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LIGHTWATER QUARRIES LIMITED

APPLICATION FOR AN ENVIRONMENTAL PERMIT

GEBDYKES QUARRY LANDFILL

OPERATING TECHNIQUES

APRIL 2023

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OPERATING TECHNIQUES

APRIL 2023

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1 INTRODUCTION

1.1.1 Gebdykes Quarry is a limestone quarry located at Masham, North Yorkshire. Lightwater Quarries Limited are applying for an environmental permit to allow the landfilling of approximately 200,000 tonnes of clean inert materials per year to restore the site to original levels. In total 3,600,000 tonnes of clean inert materials will be deposited.

1.1.2 Landfill operations will be undertaken in five distinct phases in the southern void of the quarry, while limestone extraction will continue within the north void. An engineered artificially established (crushed and screened dolomite fines) geological barrier will be constructed to ensure compliance with the Landfill Directive. All clean inert materials to be landfilled at the site will meet the definition of inert in accordance with the Landfill Directive.

1.1.3 The site location and boundary of the permitted area are shown on drawing NT14621/003.

1.1.4 The site will be operated in accordance with Lightwater Quarries' environmental management system. All operations at Gebdykes Quarry will be managed by a Technically Competent Manager.

1.1.5 Operations at the site will meet the requirements of the Environment Agency's guidance "Landfill operators: environmental permits". This application fulfils requirements that are set out within the guidance. The following are included:

- a conceptual model of the site is provided within the Environmental Setting and Site Design (ESSD);
- details of the potential hazards and receptors at the site, and how risk will be mitigated are provided within the Accident and Amenity, and Habitats Risk Assessment;
- a description of the hydrogeological conditions of the site is provided within the Hydrogeological Risk Assessment (HRA);
- an initial desk study has been undertaken that identifies the conditions at the site and around the site. This is summarised in the ESSD;
- details of the site monitoring regime are provided within Section 8 and in the HRA;

- a list of permitted materials to be accepted at the site is provided as Appendix 1;
- details of material pre-acceptance and acceptance procedures, including compliance testing, are presented in Section 4;
- a Financial Provision spreadsheet is included in the application; and
- details of site closure are presented in Section 10.

1.1.6 Section 2 of this document details the permitted activities that are to be undertaken at the site.

1.1.7 The history of the site is detailed in Section 3.

1.1.8 The layout of the site is described in Section 4.

1.1.9 Details of pre-acceptance, acceptance and rejection criteria are described in Section 5.

1.1.10 A description of the operations that will be undertaken at the site is provided in Section 6.

1.1.11 Section 7 details how potential amenity issues (e.g. noise and dust) will be mitigated, and how records are kept.

1.1.12 The management of surface water is detailed in Section 8.

1.1.13 Section 9 provides details of the site monitoring regime.

1.1.14 Site management procedures are detailed in Section 10.

1.1.15 Section 11 covers procedures relating to the closure of the site and the aftercare period.

2 PERMITTED ACTIVITIES

2.1.1 The permitted activities will be limited to the landfilling of clean inert materials as set out in Table 1, below.

Table 2.1: Permitted Site Activities

Activity	Schedule 1 Reference under EPR2016	Waste Framework Directive Classification
Inert landfill	Not listed	D1 deposit into or onto land, e.g. landfill

2.1.2 It is intended that the site will accept approximately 200,000 tonnes of clean inert materials per annum. The total amount of inert materials to be deposited at the site is 3,600,000 tonnes.

2.1.3 The site operations will be under the control of a Technically Competent Manager (TCM) who holds the appropriate WAMITAB certification. The TCM will attend site at a frequency in compliance with the Environment Agency's requirements for site attendance. In accordance with the guidance this is equivalent to 20% of operational hours during the first six months of site operations.

3 SITE HISTORY

3.1.1 Extraction of stone from land within the vicinity of the current Gebdykes Quarry dates back to at least the 1860s. The current Gebdykes Quarry and a quarry located adjacent to the site boundary to the northwest were known as “Gybdykes Quarry” at this time.

3.1.2 Gybdykes Quarry to the northwest of the current site has since been worked and restored into a small, wooded area.

3.1.3 The first permission for mineral extraction at the site was granted in 1949. The permission requires the following:

- All topsoil and overburden to be deposited in a level manner within the quarry workings, and the land to be returned to agriculture so far as practicable.

3.1.4 This planning permission was reviewed, resulting in a new permission (C2/97/135/0051C/MR) containing revised conditions being issued on 3rd February 1998.

3.1.5 Planning permission was granted on 5th November 2001 for a northern, eastern and southern extension to Gebdykes Quarry (C2/99/135/0051D). These permitted extensions form the scope of the existing quarry boundary. The permission required that:

- Following mineral extraction, overburden and other waste materials should be replaced to such levels so that, after the replacement of subsoil and topsoil the contours of the restored land shall conform with the restoration contours as indicated in the application details.

3.1.6 In accordance with the planning permission, the site is to be restored to original ground levels and for the purpose of agriculture. This is shown on drawing NT14834/Figure 3.6.

4 SITE LAYOUT

4.1.1 The quarry void is divided into a northern and southern void. Limestone extraction will continue within the north void area, while waste infilling commences within the southern excavation as per the subject of this permit application. It is proposed the northern void area will not be infilled, but will be restored at the quarry base level. Drawing NT14834/ 014 shows the proposed restoration level of the full extent of the inert landfill and the northern void area.

4.1.2 The landfill will completed in 5 phases, as shown in Drawings NT14834/Figure 3.1 – 3.5. The site will be subject to progressive restoration with each phase restored as it is completed.

4.1.3 Access to the site is gained from the site entrance at Halfpenny House Lane to the east, which is surfaced with concrete. Internal roads will be constructed from hardcore.

4.1.4 A weighbridge is located on site. This will be properly maintained and calibrated to allow accurate recording of materials entering and leaving the site.

5 MATERIAL ACCEPTANCE

5.1.1 A list of permitted inert materials to be accepted at the site is provided in Appendix 1. All materials accepted for landfilling will be inert and will either be accepted in accordance with the list of materials acceptable without testing or will be tested to demonstrate compliance with the inert material acceptance criteria in accordance with the Landfill Directive.

5.1.2 Pre-acceptance checks will be undertaken by the operator to confirm that the materials to be accepted are clean inert wastes are suitable for use prior to being accepted on to site.

5.1.3 Wastes listed under 2.1.1 of Annex 2003/33/EC [1]of the Landfill Directive may be accepted for disposal at the site without being subject to any additional testing provided:

- the waste is from a single stream and single source material. Different wastes contained within the list of wastes acceptable without testing may be accepted together, provided they are from the same source;
- the site of origin is not contaminated and the wastes do not contain other material or substances to an extent which increases the risk associated with the waste sufficiently to justify its disposal in another class of landfill.

5.1.4 Where inert materials are sourced from a brownfield site or there is any other reason to believe materials may not be fully inert or meet the above description, the materials producer will be required to provide representative analysis, showing that the material meets inert material acceptance criteria.

5.2 Pre-Acceptance

Initial Assessment

5.2.1 Pre-acceptance checks will be made to ensure that clean inert materials are compliant with the permit conditions. Inert materials will be subject to Level 1 Basic Characterisation, which will involve collecting details regarding the:

[1] 2003/33/EC: Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (legislation.gov.uk)

- Material producer;
- Process generating the inert materials;
- Quantity of clean inert materials;
- Material type;
- Material appearance (smell, colour and physical form);
- Classification under the list of waste regulations;
- Chemical analysis of the material, including leaching behaviour (unless on the list of materials acceptable without testing); and
- Six figure code according to the European Waste Catalogue.

5.2.2 This information will be assessed by a suitably competent person, to determine whether the clean inert materials are acceptable for deposit at the site. Where the results of Level 1 Basic Characterisation show that a material stream is not acceptable for deposit, the material will not be accepted at the site.

5.2.3 Where wastes are deemed to be acceptable the site weighbridge will be informed that the waste stream has been approved and the pre-acceptance data will be forwarded to the weighbridge, so that it is available to staff to make their acceptance checks when the waste arrives on site.

Compliance Testing

5.2.4 The operator will undertake Level 2 Compliance Testing at least once a year for each material stream subject to leaching tests by the producer. At least one sample will be taken for each relevant material stream. Level 2 Compliance Testing will demonstrate the integrity of Level 1 Basic Characterisation Testing and ensure compliance with the requirements of the Environmental Permit.

5.2.5 Level 2 compliance testing constitutes periodic testing which will be determined by the Site Manager based upon the type and tonnage of clean inert materials being accepted. It will be a simple standardised analysis to determine whether the inert material complies with the results of the basic characterisation and inert WAC.

5.2.6 All samples for Level 2 Compliance Testing will be stored in a closed container suitable for the material being contained (to be determined by a technically competent person). The containers will be clearly labelled and/or referenced sufficiently to identify sample source and date of delivery.

5.2.7 Samples will be submitted to an independent laboratory for analysis using MCERTs accredited techniques. The determinants for analysis will be selected on the basis of Level 1 basic characterisation. Copies of analytical results will be kept in a site log and made available to authorised officers of the Environment Agency.

5.2.8 Each load arriving at the site will be subject to Level 3 On-Site Verification. This comprises a check of the material transfer note or annual season ticket, and a visual inspection prior to and following deposit of clean inert materials at the site to ensure that the material appears compliant with the basic characterisation.

Acceptance

5.2.9 Clean inert materials will only be accepted when the site is adequately manned, allowing for acceptance checks and controlled deposit of the material.

5.2.10 On arrival at the site, clean inert materials will be weighed in at the weighbridge and transfer notes will be checked. If the driver does not have a Duty of Care Transfer Note or if the clean inert material is not in compliance with the permit conditions or the pre-acceptance information the Material Rejection Procedure will be followed.

5.2.11 The operator will inspect each load of clean inert material during unloading to ensure that it is acceptable and consistent with the pre-acceptance checks. Should non-conforming inert material be detected, this will wherever possible be reloaded onto the delivery vehicle and rejected from the site.

5.2.12 Records of all enquiries will be kept with pre-acceptance documentation (basic characterisation) in a log maintained in the site office. When a load of inert material is delivered to the site, this pre-acceptance documentation will be cross-referenced against the details given on the relevant material transfer notes/season tickets accompanying the inert material and the contents of the load.

5.2.13 The weight of each load will be recorded electronically, allowing the quantity of inert material that is deposited to be easily monitored.

5.2.14 Pre-acceptance and acceptance documentation will be made available for inspection by authorised officers of the Environment Agency on request.

Rejection

5.2.15 Any discrepancies found as a result of the checks detailed above will result in:

- referral to a suitable competent person;

- referral to the material producer or the material carrier's base, to confirm the nature of the inert material load;
- a written record being made in the site log to record the nature of the material and the actions that are taken; and
- where necessary, referral to the Environment Agency.

5.2.16 Where the investigation shows that waste is acceptable it will be directed to the tipping area. Otherwise, the waste will be rejected following the procedure below and a record will be made in the site log.

5.2.17 Where appropriate, material will either be returned to the producer/previous holder or re-directed to an appropriate authorised facility for disposal. Where it is not possible to directly reject the load, it will be removed to an on-site quarantine area for temporary storage prior to off-site removal to an authorised facility.

5.2.18 Should the non-compliance involve hazardous material or material that otherwise poses a heightened risk to the environment, the Environment Agency will be informed as soon as possible.

6 LANDFILLING

6.1 Site Activities

6.1.1 Landfill operations will be undertaken in five distinct phases in the southern void of the quarry as shown in Drawings NT14834/Figure 3.1 – 3.5. Limestone extraction will continue within the north void area contemporary to landfilling operations in the south. The infill works will comprise the placement of clean inert waste in layers of 2 – 3m, working up from the base of excavation to produce the agreed restoration profile.

6.1.2 The maximum depth of landfill will be 30m. A series of cross sections through the site, showing formation and levels are shown on Drawing NT14834/Figure 3.7. The sections show the existing profile of the quarry excavation, the site boundary and restoration profile. The Hydrogeological Cross Section (included in the Hydrogeological Risk Assessment) is provided as NT14621-Figure 5, showing the design of the design of the liner in context with the surrounding geology. The final restoration profile of the landfill area is that of a uniform surface, matching closely that of the original landform.

6.1.3 The basal and side slope lining systems will be constructed in accordance with the requirements of the Landfill Directive. The initial side slope lining system will comprise a bund constructed from crushed and screened dolomite fines, 2m in height and 3m in width, to connect to the existing side slope. The side slope lining system will be installed progressively with each waste lift. The basal liner will be 650mm in thickness. The artificially established geological barrier will comprise crushed and screened dolomite fines that will be compacted to provide a permeability equal to or less than $6.5x10^{-8}$m/s, which is equivalent to a maximum of $1x10^{-7}$ m/s for a 1m thick barrier, as evidenced in the Materials Suitability Assessment in Appendix 2, submitted to the EA on 5th October 2022. If there is a shortfall of dolomite fines or the material becomes otherwise inconsistent, other suitable imported material will be used which is able to meet the required liner specification.

6.1.4 The north face of the landfill will be left as an open slope within the waste at a design profile of 1 in 3.

6.1.5 Inert materials will not degrade and can be properly compacted in layers to minimise settlement and achieve a stable landform.

6.2 Restoration

6.2.1 The site is to be restored to agricultural and nature conservation (calcareous grassland) uses. The final restoration profile is shown in drawing NT14834/Figure 3.6. In order to allow for the emplacement of final restoration materials, the last layer of inert material that is placed will placed to the necessary level below the adjoining undisturbed ground levels, to ensure the final restoration of the site will tie in to existing adjacent ground levels.

6.2.2 Following landfilling, overburden, subsoils and topsoil stripped from the site, along with any necessary imported subsoils will be placed over the clean inert material.

6.2.3 Phase 1 will be restored to Magnesian limestone grassland, while phases 2 – 5 will be restored to agricultural grassland.

6.2.4 To restore the site to magnesian limestone a soil profile will be created comprising 100mm of topsoil emplaced over limestone fines. For the agricultural grassland areas, the restoration soil profile will comprise approximately 300mm of topsoil (previously stripped from the site) over 600mm of subsoil (See Appendix 3 Landscape, Biodiversity and Restoration Management Plan).

6.2.5 No large pieces of inert material (over 150mm in size) will be included within the restoration layer.

6.2.6 Topsoil will form the final restoration contours and the site will be seeded to establish a healthy vegetation cover.

7 RECORD KEEPING AND CONTROL OF AMENITY ISSUES

7.1.1 The site will be inspected on a daily basis. Site staff will carry out a visual and olfactory assessment around the site boundary to check for emissions of litter, odour, noise, mud, or dust.

7.1.2 Should any issues be noted during the daily inspections these will be raised with site management and appropriate remedial action will be agreed. The remedial action agreed and the time that it was (or is to be) carried out will be noted in the site log.

7.1.3 All site infrastructure and site plant will be regularly inspected for leaks or damage. Inspections will be recorded within the site diary. Where leaks or damage are identified the equipment will be immediately repaired by suitably qualified staff or taken out of service. Any spills will be cleaned using a spill kit and recorded.

7.1.4 The site diary will be made available to warranted officers of the Environment Agency on request. Should any incident have the potential to cause significant emissions, the Environment Agency will be informed by telephone and remedial action will be agreed with the local environment officer.

7.1.5 Other records that are kept on site (either in electronic or hard copy format) include details of inert material enquiries and pre-acceptance information, copies of all material transfer notes for incoming and outgoing materials, details of any rejected loads, copies of the analysis of inert materials where required and results of any environmental monitoring.

7.2 Environmental Protection Measures

7.2.1 Measures will be employed throughout the operational life of the site to ensure that operations do not impact on the environment or amenity of the locality. Further details are provided in an Amenity and Accident Risk Assessment that is included with the permit application.

Mud

7.2.2 The site will be kept tidy with hardcore surfacing being provided for internal site roads to minimise the formation of mud. All site access roads will be maintained on a regular basis to minimise mud and dust arisings.

7.2.3 If appropriate the site entrance road will be swept at regular intervals to prevent any build-up of mud or debris.

7.2.4 Vehicles will be inspected before leaving the site and wheel cleaning facilities will be available to clean excessive mud from vehicles prior to exiting the site, as necessary. The 250m long entrance road onto Halfpenny Lane will be hard surfaced, further ensuring mud will not be tracked onto the highway.

7.2.5 Should any mud be tracked out of the site arrangements will be made to sweep the highway as soon as possible.

Dust

7.2.6 The production of dust will be minimised by ensuring that the site roads are properly maintained and where necessary cleaned. Clean inert materials processing will be located within the quarry so that the quarry walls provide screening and will also be located away from sensitive boundaries.

7.2.7 Clean inert materials placed in the landfill will be compacted before the end of the working day.

7.2.8 Vehicles entering and leaving the site that may contain dusty material will be covered or sheeted to contain dust.

7.2.9 A speed limit will be applied on site, helping to minimise the quantity of dust generated by moving vehicles.

7.2.10 To prevent the dispersal of dust that is created at the site, water from a bowser will be applied to the tipping face and site roads in dry weather or at other times when dust may be an issue.

Odour

7.2.11 The materials to be accepted at the site are inert and are not inherently odorous. Odorous materials will be rejected during waste acceptance check.

7.2.12 Regular checks for odour will be made around the site boundary. Should noticeable odour be detected, the source will be identified and appropriate remedial action will be taken.

7.2.13 Any non-conforming material that is causing a significant odour will be prioritised for removal off site and will be removed before the end of the working day where possible.

Noise

7.2.14 The site is situated within a rural setting with a number of farms nearby. The closest residential property is Gebdykes Farm, which is adjacent to the site boundary to the northwest. East Gebdykes Farm is located 150m to the southwest of the existing quarry.

7.2.15 Operations will be restricted to daytime hours (07:00 – 19:00 Monday to Friday and 07:00- 13:00 on Saturday) to minimise disturbance. Noise levels will be in compliance with the limits set in the planning permission for the site, as shown in Table 7.1, below

Table 7.1: Existing Noise Sensitive Receptor Locations

Receptor	Long Term Noise Limit $L_{Aeq\ 1\ hour}$ (dB)
ESR1 - Gebdykes Farm	52
ESR2 - High Burton Bungalow	42
ESR3 - Watlass Moor Cottages and Watlass Moor Farm	45
ESR4 - Snape Lodge Cottages and Snape Lodge Farm	46
ESR5 - Dales View	46
ESR6 - East Gebdykes Farm	44

7.2.16 All plant and equipment will be maintained in accordance with the manufacturer's recommendations to ensure that it functions correctly and without excessive noise.

7.2.17 Silencers shall be fitted, used, and maintained in accordance with manufacturers' instructions on all vehicles, plant and machinery used on the site. No machinery shall be operated with the covers open or removed.

7.2.18 Engines on delivery vehicles or mobile plant will be switched off where appropriate to prevent excessive idling.

7.2.19 Noise levels will be taken into consideration during the purchase of new equipment, with quieter models being utilised where this is practical and economically viable.

Vermin and Pests

7.2.20 Vermin and pests are not considered to be a significant risk as the site does not accept food wastes or other wastes likely to attract vermin. Inert materials will be compacted at the end of each working day to minimise areas on site where vermin may shelter.

7.2.21 An inspection of the site will be made on a daily basis and should there be any signs of a pest infestation a pest control contractor will be required to attend the site and eradicate the problem.

Litter

7.2.22 Due to the nature of the clean inert materials to be accepted on site, litter is not expected to be an issue.

7.2.23 Daily inspections of the site will be made, and any litter noted will be collected and placed in an appropriate receptible pending removal to an authorised site for disposal.

Storage of Potentially Polluting Substances

7.2.24 Fuel and other potentially harmful fluids for use in site plant will be stored in a tank or container with appropriate secondary containment. Any bunds will have a capacity of 110% of the largest tank.

7.2.25 Deliveries and refuelling will be supervised to ensure that any leakage or spillage is detected immediately and cleaned quickly. The level of liquid within the tanks will be checked before filling to avoid over filling.

7.3 Complaints

7.3.1 If any complaints are received about the landfilling operations, they will be recorded, investigated, and responded to without delay in accordance with the Lightwater Quarries' complaints handling procedures.

8 SURFACE WATER MANAGEMENT

8.1.1 There are no surface water courses within close proximity to the site. The closest is a pond located over 350m away to the southwest.

8.1.2 Runoff from outside the operational areas of the Site will be allowed to infiltrate directly into the underlying bedrock in line with the quarry's present surface water management arrangements. Surface water runoff from the operational areas of the Site, including that which has been in direct contact with waste, will be intercepted and diverted to a large lagoon to the north of the void area, and will be prevented from discharging directly to groundwater.

8.1.3 The lagoon will be lined by a 1m thick layer of engineered clay, with no pathway for infiltration. Water within the lagoon will be tested to ensure it meets the permitted water quality parameters before being pumped out to the wide quarry void where it will be allowed to infiltrate to ground. Preliminary compliance limits will be set in line with those for BHWA03, as supported by the Hydrogeological Risk Assessment provided with the permit application.

8.1.4 Any captured surface water which exceeds the permitted limits will be isolated and will not be allowed to discharge to groundwater. Mitigative measures to treat or remove the water to a permitted facility will be undertaken.

8.1.5 Appendix 4 provides the Flood Risk Assessment, which provides details of how surface water will be managed throughout each of the five landfill phases.

9 ENVIRONMENTAL MONITORING

9.1.1 Environmental monitoring will include the monitoring regime set out in Table 2 below.

Table 9.1: Environmental Monitoring Regime

Parameter	Monitoring Point	Determinands	Frequency
Groundwater	BHWA01	Groundwater elevation. Dip to base. Chloride, Nitrite, Nitrate, Nitrogen, Sulphate, Cyanide, Lead, Arsenic, Cadmium, Calcium, Copper, Chromium, Manganese, Magnesium, Mercury, Nickel, Potassium, Selenium, Sodium and Zinc.	Every six months
	BHWA02		
	BHWA03		
	BHWA04		
Landfill Gas	From internal monitoring points	Methane, Carbon Dioxide, Oxygen , Atmospheric Pressure, Differential Pressure	Monthly following installation of boreholes.

