Transport, Environment & Design

Zig Zag Quarry
Environmental Setting and Site Design Report

January 2026

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1	Jamie Howourth	Alex Large	12-Sept-24
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1	Jamie Howourth	Minor updates to take into account comments including surface water management, interaction with existing operations and updates to Site Infrastructure Plan.	12-Sep-2024
2	Alex Large	Report updated in 2025 to reflect changes to other permit reports (e.g. Gas Risk Assessment, Hydrogeological Risk Assessment, Dust & Emissions Management Plan).	21-Nov-2025
3	Alex Large	New Section 5.3 added in response to query from Environment Agency.	30-Jan-2026

1. Introduction

1.1 Commission

1.1.1 Horizon Consulting Engineers Limited (Horizon) was commissioned by BT Jenkins Limited (BTJ or "the Client") behalf of the Operator (Harleyford Aggregates Limited) to prepare an updated Environmental Setting and Site Design Report (ESSD) for Zig Zag Quarry in support of an application to vary the existing Environmental Permit (Reference: HB3705XG). Zig Zag Quarry is located to the north of the town of Kingskerswell, Newton Abbot, Devon, TQ12 5AT.

1.1.2 A variation is required to the existing Environmental Permit to facilitate the final restoration of the Site under Devon County Council (DCC) Planning Permission Reference DCC/4339/2023.

1.1.3 The overarching aim is to infill the void, restoring the Site to pre-quarrying levels. The Site is to be restored to a long-term end use of pastoral grazing fields separated by Devon hedge banks together with scrub and woodland habitats.

1.1.4 A previous ESSD report[1] was prepared by Aardvark EM Limited (Aardvark) in 2021 to support the original environmental permit application. This version of the ESSD report has been prepared by Horizon to support a substantial variation to the existing permit increasing the mass of material to be deposited to circa 1.5 M tonnes, in line with both the approved 2024 Waste Recovery Plan (WRP[2]) and Planning Permission.

1.2 Background & Planning Permission

1.2.1 Zig Zag Quarry (the Site for the purposes of this report) is an existing sand and gravel quarry located approximate 2 km south-east of Newton Abbot and immediately north of the village of Kingskerswell. The approximate centre of the Site is located at Ordnance Survey grid reference: 288033E, 069043N. A Site Infrastructure Plan (**Drawing 0269.103**) is included in **Appendix A** with photographs showing the Site in Appendix C of the CSM report[3].

1.2.2 The Site occupies an area of approximately 9.44 hectares and is bound by Torquay Road to the west and Under Way to the south. The Yew Tree Walk forms the eastern and northern border of the Site.

1.2.3 The Site comprises one void which slopes down from the north and east to a low point at the Site entrance in the west. The contour plans (see Appendix A in the CSM report[3]) show existing ground levels drop steadily around the perimeter of the Site from a high point of circa 87 m AOD in the north-east corner. The most northerly point is at an elevation of circa 65 m AOD, with the entrance in the west of the Site at an elevation of circa 34 m AOD.

1.2.4 A previous WRP[4] for the Site (henceforth referred to as the "2019 WRP") was approved by the EA on 23 December 2019 (EA Letter Reference: EPR/HB3705XG/A001) with the existing Environmental Permit (reference: EPR/HB3705XG) subsequently granted on 01 December 2021.

[1] Aardvark (April 2021) Zig Zag Quarry. Environmental Permit Application. Environmental Setting & Site Design Report. Ref: 1922-R005. Rev. Final v2

[2] Horizon (April 2024) Zig Zag Quarry. Waste Recovery Plan. Ref: HCE0269.WRP.Rev2

[3] Horizon (November 2025). Zig Zag Quarry. Conceptual Site Model. Ref: HCE0269.CSM.Rev3

[4] Aardvark (20 December 2019) Zig Zag Quarry Environmental Permit. Waste Recovery Plan. Ref: 1922-R001. Revision: FINAL 2

1.2.5 The 2019 WRP[4] enabled the partial infilling of Zig Zag Quarry, plus the silt lagoons associated with Aller Quarry to the north to meet the restoration requirements as per the 2016 Planning Permission. Along with available indigenous material, a total of 285,000 tonnes of suitable material was approved for import in 2019 to support restoration works.

1.2.6 The import of suitable material has been undertaken both under the CL:AIRE DOWCOP[5] scheme and the existing Environmental Permit with reference to the approved quantities in the 2019 WRP[4]. The import of material under the CL:AIRE DOWCOP is reported in a standalone Verification Report[6].

1.2.7 Zig Zag Quarry is now subject to Planning Consent DCC/4339/2023, which was granted by Devon County Council (DCC) on 03 July 2023. The approved 2023 restoration scheme requires the import of a further 1.5 million tonnes of inert waste in order to provide a safe and stable landform that is in keeping with the surrounding landscape. Drawings from the 2023 Planning Permission are included in Appendix A of the CSM report[3]. The following observations are made:

- The 2023 restoration scheme changes the restoration and aftercare proposals at the Site. For example, the 2016 restoration scheme provided for a step-down profile from Milber Lane to the base of the quarry. This is no longer the case on the basis that the retail sales area and plant site will no longer be retained (it was originally envisaged this area would be used for the continued import and sale of construction material);
- The 2016 restoration scheme excluded the eastern side of the quarry; this is no longer the case with the 2023 restoration scheme;
- The 2023 restoration scheme looks to reverse the decline in agricultural practices, particularly species rich grassland and Devon hedge banks. The 2023 restoration scheme will facilitate the long-term use of the Site for an economically beneficial purpose (pastoral farming);
- Works associated with the 2023 restoration scheme are planned to take place in three phases, over a circa ten-year period;
- A requirement for topsoil to complete the restoration is set out within the agreed landscaping plan[7] and includes 150 mm cover in grassed areas, locally deepened to 400 mm in some plant bed areas. The topsoil should conform to BS3882:2015[8].

1.2.8 This ESSD report has been prepared with reference to Environment Agency (EA) guidance and report template for ESSD reports[9] as part of the substantial variation to fully restore the Site in accordance with the 2023 Planning Permission. To reiterate, this 2025 ESSD report only relates to Zig Zag Quarry and does not include the Aller Quarry to the north, albeit Aller Quarry remains within the Environmental Permit boundary. A plan showing the Site boundary and Permit boundary is included in Drawing 0269.101 of Appendix D of the CSM report[3].

[5] CL:AIRE (March 2011) The Definition of Waste: Development Industry Code of Practice. Version 2
[6] Horizon (July 2021) Zig Zag Quarry. DOWCOP Verification Report. Ref: HCE0269.VR.Rev1
[7] Swan Paul Partnership (2023). Zig Zag Quarry, Aller. Landscape Planting Plan. Ref SPP09
[8] BSI (2015). BS3882:2015 – Specification for topsoil
[9] https://www.gov.uk/guidance/landfill-operators-environmental-permits/what-to-include-in-your-environmental-setting-and-site-design-report [Accessed 22 May 2024]

1.3 Waste Recovery

1.3.1 The EA has confirmed (letter dated 22 April 2024, reference EPR/HB3705XG/P002) that the proposed restoration works associated with the 2023 Planning Permission is agreed to be a recovery activity.

1.4 Operator

1.4.1 The permit is held in the name of the Site owner, Harleyford Aggregates Ltd. BT Jenkins will continue to be the Operator of the permit on behalf of Harleyford Aggregates.

1.5 Report Author

1.5.1 This ESSD report has been prepared by Horizon Consulting Engineers Ltd (company number 08219154) and approved by Dr Hailey Tamblyn. Dr Tamblyn is a Chartered Civil Engineer with a PhD in Mathematical modelling of landfill biodegradation processes. Dr Tamblyn has more than 20 years professional experience as an environmental engineer, is a Qualified Person under the CL:AIRE Development Industry Code of Practice and holds WAMITAB certificates for the treatment and transfer of hazardous waste plus landfilling of non-hazardous waste.

1.6 Report Structure

1.6.1 This ESSD report sets out the details of the conceptual model developed for the Site along with proposed installation design, control measures and monitoring based on the Site's environmental setting. The remainder of this report is structured as follows:

- Section 2 sets out the Site details and some of the key features of the Site's environmental setting and site design;
- Section 3 summarises the output of the CSM, and the subsequent risk assessments undertaken;
- Section 4 presents details of the compliance points;
- Section 5 outlines the proposed essential and technical precautions to be adopted during the restoration works such that the assumptions in the hydrogeological assessment are met; and
- Section 6 sets out details of proposed scope and nature of monitoring including proposed trigger levels and compliance limit.

2. Site Details

2.1 Site Location & Access

2.1.1 The Site is located approximately 2 km south-east of Newton Abbot and immediately north of the village of Kingskerswell in Devon. The approximate centre of the Site is located at Ordnance Survey grid reference: 288033E, 069043N. A plan showing the site location (including permit boundary) is in Appendix D of the CSM report[3] (Drawing 0269.101).

2.1.2 The Site is accessed off Torquay Road, with the access located towards the south-west of the Site. The grid reference of the access is 287847E, 068976N.

2.2 Site Classification

2.2.1 The Site has an existing bespoke Environmental Permit for the deposit of waste for recovery. The waste recovery activities that will continue to be caried out at the Site as defined under Annex II of the Waste Framework Directive can be summarised as follows:

- R5: Recycling or reclamation of other inorganic materials'
- R10: Land treatment resulting in benefit to agriculture or ecological improvement; and
- R13: Storage of wastes pending any of the operations numbered R1 and R12 (excluding temporary storage, pending collection, on the site where it is produced).

2.3 Site Boundary & Security

2.3.1 No change to the permit boundary is proposed as part of this significant permit variation however further deposition is only planned within the Zig Zag Quarry area, refer to Site Infrastructure Plan (**Appendix A**).

