered to be at 'medium probability' of flooding.
- *Zone 3a - High Probability* (Flood Zone 3a) is defined as land which could be at risk of flooding with an annual probability of occurrence greater than 1% (1:100 year) from fluvial sources and greater than 0.5% (1:200 year) from tidal sources i.e. considered to be at 'high probability' of flooding.
- *Zone 3b - the Functional Floodplain* (Flood Zone 3b) This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:
    - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
    - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).
    - Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

In assessing the boundary between Flood Zones 1, 2 and 3, the protection afforded by any flood defence structures, and other local circumstances, is not taken into account by the Environment Agency.

Based upon data from the Flood Map for Planning[9] (Figure 3-1) the application site is located in Flood Zone 1 with the nearest area of Fylls Brook being located about 480m southeast of the application site. This is supported by mapping included within the Strategic Flood Risk Assessment (SFRA)[10].

9 Environment Agency, Flood Map for Planning, https://flood-map-for-planning.service.gov.uk/, Accessed November 2022
10 JBA Consulting, Reigate & Banstead Borough Council, mole Valley District, Council and Tandbridge District Council, level 1 Strategic Flood Risk Assessment, Final Report, December 2017

Figure 3-1
Extract of the Flood Map for Planning



3.3 Planning Policy

This FRA report has been completed in accordance with the guidance presented in the NPPF[1] and with reference to PPG[2]. The NPPF states that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and develop policies to manage flood risk from all sources taking account of advice from the EA. It is crucial that Local Planning Authorities consider the risks posed by flooding within their boundary when determining planning applications.

As stated within the Surrey Waste Local Plan **Policy 14 - Protecting Communities & the Environment**

"Planning permission for waste development will be granted where it can be demonstrated that:…

B) It would not result in unacceptable impacts on communities and the environment. The term 'unacceptable impact' should be interpreted in accordance with current national and local planning policy and planning guidance relevant to each of the following matters:…

iv) The Water Environment including:

- *Flood risk (arising from all sources), including impacts on, and opportunities to provide and enhance, flood storage and surface water drainage capacity; and*
- *Water resources, including impacts on the quantity and quality of surface water and groundwater resources, taking account of Source Protection Zones, the status of surface watercourses and water bodies and groundwater bodies."*

3.3.1 Sequential Test

With reference to the NPPF, the Sequential Test gives preference to locating new development in areas that are at lowest risk of flooding (i.e. Flood Zone 1). The EA flood map for planning (Figure 3-1) and SFRAs are geared to providing the basis for applying this test.

The Sequential Test requires developers to:

> *"…. the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding."*

As the application site is located within Flood Zone 1, the lowest flood risk zone, the proposals are deemed to satisfy the requirements of the NPPF 'Flood Risk' Sequential Test.

3.3.2 Exception Test

With reference to PPG Table 3: Flood risk vulnerability and Flood Zone 'compatibility' (reproduced as Table 3-1) the flood risk vulnerability of the proposed development is deemed appropriate and compatible for the Flood Zone in which it sits. This is in accordance with NPPF, and the Exception Test need not be applied in this instance.

Table 3-1
Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (PPG Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
	Zone 3b (functional floodplain)	Exception Test Required	x	x	x	✓

Key: ✓ Development is appropriate x Development should not be permitted

This FRA considers flood risks from all sources and concludes that development at this site is appropriate and provided that measures outlined in the assessment are applied, should be sustainable and safe in flood risk terms. Based on the above information the proposed development meets the requirements of the Exception Test as set out in NPPF, were it to apply.

3.4 Climate Change

In February 2016, the EA issued guidance[11] on the impacts of climate change on flood risk in the UK to support NPPF[1]. This was most recently updated in May 2022 and the advice sets out that peak rainfall intensity, sea level, peak river flow; offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change. Consideration of the changes to these parameters should including within a Flood Risk Assessment using the allowances outlined below.

Given the location of the application site remote from the sea and larger watercourses only changes to peak rainfall are only of relevance in this assessment.

The guidance acknowledges that there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, the document provides estimates of possible changes that reflect a range of different emission scenarios and different timeframes (i.e. expected development lifetimes).

Peak Rainfall Intensity

For peak rainfall intensity, guidance states that flood risk assessments for developments with a lifetime beyond 2100 (i.e., the restored landform), the upper end allowance for the 2070s epoch should be used. As detailed in Table 3-2, for the 1% annual exceedance probability event this equates to a 45% uplift.

Table 3-2
Peak Rainfall Intensity Allowances

Management Catchment	Annual Exceedance Probability (%)	Allowance Category	Total potential change anticipated for the 2050s	Total potential change anticipated for the 2070s
Arun and Western Streams	3.3	Upper End	35%	40%
		Central	25%	40%
	1	Upper End	45%	45%
		Central	20%	25%

11 Environment Agency, Flood risk assessments: climate change allowances, https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, Updated May 2022

4.0 Flood Risk

4.1 Methodology and Best Practice

This FRA report has been prepared in accordance with the advice and requirements prescribed in current best practice documents relating to management of flood risk in development published by the Construction Industry Research and Information Association (CIRIA)[12], and British Standard BS8533[3].

A screening study has been completed to identify whether there are any potential sources of flooding at the application site which may warrant further consideration. If required, any potential significant flooding issues identified in the screening study are then considered in subsequent sections of this assessment.

4.2 Screening Study

Potential sources of flooding include:

- Flooding from the sea or tidal flooding;
- Flooding from rivers or fluvial flooding;
- Flooding from surface water and overland flow;
- Flooding from groundwater;
- Flooding from sewers and water supply pipes;
- Flooding from reservoirs, canals, and other artificial sources; and
- Flooding from infrastructure failure.