9.1.2 There will be no discharges to surface water from the active landfill areas.

9.1.3 All monitoring that is undertaken will be recorded within the site diary and a copy of the results will be maintained in the site office.

9.1.4 Landfill gas monitoring boreholes will be installed as the landfill is completed. Two gas boreholes will be constructed per hectare. This is sufficient as part of the criteria to achieve surrender of the permit.

9.1.5 Due to the low risk of landfill gas generation there are no plans for peripheral monitoring boreholes around the site. In the unlikely event potential landfill gas is detected in an in-waste borehole during routine monitoring (i.e monitoring results detect methane >1% or carbon dioxide >5%), then monitoring will be increased to a weekly frequency. If the gas emissions continue to be detected, the operator will install peripheral monitoring boreholes to establish if the gas is migrating, with careful consideration to nearby sensitive receptors. The operator will contact the EA to report the findings and agree appropriate actions to protect the environment.

9.1.6 All monitoring boreholes will be installed in accordance with the methods and standards giving in the Environment Agency's "Landfill operators: environmental permits" guidance. The design of the boreholes will be agreed with the Environment Agency and construction of the boreholes will be undertaken in accordance with an agreed CQA Plan.

9.1.7 The landfill gas boreholes will be fitted with gas taps and provided with adequate protection to prevent any damage. The boreholes will be maintained and monitored during the post closure period. Given the inert nature of the material it is expected that gas monitoring will continue for 24 months following closure.

9.1.8 Further details regarding groundwater and surface water monitoring are provided in Section 5 of the Hydrogeological Risk Assessment.

9.1.9 An annual topographic survey will be carried out to monitor the landfill development and remaining void space.

10 MANAGEMENT

10.1 General

10.1.1 The site will be operated to ensure a high level of environmental protection. Potential causes of pollution will be managed in accordance with environmental management system which provides written procedures to be followed in carrying out the activities on site.

10.1.2 All site-based personnel will be aware of the potential causes of pollution at the site, and their roles in preventing pollution through good practice and following environmental legislation.

Site Management and Staffing

10.1.3 The site will be appropriately manned and supervised by competent and suitably trained personnel during operational periods.

10.1.4 The site will be under the direct control of a Technically Competent Manager (TCM). The TCM will ensure that the site is operated and maintained in accordance with the required standards.

10.1.5 All site-based personnel and contractors will be required to complete an induction before being allowed to start working on the site. The induction will include health and safety and environmental protection elements to ensure all those working on site are aware of the potential environmental issues and their role in managing the risks in accordance with the EMS.

10.1.6 Staff training will include the management of environmental risk in day to day operations, an awareness of all environmental consents and their conditions and the documented emergency procedures for dealing with incidents such as spills.

10.1.7 The qualifications, skills, and experience necessary for each role on site will be recorded. Training will be reviewed annually to identify where additional training or refresher training is required to keep these skills up to date.

10.1.8 Environmental considerations will apply to purchasing and process change to ensure that the site is operated with a high level of protection for the environment.

11 CLOSURE AND AFTERCARE

11.1.1 As detailed in Section 6, the site will be restored back to original ground level in the south, with the void remaining in the north. Following closure of the site the land will be returned to agricultural use.

11.1.2 The Landfill Directive only requires capping where there is a need to minimise leachate formation, i.e. at hazardous and non-hazardous landfills. As the site is only going to accept inert wastes no formal cap is required.

11.1.3 The restoration profile for the landfill has been designed to replicate the landform of the site before the quarry was developed, tying the landfill into the profile of the east, west and south and would be at 144m AOD at the highest point in the southern section of the landfill. The northern edge of the landfill would then slope down to the quarry floor to tie in with the existing access ramp. As shown in drawing NT14834/Figure 3.6, Phase 1 will be restored to Magnesian limestone grassland, and the remaining phases will be restored to agricultural grassland. Appendix 3 provides further details of the restoration design in the Landscape Biodiversity and Restoration Management Plan.

11.1.4 There will be minimal infrastructure to be maintained in the aftercare period, with the deposited inert material itself posing a low risk to the environment. Settlement will be minimal and the site is expected to be stable in the post closure period. This will be confirmed by an annual topographic survey.

11.1.5 It is very unlikely that there will be any damage to the engineered artificial geological barrier or other landfill infrastructure that might lead to pollution being caused. However, the restored surface and the monitoring boreholes will be inspected on a quarterly basis to ensure they remain fit for purpose and repairs will be made as necessary.

11.1.6 Monitoring of groundwater and landfill gas will continue during the post closure period in order to demonstrate that the site is chemically and physically stable and will not pose a risk to the environment.

11.1.7 Surrender of the permit will be largely based on records demonstrating good characterisation of the clean inert materials throughout the life of the site, proving that only inert materials have been deposited. This will be supplemented by the results of the environmental monitoring undertaken during the operational and post closure periods.

APPENDIX 1

List of Permitted Clean Inert Materials

Appendix 1 – Permitted Wastes

List of Inert Wastes	
01	**WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS**
01 01	**Wastes from mineral excavation**
01 01 02	Waste from mineral non-metalliferous excavation restricted to subsoil, clay, rock, limestone, stone, sand and gravel
01 04	**Wastes from physical and chemical processing of non-metalliferous minerals**
01 04 08	Gravel and crushed rocks other than those mentioned in 01 04 07 (excluding material which has been chemically processed)
01 04 09	Waste sand and clays (excluding material which has been chemically processed and moulding sands containing organic binders)
02	**WASTES FROM AGRICULTURE**
02 04	**Wastes from Sugar Processing**
02 04 01	Soil from cleaning and washing of beet (excluding topsoil and peat)
10	**WASTES FROM THERMAL PROCESSES**
10 12	**Wastes from manufacture of ceramic goods, bricks, tiles and construction products**
10 12 08	Waste ceramics, bricks, tiles and construction products (after thermal processing)
10 13	**Wastes from manufacture of cement, lime and plaster and articles and products made from them**
10 13 14	Waste concrete (excluding concrete plant washings)
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	**Concrete, bricks, tiles and ceramics**
17 01 01	Concrete
17 01 02	Bricks
17 01 03	Tiles and ceramics
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06 which have not been mechanically or physically processed
17 05	**Soil, stones and dredging spoil**
17 05 04	Soil and stones, including chalk, other than those mentioned in 17 05 03 (excluding topsoil, peat; excluding soil and stones from contaminated sites)
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 02	**Garden and park wastes (including cemetery waste)**
20 02 02	Soil and stones, only from gardens and parks (excluding topsoil and peat)

APPENDIX 2

Materials Suitability Assessment

Wardell Armstrong
Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom
Telephone: +44 (0)1782 276 700 www.wardell-armstrong.com

Our ref: EW/GM/NT15899/RPT/001 *Date*: 05 October 2022
Your ref:

Mr Peter Marris
Environment Officer – Yorkshire Area Landfill
Environment Agency
First Floor, Foss House
Kings Pool
Peasholme Green
York, YO1 7PX

Dear Peter

Lightwater Quarries Limited - Gebdykes Quarry Landfill Site
Dolomite - Materials Suitability Trial Pad Protocol

Background

Gebdykes Quarry located in Masham North Yorkshire, is a Magnesian Limestone (Dolomite) Quarry operated by Lightwater Holdings Limited (the Client). Lightwater Holdings are proposing to fill the void created by the quarrying operations with inert waste. Lightwater Holdings are proposing to use the site won Dolomite in the construction of proposed mineral liner.

Material Suitability

It is proposed to use the site won Dolomite in the construction of the mineral liner. Two pre-placement samples of the Dolomite were tested in May 2022, the results of which are contained in Annex A. Samples were tested for Plasticity Index, Undrained Shear Strength and Permeability. The results of the Permeability Testing demonstrates that the material is capable of achieving the required permeability of $1.0x10^{-7}$m/s.

Proposed Site Investigations and Trial Pad Protocol

To confirm the suitability of the site-won Dolomite for use in the Engineered Mineral Liner we proposed to carry out a trial pad at the site using the proposed materials. A copy of the trial pad protocol is attached at Annex B. As part of the trial pad works a number of materials

classification tests will be taken, the results of which will be used to further classify the material in line with LFE4.

We trust that our proposals are to your satisfaction, if you have any queries please do not hesitate to contact us.

Yours sincerely
for Wardell Armstrong LLP

EMMA WAINWRIGHT
Principal Engineering Geologist
ewainwright@wardell-armstrong.com

Enc

Annex A – Dolomite Testing Results
Annex B - Trial Pad Protocol Report

Annex A

Dolomite Testing Results

TEST REPORT

Lightwater Quarries Ltd
Potgate Quarry
North Stainley
Ripon
HG4 3JN

White Rose Laboratory Services Ltd
Lumley St • Castleford • WF10 5LB
01977 520625 • enquiries@whiteroselabs.co.uk

Report	WRL/22/0580perm
Issue date	25/05/22

Material	Old Stock Aggregate Lime		
Site	Gebdyke Quarry		
Specification	-	Sample Ref	S/22/0580
Source	Gebdyke Quarry	Sampled by	J Johnson
Supplier	Lightwater Quarries Ltd	Date sampled	04/05/22
Sample location	Stockpile	Date received	04/05/22
Sample type	Bulk	Date tested	24/05/22
Order number	-	Date reported	25/05/22

Subcontract Testing

Please find attached results of the following subcontracted testing

Permeability in a triaxial cell	(PSL)

J Whelan
Laboratory Services Section Manager

LABORATORY REPORT

4043

Contract Number: PSL22/3343

Report Date: 24 May 2022

Client's Reference: ORD/22/185

Client Name: White Rose Laboratory Services Ltd
Lumley Street
Castleford
West Yorkshire
WF10 5LB

For the attention of: Joe Whelan

Contract Title: Lightwater Quarries - Gebdyke

Date Received: 11/5/2022
Date Commenced: 11/5/2022
Date Completed: 24/5/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)
R Berriman (Quality Manager)
S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technician)
T Watkins (Senior Technician)

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fax: +44 (0)844 815 6642
e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990: Clause 6

Hole Number:	**Old Stockpile**	**Top Depth (m) :**	
Sample Number:	**S-22-0580**	**Base Depth (m) :**	
Sample Type:	**B**	**Lift Number:**	
Date	**04/05/22**	**Grid Reference:**	

Description of Specimen
Aggregate Lime
Remarks
Remoulded with 2.5Kg effort, natural moisture contact.

Initial Specimen Conditions		
Height	mm	101.15
Diameter	mm	101.51
Area	mm^2	8092.96
Volume	cm^3	818.60
Mass	g	1730
Dry Mass	g	1534
Bulk Density	Mg/m^3	2.11
Dry Density	Mg/m^3	1.87
Moisture Content	%	13
Voids Ratio	-	0.414
Specific Gravity	Mg/m^3	2.65
(assumed/measured)	-	assumed

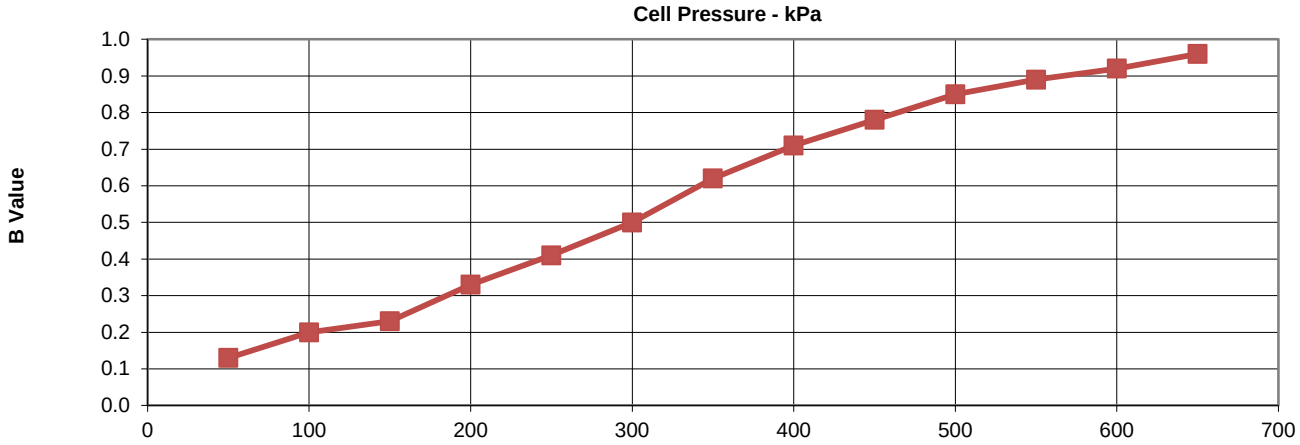
Final Specimen Conditions		
Moisture Content	%	17
Bulk Density	Mg/m^3	2.19
Dry Density	Mg/m^3	1.87

Test Setup		
Date Started		11/05/2022
Date Finished		13/05/2022
Top Drain Used		Y
Base Drain Used		Y
Method of Saturation		By back pressure
Direction Of Flow		Vertically Downwards
Saturation Time	Days	1
Consolidation Time	Days	1
Permeability Time	Days	1

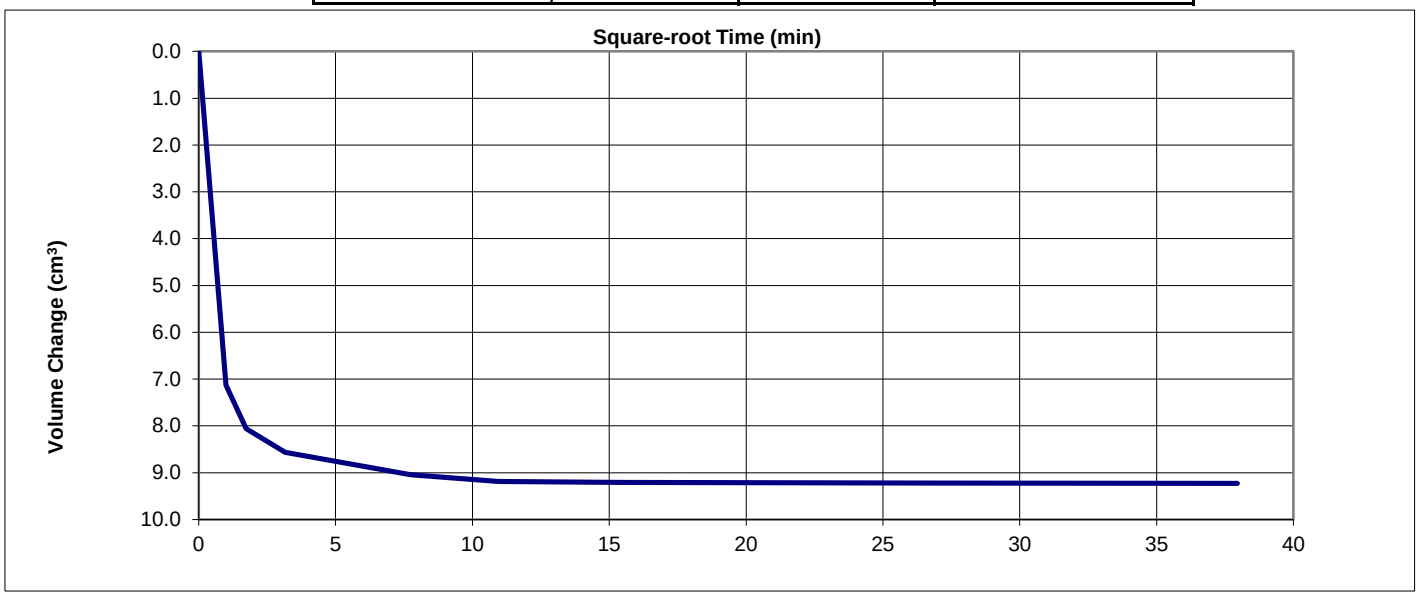
PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		Old Stockpile
Sample Depth	m	
Sample No,		S-22-0580
Grid Reference		
Lift Number		
Saturation		
Cell Pressure Incr.	kPa	50
Back Pressure Incr.	kPa	50
Differential Pressure	kPa	10
Final Cell Pressure	kPa	650
Final B Value	-	0.96



Consolidation		
Effective Pressure	kPa	100
Cell Pressure	kPa	700
Back Pressure	kPa	600
Final PWP	kPa	600
PWP dissipation	%	100



UKAS TESTING 4043

PSL Professional Soils Laboratory

Lightwater Quarries - Gebdyke

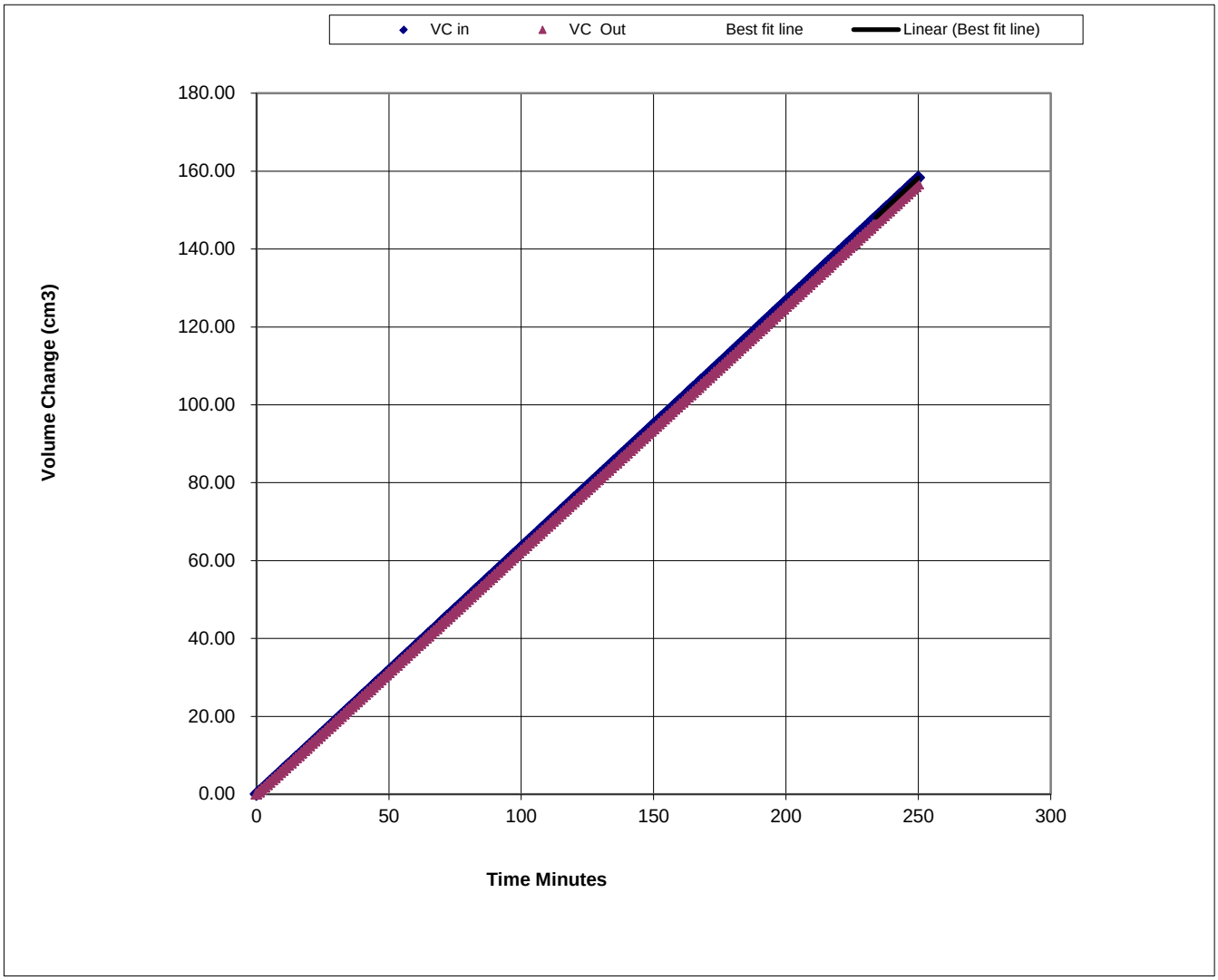
Contract No.
PSL22/3343
Client Ref
ORD/22/185

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		Old Stockpile
Sample Depth	m	
Sample No.		S-22-0580
Grid Reference		
Lift Number		

Permeability Stage



Permeability Stage		
Cell Pressure	kPa	700
Mean Effective Stress	kPa	100
Back Pressure Diff.	kPa	20
Mean Rate of Flow	ml/min	0.6325
Average Temperature	'C	20
Vertical Permeability Kv	m/s	6.4E-08

TEST REPORT

Lightwater Quarries Ltd
Potgate Quarry
North Stainley
Ripon
HG4 3JN

UKAS TESTING
8950

White Rose Laboratory Services Ltd
Lumley St • Castleford • WF10 5LB
01977 520625 • enquiries@whiteroselabs.co.uk

Report	WRL/22/0580pi
Issue date	25/05/22

Material	Aggregate Lime		
Site	Gebdyke Quarry		
Specification	-	Sample Nº	S/22/0580
Source	Gebdyke Quarry	Sampled by	J Johnson
Supplier	Lightwater Quarries Ltd	Date sampled	04/05/22
Sample location	Old stockpile	Date received	04/05/22
Sample type	Bulk	Date tested	12/05/22
Order number	-	Date reported	13/05/22

BS 1377-2 1990 Determination of liquid limit, cone penetrometer method

Liquid limit was determined by the one-point cone penetrometer method.
Test performed on wet-sieved material.

Liquid Limit	26	Pass 425µm	45 %

BS 1377-2 1990 Determination of plastic limit and plasticity index

Test performed on wet-sieved material.