2.3.2 Lorries will continue to enter the Site from the access off Torquay Road, pass over the weighbridge and drive to the deposition area. All lorries leaving the Site will exit via the weighbridge back onto Torquay Road.

2.3.3 The boundary of the permitted area will continue to be kept secure throughout the works to prevent unauthorised access. Post and wire fencing and, in some areas, dense vegetation and steep slopes, ensures a high level of security around the Site and deterrence to trespassers.

2.3.4 The boundary is inspected at least once per week by the Operator to check integrity. CCTV security cameras are installed at the Site, with associated movement sensors. A third-party security firm is retained to respond out-of-hours to any potential security breaches.

2.3.5 Equipment and tools are predominantly stored in the office building buildings located to the west of the Site near the entrance as shown on the Site Infrastructure Plan (**Appendix A**). Doors and windows are reinforced against vandalism as necessary. A padlocked gate is present at the entrance to the Site.

2.3.6 All site visitors are required to sign the visitors book on entry, and again on exiting the Site. The exception is drivers of vehicles depositing waste at the Site who are required to remain in their vehicles at all times.

2.4 Adjacent Waste Management Activities

2.4.1 With reference to the Envirocheck report (Appendix B of the CSM report[3]), there are no active registered landfill and waste facilities within a 500 m radius of the Site, other than the existing deposit for recovery permit on-Site.

2.4.2 Historical landfill sites within a 1 km radius include:

- **Colesville Quarry**. Historical landfill located approximately 360 m north-west of the Site, no details on waste types of dates available.
- **Craxford, Kingskerswell**. Landfill accepting construction, demolition and dredging waste, licence expired.
- **South Quarry**. Historical landfill accepting household waste, located approximately 850 m west of the Site. No dates available.

2.5 Site Context

2.5.1 The Site comprises one void which slopes down from the north and east to a low point at the Site entrance in the west. The contour plans (see Appendix A of the CSM report[3]) show existing ground levels drop steadily around the perimeter of the Site from a high point of circa 87 m AOD in the north-east corner. The most northerly point is at an elevation of circa 65 m AOD, with the entrance in the west of the Site at an elevation of circa 34 m AOD.

2.5.2 Sensitive receptors in the vicinity of the Site are shown on the Sensitive Receptors Plans (Appendix D of the CSM report[3]).

2.6 Interaction with Existing Operations

2.6.1 Imported subsoil will be brought to the relevant deposition area using existing internal half roads and tracks and unloaded. The subsoil will then be moved into position by bulldozer and deposited in layers.

2.6.2 Quarry operations are drawing to a close with the final mineral extraction process being carried out in the vicinity of the main plant processing area. It is anticipated that this will be completed within the next 12 months. Due to the location of the permitted operations' first phase, there will be limited interaction between quarry operations and permitted operations.

2.6.3 The existing storage and distribution yard at the front of the Site (towards south-west) will be retained and remain operational throughout the restoration period.

2.6.4 The bridleway and footpath that runs along the northern boundary of the Site will not be affected by the proposed restoration. The existing storage and distribution yard at the front of the Site (towards south-west) will be retained and remain operational throughout the restoration period.

2.6.5 On average, there are going to be 58 HGV trips and 18 car trips per day during the restoration period. This relates to a total 76 vehicle movements per day in total. This is significantly less than the number of trips associated with the extraction phase of the quarry. During the extraction phase, 234 vehicle trips were recorded on a typical day.

2.6.6 Appropriate car parking provision for workers and visitors will be provided within the wider Site and a temporary contractor compound. Further details relating to the above are provided in the Construction Environmental Management Plan (CEMP)[10] agreed as part of the Planning Permission.

2.7 Impact of Climate Change

2.7.1 The overarching aim of the works is to infill the void, restoring the Site to pre-quarrying levels. A Flood Risk Assessment (FRA)[11] was submitted as part of the planning application that accompanies this permit variation. The report, which takes into account extreme rainfall events, concluded that the completed restoration will not be subject to unacceptable flood risk and should not increase the risk of flooding elsewhere. Periods of extreme drought will not impact the Site given the lack of water resources associated with the it.

2.7.2 In September 2023 DCC published a position statement on inert landfill capacity in Devon. This document was updated (Revision 1) in October 2023[12]. Paragraph 6.17 states:

- *"Planning permission was granted in July 2023 [DCC/4339/2023] for the importation of 1.5 million tonnes of inert waste to facilitate the restoration of Zig Zag Quarry, between Newton Abbot and Kingskerswell. This waste recovery operation would provide capacity for approximately 940,000 cubic metres of waste materials."*

2.7.3 DCC's October 2023 Position Statement in Devon identifies a need for facilities to dispose of inert waste within the County. The restoration of Zig Zag Quarry is seen an important waste recovery operation, with the additional benefit of providing DCC with a facility that is located strategically that can beneficially recover inert soil and stone and reduce unnecessary haulage distance of waste soils to disposal facilities outside the county. This will reduce carbon dioxide emissions significantly and therefore reduce the impacts to climate change.

[10] Western Ecology (March 2023). Construction Environmental Management Plan. Zig Zag Quarry. Ref: WOR 3623

[11] RMA Environmental (20 January 2023) Flood Risk Assessment and Surface Water Drainage Strategy. Zig Zag Quarry. Ref: RMA-RC2403. Issue 1.

[12] Position Statement: Inert Waste Landfill Capacity (Revision 1) - Planning (devon.gov.uk) [Accessed 21 November 2023]

3. Conceptual Site Model

3.1 Conceptual Site Model

3.1.1 A standalone CSM report[3] has been developed for this project with reference to guidance on GOV.UK[9]. The CSM report[3] draws on the data in earlier reports by Aardvark as part of the original permit application and looks to establish the environmental setting of the Site along with potential hazards associated the proposed restoration and receptors that might be affected by the works.

3.1.2 The CSM report[3] includes details relating to:

- Historical activities at Zig Zag Quarry;
- The approved restoration works including proposed waste types and phasing plus outline management measures and technical controls;
- Precipitation data (i.e., rainfall record);
- Local surface water features;
- Geological and hydrogeological setting;
- Man-made pathways that may be affected by the restoration works; and
- Receptors in the vicinity of the Site including amenity, habitats and natural heritage.

3.1.3 Data and discussion presented in the CSM report[3] is generally not repeated in this ESSD report. It is assumed the reader of this ESSD report has read and is familiar with the CSM report[3].

3.1.4 The aim of the CSM report[3] is to evaluate the scope of specific risk assessments that are required as part of the permit. With respect to this permit variation, three documents that have been produced, namely a Gas Risk Assessment (GRA)[13], a Hydrogeological Risk Assessment (HRA)[14] and a Stability Risk Assessment (SRA)[15]

3.2 Gas Risk Assessment

3.2.1 A GRA[13] was carried out by Horizon on the basis of the thickness of waste being deposited being greater than 2 m.

3.2.2 A complete source-pathway-receptor linkage was identified given there is the potential for any landfill gas to impact overlying crops. However, the intention is to import inert subsoil under strict Waste Acceptance Procedures[16] to restore the Site for beneficial agricultural purposes, on which basis the flux of landfill gases from the waste is anticipated to be very low. The crops are anticipated to be of low sensitivity and whilst a capping layer is not proposed, the overall risk associated with this contaminant linkage is considered to be very low.

[13] Horizon (November 2025). Zig Zag Quarry. Gas Risk Assessment. Ref: HCE0269.GRA.Rev2

[14] Horizon (November 2025) Zig Zag Quarry. Hydrogeological Risk Assessment. Ref: HCE0269.HRA

[15] Slope Stability Southwest (September 2024). Restoration Works at Zig Zag Quarry, Aller, Newton Abbot, Devon. Stability Risk Assessment Report. Ref: TJG/SRA/GO43.Zig Zag Quarry.Rev1

[16] Horizon (November 2025). Zig Zag Quarry. Waste Acceptance Procedures (2025 Permit Variation). HCE0269.WAP.Rev1

3.3 Hydrogeological Risk Assessment

3.3.1 A previous HRA for the original permit was carried out by JH Groundwater in April 2021[17]. The updated HRA[14] prepared by Horizon looks to build on the original work, taking into account the updated restoration proposals, additional data obtained on ground conditions along with the results of monitoring obtained.

3.3.2 The quantitative assessment considers that risks to receptors associated with the water environment are low notwithstanding the presence of sensitive receptors including a Principal Aquifer located directly beneath the Site.

3.3.3 The key outputs of the updated HRA[14] are as follows:

- Material import is subject to strict waste acceptance procedures.
- Part of the Site footprint has already been restored with indigenous and imported restoration material. The restoration area varies in thickness (see plans and cross sections in **Appendix A**). The material has been described as being generally cohesive and is interpreted to be generally low permeability.
- It is proposed that where this is greater than 1 m in thickness, the currently placed material would form the geological barrier for the new materials to be placed, subject to some confirmatory permeability testing prior to tipping in those areas. Newly imported material would be placed directly on this.
- In areas where material is yet to be placed, or where this is less than 1 m thickness, the use of compacted indigenous or greenfield derived imported materials is proposed in order to form a suitable geological barrier before placement.

3.4 Stability Risk Assessment

3.4.1 An SRA[15] was carried out by Slope Stability Southwest (SSSW) in September 2024. The stability analysis undertaken as part of the assessment demonstrated that adequate Factors of Safety (long-term stability) will be attained for the proposed restoration provided it is correctly constructed with material of suitable strength and condition. All works should be undertaken in accordance with recognised standards and best practice for earthworks as detailed below.

- The inspection and assessment of all imported material to ensure the imported material is in accordance with planning conditions and specification of the Permit;
- Material is to be placed and compacted in horizontal layers and compacted in accordance with the Construction Management Plan and established best practice; and
- Surface water and run-off is to be controlled during the construction works and restoration profiling to ensure the imported material and restoration works are not subject to saturation or erosion due to run-off.