The flood risk from each of these potential sources is discussed below and summarised in Table 4-1.

4.2.1 Flooding from the Sea or Tidal Flooding

The application site is remote from the seas and is located at an elevation of over 70m AOD and therefore is not at risk from flooding from the sea and tidal flooding.

4.2.2 Flooding from Rivers or Fluvial Flooding

As discussed in Section 3.2, the application site is located in Flood Zone 1, which is defined as land defined as having a less than 0.1% AEP of flooding from fluvial sources. However, it is noted that the watercourses adjacent / within the ownership boundary are unlikely to be included within the Flood Map for Planning due to their limited catchment size.

As discussed in Section 2.3, the catchments of these watercourses are limited and they are located within oversized valleys.

The highest of these small watercourses is Clock House Gill with an elevation of approximately 83.1mAOD where is enters the ownership boundary in the northwest. However, the application site in this area has an elevation of approximately 90.7mAOD and therefore would is not considered to be at risk of flooding from this source. It is noted that this passes through a culverted section beneath the site entrance circa 70m north of the application site boundary. Whilst it is possible that blockage or surcharging could result in excess flows following topographic gradients across the access road, the risk is considered to be relatively low. There are a number of small

12 CIRIA Report C624, Development and flood risk: guidance for the construction industry

topographic lows that would likely fill with the water prior to reaching the site entrance. The water would likely be shallow and pass into the watercourse to the south of the access. The risk would be similar to that of surface water flow from the north, which is considered further in Section 4.2.3.

The unnamed tributary of the Fylls Brook to the east of the application site slopes steeply away from the application site and flows within this watercourse would be generated from the application site, therefore the risk of fluvial flooding from this course is negligible.

Fylls Brook itself, located to the south of the application site, is over 10m lower than the existing elevations (i.e. lower than proposed at any point through the restoration) in this area. Flooding from this source is therefore also considered negligible.

4.2.3 Flooding from Surface Water Flooding

Due to the natural topography of the region as discussed in Section 2.2, the main area of higher ground local to the application site is to the north. Any overland flow from this direction would flow towards the application site. The raised bund immediately to the north of the application site would intercept any such flows and prevent surface water progressing onto the application site from this direction.

During a site walkover survey in September 2022, it was observed that this area to the north has had initial preparation for permitted quarrying. This included the construction of surface water channels that collect runoff from that land and route it into a shallow depression planted with plant species typical of wet / damp land to the north of the application site. Levels then rise up along the northern boundary of the application site creating a slight ridgeway. It is assumed that the outlet from the depression would be into Clockhouse Gill to the northwest of the application site.

Long Term Flood Risk Information (LTFRI)[13] provided by the EA includes mapping of surface water flood risk. Surface water modelling has been undertaken in order to seek to establish areas at risk of surface water flooding based upon latest hydrological techniques and surface terrain data.

An extract of the map for the application site and surrounding area is presented in Figure 4-1 where the EA define the surface water flood risk categories as:

- **Very Low:** less than 1 in 1,000 annual probability of flooding in any given year;
- **Low:** less than 1 in 100 annual probability but greater than or equal to 1 in 1,000 annual probability of flooding in any given year;
- **Medium**: between 1 in 100 annual probability and 1 in 30 annual probability of flooding in any given year; and
- **High:** greater than 1 in 30 annual probability of flooding in any given year.

The flood mapping supports the general conceptual understanding of the surface water flood risk; however, it does indicate a surface water flow path into the north eastern corner of the application site. As discussed above the area to the north of the application site has already been prepared for permitted quarrying with the construction of a bund preventing surface water flow into this corner. Even during a very extreme 1 in 1,000 (0.1% AEP) flood event, the anticipated depth of the surface water flow pathway is less than 300mm. This flood risk is therefore not considered significant.

Additionally, there is an area to the north of the west side of the application site (the access road) that is shown to be at high risk of surface water flooding. The high risk area is not indicated to cross into the application site.

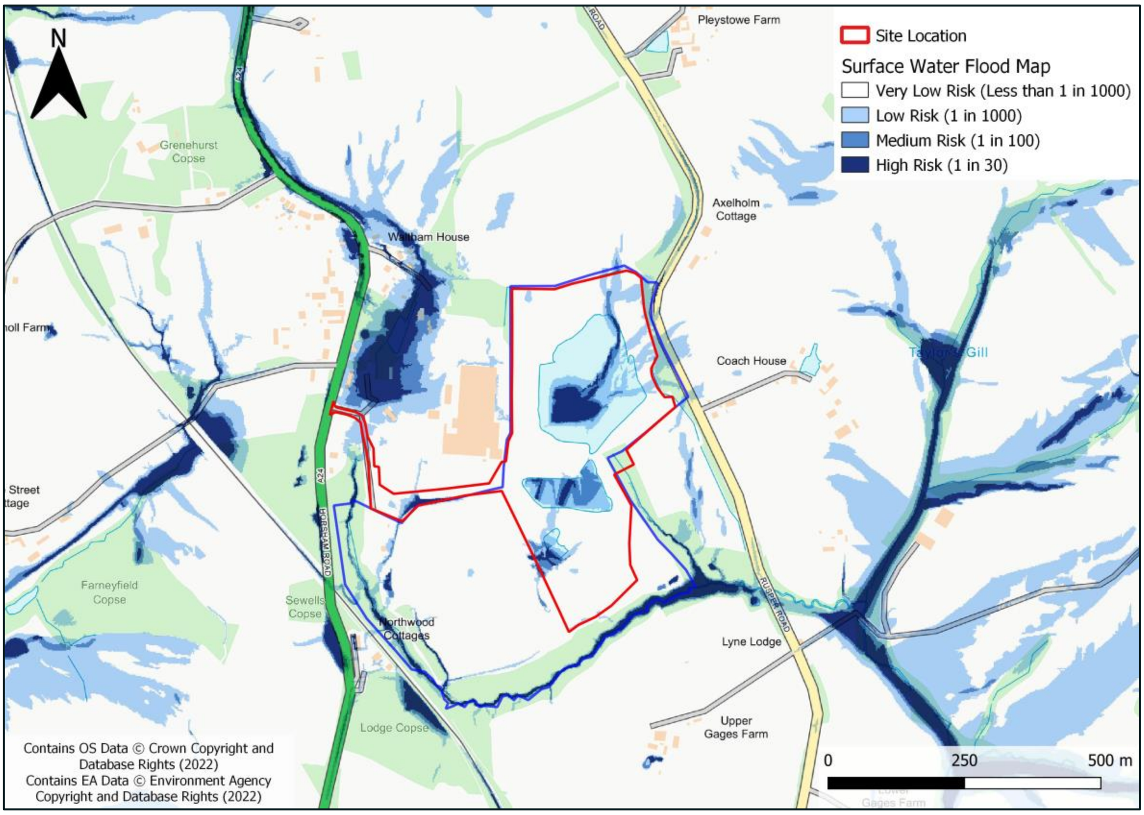
13 Environment Agency, Long Term Flood Risk Information Service: https://flood-warning-information.service.gov.uk/long-term-flood-risk