Plastic Limit	Non Plastic	Pass 425µm	45 %
Plasticity index	Non Plastic		

All testing carried out at White Rose Laboratory Services Ltd, Lumley Street, Castleford
Test results relate only to items tested

J Whelan
Laboratory Services Section Manager

RT005/21/01

TEST REPORT

Lightwater Quarries Ltd
Potgate Quarry
North Stainley
Ripon
HG4 3JN

UKAS TESTING
8950

White Rose Laboratory Services Ltd
Lumley St • Castleford • WF10 5LB
01977 520625 • enquiries@whiteroselabs.co.uk

Report	WRL/22/0580uss
Issue date	25/05/22

Material	Aggregate Lime		
Site	Gebdyke Quarry		
Specification	-	Sample Nº	S/22/0580
Source	Gebdyke Quarry	Sampled by	J Johnson
Supplier	Lightwater Quarries Ltd	Date sampled	04/05/22
Sample location	Old stockpile	Date received	04/05/22
Sample type	Bulk	Date tested	13/05/22
Order number	-	Date reported	13/05/22

BS 1377-7 1990 Cl 8 Determination of undrained shear strength in triaxial compression without measurement of pore pressure

Specimen parameters

The specimen was remoulded with a 2.5kg rammer.

Specimen height	200 mm	Specimen diameter	100 mm
Moisture content	12 %	Bulk Density	2.24 Mg/m³
		Dry density	2.00 Mg/m³

Test parameters

Rate of strain	0.625 %/min	Membrane type	laytex
Cell pressure, σ_3	200 kPa	Membrane thickness	0.3 mm
		Membrane correction	0.39 kPa

Test results

Corrected maximum deviator stress at failure $(\sigma_1 - \sigma_3)_f$		852 kPa
Strain at failure		5 %
Mode of failure		Barrelling
Shear strength	$c_u = ½(\sigma_1 - \sigma_3)_f$	426 kPa

All testing carried out at White Rose Laboratory Services Ltd, Lumley Street, Castleford
Test results relate only to items tested

J Whelan
Laboratory Services Section Manager

RT007/21/03

TEST REPORT

Lightwater Quarries Ltd
Potgate Quarry
North Stainley
Ripon
HG4 3JN

White Rose Laboratory Services Ltd
Lumley St • Castleford • WF10 5LB
01977 520625 • enquiries@whiteroselabs.co.uk

Report	WRL/22/0581perm
Issue date	25/05/22

Material	Aggregate Lime		
Site	Gebdyke Quarry		
Specification	-	Sample Ref	S/22/0581
Source	Gebdyke Quarry	Sampled by	J Johnson
Supplier	Lightwater Quarries Ltd	Date sampled	04/05/22
Sample location	New stockpile	Date received	04/05/22
Sample type	Bulk	Date tested	24/05/22
Order number	-	Date reported	25/05/22

Subcontract Testing

Please find attached results of the following subcontracted testing

Permeability in a triaxial cell	(PSL)

J Whelan
Laboratory Services Section Manager

LABORATORY REPORT

4043

Contract Number: PSL22/3343

Report Date: 24 May 2022

Client's Reference: ORD/22/185

Client Name: White Rose Laboratory Services Ltd
Lumley Street
Castleford
West Yorkshire
WF10 5LB

For the attention of: Joe Whelan

Contract Title: Lightwater Quarries - Gebdyke

Date Received: 11/5/2022
Date Commenced: 11/5/2022
Date Completed: 24/5/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)
R Berriman (Quality Manager)
S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technician)
T Watkins (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
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e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990: Clause 6

Hole Number:	**New Stockpile**	**Top Depth (m) :**
Sample Number:	**S-22-0581**	**Base Depth (m) :**
Sample Type:	**B**	**Lift Number:**
Date	**04/05/22**	**Grid Reference:**

Description of Specimen
Aggregate Lime
Remarks
Remoulded with 2.5Kg effort, natural moisture contact.

Initial Specimen Conditions		
Height	mm	101.15
Diameter	mm	101.49
Area	mm^2	8089.77
Volume	cm^3	818.28
Mass	g	1703
Dry Mass	g	1525
Bulk Density	Mg/m^3	2.08
Dry Density	Mg/m^3	1.86
Moisture Content	%	12
Voids Ratio	-	0.422
Specific Gravity	Mg/m^3	2.65
(assumed/measured)	-	assumed

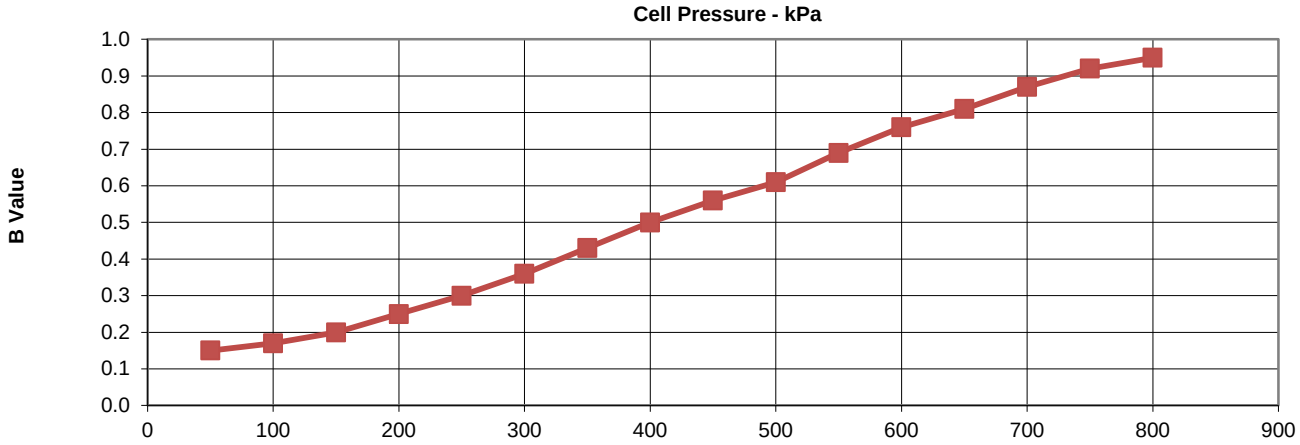
Final Specimen Conditions		
Moisture Content	%	15
Bulk Density	Mg/m^3	2.14
Dry Density	Mg/m^3	1.86

Test Setup		
Date Started		11/05/2022
Date Finished		13/05/2022
Top Drain Used		Y
Base Drain Used		Y
Method of Saturation		By back pressure
Direction Of Flow		Vertically Downwards
Saturation Time	Days	1
Consolidation Time	Days	1
Permeability Time	Days	1

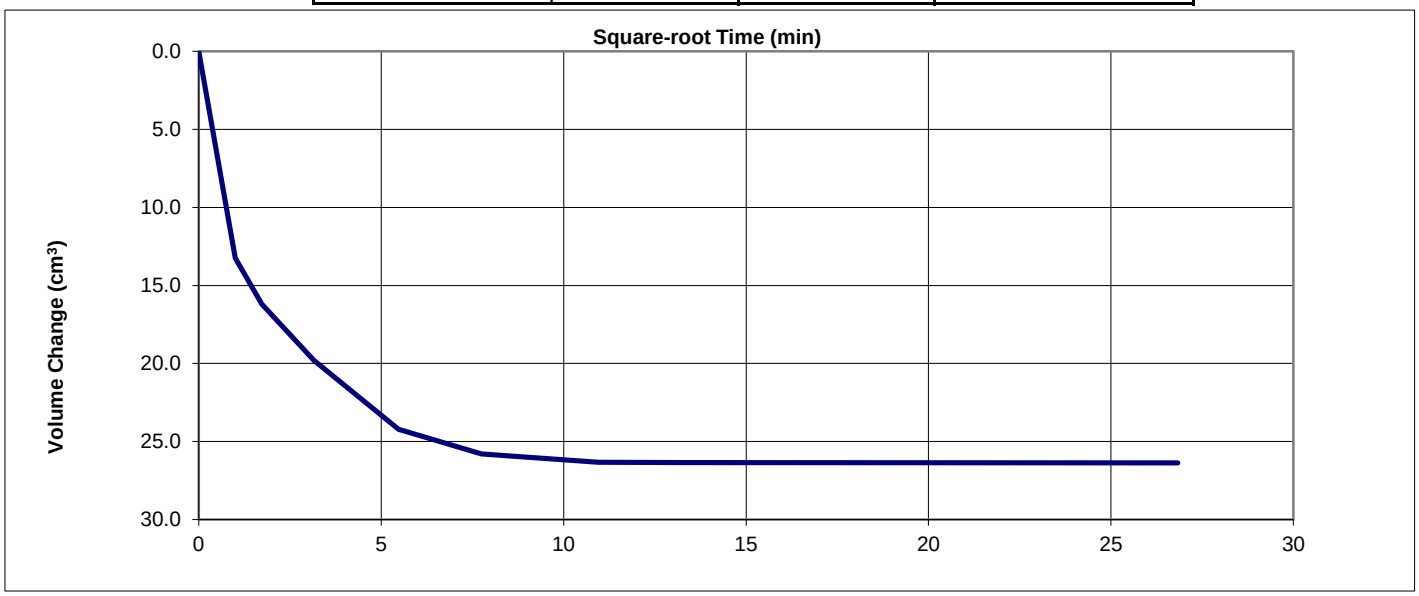
PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		New Stockpile
Sample Depth	m	
Sample No,		S-22-0581
Grid Reference		
Lift Number		
Saturation		
Cell Pressure Incr.	kPa	50
Back Pressure Incr.	kPa	50
Differential Pressure	kPa	10
Final Cell Pressure	kPa	800
Final B Value	-	0.95



Consolidation		
Effective Pressure	kPa	100
Cell Pressure	kPa	850
Back Pressure	kPa	750
Final PWP	kPa	750
PWP dissipation	%	100



UKAS TESTING 4043

PSL Professional Soils Laboratory

Lightwater Quarries - Gebdyke

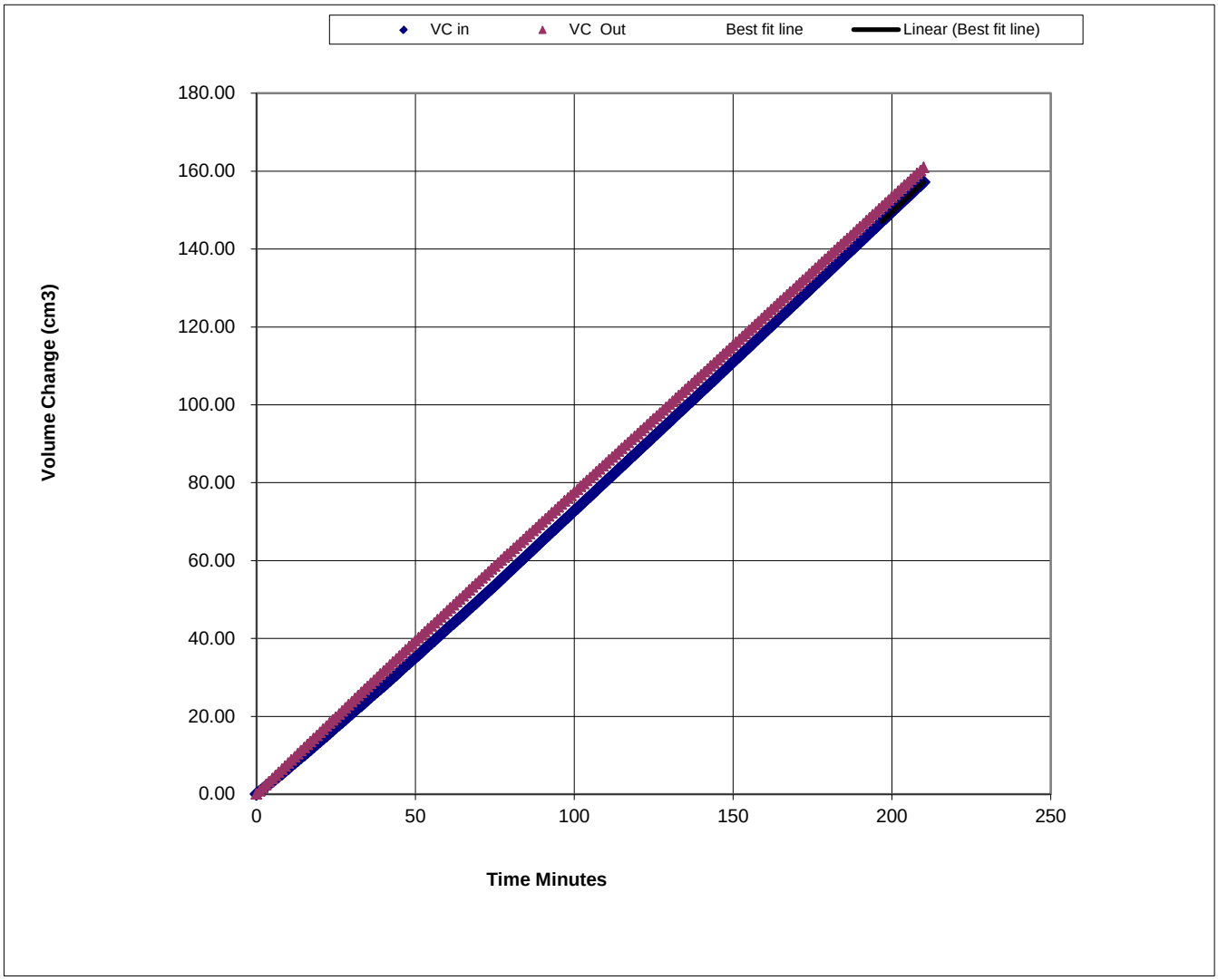
Contract No.
PSL22/3343
Client Ref
ORD/22/185

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		New Stockpile
Sample Depth	m	
Sample No.		S-22-0581
Grid Reference		
Lift Number		

Permeability Stage



Permeability Stage		
Cell Pressure	kPa	850
Mean Effective Stress	kPa	100
Back Pressure Diff.	kPa	20
Mean Rate of Flow	ml/min	0.7708
Average Temperature	'C	20
Vertical Permeability Kv	m/s	7.9E-08

TEST REPORT

Lightwater Quarries Ltd
Potgate Quarry
North Stainley
Ripon
HG4 3JN

UKAS TESTING
8950

White Rose Laboratory Services Ltd
Lumley St • Castleford • WF10 5LB
01977 520625 • enquiries@whiteroselabs.co.uk

Report	WRL/22/0581pi
Issue date	25/05/22

Material	Aggregate Lime		
Site	Gebdyke Quarry		
Specification	-	Sample Nº	S/22/0581
Source	Gebdyke Quarry	Sampled by	J Johnson
Supplier	Lightwater Quarries Ltd	Date sampled	04/05/22
Sample location	New stockpile	Date received	04/05/22
Sample type	Bulk	Date tested	09/05/22
Order number	-	Date reported	13/05/22

BS 1377-2 1990 Determination of liquid limit, cone penetrometer method

Liquid limit was determined by the one-point cone penetrometer method.
Test performed on wet-sieved material.

Liquid Limit	28	Pass 425µm	55 %

BS 1377-2 1990 Determination of plastic limit and plasticity index

Test performed on wet-sieved material.

Plastic Limit	Non Plastic	Pass 425µm	55 %
Plasticity index	Non Plastic		

All testing carried out at White Rose Laboratory Services Ltd, Lumley Street, Castleford
Test results relate only to items tested

J Whelan
Laboratory Services Section Manager

RT005/21/01

TEST REPORT

Lightwater Quarries Ltd
Potgate Quarry
North Stainley
Ripon
HG4 3JN

UKAS TESTING
8950

White Rose Laboratory Services Ltd
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01977 520625 • enquiries@whiteroselabs.co.uk

Report	WRL/22/0581uss
Issue date	25/05/22

Material	Aggregate Lime		
Site	Gebdyke Quarry		
Specification	-	Sample Nº	S/22/0581
Source	Gebdyke Quarry	Sampled by	J Johnson
Supplier	Lightwater Quarries Ltd	Date sampled	04/05/22
Sample location	New stockpile	Date received	04/05/22
Sample type	Bulk	Date tested	09/05/22
Order number	-	Date reported	13/05/22

BS 1377-7 1990 Cl 8 Determination of undrained shear strength in triaxial compression without measurement of pore pressure

Specimen parameters

The specimen was remoulded with a 2.5kg rammer.

Specimen height	200	mm	Specimen diameter	100	mm
Moisture content	12	%	Bulk Density	2.13	Mg/m³
			Dry density	1.90	Mg/m³

Test parameters

Rate of strain	1	%/min	Membrane type	laytex	
Cell pressure, σ_3	200	kPa	Membrane thickness	0.3	mm
			Membrane correction	0.68	kPa

Test results

Corrected maximum deviator stress at failure $(\sigma_1 - \sigma_3)_f$		726	kPa
Strain at failure		10	%
Mode of failure		Barrelling	
Shear strength	$c_u = ½(\sigma_1 - \sigma_3)_f$	363	kPa

All testing carried out at White Rose Laboratory Services Ltd, Lumley Street, Castleford
Test results relate only to items tested

J Whelan
Laboratory Services Section Manager

RT007/21/03

Annex B

Trial Pad Protocol Report

wardell-armstrong.com

ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

LIGHTWATER QUARRIES LIMITED

GEBDYKES QUARRY LANDFILL SITE

PROTOCOL FOR THE CONSTRUCTION OF EARTHWORKS TRIAL PAD

OCTOBER 2022

wardell armstrong

Wardell Armstrong
41-50 Futura Park, Aspinall Way, Middlebrook, Bolton, BL6 6SU
Telephone: +44 (0)1204 227 227 www.wardell-armstrong.com

DATE ISSUED:	**OCTOBER 2022**
JOB NUMBER:	**NT15899**
REPORT NUMBER:	**001**
VERSION:	**V1.0**
STATUS:	**FINAL**

LIGHTWATER QUARRIES LTD

GEBDYKES QUARRY LANDFILL SITE

PROTOCOL FOR THE CONSTRUCTION OF EARTHWORKS TRIAL PAD

OCTOBER 2022

PREPARED BY:

Emma Wainwright	Principal Engineering Geologist	

APPROVED BY:

Andy Belton	Technical Director	

CONTENTS

1 OBJECTIVES

1.1.1 The aim of this field trial is to assess the suitability of the site won dolomite materials for use as a mineral liner during the construction of landfill cells at Gebdykes Quarry Landfill Site.

1.1.2 The field trial shall be supervised by a suitably qualified and experienced engineer.

2 MATERIAL TYPE

2.1.1 The Trial Pad will be constructed with the proposed material for the mineral liner.

2.1.2 Site-won dolomite has already been tested characterised as a suitable source material for the liner works as the proposed liner material, at time of writing. The engineering properties of the dolomite will be assessed following placement and compaction in the trial liner and compared to the results of laboratory testing undertaken for the classification of the material.

2.1.3 Any unsuitable materials will be removed during construction of the trial pad, unsuitable materials will include stones larger than 100mm.

3 TRIAL PAD DIMENSIONS

3.1.1 The area (excluding the perimeter zones) must be at least three machine widths wide (approximately 10m) by three-five machine lengths long (approximately 30m long, with 15m on the base and 15m on the batter) with additional zones for plant acceleration and deceleration.

3.1.2 The trial pad will be located either on prepared subgrade for the permanent liner or suitable subgrade which is representative of the conditions proposed for the permanent liner.

4 METHOD OF LAYER CONSTRUCTION

4.1.1 The trial pad will be constructed in accordance with Specification for Highway Works 2016 (SHW), tables 6/1 and 6/4 according to the following method:

4.1.2 250 mm thickness of dolomite (placed at 300mm);

4.1.3 So that the trial pad can be incorporated into the mineral liner, each lift will be compacted in accordance with the following number ofpasses from the roller:

Lift 1 6 passes

Lift 1 8 passes (2 additional passes on top of the 6 done previously)

Lift 2 4 passes

5 MATERIALS TESTING

5.1.1 Eight core (undisturbed) samples and 1 bulk (disturbed) will be taken from each 250mm layer on completion of each lift and subjected to the following tests and frequencies according to BS 1377: 1990:

Test	No. of Tests
Coefficient of Permeability - Triaxial Cell	2 per layer
Permeability Soakaway test	2 per layer
Hand Shear Vane	8 per layer
Particle Size Distribution (wet sieving)	1 per layer
Particle Size Distribution (sedimentation - pipette)	1 per layer
Index Properties (Atterberg limits, particle density)	1 per layer
Moisture Content (oven drying)	2 per layer

5.1.2 The shear strength of the dolostone will be recorded by hand shear vane at each test location to determine correlation between moisture content and shear strength for the placed material.

5.1.3 As part of the field trial the material will be reworked and wetted and dried to achieve a moisture content considered by the engineer to be suitable for compaction. Moisture content testing will be carried out as part of the testing suite above. The moisture content of the dolomite used in the field trial will be used to confirm the moisture content range required for the proposed works.

5.1.4 Upon completion of the trial pad, the adequacy of bonding between the individual layers will be investigated by careful stripping of the upper layer to verify that no definable interface is present between the layers.

6 PROGRAMME FOR THE WORKS

6.1.1 The commencement date for the trial pad construction is to be confirmed. The Environment Agency will be invited to observe the works with 48 hours' notice given.

6.1.2 As a minimum, the information to be recorded by the CQA Engineer will be:

6.1.3 Records of the type and condition of the material;

- Details of the method of excavation, transportation, treatment, conditioning, wetting and drying process and placement of the material;
- Details of the type, dimensions, weight and operating speed of compaction plant used along with all relevant specification sheets for the roller(s) used;
- The number of passes of the roller (or for each type of roller if more than oneis used);
- The method used for measuring moisture content and density of each sample point;
- Records of all field tests and samples, including failures with a diagramshowing sample positions;
- A photographic record of the trial must be maintained (especially for destructive testing; and
- Records of the survey and testing of the subgrade in accordance with the CQA Plan if the field trial liner is to be incorporated into the works.

7 REPORTING OF RESULTS

7.1 A discussion of the results and records of all field and laboratory testing will be submitted in a report to the Environment Agency.

7.2 Any required amendments to the proposed construction method statement following the trial or during subsequent construction shall be agreed with the CQA Engineer and approved by the Environment Agency.