[17] JH Groundwater (September 2021) Zig Zag Quarry Restoration. Hydrogeological Risk Assessment. Rev: 1164/001_r1_Rev3

4. Compliance Points

4.1 Groundwater

4.1.1 No Site-specific groundwater quality data was collected historically and following consultation with the Environment Agency as part of the April 2021 HRA[17], groundwater monitoring was not a requirement of the existing Environmental Permit.

4.1.2 Subsequently 6No. groundwater boreholes have been installed at the Site in 2025, as shown on the Monitoring Point Plan (**Appendix A**). Moving forwards, it is proposed that monitoring of groundwater quality will provide the principal mechanism for evaluating effectiveness of the engineering measures. The proposed groundwater monitoring regime is presented in Section 8 of the HRA[14].

4.1.3 Control and trigger levels have been derived on a borehole-specific basis for key indicator parameters for downgradient monitoring wells BH01 and BH02 (refer to Table 8-3 of the HRA[14]).

4.2 Surface Water

4.2.1 Surface water monitoring is being undertaken under the existing Environmental Permit with reference to the monitoring regime set out in the April 2021 HRA[17]. No change is proposed to this monitoring regime in the 2025 HRA[14], with surface water samples continuing to be obtained from two sampling points, one upstream and one downstream of the restoration area (shown on the Site Infrastructure Plan (**Appendix A**)).

5. Pollution Control Measures

5.1 General & Phasing

5.1.1 The principal pollution control measure at the Site is strict adherence to the Waste Acceptance Procedures[16] along with limiting the potential for unauthorised waste deposition. Details of the security infrastructure plus details of equipment and fuel storage are shown on the Site Infrastructure Plan in **Appendix A**.

5.1.2 It is proposed to carry out the works broadly in three phases working from the rear (north-east) of the quarry, towards the south-west, progressing the final landform shape. Phasing drawings are included in **Appendix A**. In relation to the works the outline sequencing is as follows:

- Enabling works will include site establishment, construction of surface water ditches and containment ponds plus review of security measures.
- Prior to the commencement of filling the existing topsoil placed on previously deposited soils will be stripped and stockpiled.
- A basal liner / side liner is to be constructed prior to waste deposition in areas where material has not been placed to date or the thickness of existing soils is less than 1 m. Details of the proposed liner are set out in Section 5.2 below.
- **Drawing 0269.601** (**Appendix A**) shows where material is to be placed during Phase 1, with **Drawing 0269.602** (**Appendix A**) showing how restoration will continue during Phase 2.
- Suitable waste soil is to be sourced from local development sites and imported to Site using sheeted lorries. The lorries will enter and exit the Site using the access in the west of the Site.
- During the works lorries are to deposit the imported waste soil as close to the working area as possible. This will then be compacted by excavator or bulldozer.
- The existing attenuation basins are to be retained as part of Phases 1 & 2. An existing Surface Water Management Plan has been approved as part of the agreed Planning Permission. Modification of the existing attenuation basins in anticipation of the start of Phase 1 works has already commenced.
- New attenuation basins are to be installed as part of the Phase 3 and final restoration period. Final restored levels are shown on the phasing drawings included in the planning permission drawings (see Appendix A of the CSM report[3]) however the Site Owner proposes to revise the Planning Permission to take into account more appropriately designed attenuation basins. On that basis, two versions of the works to take place in Phase 3 are shown:
    - **Drawing 0269.604** (**Appendix A**). This drawing retains the existing drainage basins; however, the final restoration levels are at the west of the Site are slightly lower than those envisaged in the Planning Permission; and
    - **Drawing 0269.603** (**Appendix A**). This drawing is based on a revised drainage scheme, with final restoration levels are at the west of the Site consistent with those envisaged in the Planning Permission.
- Cross-sections showing the restoration profile with and without the existing drainage basins are included in **Appendix A** (**Drawings 0269.605** and **0269.606**).

- A veneer of topsoil (typically 150 mm thick) is to be placed over the subsoil to complete the restoration works. Topsoil is to be placed on a staged basis as final levels are achieved with the Site returning to agricultural land. Details with regards to proposed topsoil thicknesses is set out within the Landscape Planting Plan[7] and summarised in Section 1.2 of this ESSD report.
- The land is to be seeded with grass and returned to agricultural use upon completion.
- All works are to be undertaken in accordance with any requirements of the Planning Permission.

5.2 Basal & Side Slope Engineering

5.2.1 Details of the earthworks, including identification of source material, placement and testing to confirm liner suitability will be set out in the CQA Design Report.

5.2.2 The 2025 HRA[14] requires a basal liner to extend up from the base of the Site to line the sides of the existing quarry.

5.2.3 Where the existing soils are greater in thickness than 1 m, testing will be undertaken to confirm these soils are of suitable quality to provide protection equivalent to a layer 1 m thick with a permeability of less than or equal to 1 $x10^{-7}$ m/s.

5.2.4 Elsewhere a basal liner is to be installed beneath all deposited waste henceforth. Where the waste tapers to less than 1.0 m thick, any deposited waste will be formed of suitable liner material, placed and compacted under CQA procedures. An indicative cross-section showing the basal liner is included **Appendix A** (**Drawing 0269.109**).

5.2.5 The material to form the liner will comprise suitable existing soils (either natural soils of the Aller Formation or existing restoration soils) or imported soils and will be subject to CQA procedures. Details of the specification for the liner (i.e., material properties and testing) is to be provided in the CQA Design Report.

5.3 Basal Liner Soil Chemistry

5.3.1 At Zig Zag Quarry, the basal liner must reduce emissions of contaminants in the fill and not cause an unacceptable discharge. On that basis, material used for the attenuation layer must be physically and chemically suitable, "*with a pollution potential less than or equal to the natural quality of the surrounding geology*."

5.3.2 Furthermore, as a minimum the waste used for basal liner construction must be inert. This is consistent with the requirements for fill material at the Site. With reference to UK.GOV[18], inert waste is "*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 that it comes into contact with, in a way likely to cause environmental pollution or harm to human health*."

5.3.3 For material imported historically and placed under the CL:AIRE DOWCOP[5] scheme, the material suitability requirements specified that "*inert waste and sand and gravel*" per the Planning Permission were used for restoration material. Inert waste is defined in the planning permission as material that is not chemically or biologically reactive and will not decompose.

[18] https://www.gov.uk/guidance/landfill-operators-environmental-permits/landfills-for-inert-waste [Accessed 30 January 2026]

5.3.4 Under the CL:AIRE DOWCOP scheme only soils meeting EWC 17 05 04 were to be imported to Site. These were only to comprise clean naturally occurring soils that met the inert waste leachate criteria. In addition, any soils were required to have concentrations of substances (such as geologically derived metals, metalloids etc) at a level that was consistent with or lower than background concentrations at the Zig Zag Quarry site.

5.3.5 The Verification Report[6] prepared upon completion of material import under the CL:AIRE DOWCOP[5] scheme evaluated the material imported and placed, to confirm it met the requirements set out above. This report was submitted to CL:AIRE and the Environment Agency as part of the transition between the use of the CL:AIRE DOWCOP[5] scheme and the Environmental Permit on-Site.

5.3.6 On the basis that the Verification Report demonstrated that only clean naturally occurring soils from greenfield Site, with naturally occurring contaminants at a level consistent with or below background concentrations at Zig Zag Quarry were imported and placed it is considered that the requirement for using waste in construction is met and that the material imported under the DOWCOP scheme has a pollution potential equal or lower than the natural ground.

5.3.7 Although any future soils imported for the basal liner elsewhere across the Site will be imported under the Environmental Permit as opposed to the CL:AIRE DOWCOP[5] scheme it is proposed to continue to use the approach set out above (i.e., inert, only clean naturally occurring soils from greenfield site, concentrations of contaminants equal to or below background concentrations at Zig Zag Quarry) such that requirement for using waste in construction continues to be met.

5.3.8 Confirmation that the above requirements are met for imported soils used as part of the future basal liner construction will be set out in the CQA Validation Report.

5.4 Surface Water Management

5.4.1 The potential for contamination of surface water and / or groundwater during construction as a result of general construction-related activities was assessed during the planning process (Chapter 6[19] of the Environmental Statement plus the supporting Flood Risk Assessment (FRA[11]. In summary, during the restoration works, the runoff from the reinstated surfaces will be attenuated within a basin in the southern part of the Site (refer to Drawing DR-001 from the FRA[11] reproduced in **Appendix B**). This is consistent with the approach adopted to date on-Site.

5.4.2 During earthwork filling operations suspended solids contained within the runoff as a result of the exposed fill surface will need to be managed. As with all large-scale earthwork operations the primary concern is the interception of surface water runoff containing large quantities of suspended solids. To address this the scheme incorporates two attenuation basins / settlement lagoons at the low point of the fill area which will be used to enable the suspended solids to settle out. If necessary, to promote early settlement of suspended solids the basins will comprise of two to three settlement bays divided by earthwork weirs.

5.4.3 Overland flow will be conveyed from the fill area to the basins via a combination of interception ditches and proprietary silt fences adjusted as necessary to suit the operational requirements of the Site. The ditches will discharge to the basins via a weir parallel to the upstream end, this lateral inflow will reduce the potential for settled silts being forced back into suspension by sudden high

[19] Aardvark (February 2023) Environmental Statement – Chapter 6 Technical Chapter – Hydrology and Hydrogeology. Ref: 2149-R003 - Hydrology and Hydrogeology

flows entering the primary settlement bay. The level of silt built up in the ditches can be easily monitored during the works to determine the appropriate intervals for the de-silting of the main basins; the volume of silt removed from the ditches on a regular basis determining the amount conveyed from the fill area towards the basins.

5.4.4 As discussed in Section 5.2, the Site Owner is redesigning the attenuation basins / settlement lagoons as part of the final restoration profile. Any redesign would be subject to approval by Devon County Council. This ESSD provides final contour plans to cover both eventualities.