Review of the topography and hydrology, it is assumed that there is a culverted pipe beneath the access road allowing water to pass into Clock House Gill. This would reduce the flood risk of this area.

If this culvert does not exist or becomes blocked surface water would overtop from the area to the north and weir over the road entering Clock House Gill. No changes are proposed to the access road under this application and the flood risk would be the same as currently occurs. This has not caused any issues during the quarrying operations at the site and therefore is considered to pose an insignificant risk to the proposed development.

The risk of surface water flooding is considered manageable and does not prohibit the proposed development.

Figure 4-1
Extract of EA Surface Water Flood Map



4.2.4 Flooding from Groundwater

As discussed within Section 2.4.2, the underlying geology has low permeability and therefore groundwater flow and storage are minimal and therefore, there is not a significant groundwater flood risk.

Naturally, the depth of the voids means they contain surface water / groundwater. Prior to infilling commencing, this would be dewatered over a period of between 87 days to 102 days depending on the season. During the operational phase, in which infilling is occurring, dewatering would be undertaken as required to remove rainwater and any small inflows of groundwater. Both the initial dewatering and ongoing dewatering would be carried out under the existing discharge consent for the site. Discharge Consent P.12567/S/05 permits the discharge of up to 2,160 m^3/day (at a rate not exceeding 25 l/s) to the unnamed tributary of the Fylls Brook at NGR TQ 1779 3854, immediately south of the northern void. This discharge would not differ from the existing drainage scenario.

The risk from groundwater flooding is therefore negligible and not considered further.

4.2.5 Flooding from Sewers and Water Mains

The application site is a former quarry and there are no public sewers or water mains passing through the site. Given the rural nature of the site and extent of the existing mineral planning permission, it is unlikely that there are any public sewers or water main directly to the north of the application site (i.e. within the area where a surcharge, burst or failure could result in water progressing into the application site).

Furthermore, even if there was sewer or water mains in this location, a failure would pose a lower risk than from surface water which has already been assessed as low above. Flows would naturally follow the same route.

The risk of flooding from sewer and water mains are considered to be very low to negligible and no further assessment is required.

4.2.6 Flooding from Reservoirs, Canals and other Artificial Sources

The application site is not indicated to fall within the flood extent of a failure from reservoir. There are no canals or other artificial source in the vicinity of the application site. The risk of flooding from these sources is negligible.

4.2.7 Flooding from Infrastructure Failure

There are no flood defences or pumping stations local to the application site that the failure of which would result in flood water progressing to the application site. The flooding from this source is considered negligible.

4.3 Summary of Flood Screening

Table 4-1 summarises the flood screening assessment.

Table 4-1
Potential Risk Posed by Flooding Sources

Potential Source	Potential Significant Flood Risk at Site?
Sea or Tidal Flooding	No
Rivers or Fluvial Flooding	No
Surface Water and Overland Flow	No
Groundwater	No
Sewers and Water Mains	No
Reservoirs, Canals and other Artificial Sources	No
Infrastructure Failure	No

5.0 Surface Water Drainage Strategy

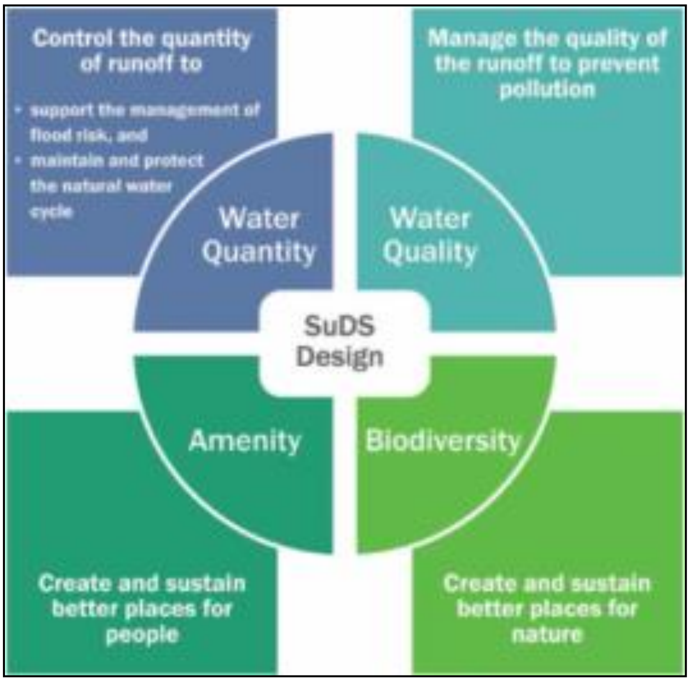
Detailed drainage design will be undertaken post-planning in line with the basic approach outlined within this assessment. At that point full drainage infrastructure designs will be prepared and submitted to Surrey County Council, in their role as Lead Local Flood Authority (LLFA), for approval.