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APPENDIX 3

Landscape Biodiversity and Restoration Management Plan v2

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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

LIGHTWATER QUARRIES LTD

Gebdykes Quarry Landfill

Landscape and Biodiversity Restoration and Management Plan

December 2022

wardell armstrong

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LIGHTWATER QUARRIES LTD

Gebdykes Quarry Landfill

Landscape And Biodiversity Restoration and Management Plan

December 2022

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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
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MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

CONTENTS

TABLES

1 INTRODUCTION

1.1.1 This Landscape and Biodiversity Restoration and Management Plan (LBRMP) has been prepared to support a planning application to North Yorkshire County Council seeking permission for an inert landfill into the southern half of Gebdykes quarry.

1.1.2 This LBRMP details the restoration proposals and short and long term management of existing adjacent habitats to be retained and protected during the development as well as proposed habitats to be created as part of the restoration scheme for the landfill. It also includes the northern half of the existing quarry, which would not be filled, the restoration and management operations for this area are the same as those proposed in the recent planning application for the northern extension to the quarry. This part of the quarry, either site of the access track to the northern extension, would be restored by 2026 as the initial phase of the extension is worked and ramps are created.

1.1.3 ES Figure 3.6 illustrates the restoration plan for the application area and ES Figures 3.1 to 3.5 illustrate the phasing of the landfill and progressive restoration.

2 BACKGROUND INFORMATION

2.1.1 Wardell Armstrong were commissioned by Lightwater Quarries to undertake a range of environmental surveys prior to submitting the both the planning applications for the landfill and the northern quarry extension. A Preliminary Ecological Appraisal (PEA) (WA, 2019, updated May 2020 and July 2021) was undertaken to map and characterise the habitats present on site and assess them for the suitability for use by protected or notable species. The results of the PEA did not identify the need for any additional Phase II ecology surveys other that those carried out for the northern quarry extension, which were undertaken throughout the 2020 survey season. The results of the surveys have been used to inform the Ecological Impact Assessment (EcIA) of the proposed development on the site. A range of mitigation and compensation measures (where necessary) have been provided to ensure that post restoration Gebdykes Quarry will provide a positive net biodiversity gain on site through retaining, enhancing and creating a diverse range of habitats and priority habitats for the area. The proposed restoration scheme has been designed through careful consideration of the natural landscape and local and national biodiversity targets. Consideration has been given to linking onsite habitats and those within the wider area to aid ecological connectivity.

2.1.2 The site was found to support limited range of habitats due to it being an operational quarry. The majority of peripheral habitats are to be retained.

2.1.3 Full reports for each species are provided as technical appendices to the ES Chapter, but in summary: no badger setts or signs of use were recorded within the application area. At least five species of bat were found to be foraging/commuting over the site, generally associated with hedgerows and woodland blocks located on the periphery of the site boundary and along Limekiln Lane which is line with mature trees on either side. GCN eDNA was recorded in one waterbody (WB2) located approximately 450m from the proposed northern quarry extension area. A total of 31 bird species were recorded within the site and the northern quarry extension area, of which 30 species were possibly, probably or confirmed breeding.

3 PROTECTION AND MANAGEMENT OF EXISTING HABITATS DURING OPERATION

3.1 Woodland, Trees and Hedgerows

3.1.1 All the existing trees, woodland and hedgerows surrounding the existing quarry void would be retained and protected during the landfill operations, they would be managed to ensure their screening potential and functionality as linking habitats is maximised.

3.1.2 For more details on the management of existing trees and woodland on site refer to section 5.7 below.

3.2 Fauna

3.2.1 A Construction Environmental Management Plan (CEMP) and site management plan will ensure impacts to fauna on site are minimised and the obligations pertaining to legally protected species are fully observed.

3.2.2 Management of retained peripheral hedgerows, trees and woodland will be carried out outside of the nesting bird season (taken to be March to August inclusive), which is the optimum time for undertaking such works.

3.3 Fencing

3.3.1 The boundary of the existing quarry is fenced in accordance with the Quarry Regulations, no further fencing is required during the operational phases.

3.3.2 All new woodland and hedgerow planting planted during restoration would be protected by stock-proof post and wire fencing or individual tree/shrub guards.

3.4 Soil handling

3.4.1 The Northern Quarry Extension ES Appendix 8.5 contains a Soil Management Plan (SMP) for both the existing quarry and the northern extension, which details soil handling, movements, storage and restoration. This would also apply to the inert landfill. No further soil stripping is required for the inert landfill. Soils stripped for the quarrying operations have been stored in bunds on the perimeters of the quarry, as shown on the topographic survey, ES Figure 2.8.

3.5 Invasive non-native species (INNS)

3.5.1 The site may be vulnerable to colonisation by some or all of the INNS listed below. In the event that INNS become established and deleteriously effect the target habitats, management will be undertaken, as required, using approved control methods.

- Japanese knotweed (*Reynoutria japonica*)
- Himalayan balsam (*Impatiens glandulifera*)
- Canadian goldenrod (*Solidago canadensis*)
- Monkeyflower (*Mimulus guttatus*)
- Australian swamp stonecrop (*Crassula helmsii*)
- Giant Hogweed (*Heracleum mantegazzianum*)
- Canadian Pondweed (*Elodea canadensis*)
- *Cotoneaster*

3.5.2 No invasive species have been recorded on site during Extended Phase I Habitat Surveys (WA, 2019/2020/2021). The arrival of invasive species (as listed above) on the site will be monitored throughout the extraction and restoration phases and the subsequent management phases, as detailed in Sections 4 and 5.

3.5.3 In the event that an invasive species is recorded on site or in adjacent land (within 50m) suitable control methods will be implemented as follows:

- The areas will be clearly marked out and areas that do not need to be disturbed will be fenced off.
- Areas that must be disturbed will be cleared of infested material as far as reasonably possible under supervision of an Ecologist. An assessment will be made as to whether it is better to retain the infested material on site for restoration within the infested area coupled with treatment or whether disposal offsite is more appropriate.
- Areas where infested materials have been identified will be cleared methodically with on-going assessment of the extent of infested ground. Only essential vehicles will be present in these areas.
- In areas of the site where invasive species have been identified, use of tracked machinery will be limited until infested areas have been cleared and/or identified and cordoned off.
- On leaving areas of the site known to contain infested material, any machinery or vehicles that have been used will be thoroughly cleaned (e.g. sterilised and cleaned) within a designated area. This area will be as close as possible to the infested area on which the machinery/vehicles have been working to avoid the spread of the species. Runoff will be contained to avoid spreading plant material.

This area will be monitored in the spring for any growth and a spraying programme/management will be implemented as necessary. Any machinery used in clearing infested areas will be similarly cleaned.

- Infested spoil will only be placed on top of a fabric/membrane in an approved, fenced area. Once the infested material is removed from these areas, they will be monitored for re-growth, particularly during the growing season and, if necessary, treated with an appropriate herbicide.
- No stockpiling of potentially infested material will take place within 10 m of a watercourse.
- All haulage lorries, dumpers, bags or skips carrying infested material will have the material covered during transit.
- Where infested material is to be removed from site this will have accompanying waste transfer documentation, for disposal in a licenced landfill site.
- Where application of herbicide is required as part the control this would only be undertaken by suitably qualified individuals (i.e. NPTC certified) and after obtaining all relevant permissions and consents from Environment Agency (for application near to water courses).
- Any areas of invasive species growth, treatment areas, bunds created for management of invasive species or buried invasive species will be demarcated on site constraint maps which will be provided to the Planning Authority.
- An invasive species management plan detailing all invasive species found within particular phased working areas and the intended treatment will be provided to the Planning Authority and approved before treatment begins.
- Any records of invasive species will be provided to the local Biodiversity Records Centre and the GB Non-Native Species Secretariat.

4 RESTORATION STRATEGY

4.1 Restoration aims and objectives

4.1.1 The key drivers behind the restoration of Gebdykes Quarry landfill are the delivery of tangible landscape and biodiversity benefits, together with the incremental realisation of appropriate nature conservation/biodiversity targets through the creation and subsequent management of interlinked terrestrial habitats.

4.1.2 The overall restoration scheme (refer to ES Figure 3.6) links together the habitat re-creation and to show continuity of conservation grasslands, hedgerows and woodland belts to provide a site that is ecologically connected both onsite and offsite linking with hedgerows and woodland compartments in the wider area.

Planning policy background

4.1.3 The Minerals and Waste Joint Plan, Publication Draft November 2016 Policy D10: Reclamation and after use provides the background to the overall aims and objectives for the restoration scheme, relevant sections of the policy are as follows:

"Part 1) Proposals which require restoration and afteruse elements will be permitted where it can be demonstrated that they would be carried out to a high standard and, where appropriate to the scale and location of the development, have demonstrably:

i) Been brought forward following discussion with local communities and other relevant stakeholders and, where practicable, the proposals reflect the outcome of those discussions;

ii) Taken into account the location and context of the site, including the implications of other significant permitted or proposed development in the area and the range of environmental and other assets and infrastructure that may be affected, including any important interactions between those assets and infrastructure;

iii) Reflected the potential for the proposed restoration and/or afteruse to give rise to positive and adverse impacts, including cumulative impacts, and have sought where practicable to maximise potential overall benefits and minimise overall adverse impacts;

iv) Taken into account potential impacts on and from climate change factors;

v) Made best use of onsite materials for reclamation purposes and only rely on imported waste where essential to deliver a high standard of reclamation;

vi) Provided for progressive, phased restoration where appropriate, providing for the restoration of the site at the earliest opportunity in accordance with an agreed timescale;

vii) Provided for the longer term implementation and management of the agreed form of restoration and afteruse (except in cases of agriculture or forestry afteruses where a statutory 5 year maximum aftercare period will apply).

Part 2) In addition to the criteria in Part 1) above, proposals will be permitted which deliver a more targeted approach to minerals site restoration and afteruse by contributing towards objectives, appropriate to the nature, scale and location of the site, including where relevant:

viii) Promoting the delivery of significant net gains for biodiversity and the establishment of a coherent and resilient ecological network, based on contributing, where practicable, towards established objectives including the creation of Biodiversity Action Plan habitats, and seeking to deliver benefits at a landscape scale."

Biodiversity aims

4.1.4 Lightwater Quarries Ltd. is committed to protecting and enhancing the value of its sites for wildlife, not only while they are active, but also during and post restoration.

4.1.5 Habitats & species occurring or with the potential to occur on site that are priority habitats & species ("Section 41 habitats & species" NERC Act 2006) or within the Harrogate and Hambleton Local Biodiversity Action Plans (LBAP) are listed in Table 1.

Table 1: Biodiversity priority habitats and species and aims for the restoration scheme

Priority habitat	Present on site	To be created	Restoration biodiversity aims
Arable field Margins	x	✓	Retain wide arable margins in re-instated farmland, to provide quality habitat for wildlife on site, increasing feeding opportunities for seed eating birds. Retain arable margins >4m wide.
Magnesian Grassland	x	✓	Magnesian grassland is to be created in the western field of the restored landfill and on steeper slopes around the periphery of the northern area of the quarry that would not be filled. The restoration scheme provides the opportunity to increase magnesian grassland in North Yorkshire and to encourage populations of associated priority species.

Table 1: Biodiversity priority habitats and species and aims for the restoration scheme			
Priority habitat	**Present on site**	**To be created**	**Restoration biodiversity aims**
Hedgerow	✓	✓	Re-instate hedgerows post- extraction and landfill. Hedgerows to be replanted using a diverse mix of species, to include elm (specifically for white letter hair streak, not recorded on site but known to be present locally). Saplings will be native species, ideally of local provenance. Manage hedgerows for the benefit of wildlife with appropriate management regime of laying/cutting.
Standing water/ wetland	x	✓	Drainage basins are required throughout the landfill process and 2 would be retained at restoration, these would be designed so as to retain some standing water and wetland areas in the base.
Priority species			**Restoration biodiversity aims**
Bats	✓	✓	Retain and protect mature trees around the periphery of the site, to provide roosting opportunities. Retain and enhance hedgerows and woodlands and a diverse range of flower rich grasslands to provide suitable sheltered foraging and commuting opportunities on site. Provide ecological connectivity through the site and to the wider area.
Great Crested Newt	x	✓	Provide suitable terrestrial and aquatic habitat (enhanced hedgerow network and standing water/ wetland) as part of the restoration scheme in the medium to long term.
Breeding birds – farmland bird assemblage Skylark, lapwing,	✓	✓	To retain existing populations and increase opportunities for breeding and foraging.
Brown Hare	✓	✓	Provide habitat (open fields) and connectivity to allow free movement of brown hares. Increase open field habitat to support populations.
Hedgehog	✓	✓	Increase habitat available by replanting hedgerows and woodland habitat. Provide cross site connectivity to enable safe passage.

Other aims

4.1.6 To restore and enhance the landscape and visual amenity value of the site.

Restoration objectives

4.1.7 In order to meet the above aims, the objectives of the restoration scheme are to create the areas/ lengths of the habitats and land uses in Table 2, as are illustrated on ES Figure 3.6. This will result in a diverse range of habitats and movement corridors

for wildlife across the site.

Table 2: Proposed habitats and land uses within Restoration Scheme	
Land use	**Area/ length**
Existing woodland and scrub	7ha
Existing agricultural land	2ha
New woodland and scrub	1.8ha
Magnesian limestone grassland	6.6ha
Agricultural land	15.5
Hedgerows	822m
Drainage basins with water bodies and wetland	0.7ha

4.1.8 The aim of providing a range of habitats including priority habitats is to increase biodiversity on the site to benefit the species currently present and to enhance the area for associated priority target species, currently absent from site. Examples would be through provision of magnesian grassland and appropriate plant species the site could provide suitable habitat for butterflies such as dingy skipper *Erynnis tages* and brown argus *Aricia agestis*, and arable and pasture fields may support a range of farmland land birds to including skylark and lapwing.

4.1.9 Lightwater Quarries will ensure a suitable structure is in place to deliver the restoration and aftercare obligations. Lightwater Quarries will appoint an appropriate landscape contractor to manage the habitats in accordance with the Landscape and Biodiversity Management Plan and the CEMP. The roles and responsibilities will be set out within the sub-contractual agreement.

4.1.10 In addition, Lightwater quarries will ensure the scheme receives adequate financial funding and logistical management as well as expertise and advice on nature conservation, habitat creation, establishment, management and monitoring to ensure the restoration objectives are delivered to the highest standard. Prescriptions may be amended as a result of the monitoring observations to ensure that the medium and long terms aims of the scheme are realised.

4.2 The Restoration Scheme

Landform

4.2.1 The restored landform is shown on Figure 3.6 and cross sections through this are shown on Figure 3.7. The landform of the landfill has been designed to replicate the landform of the site before the quarry was developed, it therefore ties into the surrounding landform to the east, west and south and would be at 144m AOD at the

highest point in the southern section of the landfill. The northern edge of the landfill would then slope down to the quarry floor to tie in with the existing access ramp.

4.2.2 The restored quarry edges of the northern area of the existing quarry would consist of a combination of slopes, both grass and scree, formed by pushing overburden and waste rock against the final worked face with varied gradients of 1:3 on average, or and combination of exposed faces no higher than 5m left as landscape features and slopes, to create a varied restoration profile. Restoration blasting would used as required to create the desired features. The aim of this restoration approach is to create a varied landform, to reduce the linear appearance of the final quarry void and to create a variety of habitats including magnesian limestone grassland, scree, and exposed faces, which are valuable for a range of specialist calcicole plant species and invertebrates. Woodland planting would also be used to soften the linear appearance. The quarry floor would be graded to gently sloping land suitable for agricultural use.

Soil Restoration

4.2.3 The restored soil profiles are listed in Table 3. Refer to the SMP in Appendix 8.5 of the Norther Quarry Extension ES for more details of the soil restoration.

Table 3: Restored soil profiles

Landcover	Topsoil depth (mm)	Subsoil depth (mm)
Agricultural land	300	600
Woodland/scrub	300	600
Magnesian limestone grassland	0	100 over limestone fines

Landcover and land use

4.2.4 The restored landfill and quarry would consist of a range of land uses from nature conservation to agriculture. A network of fields would be created divided by hedgerows with central fields returned to agricultural use and a magnesian limestone grassland field created in the west. Magnesian limestone grassland would also be created on the steeper slopes of the northern half of the existing quarry, along with scree and exposed rock faces as described above.

4.2.5 Pockets of additional woodland planting and scattered trees and scrub would be planted around the quarry perimeter at restoration. This, along with the management and thinning of the existing screening belts would aim to soften the appearance of the linear screening belts and add to landscape and habitat diversity of the restored site.

4.2.6 Drainage basins are required throughout the landfill process and 2 would be retained at restoration, these would be designed so as to retain some standing water and wetland areas in the base.

4.2.7 Estimated areas of different land uses that would be created within the restored quarry are presented in Table 2 above.

4.3 Methods of Habitat Creation and Planting Specifications

Woodland, scrub and Hedgerows

4.3.1 The woodland to be planted at restoration would consist of the species listed in Table 4 below. Scrub planting would consist of the species listed in Table 5 below.

4.3.2 Tree species to be planted in groups of 5-10 at an average 2.5m spacing (varying between 2m to 5m), within staggered wavy lines.

4.3.3 Pockets of additional woodland planting and scattered trees and scrub would be planted around the quarry perimeter at restoration. This, along with the management and thinning of the existing screening belts would aim to soften the appearance of the linear screening belts and add to landscape and habitat diversity of the restored site.

Table 4: Woodland planting mix

Common name	Species	%	Height (cm)	Specification
Canopy trees				
Field Maple Not within 3m of gas pipeline	*Acer campestre*	25	40-60	1+1 Transplant B
Oak Not within 6m of gas pipeline	*Quercus robur*	25	100-125	1+2 Transplant B
Rowan Not within 3m of gas pipeline	*Sorbus aucuparia*	20	40-60	1+1 Transplant B
Scots Pine Not within 6m of gas pipeline	*Pinus sylvestris*	10	40-60	Leader & laterals 2L C
Wych Elm/ English Elm/ Sapporo Autumn Gold Elm* Not within 6m of gas pipeline	*Ulmus glabra/ Ulmus procera/ Ulmus davidiana var. japonica × U. pumila*	20	40-60	1+1 Transplant B
Shrubs layer				
Blackthorn	*Prunus spinosa*	30	40-60	1+1 Transplant B
Dog Rose Not within 1.5m of gas pipeline	*Rosa canina*	10	40-60	1+1 Transplant B
Hawthorn	*Crataegus monogyna*	30	40-60	1+1 Transplant B
Hazel Not within 1.5m of gas pipeline	*Corylus avellana*	10	40-60	1+1 Transplant B

Table 4: Woodland planting mix				
Common name	**Species**	**%**	**Height (cm)**	**Specification**
Holly Not within 1.5m of gas pipeline	*Ilex aquifolium*	10	40-60	Leader & laterals 2L C
Wayfaring Tree Not within 1.5m of gas pipeline	*Viburnum lantana*	10	40-60	1+1 Transplant B
* Sapporo Autumn Gold Elm will only be used if disease resistant Wych Elm/ English Elm plants are not available, this would be agreed with the Planning Authority prior to planting				

Table 5: Scrub planting mix				
Blackthorn	*Prunus spinosa*	10	40-60	1+1 Transplant B
Dog Rose Not within 1.5m of gas pipeline	*Rosa canina*	10	40-60	1+1 Transplant B
Dogwood Not within 1.5m of gas pipeline	*Cornus sanguinea*	10	40-60	1+1 Transplant B
Hawthorn	*Crataegus monogyna*	20	40-60	1+1 Transplant B
Hazel Not within 1.5m of gas pipeline	*Corylus avellana*	30	40-60	1+1 Transplant B
Holly Not within 1.5m of gas pipeline	*Ilex aquifolium*	10	40-60	Leader & laterals 2L C
Wayfaring Tree Not within 1.5m of gas pipeline	*Viburnum lantana*	10	40-60	1+1 Transplant B

4.3.4 The trees and shrubs would be planted between November and March during their dormant period. Young plants would be protected from damage by browsing wild animals using suitable biodegradable tree guards. Species required to be supported by stakes would be checked annually to ensure no damage has occurred.

4.3.5 The hedgerow planting would consist of the species listed in Table 6.

Table 6: Hedgerow species				
Common Name	**Species**	**Height (cm)**	**Specification**	**%**
Hawthorn	*Crataegus monogyna*	40-60	1+1 Transplant B	40
Hazel Not within 1.5m of gas pipeline	*Corylus avellana*	40-60	1+1 Transplant B	20
Blackthorn	*Prunus spinosa*	40-60	1+1 Transplant B	10
Field maple Not within 3m of gas pipeline	*Acer campestre*	40-60	1+1 Transplant B	10
Wych Elm/ English Elm/ Sapporo Autumn Gold Elm* Not within 6m of gas pipeline	*Ulmus glabra/ Ulmus procera/ Ulmus davidiana var. japonica × U. pumila*	40-60	1+1 Transplant B	10

Table 6: Hedgerow species				
Common Name	**Species**	**Height (cm)**	**Specification**	**%**
Holly Not within 1.5m of gas pipeline	*Ilex aquifolium*	40-60	Leader & laterals 2L C	5
Dog Rose Not within 1.5m of gas pipeline	*Rosa canina*	40-60	1+1 Transplant B	5
* Sapporo Autumn Gold Elm will only be used if disease resistant Wych Elm/ English Elm plants are not available, this would be agreed with the Planning Authority prior to planting				

4.3.6 Native species hedgerow trees (including oak, field maple, rowan, wild cherry, Elm) would also be introduced at random spacings at the rate of 4 trees/200m, except for within the vicinity of the gas pipeline. These trees would be individually marked with coloured tags and would not subsequently be trimmed as part of any early hedgerow management operations. The hedgerow trees would be planted as Standard trees (250 - 300cm high) pit planted and protected using individual tree shelters.

4.3.7 Pre-planting, the areas would be rotovated and a bark mulch applied to reduce the growth of competitive weeds at least 3 weeks prior to planting.