5.5 Amenity

5.5.1 The CSM[3] identified numerous receptors which could be impacted by the development including nearby residential and commercial properties (see Sensitive Receptors Plan included in Appendix A of the CSM[3]).

5.5.2 With respect to the proposed development, the biggest impact to amenity use is likely to be from dust. Given the Site has a history of industry, specifically the quarrying and processing of sand and gravel, effective dust management practices are already in place.

5.5.3 An assessment of the risk to amenity use from dust was carried out under planning for the proposed development (Chapter 6 of the Environmental Statement[20]). In summary, the assessment demonstrated that the overall air quality effect of the proposed scheme will be 'not significant'; restoration dust emissions will not have a significant effect on amenity or human health and the development-generated traffic emissions will not have a significant effect on local air quality. Nevertheless, it is good practice for measures to be implemented to ensure dust emissions are minimised, particularly during adverse (dry and windy) weather conditions.

5.5.4 On that basis no additional control measures (i.e., over and above dust management etc) are proposed. Details of the dust management controls, and monitoring are set out within the Dust & Emissions Management Plan (DEMP)[21] prepared by Horizon in 2025 to take account of the increased volume of material to be placed.

5.6 Post Closure Controls (Aftercare)

5.6.1 Drawings showing the approved restoration scheme are included in Appendix A of the CSM report[3]. The proposal is to infill the Site to pre-quarrying levels. This provides for a restoration scheme that results in a landform in keeping with the surrounding area and providing a safer and more ecologically beneficial landscape.

5.6.2 The 2023 restoration proposals are considered in the Landscape and Visual Impact Assessment (LVIA[22]) to provide a positive permanent change including:

- *"New field pattern with hedge banks and hedgerow trees;*
- *New areas of woodland;*
- *Long-term management changes to hedges – cut less frequently and higher;*
- *Retention and enhancement of the existing drainage attenuation;*

[20] Air Quality Consultants (2023). Zig Zag Quarry Restoration. Environmental Statement – Chapter 6 Technical Chapter – Air Quality and Dust. Ref: 2149-R003-Chapter 6 –Air Quality and Dust

[21] Horizon (November 2025) Zig Zag Quarry. Dust & Emissions Management Plan. Ref: HCE0269.DEMP.Rev1

[22] Swan Paul Associates (2023) Zig Zag Quarry. Landscape and Visual Impact Assessment.

- *Restored Site levels; and*
- *Improved levels of tranquillity."*

5.6.3 The significance and nature of the effect of returning the Site to its historic pre-quarrying baseline was considered in the LVIA[22] and is considered to provide a moderate and permanent positive change to the existing situation. Additional restoration phase mitigation set out in the LVIA[22] includes a commitment to maintain hedges for wildlife benefit in the longer term. They will continue to be cut longer and less frequently. Hedges will be on traditional Devon hedge banks and there will be hedgerow trees in some locations and additional woodland copses to the perimeters.

5.6.4 Following placement of the soil layer the Site is to be restored in accordance with the Masterplan approved in the 2024 Planning Permission. This will include decommissioning and removal of plant and equipment not associated with the long-term use of the Site (e.g. weighbridge) and placement of overlying surface materials (e.g., areas of grassland / woodland / scrub / bushes etc).

5.6.5 The post-closure controls are considered to represent on-going operational requirements associated with the new landscape, as opposed to post-closure controls. Provided the material is imported as per the requirements of the Waste Acceptance Procedures[16], placed as required by the SRA[15] and this ESSD report, no post closure controls is required for the Site.

5.6.6 Aftercare of the Site will be undertaken for a minimum of three years post placement of the capping layer to demonstrate that the restoration scheme has met the design objectives. During this period, it is envisaged that public access will be permitted to the Site however overall responsibility for access and security will remain with BTJ.

5.6.7 Monitoring during the aftercare period will include:

- Groundwater quality monitoring;
- Surface water quality monitoring; and
- Topographic surveys.

5.6.8 Site completion will occur when sufficient monitoring has been undertaken to demonstrate that the Site has met the design objectives, does not pose a significant risk to the environment and the Environmental Permit can be surrendered.

5.7 Incident Response & Quarantine Area

5.7.1 Any waste deemed to be unacceptable based on visual inspection following importation and deposition at the Site (i.e., prior to material being compacted by excavator or bulldozer) will be excavated and placed in a dedicated quarantine area (location shown on Site Infrastructure Plan included in **Appendix A**).

5.7.2 On the basis of the visual or olfactory observations (i.e., the rationale for moving material to the Quarantine area) a plan of action will be determined for the quarantined material. This may involve consultation with the EA and/or additional chemical testing of the material.

5.7.3 Should the Quarantine area become full, then the Site will cease to accept waste for deposition until such time as space is available within the Quarantine area and/or a course of action is agreed with the EA.

6. Monitoring

6.1 Weather

6.1.1 A Dust Management Plan[23] was prepared for the Site as part of the original permit application. No complaints have been received to date relating to dust. The updated DEMP[21] has been prepared taking into account the effective existing mitigation measures.

6.1.2 Monitoring weather conditions is a requirement of the DEMP[21] with details recorded in the Site diary. This includes reviewing the weather forecast in advance of works, monitoring wind conditions and visual monitoring to assess if dust control measures, such as damping down exposed surfaces, are required during the works. This is to include comments along the lines of whether the source of any dust is evident, is the dust constant or intermittent, can the dust be seen to be settling on surfaces.

6.1.3 During periods of particularly inclement weather the Site Manager has the authority to shut the Site to minimise potential for trafficking dust / mud off-Site.

6.1.4 It is not proposed to install a weather station at the Site given measurements of wind speed are less important than visual observations from the Site Manager or his nominated deputy.

6.2 Gas Monitoring & Infrastructure

6.2.1 No gas monitoring was proposed in the original ESSD report[4] on the basis that the "*application was for inert waste and topsoil*" only and no gas monitoring infrastructure has been installed at the Site.

6.2.2 More recently, gas monitoring commenced from boreholes BH01, BH02, BH03 and BH04 in March 2025, with monitoring of boreholes BH05 and BH06 scheduled to commence in November 2025. Given boreholes are available, it is proposed that moving forwards gas monitoring be conducted on as per **Table 6-1** below.

Monitoring Point	Parameter (s)	Monitoring Frequency	Method	Notes
During Infilling				
BH01, BH02, BH03, BH04, BH05* & BH06*	Atmospheric Pressures	Quarterly	As specified in Environment Agency Guidance TGN03[24]	Record ground conditions (e.g., whether ground is waterlogged, frozen or snow covered) plus meteorological conditions at time of monitoring.
	Differential Pressure			
	Flow Rate**			
	Methane**			
	Carbon Dioxide**			
	Carbon Monoxide**			
	Hydrogen Sulphide**			
	Oxygen**			
Notes: * Borehole to be monitored whilst available until location is lost during restoration. ** During each monitoring visit, both peak and steady-state values for parameter to be recorded.				

Table 6-1*:* Ground Gas Monitoring Frequency

[23] Aardvark (May 2021) Zig Zag Quarry. Environmental Permit Application. Dust Management Plan. Ref: 1922-R008. Rev. Final v3
[24] Environment Agency (September 2004) Guidance on the Management of Landfill Gas. Ref: LFTGN03

6.2.3 The risk from ground gas is evaluated in the GRA[13]. Given the Site is to be restored primarily with inert subsoil under strict Waste Acceptance Procedures, with no biodegradable wastes (e.g. paper, cardboard, wood, garden refuse, textiles, sewage sludge) accepted, the potential for gas generation is considered to be very low.

6.2.4 In the absence of a significant source of off-site ground gas, it is proposed to adopt Completion Criteria 1 values (as set out in GOV.UK landfill surrender guidance[25]) of 1.5% (methane) and 5% (carbon dioxide) as control levels during operation of the Site. Should elevated gas concentrations be recorded, consideration will be given to installation of in-waste gas monitoring wells.

6.3 Surface Water Monitoring

6.3.1 Monitoring surface water quality is considered to represent an important data source through which performance and effectiveness of the works is evaluated. Monitoring on the Aller Brook is to continue; details of the surface water monitoring are set out in Section 8.2 of the HRA[14].

6.3.2 Water samples are currently obtained from two locations on the Aller Brook as shown on the Site Infrastructure Plan (**Appendix A**) and drawing in **Appendix C**.

6.4 Groundwater Monitoring Infrastructure

6.4.1 No groundwater monitoring was required in the existing Environmental Permit however subsequently six groundwater boreholes have been installed at the Site. Borehole locations shown on Monitoring Point Plan (**Appendix A**).

6.5 Groundwater Monitoring

6.5.1 Groundwater monitoring was not a requirement of the existing Environmental Permit however is being undertaken currently to establish a baseline with future monitoring of groundwater quality proposed to evaluate effectiveness of the engineering measures. The proposed groundwater monitoring regime is presented in Section 8.3 of the HRA[14].

6.5.2 Compliance limits for boreholes BH01 and BH02 are set out in the HRA[14].

6.6 Amenity Monitoring

6.6.1 Amenity monitoring is not specified with the requirements of the DEMP[21].

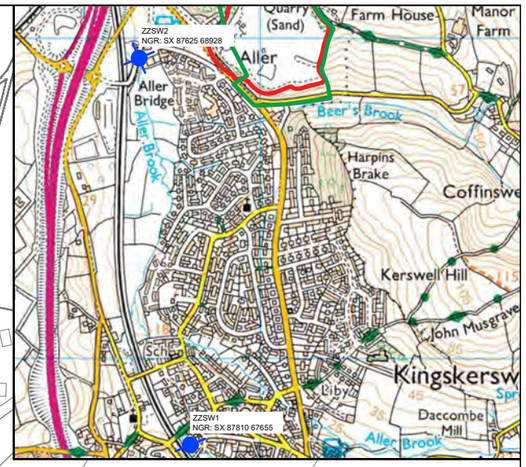
6.6.2 The Site Manager or his deputy is required in the EMS to walk the Site boundary at least once per week or more frequently during periods of extreme weather. This walkover is intended to confirm the effectiveness of mitigation measures on-Site and that nuisance is not occurring.