5.1 Key Principles of Surface Water Management

5.1.1 Overview

Current best practice guidance document, The SuDS Manual (CIRIA Report C753)[14], promotes sustainable water management through the use of sustainable drainage techniques (SuDS). There are four main categories of SuDS which are referred to as the 'four pillars of SuDS design' as depicted in Figure 5-1.

Figure 5-1
Four Pillars of SuDS (extract from CIRIA Report C753)



The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train'. The hierarchy of techniques is identified as:

- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
- **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).

14 Report C753, The SuDS Manual; CIRIA (2015). Report C753, November 2015.

- **Regional Control** – management of runoff from several sites, typically in a retention pond or wetland.

5.1.2 National Policy Context

Current national planning policy guidance and best practice, namely NPPF and PPG, require development proposals in all Flood Zones to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

5.1.3 Local Policy Context

As discussed in Section 3.3, adopted policy indicates that sustainable drainage systems should be utilised to avoid an increase in potential off-site flood risk. Further guidance is provided in the Surrey County Council Guide to Sustainable Drainage in Planning[15].

5.2 Existing Surface Water Drainage Regime

In the vicinity of the voids, surface water runoff drains by gravity into the voids. Water is then either lost through evaporation, lost into surrounding ground (very minimal due to geology) or pumped and discharged under the consented discharge to the unnamed tributary of Fyll's Brook to the south of the north area of the application site. The consented discharge is for 2,160 m^3/day (at a rate not exceeding 25 l/s),

Away from the voids, as well as for the whole site prior to the quarrying, runoff from the majority of the application site would flow southwards and into Fyll's Brook and the unnamed tributary on the eastern side of the application boundary.

Currently there is an area of previously restored land to the west of the application boundary. The landform of this area creates an area of land that during extreme rainfall events could route water onto the application site. This area is therefore conservatively assumed to drain to the proposed drainage strategy.

A technical memorandum[16] on a "do nothing" scenario is provided in Appendix 04.

5.2.1 Greenfield Runoff Rates

Greenfield runoff rates for the application site were estimated through application of the Revitalised Flood Hydrograph Model (ReFH2). ReFH2 is recommended by the EA as an appropriate methodology for estimating flood peaks and hydrographs for small catchments[17]. The parameters applied for the ReFH2 model have been reviewed and are appropriate for a sloping site underlain by Weald Clay. The high proportion of runoff predicted is also supported anecdotally by the observations made by local residents during public consultation of high surface water runoff in the area.

Older methodologies such as IH 124 have been reviewed and poorly represent the site. Furthermore, best practice would be to use the more recent methodology that have a higher resolution base data set.

The ReFH2 method has been applied using 'The Revitalised Flood Hydrograph' modelling tool within Micro Drainage using FEH parameters (obtained from FEH webservice for 1km grid) for a 1ha area. The results are summarised in Table 5-1 below and full results for 1ha area are included in Appendix 03.

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15 Surrey County Council, Guide to Sustainable Drainage in Planning, https://www.surreycc.gov.uk/community/emergency-planning-and-community-safety/flooding/more-about-flooding/suds-drainage/drainage-guidance

16 SLR, Surface Water Runoff "Do Nothing" Scenario Technical Memorandum, June 2023

17 Environment Agency, Estimating flood peaks and hydrographs for small catchments: Phase 1, Project: SC090031, May 2012

Table 5-1
Greenfield Runoff Analysis

Annual Probability	Site Greenfield Runoff Rate (l/s/ha)
100%	9.9
50%	11.4
3.3%	26.1
1%	33.6

The equivalent greenfield runoff rates for the application site (15.30 ha) are shown in Table 5-2 and the restoration area (approximately 10.8 ha).

Table 5-2
Equivalent Greenfield Rates for Proposed Contributing Catchments

Annual Probability	Restored Area Runoff Rate (l/s)	Total Site Greenfield Runoff Rate (l/s)
100%	122	152
50%	141	175
3.3%	322	400
1%	414	515

5.3 Constraints on the use of SuDS

5.3.1 Geology

As discussed in Section 2.4, the application site is underlain by geology of the Weald Formation. The majority of the application site is underlain by mudstone members of the group. There is not sufficient permeability within this geology to allow infiltration techniques.

Furthermore, the application site has been significantly quarried and the near surface geology post restoration would essentially be made ground. Infiltration through made ground is not considered good practice for geotechnical reasons.

5.3.2 Restoration

The restoration material would consist of inert fill material (waste or non-waste), topped with soil and vegetated with a mosaic of different habitat types. The soil although imported would have similar characteristics to the natural soils.

5.3.3 Topography

As discussed in Section 2.2, prior to quarrying the site would have sloped towards Clockhouse Gill on the west, Fylls Brook in the south and the unnamed tributary in the east. In order to manage the surface water as a single system and to allow for the creation of biodiverse habitats, the restoration scheme routes the surface water towards the centre of the application site and then discharges to the unnamed tributary on the east side of the site.