4.3.8 In order to ensure that healthy, vigorous growth is achieved in newly planted trees and shrubs, the following specification would be applied:

- all planting stock supplied would be in accordance with BS3936 and would be the best quality of their respective kind;
- all plant stock would be supplied from a reputable nursery which can supply species of local provenance where possible;
- all plant material would be healthy, vigorous and sound transplanted nursery stock with well-formed fibrous root systems and well-formed heads; and
- plant material to be free from pest and diseases, undamaged and any containers free from weeds, prior to planting.

4.3.9 The trees and shrubs would be notch planted, with the exception of the holly and pine which would be pit planted, and protected using 1.2m high tree tubes or guards constructed of a biodegradable material and/or post and wire fencing. The hedgerow trees and shrubs would be planted in double staggered rows, at 30cm spacings.

4.3.10 Ground flora will be allowed to develop naturally.

Agricultural land

4.3.11 Land intended for an agricultural after use would either be seeded with an agricultural grassland mix (medium to long-term grass-ley mixture with clover) or entered into arable cropping (wheat – barley rotation). Seeding would be carried out in March to May or September to October, when climatic conditions are suitable for establishment. The restoration of land to agricultural land will aim to achieve ALC grades 3a and 3b.

Arable margins

4.3.12 The aim is to retain arable margins ranging from >4m in width, in areas of arable agricultural restoration. The margins will be allowed to naturally regenerate from the natural seed bank to encourage wildlife on arable farmlands and reduce fertiliser and pesticide drift (if used) on conservation grasslands. For more floristically diverse swards within the arable margins a commercial seed[1] can be used (such as cornfield Annuals) and sown as detailed within paragraph 4.3.19.

Magnesian limestone grassland

4.3.13 The aim is for the creation and management of the calcareous grassland is to work towards achieving a floristically diverse, identifiable magnesian limestone grassland community, which would ultimately have affinities with NVC community CG3 - *Bromopsis erecta* grassland. Much of the below, follows prescriptions outlined within Ashwood (2014), and the CIEEM webinar Habitat Creation: Creating and Restoring Grasslands (2019), presented by Penny Simpson.

Seeding from Green Hay

4.3.14 This is the preferred method of habitat creation and would involve consultation with the LPA and liaison with site managers of local sites to discuss obtaining an appropriate source or if magnesian limestone grassland already created on site or at Potgate Quarry is establishing successfully this would be used as a green hay source. Seeding from green hay requires taking a hay cut at the appropriate time of year and spreading it over the freshly prepared ground. However, it must be noted that magnesian limestone grassland is traditionally managed through grazing, so this might not be a feasible option.

[1] John Chambers Wildflower Seed - https://www.johnchamberswildflowers.co.uk/wildflower-seeds-mixes/100-wildflower-mixes/john-chambers-pro-cornfield-annuals-100-wildflower-seed-mix

4.3.15 Should a suitable donor site be available, the hay crop would be taken after flowering, but prior to seeds being dropped. Given that a key target species in this instance would be upright brome, which flowers from late May, a hay cut will be taken in late June or mid-July (subject to the donor sites management plan/HLS scheme). The cut hay would be spread on the prepared ground within 24 hours. Hay from the donor site can be spread at a ratio of 1:3, where hay from 1ha of cut grassland can be used as a source for 2-3ha of newly created grassland.

4.3.16 Biosecurity measures would be undertaken to stop the spread of undesirable species between the donor and receptor sites, in this instance the spread of invasive species such as Himalayan balsam and butterfly bush. This could involve the cleaning of equipment between sites.

4.3.17 The phased restoration might allow green hay to be utilised across a number of different phases of the scheme. Once established within the site, the restored areas of magnesian limestone grassland, could be used as donor sites.

4.3.18 Seed from target species could be hand collected from the donor site to be spread on the receptor site, particularly upright brome, which is not widely available within commercial seed mixes and is a key component of magnesian limestone grassland communities.

Seeding from commercial Seed

4.3.19 If a green hay source cannot be found, or the quantity of available hay is not sufficient for the amount of habitat to be created, a suitable commercial[2] calcareous seed mix would be used. The seed mix would be of local provenance, where available. A mix of both grasses and wildflowers would be used and as a minimum the species listed in Table 7 would be included within the mix (subject to agreement with local nature conservation organisations):

Table 7: Calcareous grassland seed mix

Common name	Species	Common name	Species
Upright brome*	*Bromopsis erecta*	Common knapweed	*Centaurea nigra*
Salad burnet	*Poterium sanguisorba*	Hoary Plantain	*Plantago media*
Glaucous sedge	*Carex flacca*	Lady's Bedstraw	*Galium verum*
Ribwort plantain	*Plantago lanceolata*	Crested hair-grass	*Koeleria macrantha*
Common bird's-foot-trefoil	*Lotus corniculatus*	Field scabious	*Knautia arvensis*

[2] John Chambers Wildflower Seed or similar

Table 7: Calcareous grassland seed mix			
Common name	**Species**	**Common name**	**Species**
Sheep's-fescue	*Festuca ovina*	Selfheal	*Prunella vulgaris*
Rough hawkbit	*Leontodon hispidus*	Quaking-grass	*Briza media*
Fairy flax	*Linum catharticum*	Common rockrose	*Helianthemum nummularium*
*If available			

4.3.20 The results of the soil analysis would dictate the desired sowing rate. Seed distributors often recommend a sowing rate as high as 40kg/ha, and it is considered that nutrient rich soils might require this sowing rate. For nutrient poor substrates 10-15kg/ha is a suitable sowing rate as grass and undesirable species growth is not expected to be as vigorous. Seeds would be sown in September/October and due to the size of the habitats created the seed would be sown using a tractor mounted seed drill. Immediately following sowing the seedbed would be rolled using a flat roller.

4.3.21 Newly sown areas would be protected from trampling by people and grazers (including rabbits where possible). Bird scarers would be used after seeding to discouraging seed eating birds.

4.3.22 It is important to note that it can take up to five years to establish a stable grassland community, with early establishment being patchy and 'weedy' in appearance.

4.3.23 The condition of the grassland would be reviewed within 6 months of seeding and any areas which have failed to establish would be re-seeded. To control any flush of annual weeds, within the first year the grassland may require up to four cuts, however, Ashwood (2014) notes that:

"Typically, first-year cutting regimes will not be necessary for grassland established on bare mineral substrate…"

4.3.24 As such, the created grassland would be monitored within the first year and if grass growth is considered to be vigorous a cut would be taken. The sward length would ideally be kept at 100mm or below.

Waterbodies and wetlands

4.3.25 The drainage basins will be profiled with irregular shorelines with gradient variations from 1:3 to 1:10 to maximise the variety of aquatic and marginal habitats. The shallower part of the shore profiles and submerged gradients will be soiled with topsoil to a depth of 300mm to promote the establishment of the micro flora and

fauna which form the base of the fish food chain. Once created, the water bodies would be left to allow vegetation to colonise naturally.

4.4 Public access

4.4.1 There would be no public access to the restored quarry.

5 AFTERCARE AND LONG TERM MANAGEMENT OF THE SITE

5.1 Introduction

5.1.1 Aftercare of the site is important for the successful establishment of the vegetation. Annual maintenance meetings will be held during the 5 year statutory period, on site to review the previous year's management. Data gathered will be used to modify site-specific management as required. The annual maintenance meetings would be attended by representatives from Lightwater Quarries, the landowners, the Planning Authority, Yorkshire Wildlife Trust and any other interested nature conservation groups and any relevant ecology/ landscape consultants.

5.1.2 Aftercare will comprise the maintenance of each phase of the quarry over a statutory period of five years to ensure the successful establishment of the target habitats. The aims of the aftercare scheme are as follows:

- management of existing and new woodlands and scrub;
- repair and maintenance of post and wire fencing where necessary;
- maintenance of existing and proposed hedgerows including pruning and cutting as required;
- conservation of the flora and fauna of the newly established species rich grasslands, wetlands and woodlands through a low nitrogen input regime;
- establishment of marginal and emergent plants within the drainage basins;
- management/control of aquatic vegetation and algae;
- management/control of INNS; and
- soil (cultivation, destoning, application of amendments, such as fertilisers and lime) and, if needed, drainage management.

5.2 Management aims and objectives

5.2.1 The long-term management aims and objectives are as follows:

Conserve and develop the amenity value of the restored site to include the following objectives:

1. *Maintain and enhance where possible, the landscape and visual amenity value of the site.*

Conserve and enhance the nature conservation and biodiversity value of the restored site to include the following objectives:

1. *Establish, maintain and enhance areas of species rich grassland habitat.*
2. *Establish, maintain and enhance areas of existing and developing broadleaved woodland and scrub habitat.*
3. *Establish, maintain and enhance species rich hedgerows with hedgerow trees.*
4. *Establish, maintain and enhance the areas of developing wetland.*
5. *Control and removal of weeds and alien species.*
6. *Seek to establish progressively the various habitats on the site.*
7. *Monitor the success of the establishment of new habitats.*

5.3 Roles and responsibilities

Ownership

5.3.1 The site is owned by the Warrington family who have managed the land for generations. They will take on the long term management of the site post-aftercare and manage the habitats is accordance with this plan.

5.3.2 Lightwater Quarries will be responsible for restoring the quarry in accordance with this management plan (and any subsequent amendments and additions) and the managing the site for the 5 year statutory aftercare period. At the end of the 5 year statutory period the site will be handed back to the landowners who will continue to manage the site in accordance with this plan. Specialist input will continue to be sought to develop the details of the restoration, to prepare detailed management plans and for monitoring.

5.4 General operations

5.4.1 The following schedules of operations (Table 8 to Table 13) would be implemented from the beginning of the aftercare period and will continue to be implemented as per the following tables for the duration of the aftercare period and in the long term.

Table 8: Maintenance regime carried out on annual basis: General

Operation	Frequency
Each general inspection would include fencing, gates and other site furniture, a scavenge and litter pick (including debris and any other deleterious matter) removing all arisings to contractor's tip, leaving the site in a neat and tidy appearance.	2 visits per year.

5.5 Woodland and scrub planting

5.5.1 Woodland and scrub planting would be inspected on an annual basis and dead and diseased stock replaced. During the establishment of the planting a 1m diameter

weed free area would be maintained around the plants, preferably by maintaining mulch cover to minimise herbicide use. If considered necessary, an appropriate herbicide, suitable for use close to water, would be applied to around the base of the trees, during the growing season (mid-April to end of September) to maintain the weed free area. Applications of herbicide would be assessed during the first 5 growing seasons; alternatively, grass growth would be managed by strimming vegetation during the growing season, avoiding damaging tree stems.

5.5.2 In the longer term, once the proposed woodland compartments have established, management priorities will change to concentrate on initially removing tree guards /protection and enclosure fence maintenance. A cyclical programme of thinning, felling and coppicing with some interplanting will be introduced with the aim of increasing the species and (especially) the structural diversity of the canopy, under-storey layers and a more open, dispersed woodland cover, particularly on the fringes of the woodland areas.

5.5.3 One of the potential threats to these developing woodland areas is the encroachment by non-native sycamore, which, if unchecked, may come to dominate certain sections of the woodland. Provided the development of young sycamore is prevented (by hand pulling of saplings) it is unlikely that serious encroachment will be a problem. However, appropriate regenerating native target species will be retained within the woodland to encourage a diverse age structure.

5.5.4 The trees in the woodland areas will be thinned to leave the canopy trees with an average spacing of between around 6-10m, with interspersed understorey trees; the timing of thinning will be dependent on local growth conditions of the trees. The woodland edges will have been scalloped to form sheltered areas creating a diversity of micro-climates. Scalloped areas along woodland edges attract flying invertebrates; these in turn have the potential to become prey items for bird and bat species. The scalloped and more open canopied edges of the woodland will be maintained (primarily by the selective removal of trees and scrub). Management of these areas - through cutting - will seek to prevent excessive scrub invasion of the grassland areas.

Monitoring

5.5.5 Monitoring of the condition of the trees, with minor management works to remove dead/diseased trees or improve the health of others will be carried out at least once every 5 years.

5.6 Hedgerows

5.6.1 The base of the hedgerows would be kept weed-free for at least three years to ensure a good plant establishment and growth rate. Chemical control would be undertaken as necessary but typically annually, and early in the year with weed growth monitored to determine if further applications are subsequently required.

5.6.2 Initial management would involve appropriate trimming of the establishing hedgeline in the first few years to encourage early lower branching and to discourage the apical tendency of hawthorn. Individual plant guards would be removed as soon as practical to avoid 'legginess' developing in the plants. Each successive trim would be progressively higher and wider as this would encourage further branching until the hedge reaches its required height and width.

5.6.3 The hedgerows would be maintained at a height of no less than 2m and a minimum width of 2m, with a mixture of heights and widths across the restored quarry. No fertilisers, manures or pesticides would be applied to this area.

5.6.4 The hedges will not be cut during the bird breeding season (28 February – 31 August). Mature hedgerows will be cut on a two or three year rotation. Avoiding annual cutting is better for wildlife as some species only flower on second year growth. Care will be taken to ensure that hedgerows trees are not significantly damaged during trimming.

5.6.5 Long term management and management of the hedgerows will involve the hedges being laid or coppiced to regenerate growth, improve their structural diversity and increase their stock-proofing capability. Clearance of invasive species, new planting where necessary and controlled cutting to thicken growth. Standard trees would be retained at a ratio of 4 every 200m. Standard trees would be retained as hedgerow trees.

5.6.6 Laying involves cutting stems part way through and interweaving them along the hedge, while coppicing involves cutting the stems at ground level. Coppicing is usually only used when the stems are too thick to allow laying. Laying is the preferred option at Gebdykes, as although requiring skilled labour, it has a less drastic effect on wildlife.

5.6.7 Both coppicing and laying will reduce birds' breeding opportunities in the few years immediately after management and will therefore be carried out progressively over many years rather than treating large sections of hedgerow in a single year.

Monitoring

5.6.8 Inspections in September to check for problems relating to protective fencing, integrity or intactness of hedgeline and requirements for gapping up will be carried out at least once every 5 years.

Table 9: Maintenance regime undertaken for Year 1: woodland, scrub and hedgerow planting	
Operation	**Frequency**
Top-up mulch/ translocated herbicide application	2 visits - April, June and September, plus 1 provisional application
Refirming of all plant material where necessary	1 visit – April
Replace shelters and stakes	Where necessary
Pruning of dead and diseased wood. All arisings will be removed to contractor's tip	1 visit – November-March
Replacement planting of dead/dying/diseased plants (maintain species mix specified in Table 4 and Table 5)	1 visit – in year 1 and Year 3 November-December

Table 10: Maintenance regime undertaken for Years 2 to 5: woodland and hedgerow planting	
Operation	**Frequency**
Top-up mulch/ translocated herbicide application	2 visits – April and June
Top-up mulch/ residual herbicide application	1 visit – November-March
Refirming of all plant material where necessary	1 visit – April
Replace shelters and stakes	Item where necessary
Pruning of dead and diseased wood. All arisings will be removed to contractor's tip	1 visit – November-March
Beat up planting	1 visit – November-December

Table 11: Long term maintenance regime: woodland and hedgerow planting	
Operation	**Frequency**
Inspection and replacement of tree guards and protective fencing and removal when no longer required	1 visit per year
Tree health inspection, arboricultural works and removal of dead and disease trees and shrubs	1 visit per year
Grassland management within woodland areas by strimming if a dense rank sward of grasses develops	1 visit per year
Any reinstatement will be done so in accordance with the restoration and aftercare specifications in this report	1 visit per year
Woodland thinning, felling and coppicing	To be determined during annual inspection
Hedgerow cutting	Then on 2/3 year cutting cycle, outside bird breeding season
Hedgerow laying and/or coppicing	To be determined during annual inspection

5.7 Tree management of existing trees and woodland

5.7.1 Tree management will be undertaken with the primary aim of sustaining and enhancing biodiversity on site. Where on site works are required, these would be carried out from October to February, in order to avoid the bird nesting season, unless required for safety and risk management reasons. Where safety and risk management works are undertaken during the bird nesting season, an ecologist will be consulted prior to the works, with the works undertaken under the directions of the ecologist.

5.7.2 Retaining and enhancing biodiversity on site will be primarily concentrated on retention of decaying wood habitats such as standing dead trees and deadwood in tree crowns. Where it is decided that there is deficit of such habitat on site, enhancement measures such as the creation of standing deadwood and dead branches in tree crowns will be undertaken by ring-barking trees and branches. This will be specified by an experienced arboriculturist, in order to ensure only poorer quality trees are subject to this this type of management and that the works do not increase the risk associated with such trees e.g. not to be undertaken where the trees are falling distance if medium to high targets. The retention of standing late-mature trees, that may transition into veteran trees in time, will also be a key objective for the management of the trees on site.

5.7.3 Other maintenance work would include:

- Arboricultural works to rejuvenate trees in poor condition;
- The felling and clearance of diseased trees where there is a clear risk of disease or pest transmission. This is to be only undertaken, following consultation with and under direction of the Forestry Commission and the Animal and Plant Health Agency, where appropriate;
- Creation of veteran tree features such holes, splits, cavities in existing poor quality trees to create habitat for invertebrates, nesting birds and bats;
- Limited selective thinning of trees, established groups of trees/ woodland and coppicing of selected species to introduce stand diversity and to benefit the growth of other trees and habitats; and
- Selective thinning of naturally regenerated juvenile trees to better the growth of the trees to be retained.

Monitoring

5.7.4 Monitoring of the condition of the trees and woodland will be carried out at least once every 5 years.

Table 12: Maintenance regime: Existing woodland and trees	
Operation	**Frequency**
Each general inspection visit will include an inspection of the woodland and trees to determine what management work is required.	1 visit per year

5.8 Magnesian limestone grassland

5.8.1 This would require low input management:

- No artificial or organic manures to be applied.
- No herbicides to be applied with the exception of spot treatment of any undesirable or invasive species.

5.8.2 In the second and subsequent years, management to maintain the diversity of the grassland would involve an annual cut to a height of c.50mm, undertaken each year in late Summer/early Autumn. This maintains the habitat for longer, allowing species to flower and set seed as well as providing more continual foraging resource for invertebrates. Alternatively, a single cut could be undertaken in early spring. The cut material would be removed after each mowing and could be gathered on-site and allowed to rot down naturally.

5.8.3 Alternatively, the established grassland would be grazed, ideally by sheep, on a management regime designed to encourage development of the sward and soil profile.

5.8.4 As well as being monitored, assessed and managed throughout the Aftercare Management Period, at the end of this period, an assessment would be made of how well the grassland has established.

5.8.5 Long-term management of grasslands is required to prevent natural succession and the sward becoming dominated by a few aggressive species. Noxious and invasive weeds will be effectively controlled in accordance with best practice.

Monitoring

5.8.6 Monitoring will be undertaken in order to determine if the management prescriptions are adequate in maintaining the structural and species diversity of the sward. Monitoring to take place in year 1 to assess initial success of the reseeding, and every

five years thereafter. If monitoring determines that the grassland is deteriorating, then changes to the management and grazing/mowing regimes will be introduced. Monitoring options include fixed point photographs, and random and fixed point quadrats.

5.9 Agricultural land

5.9.1 Generally, grassland established on the agricultural land would be managed after the first year's growth by:

- taking a single late summer hay or silage crop a year; or
- grazed on a management regime designed to encourage development of the sward and soil profile.

5.9.2 Long-term monitoring of the species composition of the grassland and the ability to respond (with alterations to the cutting /grazing regimes) is very important and would form part of the management regime for the site.

5.9.3 For arable land, this would depend on the choice of crop and farming method used. In any case, good agricultural practice with regards to grazing management, soil cultivation, use of fertilisers, lime and pesticides will be followed. The need for agricultural drainage would be assessed two years after the fields have been created.

Table 13: Maintenance regime: Agricultural Grass seeded areas	
Operation	**Frequency**
General inspection of: Germination and the establishment of grasses until the mix has shown successful germination and establishment Surface erosion and, where necessary the requirement for intermediate grips to control run-off	2 visits per year or as required for success
Grass cutting	Twice in the first year, thereafter the fields will be grazed by sheep
Selective herbicide application or removal by hand pulling of pernicious or notifiable weeds Refer to *The Code of Practice for the Safe Use of Pesticides on Farms and Holdings [PB3528]* for regulations on herbicide application	2 visits per year before onset of seed dispersal or as required for success Site operatives will be trained to recognise the different species
Making good and reseeding dead or damaged areas	Annually
Maintenance regime: Arable crops	
Due to many options possible depending on the crop and farming system used, this will be specified following restoration. As a minimum, good agricultural practice tailored to soil condition will be followed based on advice from an experienced agronomist.	

5.10 Water bodies and wetlands

5.10.1 Management works will be carried out between September and October to minimise disturbance to wildlife.

5.10.2 Initial monitoring will take place after the first growing season. Any necessary supplementary planting will be carried out the following season (June) if the area regenerated were to be less than 50% successful. Locally sourced transplanted material or seedlings will be used.

5.10.3 Water bodies are at risk from invasion by invasive, non-native species such Canadian pondweed, Australian stonecrop etc. For this reason, it is recommended that plants are only transferred from one waterbody to another following a check by a competent ecologist. Invasive, non-native species would be controlled by hand, if herbicides are required; these will be applied by a contractor with an appropriate Certificate of Competence. The Environment Agency can provide a list of approved contractors.

5.10.4 Algal growth typically becomes excessive when the water is too nutrient-rich. The aim will be to prevent the build-up of nutrients in water bodies when they are formed, as well as minimising runoff of fertilisers from adjacent land.

5.10.5 The control of algal blooms, if required, will utilise submerged barley straw in the shallower water of the lakes, in accordance with emerging management techniques. Bales of barley straw will be loosely broken apart and placed in netting bags to allow water and air to circulate. The application rate will be 250kg of straw/ha of water (assuming a depth of approximately 1 - 2m). The straw will be applied in March – April.