[25] https://www.gov.uk/government/publications/landfill-epr-502-and-other-permanent-deposits-of-waste-how-to-surrender-your-environmental-permit [Accessed 21 November 2025]

Appendix A
Horizon Drawings

NOTES: GENERAL

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS.
2. INSET IN TOP RIGHT OF DRAWING SHOWING OTHER SAMPLING LOCATION ZZSW1. FOR INDICATIVE PURPOSES ONLY. FOR DETAILED PLAN SHOWING MONITORING LOCATIONS REFER TO DRAWING 0269.105.
3. NO BUILDINGS OR PERMANENT SERVICES WITHIN PERMITTED AREA.



DEPOSITION AREA DEFINED BY RED LINE BOUNDARY. NO DEPOSITION TO OCCUR OUTSIDE OF PERMIT BOUNDARY (ONLY RE-PROFILING OF EXISTING SOILS)

NOTE: SITE SECURITY
- SECURE SITE BOUNDARY INCLUDING POST AND WIRE FENCING. PADLOCK GATED ENTRANCE.
- DENSE VEGETATION GROWTH AND STEEPS SIDES ACT AS A DETERRENT TO TRESSPASSERS.
- WEEKLY BOUNDARY CHECKS.
- ON-SITE CCTV AND THIRD PARTY SECURITY FOR OUT OF HOURS CALL OUTS.
- EQUIPMENT AND TOOLS STORED IN LOCKED CONTAINERS BY SITE OFFICES.
- DOORS AND WINDOWS RE-ENFORCED AS APPROPRIATE.
- ALL VISITORS TO SIGN IN AND OUT.

EXISTING WASH PLANT USED FOR QUARRYING PURPOSES (NOT ASSOCIATED WITH ENVIRONMENTAL PERMIT)

EXISTING SITE OFFICES, WELFARE FACILITIES, WEIGHBRIDE AND PARKING, MAINS WATER

SITE ENTRANCE FOR ALL VEHICLES INCLUDING EMERGENCY SERVICES

EXISTING SAND AND GRAVEL BATCHING AREA (NOT ASSOCIATED WITH ENVIRONMENTAL PERMIT)

11 kV SUBSTATION

EXISTING SETTLEMENT LAGOON

BH01 BH02 BH03 BH04 BH05 BH06

ZZSW2

KEY:
- SITE BOUNDARY (2023 PLANNING PERMISSION)
- PERMIT BOUNDARY (TO REMAIN UNCHANGED FROM EXISTING PERMIT)
- SURFACE WATER MONITORING POINT
- BH04 GROUNDWATER MONITORING POINT
- WATER SERVICES
- ELECTRICITY SERVICES

Rev	Description	Drn	Chk	Date
A	Plan updated to include October 2025 boreholes.	JH	AL	31.10.25

REVISIONS

Preliminary		Approval		Tender		Const.	

DRAWING STATUS

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Tresco House, Westpoint Crt, Sidmouth Rd, Exeter EX5 1DJ
T: 01392 363364 www.horizon-ce.co.uk

BT JENKINS LTD

JOB TITLE
ZIG ZAG QUARRY
KINGSKERSWELL

DRAWING TITLE
SITE INFRASTRUCTURE PLAN

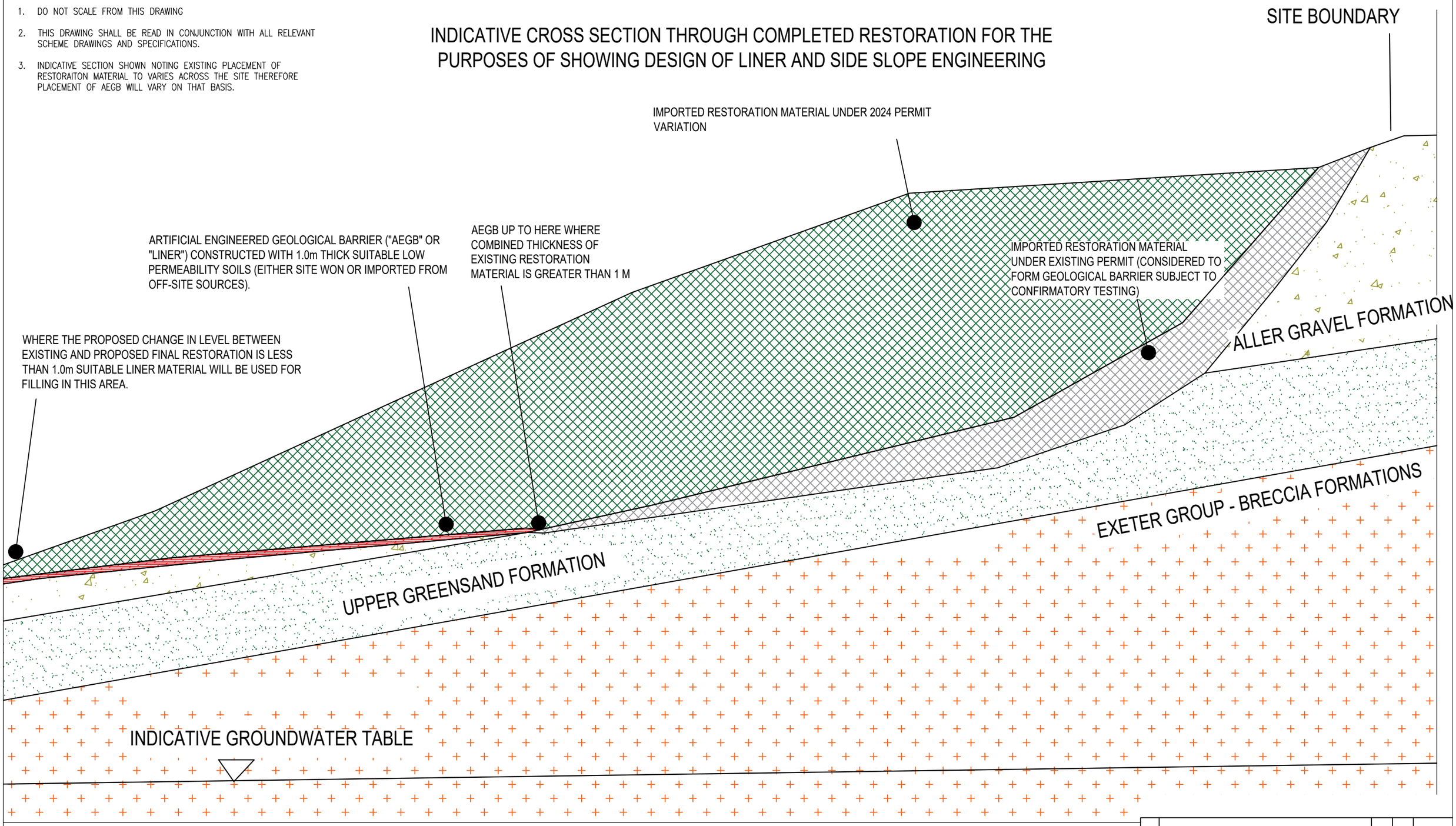
DATE JUN' 24 | DRAWN JH | CHECKED .

DRAWING No. 0269.103 | REV . | SCALE 1:2,500 @ A3

NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS.
3. INDICATIVE SECTION SHOWN NOTING EXISTING PLACEMENT OF RESTORAITON MATERIAL TO VARIES ACROSS THE SITE THEREFORE PLACEMENT OF AEGB WILL VARY ON THAT BASIS.

INDICATIVE CROSS SECTION THROUGH COMPLETED RESTORATION FOR THE PURPOSES OF SHOWING DESIGN OF LINER AND SIDE SLOPE ENGINEERING



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BT JENKINS LTD

JOB TITLE
ZIG ZAG QUARRY
KINGSKERSWELL

DRAWING TITLE
INDICATIVE LINER AND SIDE SLOPE ENGINEERING
ENVIRONMENTAL SETTING AND SITE DESIGN

Rev	Description	Drn	Chk	Date

REVISIONS

Preliminary		Approval		Tender		Const.	

DRAWING STATUS

DATE	DRAWN	CHECKED	ISSUE CHECKBOX
SEP '24	JH	AL	

DRAWING No.	REV	SCALE	
0269.109	–	NTS	@ A3

PHASE 1 CUT / FILL
FILL 580,000 m^3
CUT 30,000 m^3
NET FILL 550,000 m^3

EXISTING BOUNDARY LEVEL TO BE CONFIRMED, CONTRACTOR TO GRADE IMPORTED FILL TO EXISTING GROUND LEVEL AT SITE BOUNDARY

QUARRY WORKS HAVE BEEN UNDERTAKEN SINCE 2022 LIDAR SURVEY, CONTRACTOR TO ENSURE PROPOSED SURFACE TIES INTO EXISTING AT SUITABLE GRADE NO STEEPER THAN 1:3

EXISTING STOCKPILES TO BE RELOCATED OR INCORPORATED INTO WASTE MASS

EXISTING WASH PLANT TO REMAIN OPERATIONAL FOR DURATION OF PHASE 1 WORKS

EXISTING CEMENT BAGGING PLANT TO REMAIN OPERATIONAL FOR DURATION OF PHASE 1 WORKS

PROPOSED BASIN AND ASSOCIATED DRAINAGE INFRASTRUCTURE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS

A

A'

B

B'

84.0
82.0
80.0
78.0
76.0
74.0
72.0
70.0
68.0
66.0
64.0
62.0
60.0
58.0
56.0
54.0
52.0
50.0
48.0
46.0
44.0

NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS STATED OTHERWISE
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS
4. COMPOSITE MODEL REF, 220628 PROVIDED BY 4DES COMPARED WITH PROPOSED MODEL USED FOR VOLUMETRIC CALCULATIONS AS PER APPROVED PLANNING DRAWINGS. ASSUMPTIONS MADE IN COMPOSITE MODEL HAVE NOT BEEN VALIDATED, CIRCA 100,000m^3 VOLUME REMOVED WHEN COMPARED TO JUNE 2022 LIDAR MODEL REF 240221

Rev	Description	Drn	Chk	Date
	REVISIONS			

Preliminary Issue	30.05.24	Submitted for S104	
Planning Issue		Issued for Tender	
Submitted for S38		Issued for Construction	
Submitted for S278		As Built	
DRAWING STATUS			

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T.F. JENKINS LTD

JOB TITLE
ZIG ZAG RESTORATION

DRAWING TITLE
PHASE 1 PLAN
PROPOSED

DATE	DRAWN	CHECKED
MAY '24	GB	HT
DRAWING No.	REV.	SCALE
0269.601	–	AS SHOWN @ A1

PHASE 2 CUT / FILL
FILL 163,000 m^3
CUT 2,000 m^3
NET FILL 161,000 m^3

EXISTING BOUNDARY LEVEL TO BE CONFIRMED, CONTRACTOR TO GRADE IMPORTED FILL TO EXISTING GROUND LEVEL AT SITE BOUNDARY

EXISTING CEMENT BAGGING PLANT TO REMAIN OPERATIONAL FOR DURATION OF PHASE 2 WORKS

EXISTING STOCKPILES TO BE RELOCATED OR INCORPORATED INTO WASTE MASS

QUARRY WORKS HAVE BEEN UNDERTAKEN SINCE 2022 LIDAR SURVEY, CONTRACTOR TO ENSURE PROPOSED SURFACE TIES INTO EXISTING AT SUITABLE GRADE NO STEEPER THAN 1:3

PROPOSED BASIN AND ASSOCIATED DRAINAGE INFRASTRUCTURE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS

A

A

B

B

NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS STATED OTHERWISE
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS
4. COMPOSITE MODEL REF, 220628 PROVIDED BY 4DES COMPARED WITH PROPOSED MODEL USED FOR VOLUMETRIC CALCULATIONS AS PER APPROVED PLANNING DRAWINGS. ASSUMPTIONS MADE IN COMPOSITE MODEL HAVE NOT BEEN VALIDATED, CIRCA 100,000m^3 VOLUME REMOVED WHEN COMPARED TO JUNE 2022 LIDAR MODEL REF 240221

Rev	Description	Drn	Chk	Date
REVISIONS				

Preliminary Issue	30.05.24	Submitted for S104	
Planning Issue		Issued for Tender	
Submitted for S38		Issued for Construction	
Submitted for S278		As Built	
DRAWING STATUS			

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JENKINS LTD

JOB TITLE
ZIG ZAG RESTORATION

DRAWING TITLE
PHASE 2 PLAN
PROPOSED

DATE	DRAWN	CHECKED
MAY '24	GB	HT
DRAWING No.	REV.	SCALE
0269.602	–	AS SHOWN @ A1

FINAL RESTORATION PHASE CUT / FILL
FILL 107,000 m^3
CUT <1,000 m^3
NET FILL 107,000 m^3

TOTAL CUT / FILL
FILL 860,000 m^3
CUT 10,000 m^3
NET FILL 850,000 m^3

EXISTING BOUNDARY LEVEL TO BE CONFIRMED, CONTRACTOR TO GRADE IMPORTED FILL TO EXISTING GROUND LEVEL AT SITE BOUNDARY

QUARRY WORKS HAVE BEEN UNDERTAKEN SINCE 2022 LIDAR SURVEY, CONTRACTOR TO ENSURE PROPOSED SURFACE TIES INTO EXISTING AT SUITABLE GRADE NO STEEPER THAN 1:3

BASINS OMITTED FROM FINAL RESTORATION ON THE ASSUMPTION THAT AN ALTERNATIVE DRAINAGE STRATEGY, DESIGN BY OTHERS, IS ACCEPTABLE

A

A'

B

B'

NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS STATED OTHERWISE
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS
4. COMPOSITE MODEL REF, 220628 PROVIDED BY 4DES COMPARED WITH PROPOSED MODEL USED FOR VOLUMETRIC CALCULATIONS AS PER APPROVED PLANNING DRAWINGS. ASSUMPTIONS MADE IN COMPOSITE MODEL HAVE NOT BEEN VALIDATED, CIRCA 100,000m^3 VOLUME REMOVED WHEN COMPARED TO JUNE 2022 LIDAR MODEL REF 240221

Rev	Description	Drn	Chk	Date
REVISIONS				

Preliminary Issue	21.06.24	Submitted for S104	
Planning Issue		Issued for Tender	
Submitted for S38		Issued for Construction	
Submitted for S278		As Built	
DRAWING STATUS			

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BY JENKINS LTD

JOB TITLE
ZIG ZAG RESTORATION

DRAWING TITLE
RESTORATION PLAN
PROPOSED
WITHOUT BASINS

DATE	DRAWN	CHECKED
MAY '24	GB	HT

DRAWING No.	REV.	SCALE
0269.603	–	AS SHOWN @ A1

FINAL RESTORATION PHASE CUT / FILL
FILL 68,000 m^3
CUT 2,000 m^3
NET FILL 66,000 m^3

TOTAL CUT / FILL
FILL 811,000 m^3
CUT 34,000 m^3
NET FILL 777,000 m^3

QUARRY WORKS HAVE BEEN UNDERTAKEN SINCE 2022 LIDAR SURVEY, CONTRACTOR TO ENSURE PROPOSED SURFACE TIES INTO EXISTING AT SUITABLE GRADE NO STEEPER THAN 1:3

EXISTING BOUNDARY LEVEL TO BE CONFIRMED, CONTRACTOR TO GRADE IMPORTED FILL TO EXISTING GROUND LEVEL AT SITE BOUNDARY

PROPOSED BASIN AND ASSOCIATED DRAINAGE INFRASTRUCTURE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS

A

A'

B

B'

NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS STATED OTHERWISE
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS
4. COMPOSITE MODEL REF, 220628 PROVIDED BY 4DES COMPARED WITH PROPOSED MODEL USED FOR VOLUMETRIC CALCULATIONS AS PER APPROVED PLANNING DRAWINGS. ASSUMPTIONS MADE IN COMPOSITE MODEL HAVE NOT BEEN VALIDATED, CIRCA 100,000m^3 VOLUME REMOVED WHEN COMPARED TO JUNE 2022 LIDAR MODEL REF 240221

Rev	Description	Drn	Chk	Date
REVISIONS				

Preliminary Issue	30.05.24	Submitted for S104	
Planning Issue		Issued for Tender	
Submitted for S38		Issued for Construction	
Submitted for S278		As Built	
DRAWING STATUS			

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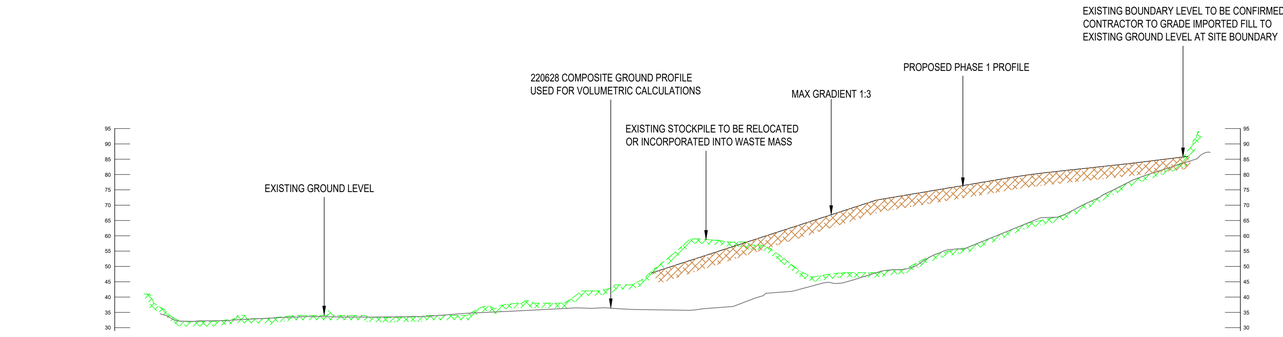
BY JENKINS LTD

JOB TITLE
ZIG ZAG RESTORATION

DRAWING TITLE
RESTORATION PLAN
PROPOSED
WITH BASINS

DATE	DRAWN	CHECKED
MAY '24	GB	HT

DRAWING No.	REV.	SCALE
0269.604	–	AS SHOWN @ A1



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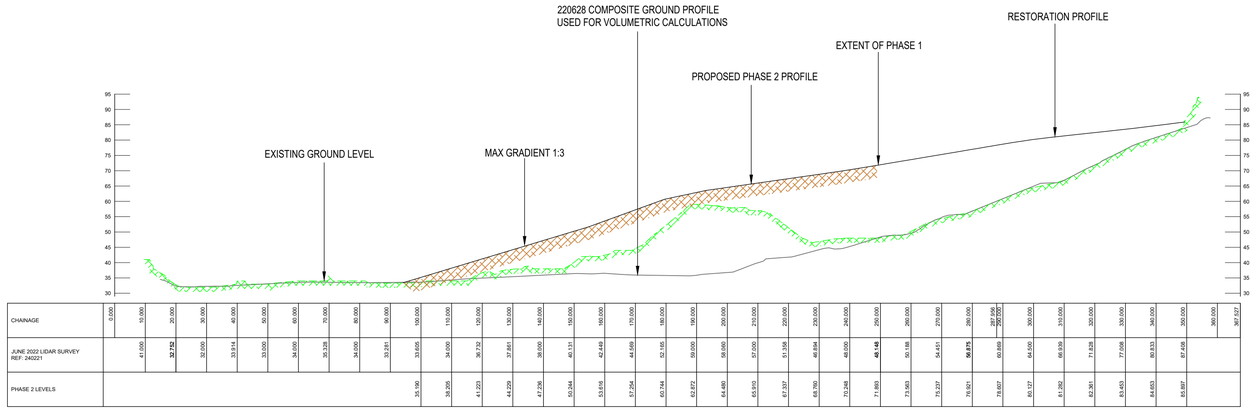
JUNE 2022 LIDAR SURVEY REF. 240221		41.000	**32.752**	32.000	33.914	33.000	34.000	35.328	34.000	33.281	33.655	34.000	36.732	37.861	38.000	40.131	42.449	44.659	52.165	59.000	58.090	57.000	51.358	46.894	48.000	**45.148**	50.188	54.451	**66.875**	60.869	64.000	66.939	71.828	77.006	80.833	87.408			
PHASE 1 LEVELS																			49.464	52.844	50.865	30.123	62.363	65.854	68.843	71.993	73.903	75.237	76.021	78.607	80.127	81.282	82.361	83.453	84.653	85.897			