5.3.4 Biodiversity and Amenity

The surface water drainage scheme has also been developed in line with the wider landscape and ecology constraints to deliver the maximum number of benefits.

To achieve this water bodies have been designed to have gentle slopes at the edges with shallow marginal areas where reeds can grow and deeper (>1m water depth) water in the centre where open water would be preserved. The system has also been designed to avoid large water level variation.

Additionally, the surface water strategy routes water to the existing discharge location which, during wetter periods, provides a baseflow within a small watercourse flowing within the area of ancient woodland. This watercourse would have received runoff from the majority of the site prior to the quarrying and ensuring that the base flows are maintained in the channel will preserve the character and quality of this important habitat.

5.4 Proposed Discharge Arrangements

With reference to the SuDS Manual, the hierarchy of preferred disposal options for surface water runoff from development sites in decreasing order of sustainability is as follows:

1. Infiltration to Ground;
2. Discharge to Surface Waters; or
3. Discharge to Sewer.

Table 5-3 summarises the suitability of disposal methods suitability in the context of the application site and the proposed development.

Table 5-3
Suitability of Surface Water Disposal Methods

Surface Water Disposal Method (in Order of Preference)	Suitability Description	Method Suitable? (Y / N)
Infiltration to Ground	As discussed in Section 5.3.1, the application site is underlain by low permeability bedrock as well as the restoration consisting of infilling thereby creating made ground. Infiltration techniques are not suitable at the application site.	N

Surface Water Disposal Method (in Order of Preference)	Suitability Description	Method Suitable? (Y / N)
Surface Water Discharge	There are surface water features located on the west, south and east of the application site. The quarry has a permit for discharging to the un-named tributary of the Fylls Brook adjacent to the centre of the eastern boundary.	Y
Sewer Discharge	There are no public surface water sewers adjacent to the application site and there are more preferential disposal methods available.	N

5.5 Proposed Area Schedule

The application site has been divided into drainage sub-catchments based on drainage direction, slope and land use which can be seen in **Drawing 01**. This includes an offsite area that potentially is already resulting in some runoff onto the site. The total area draining to the ponds system is **15.2ha**.

The coal board nomogram methodology[18] has been used to assign an appropriate runoff coefficient for each area. This is summarised in Table 5-4 and is set out by attenuating features. The coal board nomogram is an extremely conservative methodology for estimating the equivalent proportional impermeable area for the application site for the restoration proposals. The methodology is based on an assumption of the underlying soils being completely waterlogged during rainfall events and grass land coverage. In reality this water would drain away in the same manner as prior to quarrying, water within the subsoils both evaporated and draining laterally as slower interflow.

18 National Coal Board (1982) Technical Management of Water in the Coal Mining Industry. NCB Mining Department, 1982, 129 pages.

Table 5-4
Contributing Area of Restored Site

Drainage Pond	Catchment ID	Length for Slope	Elevation Change	Slope (1 in X)	Slope (X in 1)	Runoff Coefficient	Area (ha)	Effective Impermeable Area (ha)	Total For Pond (ha)
Pond 1	POND					1.00	0.28	0.28	2.79
	A	108	6	18	0.06	0.72	1.84	1.33	
	B	98	4	25	0.04	0.70	0.93	0.65	
	C	44	7.5	6	0.17	0.77	0.69	0.53	
Pond 2	POND					1.00	0.22	0.22	1.30
	D	112	8	14	0.07	0.74	1.04	0.77	
	E	40	5	8	0.13	0.75	0.41	0.31	
Pond 3	POND					1.00	0.17	0.17	1.29
	F	95	9	11	0.09	0.75	0.77	0.58	
	G	21	4	5	0.19	0.78	0.69	0.54	

Drainage Pond	Catchment ID	Length for Slope	Elevation Change	Slope (1 in X)	Slope (X in 1)	Runoff Coefficient	Area (ha)	Effective Impermeable Area (ha)	Total For Pond (ha)
Pond 4	POND					1.00	0.10	0.10	0.65
	H	90	9	10	0.10	0.75	0.45	0.34	
	I	15	4	4	0.27	0.79	0.20	0.16	
	J	7	2	4	0.29	0.79	0.07	0.06	
Swale 1	Swale					1.00	0.24	0.24	1.48
	K	124	9	14	0.07	0.74	1.11	0.82	
	L	36	1.5	24	0.04	0.70	0.61	0.42	
Pond 5	POND					1.00	0.51	0.51	4.12
	M	76	9	8	0.12	0.75	2.53	1.89	
	N	17	1	17	0.06	0.72	2.38	1.71	
Grand Total							15.24	11.63	11.63

5.6 Conceptual Surface Water Drainage Preferred Strategy

5.6.1 Overview

The proposed drainage strategy is shown in **Drawing 02**. Overland flow generated from a rainfall event would progress following topographic gradients into a series of ponds located through the centre of the site in a north-south orientation. The ponds are connected by swales which will route flows into Pond 4. Flows out of each pond will be controlled to the equivalent greenfield rate for the upstream area using a weir. Flow control in the upper ponds is necessary to keep the water spread through the features rather than all the attenuation occurring within the final and lowest pond. Additionally, this would also enable the development of the phased surface water drainage strategy as part of post planning works, without installing additional infrastructure.

In the south of the application site (between Pond 5 and 4), the swale is larger and its volume would also be important to hold and attenuate some of the excess flows.

5.6.2 Drainage Features

A long section cutting through the main drainage features is provided in **Drawing 03.** The majority of the attenuation within the restoration landform would be provided within the five ponds through variation in water level. These ponds would have an area of permeant water with the water level rising during rainfall events.