5.10.6 Once vegetation is established the long term management will ensure that an area of open water is maintained. Removal of excess vegetation will be undertaken annually to ensure a varied structure. Pond clearance will be carried out during October - February when most amphibians have left the pond to over winter within terrestrial habitats. Vegetation will be left on the bank for 24 hours before removing off site.

Table 14: Maintenance regime: Water bodies and wetlands	
Operation	**Frequency**
Each general inspection visit will include an inspection of the basins to determine if any of the management operations listed above are required. Any works required will be carried out in September to October.	2 visits per year

Removal of native and non-native invasive species (INNS)

5.10.7 The site may be vulnerable to colonisation by invasive species as listed above in section 3.5. In the event that invasive species become established and deleteriously effect the target habitats, management will be undertaken, as required, using approved control methods.

5.11 Other monitoring

5.11.1 Monitoring will focus primarily on habitats on site. With incidental sightings of wildlife (birds, butterflies etc) recorded whilst on site.

5.11.2 The results of protected species surveys will be forwarded to the LPA and any changes incorporated into relevant management plans and/or mitigation plans.

5.11.3 A full programme of protected species surveys will be incorporated into the Construction and Environmental Management Plan (CEMP) which will allow updated survey results to be to feed into site clearance and method statements and any associated licenses throughout the different phases of the development.

5.11.4 A review will be conducted in the last winter of the aftercare period. The success of the management strategies used in the aftercare period will be assessed and amendments made to the long-term management plan if necessary.

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APPENDIX 4

Flood Risk Assessment

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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

LIGHTWATER QUARRIES LIMITED

GEBDYKES QUARRY LANDFILL
PLANNING APPLICATION AND ENVIRONMENTAL STATEMENT

FLOOD RISK ASSESSMENT

FEBRUARY 2023

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LIGHTWATER QUARRIES LIMITED

GEBDYKES QUARRY LANDFILL
PLANNING APPLICATION AND ENVIRONMENTAL STATEMENT

FLOOD RISK ASSESSMENT

FEBRUARY 2023

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CONTENTS

APPENDICES

DRAWINGS

1 INTRODUCTION

1.1 General

1.1.1 Wardell Armstrong LLP (WA) has been commissioned by Lightwater Quarries Limited to prepare a Flood Risk Assessment (FRA) for the proposed development of an inert landfill site at Gebdykes Quarry, Masham, North Yorkshire.

1.1.2 This report sets out the findings of the FRA required by the Local Planning Authority to support the planning application for development of the site. The assessment has been carried out in accordance with the guidance set out in National Planning Policy Framework (NPPF).

1.2 Methodology

1.2.1 The methodology for this FRA has comprised a desktop study of online mapping, existing literature and previous site investigation works. Reference has been made to relevant plans and documents including:

- North Yorkshire County Council (2011) *Preliminary Flood Risk Assessment;*
- Harrogate Borough Council with Craven District Council and Richmondshire District Council (2010) *North West Yorkshire Level 1 Strategic Flood Risk Assessment – Volume II: Technical Report;* and
- North Yorkshire County Council, City of York Council and the North York Moors National Park Authority (2016) *Minerals and Waste Joint Plan – Sustainability Appraisal Strategic Flood Risk Assessment*.

2 FLOOD RISK AND PLANNING POLICY

2.1 National Planning Policy

2.1.1 The NPPF and the accompanying Planning Practice Guidance (PPG) aim to ensure that flood risk is taken into consideration at all stages of the planning process and advocates the use of a risk-based 'Sequential Test' to preferentially locate development in areas with a low risk of flooding. Where development is necessary in high risk areas, the NPPF aims to ensure that the development is safe without increasing flood risk through the application of the Exception Test.

2.1.2 The PPG defines the levels of flood risk within England as follows.

- Flood Zone 1 – Low Probability – Land having less than a 1 in 1,000 annual probability of river or sea flooding.
- Flood Zone 2 – Medium Probability – Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
- Flood Zone 3a – High Probability – Land having a 1 in 100 or greater annual probability of river flooding; or having a 1 in 200 or greater annual probability of sea flooding.
- Flood Zone 3b – Functional Floodplain – Land where water has to flow or be stored in times of flood.

2.1.3 The PPG states that a site-specific FRA is required for all new development proposals located in Flood Zones 2 and 3, and for any proposal of 1 hectare or greater regardless of its flood zone classification. The flood zones as described above are shown on the Environment Agency's Flood Map for Planning, available online.

2.1.4 Table 2 of the PPG classifies development types based on their vulnerability to flooding, ranging from 'Essential Infrastructure' which has to be operational in times of flood, through 'Highly Vulnerable' (e.g., emergency service stations), 'More Vulnerable' (e.g., residential dwellings and establishments), 'Less Vulnerable' (e.g., offices/retail), to 'Water Compatible' development (e.g. open space, docks, marinas and wharves).

2.1.5 Based on Table 2 of the NPPG, the proposed inert landfill development is classified as a 'Less Vulnerable' development.

2.1.6 Table 3 of the PPG indicates which 'vulnerability classes' are acceptable in each of the Flood Zones, and when the Exception Test should be applied. This is reproduced as Table 1 below.

Table 1: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1 (>0.1%)	✓	✓	✓	✓	✓
2 (0.1 – 0.5%)	✓	Exception Test	✓	✓	✓
3a (>0.5%)	Exception Test	×	Exception Test	✓	✓
3b (>5%)	Exception Test	×	×	×	✓

2.1.7 The Environment Agency's Flood Map for Planning shows that the site is wholly located within Flood Zone 1 (see Figure 1). Based on Table 3, the 'Less Vulnerable' development is appropriate within Flood Zone 1.

Figure 1. Environment Agency Flood Map for Planning

2.2 Application of the Sequential and Exception Test

2.2.1 The Sequential Test, as set out in the NPPG, aims to steer developments to areas with the lowest risk of flooding (i.e., Flood Zone 1 where possible). As the proposed development is located wholly within Flood Zone 1, it is considered that the Sequential Test is passed.

2.2.2 The Exception Test should be applied after the Sequential Test has been applied in circumstances when 'More Vulnerable' development and 'Essential Infrastructure' cannot be located within Flood Zones 1 or 2, or 'Highly Vulnerable' development cannot be located within Flood Zone 1. As the proposed development has passed the Sequential Test, the Exception Test is not required.

3 SITE SETTING

3.1 Site Description and Location

3.1.1 A summary of the site and its characteristics is provided in Table 2.

Table 2: Site Location Summary	
Site Name	Gebdykes Quarry
Site Address	Land off Limekiln Lane, near Masham, North Yorks, HG4 4BT
Site Area (ha)	c. 33.7 ha (quarry) c. 10.7 ha (development area)
National Grid Reference	SE 23844 82202
Existing Land Use	Mineral extraction
Proposed Land Use	Inert Landfill
Local Planning Authority	North Yorkshire
Sewerage Undertaker	Yorkshire Water

3.1.2 Gebdykes Quarry is an active magnesian limestone quarry located approximately 2km to the north-east of Masham. Southern areas of the wider Gebdykes Quarry are nearing exhaustion of the permitted reserves and this area currently forms a large void. The proposed development (referred to as 'the site' where appropriate) forms the southernmost part of this void.

3.1.3 The National Grid reference for the approximate centre of the site is SE 23844 82202 and the nearest postcode is HG4 4BT. The location of the site is shown on Drawing No. NT14834-Figure 1.1 *'Location Plan'.*

3.1.4 The proposed development is bounded to the north by operational areas of Gebdykes Quarry, to the east by Halfpenny House Lane (B6268), to the south and west by undeveloped agricultural land.

3.1.5 The site is approximately 10.7 hectares and is irregular in shape, consisting of exposed rock, loose mineral and large stockpiles. Access to the site is from the wider Gebdykes Quarry to the north.

3.1.6 The site topography is shown on Drawing No. LQ/GDQ/MAR21-02 *'Quarry Update and Stockpile Survey 30th March 2021'*. Northern and central areas of the site contain large mounds of stockpiled mineral and topsoil which are up to 10m in height. Exposed areas of quarry floor are minimal with only haul roads passing between the mounds.

North-western areas of the site consist of side slopes extending inwards from the site boundaries and areas of rough vegetation. Side slopes in this area are generally shallower than elsewhere on site, with typical gradients of between 1 in 4 and 1 in 12.

3.1.7 Southern areas of the site have larger areas of exposed quarry floor, which are relatively flat, split across two 'tiers'. Stockpiles in these areas are generally smaller and lower in height. Side slopes in this area are steeper, with gradients of approximately 1 in 2.

3.1.8 Ground levels around the site boundaries are generally between 136mAOD and 140mAOD. Adjacent areas of quarry floor in northern and western areas of the site are between 18m and 26m lower than land at the site boundary, with elevations of approximately 118mAOD. Ground levels in central areas of the site are approximately 12m lower than land at the site boundary, with elevations of approximately 132mAOD. Ground levels in southern areas are within 4m of the surrounding ground with elevations of approximately 140mAOD.

3.2 Existing Watercourses and Waterbodies

3.2.1 The closest Main River to the site is the River Ure, which is located approximately 1.2km to the west of the site. The river flows generally south-eastwards adjacent to the towns of Masham and Ripon to join the River Nidd to become the River Ouse, approximately 35km to the south-east of the site

3.2.2 The closest watercourse to the site is a short, unnamed watercourse which extends northwards from farm buildings located approximately 0.6km to the south-west of the site. This discharges to a series of ponds located approximately 0.4km to the south-west of the site. These are assumed to be isolated, man-made waterbodies with no downstream connections to any watercourses or drainage networks.

3.3 Flood Risk Setting

3.3.1 As shown on the EA Flood Map for Planning (Figure 1), the site is located wholly within Flood Zone 1 with an annual probability of flooding of less than 1 in 1,000 (i.e., a probability of less than 0.1%). The closest areas of Flood Zone. with an annual probability of flooding of greater than 1 in 100 (i.e., a probability of greater than 1 in 100), is located approximately 1.1km to the west of the site within an area of flat ground adjacent to the River Ure.

3.4 Existing Drainage

3.4.1 Due the remote and rural nature of the area, it is assumed that there are no public or private sewers within the site area or its vicinity.

3.4.2 The existing quarry presently drains via infiltration to the underlying limestone bedrock at the base of the void with no formal drainage systems.

3.5 Ground Conditions

3.5.1 The online British Geological Survey (BGS) *'Geology of Britain Viewer'*[1] shows that the site is underlain by limestone of the Cadeby Formation. This is classified as a Principal aquifer, defined by the Environment Agency as *'layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale'*. There are no superficial deposits within the site area.

3.5.2 The Cranfield Soil and Agrifood Institute *'Soilscapes'* map[2] classifies the soils within the site as *'freely draining lime-rich loamy soils'.*

[1] BRITISH GEOLOGICAL SURVEY *'Geology of Britain Viewer'* Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[2] CRANFIELD SOIL AND AGRIFOOD INSTITUTE *'Soilscapes'* Available at: http://www.landis.org.uk/soilscapes/

4 DEVELOPMENT PROPOSALS

4.1 Description of the Proposed Development

4.1.1 The proposed development comprises the creation of a new inert waste landfill ('the Site') within the southern area of the existing void of Gebdykes Quarry. Approximately 200,000 tonnes per annum of inert waste would be required to fill this area of the quarry void. The void will be lined with impermeable materials prior to landfilling, creating a landfill 'cell'. It is also proposed to develop a weighbridge and single storey portable office building within the wider Gebdykes Quarry.

4.1.2 Once sufficient inert waste has been brought into the site to achieve the required restoration profile, a 0.5m layer of topsoil, currently stockpiled within the quarry site, will be spread across the landfill cap to return the site back to agricultural use.

4.1.3 The landfilling will be conducted over five phases, commencing in the north-western corner of the site and then working northwards. The landfill operations would be for a duration of 19 years, with a start date in 2023 and an end date in 2042. The restoration phase will extend for an additional two years beyond completion of the landfilling.

4.1.4 The proposed phases are shown in Figure 2 below and ES Figures 3.1 to 3.5. The proposed restoration phase is shown on ES Figure 3.6 *'Restoration'*.

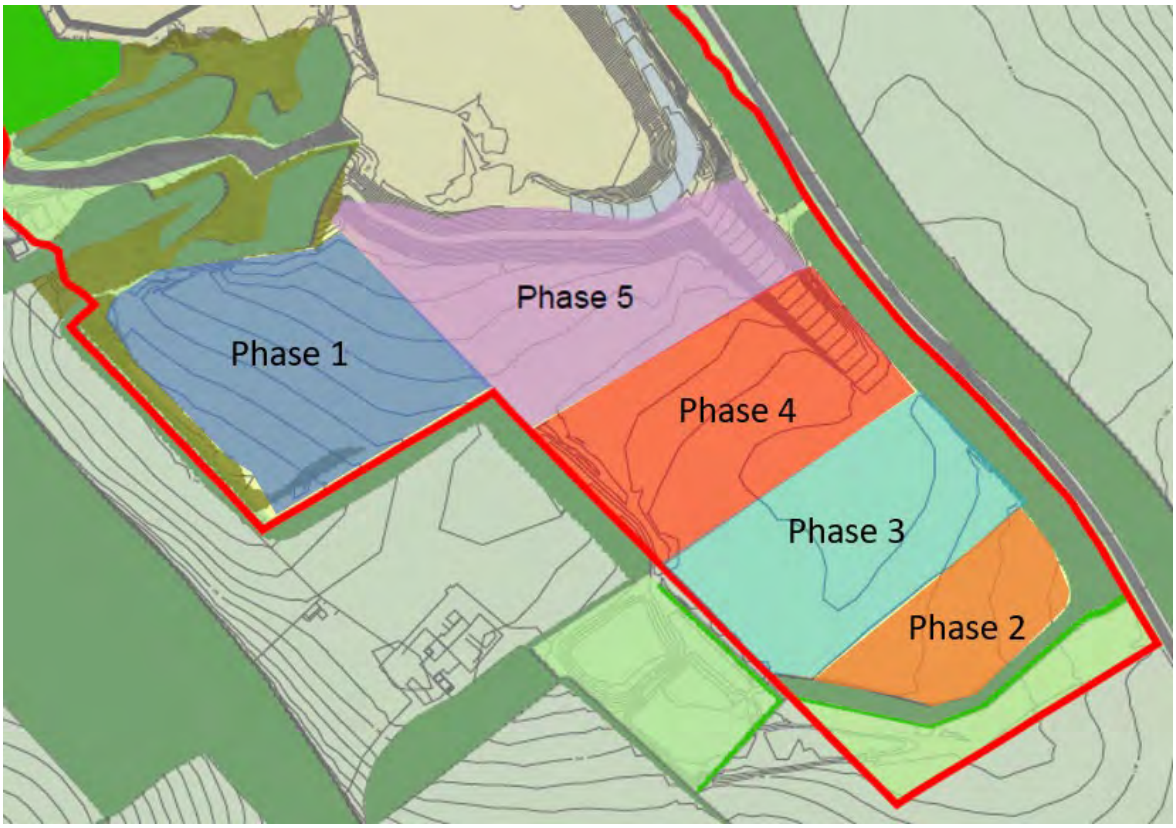

Figure 2. Landfill Phases

Phase 1

4.1.5 Landfilling will commence in a 3.49ha area in the north-western corner of the site as shown on ES Figure 3.1 *'Phase 1 Plan'*. Landfilling will raise ground levels to a maximum of approximately 145mAOD at the western site boundary, which matches the existing elevation of the adjacent land to the west. Following completion of the landfilling, ground levels will fall north-eastwards into the quarry area at a gradient of approximately 1 in 20, before falling steeply at a gradient of approximately 1 in 3 to the base of the void situated at 118mAOD. Stockpiles within other areas of the site will be removed and the base of the void will be generally flat.

Phase 2

4.1.6 The area of landfilling will cover an area of approximately 1.37 hectares in the southernmost extent of the site as shown in Figure 2 and on ES Figure 3.2 *'Phase 2 Plan'*. Landfilling will raise ground levels to a maximum of 143mAOD to match the existing ground levels adjacent to the void in the south and west of the site. The raised ground levels will fall generally south-eastwards at a maximum gradient of approximately 1 in 30 to a minimum of elevation of 140mAOD at the south-eastern corner of the site. Ground levels at the northern extent will fall steeply north-

westwards to the base of the void at a gradient of 1 in 3, to a minimum elevation of 118mAOD.

4.1.7 Restoration works will commence in the Phase 1 area, with the landfill material being recontoured and covered with a layer of topsoil. Limestone grassland vegetation will then be introduced across the flatter areas of the restored ground. The side slopes extending into the void will be left as bare ground.

4.1.8 Ground outside of the existing quarry void will remain undeveloped. Additional tree planting along southern and eastern site boundaries in this area commenced in 2020.

Phase 3

4.1.9 The area of landfilling will be located to the north-west of Phase 2 and will cover an area of approximately 2.20 hectares as shown in Figure 2 and on ES Figure 3.3 *'Phase 3 Plan'.* The completed profile will be relatively flat, falling from a maximum elevation of 144mAOD at the centre of the restored area to a minimum of 143mAOD in the south-eastern corner to match ground levels within the Phase 2 area, with a maximum gradient of 1 in 30. Ground levels at the northern extent of the Phase 3 landfill area will fall steeply north-westwards at gradients of 1 in 3 to a minimum of 118mAOD at the base of the void.

4.1.10 Areas within Phase 2 will undergo restoration works, with topsoil and grassland reinstated.

Phase 4

4.1.11 The area of landfilling will be located to the north-west of Phase 3 and will cover an area of approximately 1.97 hectares, as shown in Figure 2 and on ES Figure 3.4 *'Phase 4 Plan'*. The completed profile will fall north-westwards from a maximum elevation of 144mAOD, initially at a gradient of approximately 1 in 30, before falling steeply at gradients of 1 in 3 to the base of the void at 118mAOD. There will also be a narrow 2m deep valley adjacent to the western site boundary with side slopes of approximately 1 in 3. This retains an existing topographical feature in this area.

4.1.12 The upper reaches of a permanent access road, which will link the base of the quarry void to the peak of the restored area, will be constructed adjacent to the eastern boundary. This road will be approximately 20m wide with a gradient of approximately 1 in 10.

4.1.13 Areas of Phase 3 will undergo restoration works, with topsoil and grassland reinstated.

Phase 5

4.1.14 This irregular-shaped parcel of land will extend between Phase 1 and 4, replacing the steep sideslopes in these areas. This will cover an area of approximately 2.64 hectares as shown in Figure 2 and on ES Figure 3.5 *'Phase 5 Plan'*. Following the completion of landfilling, ground levels will fall northwards and north-eastwards continuing the fall of the restored ground within Phases 1 and 4 at a maximum gradient of approximately 1 in 20. Ground levels at the edge of the restored area will fall steeply north-eastwards in two tiers towards the base of the quarry void at a gradient of 1 in 3.

4.1.15 The access road will extend along the eastern boundary of Phase 5, to a minimum elevation of 125mAOD to join an access road extending around the southern and eastern boundaries of the adjacent quarry void.

4.1.16 Areas of Phase 4 will undergo restoration works, with topsoil and grassland reinstated.

Restoration

4.1.17 Restoration works will be ongoing throughout the works, with completed areas within previous phases being overlain by restoration soils and reseeded. The completed post-restoration layout is shown on ES Figure 3.6 *'Restoration'*.

5 FLOOD RISK

5.1 Flood Risk to the Development

5.1.1 The main sources of flooding identified within the NPPF are rivers, tidal waters and the sea, surface water, groundwater, sewers and drains, and artificial sources such as canals and reservoirs.

5.1.2 The presence of a potential flooding source does not necessarily translate into a high risk of flooding. Table 3 below summarises the potential flood sources and the related flood risk posed to the site.

Table 3: Sources of Flood Risk

Flood Source	Presence at Site	Potential Risk at Site	Description
Rivers (*fluvial flooding)*	Y	Very Low	Located within Flood Zone 1 with no unmodelled watercourses in the vicinity
Tidal	N	n/a	-
Groundwater	Y	Very Low	Base of existing void is over 2m above water table
Surface Water Flooding (*pluvial flooding)*	Y	Very Low	Permeable bedrock and few areas of elevated risk within the site
Sewer	N	n/a	No sewers within the site area
Artificial	N	Very Low	No risk of reservoir flooding or impounded bodies of water in the vicinity

Historical Flooding Incidents

5.1.3 The *'Harrogate BC: Historical Flood Events'* map in the North Yorkshire Strategic Flood Risk Assessment (SFRA) shows that there have been no historical flooding incidents in the vicinity of the site.

5.1.4 The North Yorkshire Preliminary Flood Risk Assessment (PFRA) also does not refer to any historical flooding events in the vicinity of the site.

Fluvial Flooding

5.1.5 The Environment Agency *'Flood Map for Planning'* (see Figure 1) shows that the site is located wholly within Flood Zone 1, defined as an annual probability of fluvial flooding of less than 1 in 1,000 (i.e., less than 0.1%).

5.1.6 The closest area of Flood Zone 3 is located adjacent to the River Ure approximately 800m to the west of the site. This land is situated at approximately 70mAOD, approximately 62m lower than the lowest ground levels within the site area.

5.1.7 There are no unmodeled Ordinary Watercourses in the vicinity of the site which could present an additional risk of fluvial flooding. Based on the available information, there risk of fluvial flooding is considered to be **VERY LOW.**

Tidal Flooding

5.1.8 The risk of tidal flooding is discounted due to the distance from tidally-influenced watercourses and the sea.

Groundwater Flooding

5.1.9 Flooding can occur when prolonged rainfall causes the groundwater table to rise above ground level. Groundwater flooding most often occurs at the same time as flooding from other sources such as overland flow.

5.1.10 It is stated in the North West Yorkshire SFRA that *'the Environment Agency indicated that they do not consider flooding from groundwater to be a significant issue in the SFRA area'*.