SECTION A-A' PHASE 1
SCALE 1:1000 HORIZ / 1:1000 VERT



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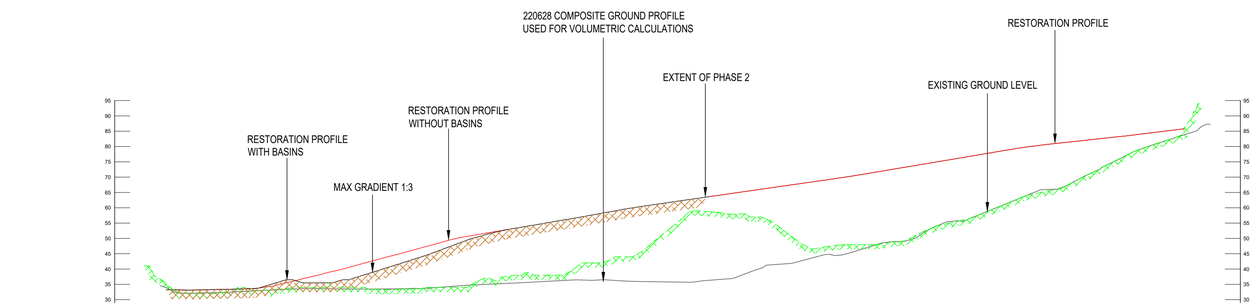
JUNE 2022 LIDAR SURVEY REF. 240221		41.000	**32.752**	32.000	33.914	33.000	34.000	35.328	34.000	33.281	33.655	34.000	36.732	37.861	38.000	40.131	42.449	44.659	52.165	59.000	58.090	57.000	51.358	46.894	48.000	**45.148**	50.188	54.451	**66.875**	60.869	64.000	66.939	71.828	77.006	80.833	87.408			
PHASE 2 LEVELS												35.190	38.295	41.223	44.229	47.298	50.244	53.616	57.254	60.744	63.973	64.480	65.910	67.337	68.760	70.348	71.993	73.903	75.237	76.021	78.607	80.127	81.282	82.361	83.453	84.653	85.897			

SECTION A-A' PHASE 2
SCALE 1:1000 HORIZ / 1:1000 VERT



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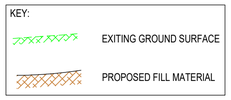
JUNE 2022 LIDAR SURVEY REF. 240221		41.000	**32.752**	32.000	33.914	33.000	34.000	35.328	34.000	33.281	33.655	34.000	36.732	37.861	38.000	40.131	42.449	44.659	52.165	59.000	58.090	57.000	51.358	46.894	48.000	**45.148**	50.188	54.451	**66.875**	60.869	64.000	66.939	71.828	77.006	80.833	87.408			
FINAL RESTORATION LEVELS			33.261	33.780	33.451	34.226	36.469	38.074	41.531	44.259	46.896	49.615	51.524	53.194	54.879	56.591	58.390	60.141	61.604	63.044	64.480	65.911	67.337	68.761	70.236	71.880	73.582	75.236	76.521	78.611	80.136	81.284	82.380	83.431	84.653	85.894			
FINAL RESTORATION LEVELS WITH ATTENUATION BASINS			33.207	33.753	33.472	34.498	36.928	38.500	37.636	40.786	43.949	47.044	50.066	53.201	54.866	56.602	58.390	60.134	61.655	63.044	64.480	65.910	67.337	68.760	70.348	71.993	73.903	75.237	76.021	78.607	80.127	81.282	82.361	83.453	84.653	85.897			

SECTION A-A' FINAL RESTORATION
SCALE 1:1000 HORIZ / 1:1000 VERT



NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
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3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS
4. REFER TO DRAWING 0269.601 FOR SECTION LINE LOCATIONS
5. JUNE 2022 LIDAR SURVEY, REF 240221 AND COMPOSITE MODEL REF, 220628 PROVIDED BY 4DES

Rev	Description	Drn	Chk	Date
	REVISIONS			

Preliminary Issue	30.05.24	Submitted for S104	
Planning Issue		Issued for Tender	
Submitted for S38		Issued for Construction	
Submitted for S278		As Built	
DRAWING STATUS			

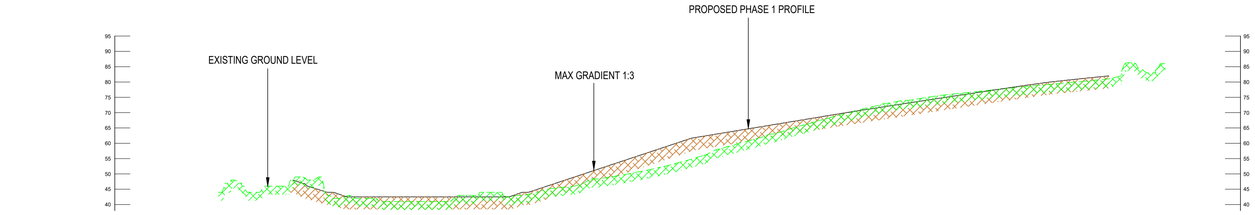
Horizon Consulting Engineers
The Dairy Barn, Westpoint Crt, Sidmouth Rd, Exeter EX5 1DJ
T: 01392 363364 www.horizon-ce.co.uk

BY JENKINS LTD

JOB TITLE
ZIG ZAG RESTORATION

DRAWING TITLE
SECTIONS PROPOSED SHEET 1

DATE	DRAWN	CHECKED
MAY '24	GB	HT
DRAWING No.	REV	SCALE
0269.605	–	AS SHOWN @ A1



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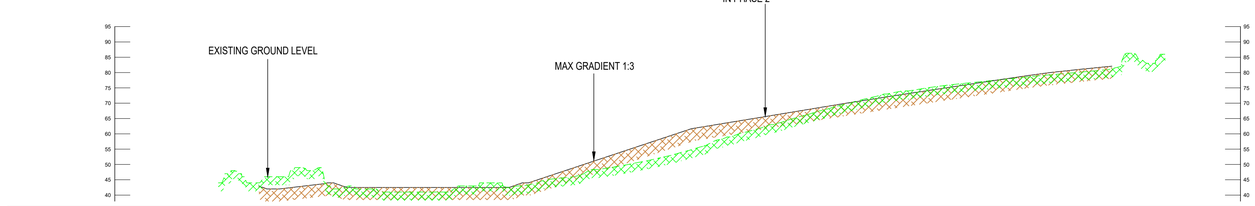
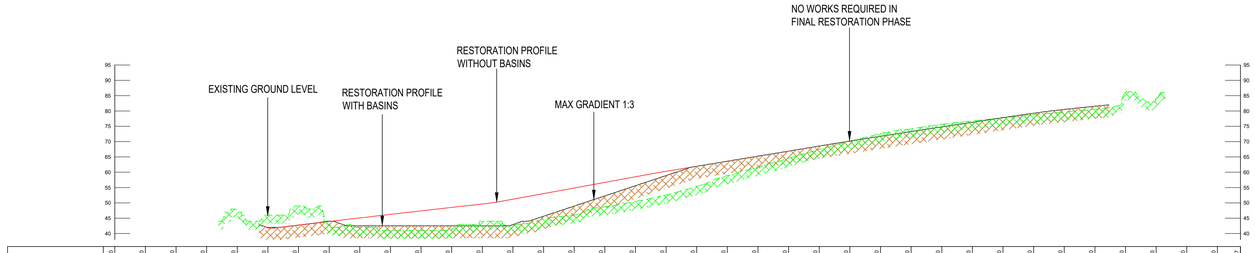
JUNE 2022 LIDAR SURVEY REF: 240221					47.755	46.000	49.000	43.000	42.000	41.000	41.000	**41.355**	44.000	42.741	44.799	46.022	48.711	50.487	52.613	55.367	58.980	61.670	64.563	67.475	70.128	72.657	74.145	75.666	76.745	77.796	78.807	79.677	80.564	**80.125**	84.500				
PHASE 1 LEVELS							47.380	44.000	42.500	42.500	42.000	42.000	42.000	42.829	45.652	48.970	52.288	55.607	58.927	61.955	63.693	65.247	66.899	68.551	70.183	71.744	73.284	74.864	76.520	77.815	79.278	80.764	81.539						

SECTION B-B' PHASE 1
SCALE 1:1000 HORIZ / 1:1000 VERT



CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	367.527
JUNE 2022 LIDAR SURVEY REF: 240221					47.755	46.000	49.000	43.000	42.000	41.000	41.000	**41.355**	44.000	42.741	44.799	46.022	48.711	50.487	52.613	55.367	58.980	61.670	64.563	67.475	70.128	72.657	74.145	75.666	76.745	77.796	78.807	79.677	80.564	**80.125**	84.500				
PHASE 2 LEVELS						42.000	42.746	44.000	42.500	42.500	42.000	42.000	42.500	42.500	42.829	45.651	48.969	52.288	55.606	58.927	61.955	63.693	65.247	66.899	68.551	70.183	71.744	73.284	74.864	76.520	77.816	79.304	80.764	81.539						