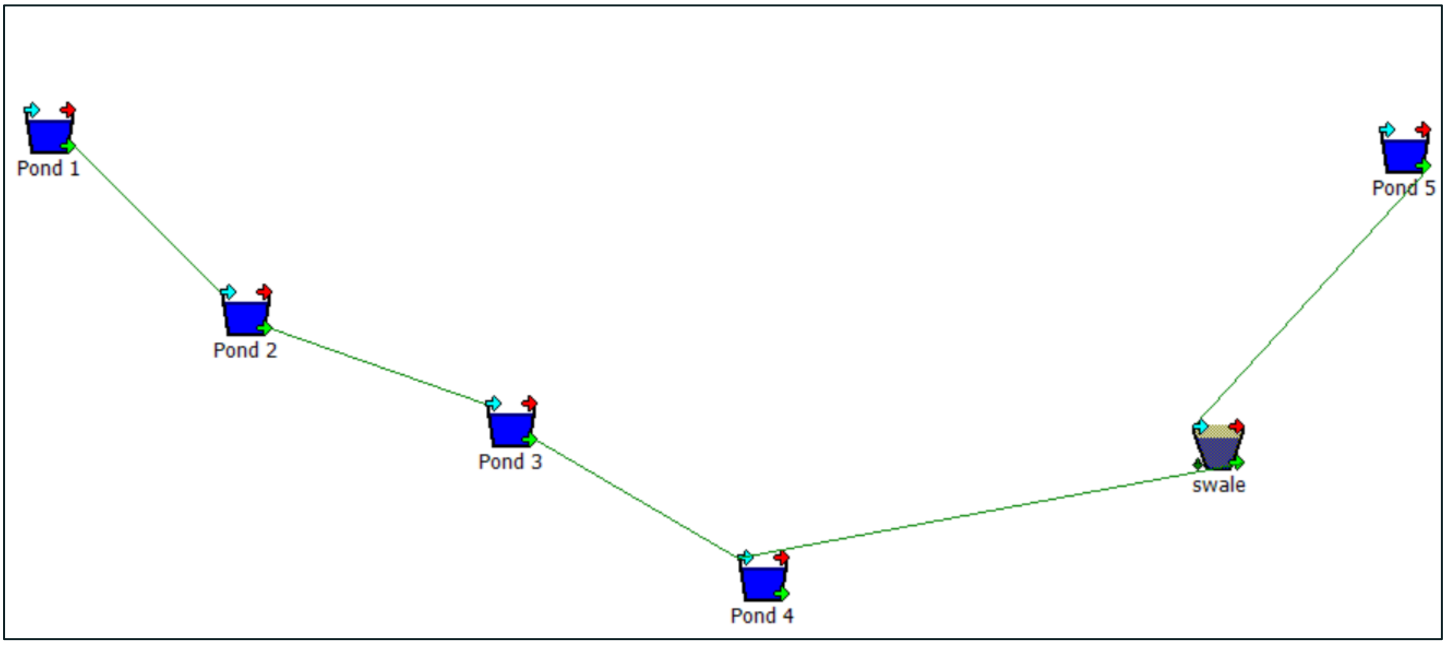
The ponds are designed such that as water level rise the plan area of the pond can increase creating a number of transitional zones of varying wetness. Although this would be subject to further detailed design this would support a diverse range of plant species and create varying habitats around the features. In some of the ponds there would be a swale like feature within part of the base between the permanent water level and the location of the weir to allow for water to drain from the feature as the water level begins to rise at the start of the storm.

The swales within each feature have a sinuous shape to resemble a more naturalised channel. These would be dry between the ponds outside of rainfall events and would be vegetated. Other than the swale located between Pond 4 and Pond 5 these would be conveyance features facilitating the flow from one pond to the other. Between Pond 4 and 5 the swale is much wider and provides additional attenuation. This swale would be wetter for a longer period through and following a storm event creating another habitat area.

5.6.3 Modelled Parameters

The proposed drainage features have been modelled within the Source Control module of MicroDrainage, which is an appropriate level of detail for planning purposes and for the nature of the scheme. Each SuDS feature has been cascaded as shown in Figure 5-2.

Figure 5-2
Source Control Cascade Diagram



Pond 1 (Northern Pond)

- Contributing Catchment (Total Area ex. pond): 3.465ha
- Contributing Catchment (Effective Impermeable Area inc. pond): 2.786ha
- Cover Level (Maximum Water Level): 83.15m AOD;
- Invert Level (Permanent Water Level): 82.50m AOD;
- Area at Invert (Permeant Water Area): 1750m^2;
- Area at Cover Level: 2,198m^2;
- Outflow Control (to Conveyance Swale): Weir
    - Crest Width: 0.112m;
    - Crest Level: 82.50m AOD

Pond 2

- Upstream Features: Pond 1
- Additional Contributing Catchment (Total Area exc. pond): 1.456ha
- Additional Contributing Catchment (Effective Impermeable Area including pond): 1.303ha;
- Cover Level (Maximum Water Level): 81.90m AOD
- Invert Level (Permanent Water Level): 81.50m AOD
- Area at Invert (Permanent Water Area): 2,000m^2
- Area at Top of Bank: 2,200m^2
- Outflow Control (to Conveyance Swale): Weir

    - Crest Width: 0.269m
    - Crest Level 81.50m AOD

Pond 3

- Upstream Features: Ponds 1 and 2
- Additional Contributing Catchment (Total Area exc. pond): 1.467ha
- Additional Contributing Catchment (Effective Impermeable Area including pond): 1.289ha;
- Cover Level (Maximum Water Level): 80.85m AOD
- Invert Level (Permanent Water Level): 80.50m AOD
- Area at Invert (Permanent Water Area: 1,550m^2
- Top of Bank Area: 1,700m^2
- Outflow Control (to Conveyance Swale): Weir
    - Crest Width: 0.425m
    - Crest Level 80.50m AOD