5.1.11 Historic groundwater monitoring at Gebdykes Quarry recorded groundwater elevations of between approximately 114mAOD and 105mAOD within the site area. These levels are a minimum of 4m below the existing ground levels within the site. Groundwater levels are shown on Drawing No. NT14621-Figure 2 *'Groundwater Contour Plot August 2020'* and NT14621-Figure 3 *'Groundwater Contour Plot January 2021'.*

5.1.12 Furthermore, the void will be lined with a clay liner prior to infilling works. This will limit any pathways for groundwater emergence within the landfilling area.

5.1.13 Based on the available information, the risk of groundwater flooding at the proposed development is considered to be **VERY LOW**. This risk will reduce further as ground levels are increased during infilling works.

Surface Water Flooding (Pluvial Flooding)

5.1.14 Surface water flooding often occurs during intense rainfall when water is unable to soak into the ground or enter drainage systems and runs quickly overland resulting in local flooding.

5.1.15 The Environment Agency's 'Extent of Flooding from Surface Water' map, shown in Figure 3, shows that the majority of the site is at a 'Very Low' risk of surface water flooding (defined as a less than 1 in 1000 (0.1%) chance of flooding in any year).

5.1.16 Small areas in the north-western corner of the site are shown to be at a 'High' risk of surface water flooding (defined as a greater than 1 in 30 (3.3%) annual probability of flooding). A comparison of Figure 3 to the site topography shows that these areas are coincident with localised depressions where runoff generated within the site area could accumulate, and are not indicative of a risk of flooding to the wider site area.

5.1.17 Figure 3 also shows that there are no significant areas with an elevated risk of surface water flooding in the vicinity of the site, with only small areas of elevated risk to the north and west of the site.

Figure 3. Environment Agency Surface Water Flood Risk Mapping

5.1.18 The EA 'Surface Water Flood Risk: Water Velocity in a Low Risk Scenario' map, included as Figure 3 below, shows the direction and velocity of surface water runoff during a 1 in 1000 year storm event. As shown on Figure 4, there are few pathways for any surface water flooding generated in off-site areas to enter the site area. Surface water runoff from small area of land adjacent to the western site boundary may potentially flow towards the site, however, it is expected that this would disperse within the area of woodland at the site boundary. Furthermore, based on the size of this area in

comparison to the 10.7 hectare site, it is considered that the volume of runoff generated would have minimal impact upon the site.

Figure 4. Environment Agency Surface Water Flood Velocity Mapping

5.1.19 Based on the available information, the risk of surface water flooding at the proposed development is considered to be **VERY LOW.**

Sewer Flooding

5.1.20 There are no public or private sewers within the site area and due to the remote rural location of the site, it is assumed that there are no public or private sewer networks in the vicinity of the site. The risk of sewer flooding is, therefore, discounted.

Artificial Sources

5.1.21 Artificial sources of flooding include reservoirs, canals and any other impounded water body which is elevated above the level of the site. Flooding can occur when the impounding structures such as dams and embankments fail, when culverts become blocked, or during extreme rainfall events when the waterbodies overflow.

5.1.22 The Environment Agency 'Flood Risk from Reservoirs' map shows that the site is not at risk of flooding from reservoirs and there are no canals or impounded water bodies within the vicinity of the site.

5.1.23 Based on the available information, the risk of flooding from artificial sources is, therefore, considered to be **VERY LOW.**

5.2 Flood Risk from the Proposed Development

5.2.1 New development can pose a risk of flooding to neighbouring properties and areas downstream of the site, often as a result of an increase in impermeable area which has the effect of increasing the rate and volume of surface water runoff. In addition, climate change can be expected to cause an increase in rainfall intensity and surface water runoff over the lifetime of the development.

5.2.2 Flood risk can also be increased as a result of new development if the development reduces the floodplain storage area or alters flood flow paths, ultimately displacing flood water and resulting in an increased risk to the surrounding area.

Fluvial Flooding

5.2.3 As the site is located wholly within Flood Zone 1, there will be no impact on floodplain storage or fluvial flood flows as a result of the proposed development.

Surface Water Runoff

5.2.4 The limestone bedrock and topsoil in the vicinity of the site is relatively freely draining. Undeveloped agricultural land outside of the quarry void will drain via a combination of evaporation, uptake by vegetation and by infiltration, with surface water percolating through the 'freely draining lime-rich loamy soils' to the underlying bedrock.

5.2.5 Exposed bedrock away from trafficked areas of the quarry void will also be relatively freely draining with a portion of surface water runoff dispersing via infiltration to the bedrock. Areas of the quarry floor which are crossed by plant and other site vehicles will, however, be well-compacted and infiltration will be relatively minimal.

5.2.6 Following completion of the landfilling works, infilled areas will be covered by freely-draining topsoil and vegetated. The combination of infiltration to topsoil and uptake by the vegetation will reduce the rate and volume of surface water runoff in restored areas compared to the present situation in operational, trafficked areas of the site and areas of ongoing landfilling.

5.2.7 The infiltration rate within restored areas of the site will be dependent upon the final composition of the infill material and, therefore, cannot be confirmed at this stage. It is also, therefore, not possible to confirm whether drainage within the restored areas will provide betterment to the pre-development scenario where rainfall infiltrates to agricultural land and the underlying bedrock.

5.2.8 It is, therefore, proposed to take a precautionary approach and assume that the rate and volume of surface water runoff will increase following the completion of restoration works when compared to the pre-development scenario.

Climate Change

5.2.9 Climate change can also be expected to cause an increase in rainfall intensity during the lifetime of the proposed development and, therefore, surface water runoff rates and volumes will increase and will require mitigation.

5.2.10 In assessing the potential flood risk at the site over the lifetime of the development climate change must, therefore, be taken into account. Climate change allowances have been based on the guidance set out in the NPPF Technical Guidance[3], which has been reproduced in Table 4 (below).

Table 4. Peak Rainfall Intensity Allowance

	Increase in Rainfall Intensity		
	2015 to 2039	**2040 to 2069**	**2070 to 2115**
Upper End	10%	20%	40%
Central	5%	10%	20%

5.2.11 For a 'Less Vulnerable' development located within Flood Zone 1, the guidance states that the central allowance is appropriate. It is proposed that the operational period extends to 2042 and based on Table 4, the rainfall intensity can be expected to increase by 10%. The restored site will be a permanent feature and based on Table 4, the rainfall intensity can be expected to increase by 20%.

5.3 Flood Risk Mitigation Measures

Surface Water Management

5.3.1 The risk of surface water flooding to areas downstream of the site may increase as a result of development during extreme storm events due to increased rates and volumes of surface water runoff. To mitigate this increased risk it is proposed that formal surface water management is incorporated into the design of the site to attenuate for all storm events up to and including the 1 in 1000 year event, including an allowance for climate change.

[3] ENVIRONMENT AGENCY (2016) *Guidance Flood Risk Assessments: Climate Change Allowances*

5.4 Residual Risk

5.4.1 There is always a possibility of a storm event that exceeds the design standards of the proposed flood risk management measures for new developments. Potential risks include the exceedance of the surface water attenuation facilities during extreme storm events.

5.4.2 The proposed development will be designed to manage any potential exceedance events, with overland flood flows directed away from the site boundaries into the wider quarry site where feasible.

5.4.3 In southern areas of the site, where the topography of the restored ground will prevent exceedance flows from being directed towards the main quarry site, exceedance flows can be expected to disperse within adjacent woodland and undeveloped agricultural land to the south of the site (shown on Drawing No. LQ/GDQ/MAR21-02 *'Quarry Update and Stockpile Survey 30th March 2021'*), which is controlled by the applicant, without risk to off-site properties.

6 SURFACE WATER DRAINAGE STRATEGY

6.1 Overview

6.1.1 Surface water runoff from the development will be controlled on site to ensure that there is no increase in the risk of flooding to areas downstream of the site and within the development itself for the design storm event.

6.1.2 The Planning Practice Guidance (PPG) stipulates a hierarchy for the disposal of surface water which should be followed as part of any surface water drainage design. This hierarchy is as follows:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain or another drainage system;
4. to a combined sewer.

6.1.3 In accordance with this hierarchy, it is proposed to disperse surface water runoff from the proposed development via infiltration to the underlying bedrock with no discharge off site.

6.1.4 Whilst the infill material will be inert and should have no contaminants present, it is proposed that a precautionary approach is taken. Surface water runoff from the operational areas of the site will be prevented from infiltrating directly into the underlying bedrock without confirmation that there is no contamination.

6.1.5 It is proposed, therefore, that surface water runoff that has come into contact with inert materials, is intercepted and diverted to a large lagoon to the north of the void area. The lagoon will be lined by a 1m thick layer of engineered clay, with no pathway for infiltration. Generally, surface water runoff from the following areas will be diverted to the lagoon:

- Direct runoff from operational landfill phases;
- Direct runoff from unrestored materials in completed phases;
- Overland flow from restored areas entering operational landfill areas;
- Runoff retained above ground percolating through inert underlying materials to emerge within the void.

6.1.6 Water within the lagoon will be tested for contamination. Any contaminated water will be isolated and mitigative measures to treat or remove the water will be undertaken. Uncontaminated water will be pumped as required to areas of quarry

void outside of the development area (within the wider quarry site) where it will infiltrate to ground.

6.1.7 Surface water runoff from the base and side slopes of all other areas of the development, which has not been in contact with inert landfill material, will be retained within the base of the void and allowed to disperse naturally via infiltration and evaporation. Water may also be discharged to the void or pumped to the wider quarry where required.

6.1.8 The proposed base level of the site, and wider quarry, is approximately 20m below the surrounding land. There are, therefore, no pathways for surface water runoff to flow out of the void and no risk of flooding to areas downstream of the site.

6.2 Attenuation Estimates

6.2.1 The volume of surface water runoff generated during extreme storm events in each phase of the works has been calculated using Causeway's 'Flow' software. As runoff which has been in contact with inert materials will be intercepted and not able to combine with runoff from the base and sideslopes within the wider development, the attenuation volumes have been calculated separately.

6.2.2 For the purposes of this assessment, areas of operational landfill and completed areas awaiting restoration will be considered to be wholly impermeable ground to provide a 'worst case' scenario.

6.2.3 It is considered that the exposed bedrock in the base of the void outside of active landfill areas will be relatively permeable where it is uncompacted by crossing plant, as per the existing situation within the wider quarry. This permeability will remain until the ground is covered by the engineered liner prior to landfilling. To provide a worst case scenario, however, calculations are based on the exposed bedrock in the base and side slopes of the void being wholly impermeable, with no infiltration to ground. This would simulate a scenario where the base of the operational area is fully compacted.

6.2.4 The gently sloping, restored areas overlying the landfill have a runoff coefficient applied to them as these will not act as a wholly impermeable surface, with the vegetation and underlying soils intercepting and dispersing a proportion of overland flows and so reducing the rate and volume of runoff during a storm event. These coefficients have been determined using the National Coal Board guidance[4] for the

[4] NATIONAL COAL BOARD (1982) *Technical Management of Water in the Coal Mining Industry*

design of spoil tip drainage schemes, which is considered appropriate to apply to runoff from restored quarries.

6.2.5 The nomogram, taken from the guidance and shown in Figure 5 below, assumes a gradient of 1 in 20 across restored areas. The 'sandy loam' soil type is considered the most appropriate based on the description of the local soils on the Cranfield Soil and Agrifood Institute *'Soilscapes'* mapping. The coefficient of 0.41 is then applied to the total area to estimate the 'contributing area'. To provide a 'worst case' scenario, all side slopes will be treated as unvegetated impermeable ground.

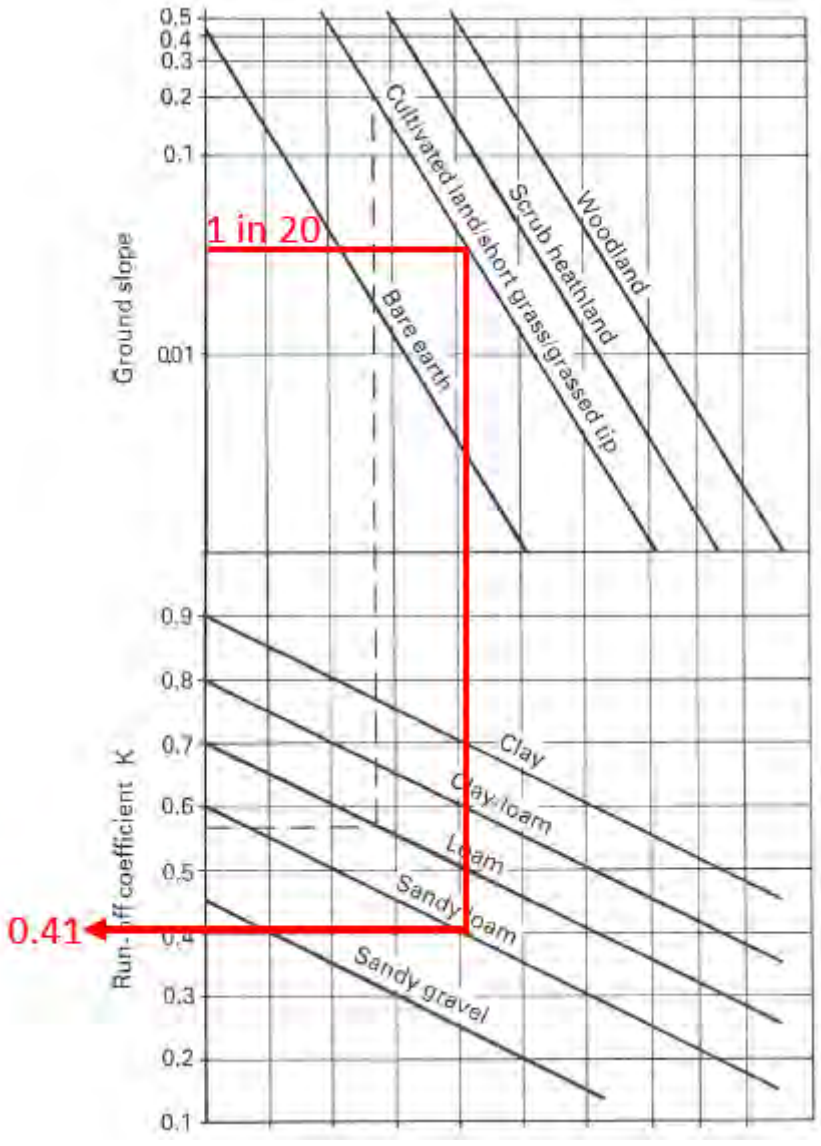

Figure 5. Runoff Coefficient from Restored Areas (reproduced from UK Coal 'Nomogram to Determine the Runoff Coefficient')

6.2.6 A proportion of surface water runoff retained within restored areas can be expected to infiltrate into the topsoil and underlying ground. As this water percolating through

the underlying material will not be able to progress beyond the clay liner at the base of the void and so will remain within the void, an infiltration rate has not been applied to the attenuation estimates for restored areas.

Phase 1

6.2.7 The proposed surface water management plan for Phase 1 is shown on Drawing No. NT14834-008 *'Phase 1 Surface Water Management Plan'*. All ground levels within the operational Phase 1 area will fall north-eastwards towards the wider quarry site. Surface water runoff will be intercepted by a drainage channel and diverted into the lagoon located outside of the development.

6.2.8 Surface water runoff from the base and sideslopes outside of the Phase 1 area will be retained in low-lying unlined areas of the void to disperse naturally, or discharged to the lagoon or wider quarry area if necessary.

6.2.9 The unlined basal areas are situated approximately 1m below the ground levels of the wider quarry located immediately adjacent to the north. Due to the size of the base of the void, there is minimal risk that surface water runoff could be generated in such volumes that the boundary of the site would be overtopped.

6.2.10 The volumes of surface water runoff generated within the site area during Phase 1 are included in Appendix 1 and summarised in Table 5 below. The proposed surface water management plan is shown on Drawing No. NT14834-008 *'Surface Water Management Plan (Phase 1)'*.

Table 5. Surface Water Attenuation Calculations: Phase 1

	Area (ha)	**Surface Water Attenuation m^3**	
		1 in 30 (+5%)	**1 in 100 (+5%)**
Quarry Base and Side slopes (non-operational)	7.49	5305	6609
Phase 1 (Landfilling)	3.24	2295	2859
Total	**10.73**	**7600**	**9468**

- Areas of landfilling which have yet to undergo restoration are treated as impermeable
- 5% climate change allowance used for 1 in 100 and 1 in 1000 year storm event (appropriate for developments present until 2039)
- Runoff from **red** areas will be discharged to the lined lagoon. Runoff from **green** areas will disperse naturally.

Phase 2

6.2.11 The proposed surface water management plan for Phase 2 is shown on Drawing No. NT14834-009 *'Phase 2 Surface Water Management Plan'.* Runoff from the restored Phase 1 area will continue to be intercepted and diverted into the lined lagoon area. Runoff from the steep side slopes at the edge of the Phase 2 landfilling area will also be intercepted and diverted to the lagoon via a new drainage channel/trench.

6.2.12 The completed landfill profile in Phase 2 will fall southwards towards the site boundaries creating a potential pathway for surface water to flow off site. It is proposed that this runoff is intercepted upstream of the site boundary by vegetated swales or drainage ditches and conveyed towards a dry detention basin in the south-eastern corner of Phase 2. Surface water runoff will be retained and allowed to disperse naturally by evaporation, uptake by vegetation and infiltration. The detention basin will be sized to attenuate for the 1 in 100 year (+5% climate change) storm event. An overflow route will be included to convey water towards the main void if the capacity of the detention basin becomes exceeded in an extreme scenario. There would, therefore, be no pathway for runoff retained within the detention basin to flow off site.

6.2.13 Runoff from the base and sideslopes of the void away from operational areas will be retained within the base of the quarry void and allowed to disperse naturally with no pathway into the wider quarry area.

6.2.14 Attenuation calculations are provided within Appendix 1 and summarised in Table 6 below.

Table 6. Surface Water Attenuation Calculations: Phase 2

	Area (ha)	Surface Water Attenuation m^3	
		1 in 30 (5%)	1 in 100 (+5%)
Quarry Base and Side Slopes (Non-Operational)	4.69	3322	4139
Phase 1 Restored Area	2.45 ***1.00***	708	882
Phase 1 Unrestored Area	0.79	560	697
Phase 2 Operational (South Draining)	1.60	1133	1412
Phase 2 Operational (North Draining)	1.20	850	1059

Table 6. Surface Water Attenuation Calculations: Phase 2			
	Area (ha)	Surface Water Attenuation m^3	
		1 in 30 (5%)	1 in 100 (+5%)
Total	***9.73***	**6573**	**8089**

- ***Italicised*** values indicate contributing areas where runoff coefficients from Figure 3 have been applied to restored areas
- Areas of landfilling which have yet to undergo restoration are treated as impermeable
- 5% climate change allowance used for 1 in 100 and 1 in 1000 year storm event (appropriate for developments present until 2039)
- No infiltration rate is applied to calculations for restored areas
- Runoff from **red** areas will be discharged to the lined lagoon. Runoff from **green** areas will disperse naturally

Phase 3

6.2.15 The restored areas of Phase 1 and the majority of the Phase 3 landfill profile will fall towards the void. Runoff from these areas will be intercepted and discharged to the lined lagoon. An existing land drain in the Phase 3 area, situated adjacent to the western site boundary, will be retained to assist with the conveyance of runoff northwards into the void.

6.2.16 The restored Phase 2 area and an the remainder of the Phase 3 landfill profile will fall south-eastwards. The vegetated swales or drainage ditches installed during Phase 2 will be extended to intercept the additional runoff from Phase 3 to convey this to the dry detention basin located within the Phase 2 area.

6.2.17 Attenuation calculations are provided within Appendix 1 and summarised in Table 7 below. The proposed surface water management plan is shown on Drawing No. NT14834-010 *'Surface Water Management Plan (Phase 3)'.*

Table 7. Surface Water Attenuation Calculations: Phase 3			
	Area (ha)	Surface Water Attenuation (m^3)	
		1 in 30 (5%)	1 in 100 (+5%)
Quarry Base and Side Slopes (Non-Operational)	2.40	1700	2118
Phase 1 Restored	2.45 ***1.00***	708	882
Phase 1 Unrestored	0.79	560	697

Table 7. Surface Water Attenuation Calculations: Phase 3			
	Area (ha)	Surface Water Attenuation (m^3)	
		1 in 30 (5%)	1 in 100 (+5%)
Phase 2 Restored (South Draining)	1.61 ***0.66***	467	582
Phase 3 Landfilling (North Draining)	2.13	1509	1879
Phase 3 Landfilling (South Draining)	1.35	956	1191
Total	***8.33***	**5900**	**7349**

- ***Italicised*** values indicate contributing areas where runoff coefficients from Figure 3 have been applied.
- Areas of landfilling which have yet to undergo restoration are treated as impermeable .
- 5% climate change allowance used for 1 in 100 and 1 in 1000 year storm event (appropriate for developments present until 2039).
- No infiltration rate is applied to calculations for restored areas.
- Runoff from **red** areas will be discharged to the lined lagoon. Runoff from **green** areas will disperse naturally.

Phase 4

6.2.18 Surface water runoff from the restored Phase 1 area, the northern portion of Phase 3 and the operational Phase 4 landfilling area will drain towards the base of the void and will be intercepted and diverted to the lined lagoon.

6.2.19 The restored Phase 2 and southern portion of restored Phase 3 will continue to drain southwards towards the existing dry detention basin. The swales will be extended to allow a greater portion of Phase 3 to drain to the detention basin. The capacity of the basin, retained from Phase 3 will be sufficient to attenuate for two consecutive 1 in 100 year storm events.