SECTION B-B' PHASE 2
SCALE 1:1000 HORIZ / 1:1000 VERT



CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	367.527
JUNE 2022 LIDAR SURVEY REF: 240221					47.755	46.000	49.000	43.000	42.000	41.000	41.000	**41.355**	44.000	42.741	44.799	46.022	48.711	50.487	52.613	55.367	58.980	61.670	64.563	67.475	70.128	72.657	74.145	75.666	76.745	77.796	78.807	79.677	80.564	**80.125**	84.500	85.000			
FINAL RESTORATION LEVELS						42.000	42.746	44.000	42.500	42.500	42.000	42.000	42.500	42.500	42.829	45.652	48.970	52.288	55.607	58.927	61.955	63.693	65.247	66.899	68.550	70.185	71.747	73.281	74.801	76.320	77.816	79.304	80.764	81.541						
FINAL RESTORATION LEVELS WITH ATTENUATION BASINS						41.647	42.746	43.935	42.500	42.500	46.343	47.955	48.516	48.650	51.710	53.032	54.653	56.999	58.519	60.303	61.955	63.693	65.247	66.899	68.550	70.185	71.747	73.281	74.801	76.320	77.816	79.304	80.764	81.541						

SECTION B-B' FINAL RESTORATION
SCALE 1:1000 HORIZ / 1:1000 VERT

KEY:

EXITING GROUND SURFACE

PROPOSED FILL MATERIAL

NOTES: GENERAL

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS STATED OTHERWISE
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS
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Rev	Description	Drn	Chk	Date
	REVISIONS			

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Planning Issue		Issued for Tender	
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DRAWING STATUS			

Horizon Consulting Engineers
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BY JENKINS LTD

JOB TITLE
ZIG ZAG RESTORATION

DRAWING TITLE
SECTIONS
PROPOSED
SHEET 2

DATE	DRAWN	CHECKED
MAY '24	GB	HT
DRAWING No.	REV	SCALE
0269.606	–	AS SHOWN @ A1

Appendix B
Drawing Reproduced from FRA

1.000-1.003 332m
450mm @ 1 in 29.4

Ditch or swale to convey runoff to 1.000

SUBCATCHMENT PHASE 1A 27,200m²

SUBCATCHMENT PHASE 2 17,400m²

Ditch or swale to convey runoff to 3.000

3.000-3.001 186m
450mm @ 1 in 186.0

SUBCATCHMENT PHASE 3 20,000m²

SUBCATCHMENT PHASE 1B 27,000m²

Pond/Basin 3
1 in 3 side slopes
Plan area at 31.000 1,320m²
Plan area at 32.000m 2,000m²

150-250mm rip-rap set in concrete at outfall

Pond/Basin 1
1 in 4 side slopes
Plan area at 45.500 2,450m²
Plan area at 47.000 4,840m²

Ditch or swale to convey runoff to 4.001

Hydro-Brake
4.0l/s @ 1.0m head
IL 31.000

4.001 109m 150mm
@ 1 in 19.0

1.004 102m
225mm @ 1 in 4.1

Hydro-Brake
IL 44.500
Phase 1
10.8l/s @ 1.5m head
Replaced with
14.3l/s @ 1.5m head for Phases 2 & 3

CL 27.000
IL 25.750

Discharge to existing culvert
CL 26.300
IL 24.700

PHASING PLAN
Phase 1
Construct Basin/Pond 1 and conduits 1.004-1.005
Reinstate Phase 1A sub-catchment
Construct swale/ditch and conduits 1.000 to 1.003

Phase 2
Reinstate Phase 2 sub-catchment
Construct swale/ditch and conduits 3.000 to 3.001
Replace Hydro-Brake in Basin/Pond 1

Phase 3
Construct Basin/Pond 2 and conduit 4.000

Notes:

REV	DATE	DESCRIPTION
A	13.01.2023	Initial issue

CLIENT:

PROJECT: ZIG-ZAG QUARRY REINSTATEMENT

TITLE: SURFACE WATER DRAINAGE STRATEGY

REV:	PROJECT No:	DRAWING No:
A	0603	DR-001

SCALE @ A1: 1:1,000

DESIGN BY: pitman associates CONSULTING ENGINEERS

Appendix C
Drawing Reproduced from 2021 HRA

Surface Water Monitoring Record.

JH Groundwater Ltd
Hydrogeological Solutions

SITE	**Zig Zag Quarry. Aller Brook upgradient of restoration area.**
Visit date and time	**22_7_21 11:00:00**
Name of sampler	**Julian Hatherall.**
Weather conditions	Hot, Dry
Ground Conditions	Dry

								Field Chemistry and Appearance					Laboratory	Notes
Sample Ref	**Grid Reference**	**Approx. Elevation**	**Type of sample**	**Location**	**Purpose**	**Water Conditions in Stream**	**Analysis type - In-situ +/or laboratory**	**Temp**	**pH**	**EC**	**TDS**	**Visual / Olfactory Description**	**Sample Collected for Lab Analysis? Any storage issues?**	
ZZ SW1	SX 87810 67655	22mAOD	Surface Water	Adjacent to public footpath. Upstream of restoration.	Initial sampling visit.	At the time of sampling sediment load was low. Flow reasonable.	In-situ and Laboratory samples collected	16	8	660	330	Light sediment loading, no other discolouration. No odour.	QTS Environmental - collected 22_7_21.	
Units		***mAOD***						***°C***		***µS/cm***	***mg/l or ppm***			

SAMPLING LOCATIONS RELATIVE TO RESTORATION AREA.

GENERAL NOTES	Add any general notes about the sampling location catchment or other observations here. This should also include any planned, near future operations close to the sampling point which could impact water quality data.

Sampling point is adjacent to a public footpath upstream of the restoration area. It has been chosen as being upstream and accessible and safe. Closer locations are either inaccessible due to height or on private land.

The sampling point is approximately 2m in width and <1m deep. The location is accessed from the footpath in playing fields.

Surrounding land use is predominantly roads and housing. There is some private sewage treatment plants discharging to surface water locally. There may also be formal and informal road drainage points. Road runoff in heavy rainfall has the potential to transmit pollutants to the brook both from the road and surrounding areas.

It is likely that water quality will be variable and reflect changes in flow and seasonal runoff. A small snapshot has been collected for baseline monitoring and changes in water quality during the operational phase will need to take account of the presence of this anticipated variability where this is identified in the water quality monitoring results.

INTERPRETATION - SEE ATTACHED SHEET FOR RESULTS OF ANALYSIS
Local conditions were dry preceding the visit.
Results similar for up and down stream samples.
Further changes to parameters are anticipated as a result of seasonal change in runoff within the catchment. This will need to be taken into account during the review of subsequent results.

Given the nature of the catchment and potential seasonal changes to water quality it is considered appropriate at this stage to review changes in water quality trends rather than apply strict control and trigger levels .
If control and trigger levels are to be applied then they should be relatively broad at this time.

Surface Water Monitoring Record.

JH Groundwater Ltd
Hydrogeological Solutions

SITE	**Zig Zag Quarry. Aller Brook downgradient of restoration area.**
Visit date and time	**22_7_21 11:00:00**
Name of sampler	**Julian Hatherall.**
Weather conditions	Hot, Dry
Ground Conditions	Dry

								Field Chemistry and Appearance					Laboratory	Notes
Sample Ref	**Grid Reference**	**Approx. Elevation**	**Type of sample**	**Location**	**Purpose**	**Water Conditions in Stream**	**Analysis type - In-situ +/or laboratory**	**Temp**	**pH**	**EC**	**TDS**	**Visual / Olfactory Description**	**Sample Collected for Lab Analysis? Any storage issues?**	
ZZ SW2	SX 87625 68928	13mAOD	Surface Water	Within roof supplies yard. downstream of restoration.	Quarterly sampling visit.	At the time of sampling sediment load was low in the river. Flow reasonable.	In-situ and Laboratory samples collected	16	8	630	310	Light sediment loading. No odour.	QTS Environmental - collected 22_7_21.	
Units		***mAOD***						***°C***		***µS/cm***	***mg/l or ppm***			

SAMPLING LOCATIONS RELATIVE TO RESTORATION AREA.

GENERAL NOTES	Add any general notes about the sampling location catchment or other observations here. This should also include any planned, near future operations close to the sampling point which could impact water quality data.

Sampling point is in a roofing supplies yard adjacent to a road bridge downstream of the restoration area. It has been chosen as being on the down stream. Unable to access private land further downstream.

The sampling point is approximately 5m in width and <1m deep. The location is accessed from the yard.

Surrounding land use is predominantly roads and housing. There is some private sewage treatment plants discharging to surface wate locally. There may also be formal and informal road drainage points. Road runoff in heavy rainfall has the potential to transmit pollutants to the brook both from the road and surrounding areas.

It is likely that water quality will be variable and reflect changes in flow and seasonal runoff. A small snapshot has been collected for baseline monitoring and changes in water quality during the operational phase will need to take account of the presence of this anticipated variability where this is identified in the water quality monitoring results.

INTERPRETATION - SEE ATTACHED SHEET FOR RESULTS OF ANALYSIS

Local conditions were dry preceding the visit.

Results similar for up and down stream samples.

Further changes to parameters are anticipated as a result of seasonal change in runoff within the catchment. This will need to be taken into account during the review of subsequent results.

Given the nature of the catchment and potential seasonal changes to water quality it is considered appropriate at this stage to review changes in water quality trends rather than apply strict control and trigger levels .

If control and trigger levels are to be applied then they should be relatively broad at this time.

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