Pond 4 (Final Pond before discharge)

- Upstream Features: Ponds 1, 2, 3 and 5, and attenuation swale
- Additional Contributing Catchment (Total Area exc. pond): 0.742ha
- Additional Contributing Catchment (Effective Impermeable Area including pond) 0.650ha;
- Cover Level (Maximum Water Level): 80.45m AOD
- Invert Level (Permanent Water Level): 80.25m AOD
- Area at Invert (Permanent Water Area): 900m^2
- Top of Bank Area: 900m^2
- Outflow Control (to discharge swale): Weir
    - Crest Width: 4.210m
    - Crest Level 80.25m AOD

Attenuation Swale[19]

- Upstream Features: Pond 5
- Additional Contributing Catchment (Total Area exc. swale): 1.719ha
- Additional Contributing Catchment (Effective Impermeable Area including swale): 1.484ha
- Cover Level (Top of Bank / Maximum Water Level): 80.65m AOD
- Invert Level (Base of Swale): 80.25m AOD

19 These parameters have been used for the purposes of modelling which is undertaken for an "lined infiltration basin". In reality to improve biodiversity and amenity the feature would be sized as shown within the drawings. This is larger than the modelled swale and would provide additional storage with lower water levels and therefore lower outflows (i.e. is conservative modelling)

- Top of Bank Area: 2,400m^2
- Basal Area: 2,000m^2
- Outflow Control (to discharge pond): Weir
    - Crest Width: 0.260m
    - Crest Level 80.25m AOD

<u>Pond 5 (Southern Attenuation Pond)</u>

- Additional Contributing Catchment (Total Area exc. pond): 1.571ha
- Additional Contributing Catchment (Effective Impermeable Area including pond): 2.091
- Cover Level (top of bank): 80.95m AOD
- Invert Level (permanent water level): 80.50m AOD
- Permanent water area:4,800m^2
- Top of Bank Area: 5,137m^2
- Outflow Control (to discharge swale): Weir
- Crest Width: 0.170m
- Crest Level 80.50m AOD

The connecting swales between the ponds other than from Pond 5 and Pond 4 have not been modelled within Source Control as they are not required for providing attenuation (conveyance features only). Additionally there is an ephemeral pond in the south of the application site, which already exists. This feature is currently lined to create a shallow pond in winter sourced from incidental rainfall . This feature is being retained for ecological purposes (subject to some reprofiling and removal of the artificial liner); however due to its position in a high point of the application site would not be connected to the wider site drainage other than excess overtopping combining to the catchment's overland flow. The pond would fill via direct rainfall with minimal overland flow due to topographic gradients.

5.7 SuDS Performance Assessment: Attenuation Volumes

The attenuation volumes within each of the ponds during the critical storm for each of the modelled storm severities at each feature are summarised for each feature in Table 5-5 to Table 5-10. Full results are provided in Appendix 05. A summary table of the summation of each of these has been provided in Table 5-11 although due to different critical storms for each feature it is likely that total attenuation would not reach these values. The results demonstrate that there is sufficient capacity to attenuate the flows for up to and including the 1% AEP and mitigate anticipated increase in rainfall intensity as a result of climate change.

Table 5-5
Summary of Pond 1 Attenuation Performance

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
50%	0.242	0.408	444

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
3.3%	0.392	0.268	738
1%	0.476	0.174	908
1% AEP + 45% CC	0.648	0.002	1276

Table 5-6
Summary of Pond 2 Attenuation Performance

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
50%	0.152	0.248	310
3.3%	0.240	0.160	495
1%	0.292	0.108	605
1% AEP + 45% CC	0.399	0.001	837

Table 5-7
Summary of Pond 3 Attenuation Performance

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
50%	0.132	0.268	208
3.3%	0.209	0.191	332
1%	0.254	0.096	407
1% AEP + 45% CC	0.348	0.002	565

Table 5-8
Summary of Pond 4 Attenuation Performance

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
50%	0.043	0.157	39
3.3%	0.072	0.128	64

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
1%	0.088	0.112	80
1% AEP + 45% CC	0.120	0.080	108

Table 5-9
Summary of Swale Attenuation Performance

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
50%	0.152	0.248	314
3.3%	0.237	0.163	502
1%	0.289	0.111	619
1% AEP + 45% CC	0.396	0.004	868

Table 5-10
Summary of Pond 5 Attenuation Performance

AEP (%)	Water Depth (m)	Freeboard to engineered exceedance outflow (m)	Attenuation Volume (m^3)
50%	0.169	0.281	822
3.3%	0.267	0.183	1,308
1%	0.326	0.124	1,604
1% AEP + 45% CC	0.450	0.000	2,235

Table 5-11
Summary of Total Attenuation Volume

AEP (%)	Whole Site Attenuation Volume (m^3)
50%	2,137
3.3%	3,439
1%	4,223

AEP (%)	Whole Site Attenuation Volume (m^3)
1% AEP + 45% CC	5,889

5.8 SuDS Performance Rates

The outflow has been assessed relative to the greenfield runoff rates as calculated in Table 5-2 for the restored area. A summary of the attenuation provided by the proposed drainage strategy is presented in Table 5-12.

Additionally, the flows have been restricted so that restoration could be carried out from either the north or the south with runoff rates not exceeding greenfield rate for each point in the restoration.

Table 5-12
Summary of SuDS Performance: Runoff

AEP (%)	Restored Area Peak Greenfield Rate (l/s)	Post Development Discharge Rate (l/s)	Reduction in Runoff Rate	
			(l/s)	(%)
50%	141.0	64.5	76.5	54%
3.3%	322.0	137.9	184.1	57%
1%	414.0	188.1	225.9	55%
1% + 45% CC	414.0	299.1	114.9	28%

5.9 SuDS Performance: Water Quality

The Simple Index Approach, as set out within the SuDs Manual, is the recommended approach of demonstrating compliance in relation to water quality for the purposes of planning. However, this is not appropriate for a quarry restoration and is not included within the hazard indices. Once the landscaping has become established, runoff from the site would have the same water quality parameters as a greenfield within the area. Until the landscape has become developed there is potential for the water to have slightly increased suspended solids. The nature of the cascading ponds and conveyance swales mean that the final discharge from the site would have these removed through the process of settlement. Additionally the bund would not be removed until the end of the restoration with the existing pumped outfall maintained to allow the vegetation to have established.

During the restoration work surface water will be pumped out of the system with the final discharge being created at the end of the restoration. Where flows are greater than the pump rate, water would be collected within the remaining void space for future discharge.

5.10 Exceedance

Due to the profile of the site, exceedance of the design events would result in water levels rising within the features. The flow rate away from the site would increase; this extra flow would enter the same watercourse as the discharge and flow within the local watercourse network as in the pre-development greenfield scenario. Additionally each pond would likely overtop with water collecting towards Pond 4 and the large attenuation feature. Due to the fairly gentle rise of the land either side of the attenuation swale, there would be additional attenuation within this area during an exceedance event.

An exceedance event does not pose a significant residual flood risk.

5.11 Maintenance and Operation

As the site is developed SUEZ are anticipated to remain the owner and operator with responsibility for the inspection and maintenance of the SuDS features. Whilst full details would be provided during post planning, detailed design and overview of the maintenance requirements is provided below.

5.11.1 Swale

The anticipated maintenance and management of both the swale and conveyance ditches is summarised below in Table 5-13.

Table 5-13
Typical Swale / Ditch Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut grass- to retain grass height within specified design range	As required.
	Inspect inlets and overflows for blockages, and clear if required	Monthly
	Inspect surfaces for ponding, compaction, silt accumulation, record areas where water is ponding > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly.
	Inspect inlets and facility surface for silt accumulation, establish appropriate slit removal frequencies.	As required or if bare soil is exposed over 10% or more of the swale treatment area
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plan types to better suit conditions, if required	Annually
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required.
	Relevel uneven surfaces and reinstate design levels	As required.

5.11.2 Pond

Formal tracks would not be included through the application site; however, the levels of the site and within the pond sides are such that plant could access to remove vegetation and silt if this was required. Typical maintenance requirements are summarised in Table 5-14 below.

Table 5-14
Typical Pond Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut the meadow grass	As required
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at the start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies, undertake contamination testing once some build up has occurred, to inform management and disposal options	Half yearly
	Check any penstocks and other mechanical devices	Half yearly
	Remove 25% of bank vegetation from waters edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional Maintenance	Remove sediment from the main body of big ponds when the pool volume is reduced by 20%	With effective pre-treatment, this would only be required rarely, e.g., 25-50 years
Remedial Actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets, and overflows	As required

5.11.3 Weirs

The benefit of weirs is that they are less prone to blockage than other forms of outlets. However, the following inspection and maintenance is recommended in Table 5-15.

Table 5-15
Typical Weir Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Inspection	Inspection of weir crest for any cracks or excessive vegetation growth.	Monthly
	Inspect the downstream side of the weir to ensure there is no scouring occurring	Monthly and after large storms originally then as required.
Regular Maintenance	Remove litter and debris collecting near the outlet	Monthly or as required
	Inspect marginal and near weir vegetation and remove nuisance plants (for first 3 years)	Monthly (at the start, then as required)

6.0 Conclusion

SLR Consulting Limited (SLR) has been appointed by SUEZ Recycling & Recovery to prepare a Flood Risk Assessment (FRA) and outline Surface Water Drainage Strategy (SWDS) in support of a planning application for the restoration with inert material and soils (waste or non-waste) of Clock House Quarry, Horsham Road, Near Capel, Surrey, RH5 5JL.

The FRA and SWDS has been prepared under the direction of a Technical Director of SLR who specialises in flood risk, drainage and associated planning matters. It has been prepared in support of a planning application and completed in accordance with guidance presented within the National Planning Policy Framework[20] (NPPF) and its associated Planning Practice Guidance[21] (PPG). Current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[22] have also been taken into account.

A flood screening reviewed potential sources of flooding and concluded that they were negligible to low and required no further assessment.

A surface water drainage strategy has been developed for the application site that restricts flows to the greenfield runoff rate or lower. This consists of five ponds and an attenuation swale orientated north south through the application site providing up to **5,889m^3** of storage**.**

Runoff rates are restricted to the equivalent greenfield runoff rate or lower for all events up to and including the 1% annual exceedance probability (AEP) storm.

An allowance of a 45% increase in rainfall intensity has also been included with flows restricted to the 'present day' 1% AEP.

Once restored the runoff should not have significant changes to water quality. However, the proposed scheme would inherently include water quality mitigation as water flows through the ponds and swales.

Once restored the drainage arrangements on site would be managed and maintained by SUEZ as the landowner.

20 Ministry of Housing, Communities & Local Government, National Planning Policy Framework, February 2012, updated July 2021
21 Planning Practice Guidance: Communities and Local Government, November 2016, updated June 2021
22 BS8533:2017, Assessing and managing flood risk in development. Code of practice, December 2017