6.2.20 Runoff from non-operational areas will be retained within the void and allowed to disperse naturally.

6.2.21 Attenuation calculations are contained in Appendix 1 and summarised in Table 8 below. The proposed surface water management plan is shown on Drawing No. NT14834-011 *'Surface Water Management Plan (Phase 4)'.*

Table 8. Surface Water Attenuation Calculations: Phase 4			
	Area (ha)	Surface Water Attenuation (m^3)	
		1 in 30 (5%)	1 in 100 (+5%)
Quarry Base and Side Slopes (Non-Operational)	0.70	467	618
Phase 1 Restored	2.43 ***1.00***	708	882
Phase 1 Unrestored	0.81	574	715
Phase 2 Restored (South Draining)	1.61 ***0.66***	467	582
Phase 3 Restored (South Draining)	2.17 ***0.89***	630	785
Phase 4 Landfilling	3.01	2132	2656
Total	***7.07***	**4978**	**6238**

- ***Italicised*** values indicate contributing areas where runoff coefficients from Figure 3 have been applied
- Areas of landfilling which have yet to undergo restoration are treated as impermeable
- 5% climate change allowance used for 1 in 100 and 1 in 1000 year storm event (appropriate for developments present until 2039)
- No infiltration rate is applied to calculations for restored areas
- Runoff from **red** areas will be discharged to the lined lagoon. Runoff from **green** areas will disperse naturally.

Phase 5

6.2.22 Surface water runoff from Phase 2 and the southern portion of Phase 3 will continue to drain southwards towards the detention basin in the south-eastern corner of the site. Surface water runoff from all other areas of the site will drain northwards and be directed towards the lined lagoon.

6.2.23 Attenuation calculations are contained in Appendix 1 and summarised in Table 9 below. As this phase will extend beyond 2039, a climate change factor of 10% has been applied to calculations, as shown in Table 4.

6.2.24 The proposed surface water management plan is shown on Drawing No. NT14834-012 *'Surface Water Management Plan (Phase 5)'.*

Table 9. Surface Water Attenuation Calculations: Phase 5			
	Area (ha)	Surface Water Attenuation (m^3)	
		1 in 30 (10%)	1 in 100 (+10%)
Phase 1 Restored	2.43 ***0.99***	735	915
Phase 2 Restored (South Draining)	1.61 ***0.66***	490	610
Phase 3 Restored (South Draining)	2.17 ***0.89***	660	823
Phase 4 Restored	1.93 ***0.79***	586	730
Phase 5 Landfilling	2.59	1922	2394
Total	***5.92***	**4393**	**5472**

- ***Italicised*** values indicate contributing areas where runoff coefficients from Figure 3 have been applied
- Areas of landfilling which have yet to undergo restoration are treated as impermeable
- 10% climate change allowance used for 1 in 100 and 1 in 1000 year storm event (appropriate for developments present beyond 2039)
- No infiltration rate is applied to calculations for restored areas
- Runoff from **red** areas will be discharged to the lined lagoon.

Post-Restoration

6.2.25 The site will continue to drain as per Phase 5, with Phases 2 and 3 draining southwards to the detention basin in the south-east corner of the site, and all other areas draining northwards to attenuated within the permanent lined lagoon. The lined lagoon in Phase 5 will be reshaped as part of the permanent restoration scheme. As the restored site will be a permanent feature, a climate change allowance of 20% has been applied to attenuation calculations (see Table 4). Calculations are contained in Appendix 1 and summarised in Table 10 below.

6.2.26 The proposed surface water management plan is shown on Drawing No. NT14834-013 *'Surface Water Management Plan (Post-Restoration)'.*

Table 9. Surface Water Attenuation Calculations: Post-Restoration			
	Area (ha)	Surface Water Attenuation (m^3)	
		1 in 30 (10%)	1 in 100 (+10%)
Phase 1 Restored	2.43 ***0.99***	801	998
Phase 2 Restored (South Draining)	1.61 ***0.66***	534	666
Phase 3 Restored (South Draining)	2.17 ***0.89***	720	898
Phase 4 Restored	1.93 ***0.79***	639	797
Phase 5 Landfilling	2.59 ***1.06***	858	1069
Total	***4.39***	**3552**	**4428**

- ***Italicised*** values indicate contributing areas where runoff coefficients from Figure 3 have been applied
- 20% climate change allowance used for 1 in 100 and 1 in 1000 year storm event (appropriate for developments present beyond 2039)
- No infiltration rate is applied to calculations for restored areas
- Runoff from **red** areas will be discharged to the permanent lined lagoon in the north. All other areas will discharge to the detention basin in the south-east

6.3 Water Quality

6.3.1 As there are no pathways for surface water runoff to flow off-site, there is no risk of mobilised silt and suspended solids impacting on areas downstream of the site during the operational phases.

6.3.2 Surface water runoff from operational landfill areas will be intercepted and retained within a lined lagoon, and only able to disperse within the wider quarry once it is confirmed that there are no contaminants present.

6.3.3 Surface water runoff from other areas of the development will be dispersed by infiltration to the ground. The maximum groundwater level is estimated to be approximately 114mAOD (as shown on Drawing No. NT14621-Figure 3 *'Groundwater Contour Plot January* 2021'), which is approximately 4m below the ground level in this area of the quarry. It is considered that this provides a sufficient thickness of unsaturated bedrock for surface water runoff from the site to percolate through and the potential for the contamination of groundwater is minimal.

6.3.4 All plant will be refuelled within designated areas in the existing mineral processing area outside of the development and not within the site area. The risk of fuel and other chemical spillages within the development areas are, therefore, low, and there will be procedures in place to treat any accidental spillages within the workings. Furthermore, as all operations will take place above the water table, there will be no direct pathway for any spillages to enter into the groundwater.

6.3.5 The mobilisation of silt and suspended solids from landfilling areas and restored areas can be reduced with the use of shallow cut-off trenches installed coincident with the topography. These trenches will prevent surface water runoff from flowing unimpeded over long distances, gathering momentum and increasing the rate of erosion. The trenches will also ensure any mobilised sediment is retained close to it source, preventing large accumulations of sediment in downstream areas. Additional sediment management measures such as strawbales, rock trap, silt fencing can also be used in conjunction with the cut-off trenches.

6.3.6 There will be no plant operating in restored areas of the site and the risk of spillages and mobilisation of silt and sediment will be minimal.

6.3.7 The vegetation within restored areas will filter overland flows, removing a portion of mobilised silt and suspended solids.

7 CONCLUSIONS

7.1.1 This report gives details of the Flood Risk Assessment, which has been carried out in accordance with the National Planning Policy Framework. The proposed development comprises the infilling of areas of Gebdykes Quarry in Masham, North Yorkshire with inert materials, and subsequent restoration works.

7.1.2 The proposed development is located within Flood Zone 1 according to the Environment Agency's Flood Map for Planning. As the proposed development is defined as a 'Less Vulnerable' development in Table 2 of the National Planning Policy Guidance, this is considered an appropriate development within Flood Zone 1.

7.1.3 The risk of flooding from fluvial sources, surface water groundwater and sewers is considered to be Very Low.

7.1.4 Surface water drainage outside of the operational areas of the site will mimic the existing proposed during operational phases will mimic the current regime, with runoff infiltrating into the bedrock at source, or flowing overland to a low point within the quarry void to disperse naturally with no flood risk to off-site areas.

7.1.5 Due to the potential for contaminants within the inert landfill material, a precautionary approach will be taken to manage surface water runoff within operational landfill areas and from restored areas of the development.

7.1.6 Surface water runoff draining to the base of the void from these areas will be intercepted and directed to a lagoon, which will be lined giving no pathway for infiltration. Water within the lagoon will then be tested, confirming it is free of contaminants, before being pumped to the quarry void to disperse naturally.

7.1.7 In areas where topography falls away from the wider site, it is proposed that surface water runoff is intercepted and retained within an unlined detention to infiltrate within the inert materials with no risk to properties downstream of the site.

7.1.8 The risk of flooding to the site is generally considered to be Very Low, the risk of flooding to surrounding areas will not increase and there will be no impact on water quality as a result of the proposed development. It is considered, therefore, that from a flood risk and drainage perspective, the site is suitable for the type of development proposed.

APPENDICES

APPENDIX 1

Attenuation Calculations

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 1 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 1	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Quarry Base and Sideslopes (non operational)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	7.490
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	5305
to	5305

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	7.490
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	6609
to	6609

Phase 1 (Landfilling)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	3.240
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	2295
to	2295

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	3.240
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	2859
to	2859

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 2 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 2	(NAME AND SIGNATURE) B Griffiths	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Quarry Base and Sideslopes (non operational)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	4.690
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	3322
to	3322

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	4.690
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	4138
to	4138

Phase 1 Restored Area

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	1.000
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	708
to	708

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	1.000
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	882
to	882

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 3 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 2, Part 2	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 1 Unrestored Area

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	560
to	560

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	697
to	697

Phase 2 Operational (South Draining)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	1.600
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1133
to	1133

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	1.600
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1412
to	1412

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 4 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 2 Part 3	(NAME AND SIGNATURE) B Griffiths	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 2 Operational (North Draining)

Storage Estimate	
Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	1.200
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	850
to	850

Storage Estimate	
Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	1.200
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1059
to	1059

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 5 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 3 Part 1	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Quarry Base and Sideslopes (non operational)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	2.400
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1700
to	1700

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	2.400
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	2118
to	2118

Phase 1 Restored Area

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	1.000
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	708
to	708

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	1.000
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	882
to	882

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 6 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 3 Part 2	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 1 Unrestored Area

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	560
to	560

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	697
to	697

Phase 2 Restored (South Draining)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	467
to	467

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	582
to	582

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 7 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 3 Part 3	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	☑ 0.750	
Winter CV	☑ 0.840	

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 3 Landfilling (North Draining)

Storage Estimate	
Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	2.130
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1509
to	1509

Storage Estimate	
Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	2.130
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1879
to	1879

Phase 3 Landfilling (South Draining)

Storage Estimate	
Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	1.350
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	956
to	956

Storage Estimate	
Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	1.350
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1191
to	1191

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 8 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 4 Part 1	(NAME AND SIGNATURE) B Griffiths	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Quarry Base and Sideslopes (non operational)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.700
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	496
to	496

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.700
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	618
to	618

Phase 1 Restored

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	1.000
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	708
to	708

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	1.000
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	882
to	882

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 9 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 4 Part 2	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.300
Summer CV	0.750
Winter CV	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 1 Unrestored

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.810
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	574
to	574

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.810
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	715
to	715

Phase 2 Restored (South Draining)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	467
to	467

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	582
to	582

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 10 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 4 Part 3	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	☑ 0.750	
Winter CV	☑ 0.840	

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Quarry Base and Sideslopes (non operational)

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	0.890
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	630
to	630

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	0.890
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	785
to	785

Phase 1 Restored

Storage Estimate

Return Period (years)	30
Climate Change (%)	5
Impermeable Area (ha)	3.010
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	2132
to	2132

Storage Estimate

Return Period (years)	100
Climate Change (%)	5
Impermeable Area (ha)	3.010
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	2656
to	2656

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 11 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 5 Part 1	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	0.750	
Winter CV	0.840	

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 1 Restored

Storage Estimate		Storage Estimate	
Return Period (years)	30	Return Period (years)	100
Climate Change (%)	10	Climate Change (%)	10
Impermeable Area (ha)	0.990	Impermeable Area (ha)	0.990
Peak Discharge (l/s)	0.000	Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc	Required Storage (m³)	Calc
from	735	from	915
to	735	to	915

Phase 2 Restored (South Draining)

Storage Estimate		Storage Estimate	
Return Period (years)	30	Return Period (years)	100
Climate Change (%)	10	Climate Change (%)	10
Impermeable Area (ha)	0.660	Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000	Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc	Required Storage (m³)	Calc
from	490	from	610
to	490	to	610

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 12 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 5 Part 2	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	☑	0.750
Winter CV	☑	0.840

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 3 Restored (South Draining)

Storage Estimate	
Return Period (years)	30
Climate Change (%)	10
Impermeable Area (ha)	0.890
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	660
to	660

Storage Estimate	
Return Period (years)	100
Climate Change (%)	10
Impermeable Area (ha)	0.890
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	823
to	823

Phase 4 Restored

Storage Estimate	
Return Period (years)	30
Climate Change (%)	10
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	586
to	586

Storage Estimate	
Return Period (years)	100
Climate Change (%)	10
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	730
to	730

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 13 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Phase 5 Part 3	(NAME AND SIGNATURE) B Griffiths	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	0.750	☑
Winter CV	0.840	☑

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 5 Landfilling

Storage Estimate		
Return Period (years)	30	
Climate Change (%)	10	
Impermeable Area (ha)	2.590	
Peak Discharge (l/s)	0.000	
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		
Required Storage (m³)	Calc	
from	1922	
to	1922	

Storage Estimate		
Return Period (years)	100	
Climate Change (%)	10	
Impermeable Area (ha)	2.590	
Peak Discharge (l/s)	0.000	
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		
Required Storage (m³)	Calc	
from	2394	
to	2394	

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 14 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Post Restoration Part 1	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	0.750	☑
Winter CV	0.840	☑

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 1 Restored

Storage Estimate

Return Period (years)	30
Climate Change (%)	20
Impermeable Area (ha)	0.990
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	801
to	801

Storage Estimate

Return Period (years)	100
Climate Change (%)	20
Impermeable Area (ha)	0.990
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	998
to	998

Phase 2 Restored (South Draining)

Storage Estimate

Return Period (years)	30
Climate Change (%)	20
Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	534
to	534

Storage Estimate

Return Period (years)	100
Climate Change (%)	20
Impermeable Area (ha)	0.660
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	666
to	666

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 15 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Post Restoration Part 2	(NAME AND SIGNATURE) B Griffiths	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	☑ 0.750	
Winter CV	☑ 0.840	

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 3 Restored (South Draining)

Storage Estimate

Return Period (years)	30
Climate Change (%)	20
Impermeable Area (ha)	0.890
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	720
to	720

Storage Estimate

Return Period (years)	100
Climate Change (%)	20
Impermeable Area (ha)	0.890
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	898
to	898

Phase 4 Restored

Storage Estimate

Return Period (years)	30
Climate Change (%)	20
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	639
to	639

Storage Estimate

Return Period (years)	100
Climate Change (%)	20
Impermeable Area (ha)	0.790
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	797
to	797

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Lightwater Quarries Limited	Gebdykes Landfill	NT18434	PAGE: 16 OF 16
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculations - Post Restoration 6 Part 3	(NAME AND SIGNATURE) B Griffiths	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 03/09/2021	DATE:	DATE:

Rainfall Methodology	FSR	
FSR Region	England & Wales	
M5-60 (mm)	20.000	
Ratio-R	0.300	
Summer CV	0.750	☑
Winter CV	0.840	☑

Areas of quarry base, sideslopes and landfilling are considered to be wholly impermeable as a 'worst case'

Phase 5 Landfilling

Storage Estimate

Return Period (years)	30
Climate Change (%)	20
Impermeable Area (ha)	1.060
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	858
to	858

Storage Estimate

Return Period (years)	100
Climate Change (%)	20
Impermeable Area (ha)	1.060
Peak Discharge (l/s)	0.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	1069
to	1069

DRAWINGS

KEY

Application Boundary

2 and 5 km Distance Buffer

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
.	.	.	.	.	.

CLIENT

Lightwater Quarries

PROJECT

GEBDYKES QUARRY LANDFILL

DRAWING TITLE

FIGURE 1.1
LOCATION PLAN

DRG No.	REV
NT14834/FIGURE 1.1	A

DRG SIZE	SCALE	DATE
A3	1:50,000	26/07/2021

DRAWN BY	CHECKED BY	APPROVED BY
SW	BP	NB

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0 2 Kilometres

DO NOT SCALE FROM THIS DRAWING

NOTES:

1. TO BE READ IN CONJUNCTION WITH FLOOD RISK ASSESSMENT (REF NT14834 APPENDIX 8.1)
2. LAYOUT IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.

KEY

- QUARRY BOUNDARY
- ACTIVE PHASE
- LANDFILL AREA
- TEMPORARY SURFACE WATER STORAGE
- FLOW DIRECTION
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PIPED GRAVITY CONNECTION
- PROPOSED PUMPING ROUTE
- PROPOSED STORAGE LAGOON (LINED)

Gybdykes

Phase 1

UNCONTAMINATED WATER PUMPED FROM LAGOON TO DISPERSE WITHIN QUARRY

PROPOSED LAGOON TO PROVIDE MINIMUM 2,859m³ STORAGE ATTENUATION (FOOT PRINT BASED ON MAXIMUM VOLUME REQUIRED FOR 1 IN 100 YEAR (+CC) STORM DURING ALL PHASES

WATER WITHIN LAGOON TESTED FOR CONTAMINANTS BEFORE DISCHARGE

DRAINAGE CHANNEL/GRAVEL TRENCH TO INTERCEPT RUNOFF FROM PHASE 1 AND CONVEY INTO LINED LAGOON (PIPED WHERE CROSSED BY ACCESS ROUTES)

APPROXIMATELY 6609,m³ OF RUNOFF DURING 1 IN 100 YEAR (+CC) STORM EVENT TO DISPERSE WITHIN UNLINED AREA OF QUARRY VOID AWAY FROM OPERATIONAL LANDFILL AREA (CONSIDERED A WORST-CASE SCENARIO) INDICATIVE AREA OF STANDING WATER @1m DEPTH

UNCONTAMINATED RUNOFF FROM SITE AREA EXCLUDING OPERATIONAL AREAS

ONGOING LANDFILLING

OPTION TO PUMP STANDING WATER TO LAGOON VIA DRAINAGE NETWORK

EXPOSED QUARRY FLOOR

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	AMENDMENT TO TEXT	02-02-23	DR	BG	NB
A	FIRST ISSUE	20/01/23	SJB	BG	NB

CLIENT: Lightwater Quarries

PROJECT: GEBDYKES QUARRY LANDFILL

DRAWING TITLE: PHASE 1 INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV
NT14834-008	B

DRG SIZE	SCALE	DATE
A2	1:2,500	03/09/2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834-008-B SURFACE WATER MANAGEMENT PLAN [PHASE 1].DWG

DO NOT SCALE FROM THIS DRAWING

NOTES:

1. TO BE READ IN CONJUNCTION WITH FLOOD RISK ASSESSMENT (REF NT14834 APPENDIX 8.1)
2. LAYOUT IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.
3. RUNOFF CO-EFFICIENT APPLIED TO RESTORED AREAS.

KEY

- QUARRY BOUNDARY
- ACTIVE PHASE
- LANDFILL AREA
- RESTORED AREA
- TEMPORARY SURFACE WATER STORAGE
- FLOW DIRECTION
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PIPED GRAVITY CONNECTION
- PROPOSED PUMPING ROUTE
- PROPOSED STORAGE LAGOON (LINED)
- PROPOSED DRY DETENTION BASIN (BASED ON VOLUME OF STORAGE REQUIRED POST RESTORATION)

Gybdykes

Phase 1

RESTORED/REVEGETATED

Phase 2

UNCONTAMINATED WATER PUMPED FROM LAGOON TO DISPERSE WITHIN QUARRY

PROPOSED LAGOON TO PROVIDE MINIMUM 3,950m³ STORAGE ATTENUATION (FOOT PRINT BASED ON MAXIMUM VOLUME REQUIRED FOR 1 IN 100 YEAR (+CC) STORM DURING ALL PHASES

DRAINAGE CHANNEL/GRAVEL TRENCH TO INTERCEPT RUNOFF FROM PHASE 1 AND CONVEY INTO LINED LAGOON (PIPED WHERE CROSSED BY ACCESS ROUTES)

WATER WITHIN LAGOON TESTED FOR CONTAMINANTS BEFORE DISCHARGE

UNCONTAMINATED RUNOFF FROM SITE AREA EXCLUDING OPERATIONAL AREAS

APPROXIMATELY 4,139m³ OF RUNOFF DURING 1 IN 100 YEAR STORM EVENT TO DISPERSE WITHIN UNLINED AREA OF QUARRY VOID (CONSIDERED A WORST-CASE SCENARIO) INDICATIVE AREA OF STANDING WATER @1m DEPTH

DRAINAGE CHANNEL/GRAVEL-FILLED TRENCH TO INTERCEPT RUNOFF AND INFLOW FROM PHASE 2 AND CONVEY TO LAGOON (PIPED WHERE CROSSED BY ACCESS ROUTES

WATER PUMPED UPSLOPE TO VOID IF REQUIRED

EXPOSED QUARRY FLOOR/CLAY LINER

DRY DETENTION BASIN TO PROVIDE APPROXIMATELY 1412m³ ATTENUATION AT 1m DEPTH OF STORAGE + 0.3m FREEBOARD (SUITABLY SIZED TO ATTENUATE FOR 1 IN 100 YEAR (+CC) STORM EVENT) UNLINED TO PROMOTE INFILTRATION. WATER ULTIMATELY DRAINS TO VOID.

ONGOING LANDFILLING

VEGETATED SWALES INTERCEPT SURFACE WATER RUNOFF AND CONVEY TO DRY DETENTION BASIN.

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	AMENDMENT TO TEXT	02-02-23	DR	BG	NB
A	FIRST ISSUE	20/01/23	SJB	BG	NB

CLIENT: Lightwater Quarries

PROJECT: Gebdykes Quarry Landfill

DRAWING TITLE: PHASE 2 INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV
NT14834-009	B

DRG SIZE	SCALE	DATE
A2	1:2,500	03/09/2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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Gybdykes

UNCONTAMINATED WATER PUMPED FROM LAGOON TO DISPERSE WITHIN QUARRY

PROPOSED LAGOON TO PROVIDE MINIMUM 5,231m³ STORAGE ATTENUATION (FOOTPRINT BASED ON MAXIMUM VOLUME REQUIRED FOR 1 IN 100 YEAR (+CC) STORM DURING ALL PHASES)

DRAINAGE CHANNEL/GRAVEL TRENCH TO INTERCEPT RUNOFF FROM PHASE 1 AND CONVEY INTO LINED LAGOON (PIPED WHERE CROSSED BY ACCESS ROUTES)

WATER WITHIN LAGOON TESTED FOR CONTAMINANTS BEFORE DISCHARGE

UNCONTAMINATED RUNOFF FROM SITE AREA EXCLUDING OPERATIONAL AREAS

APPROXIMATELY 2,118m³ OF RUNOFF DURING 1 IN 100 YEAR (+CC) STORM EVENT TO DISPERSE WITHIN UNLINED AREA OF QUARRY VOID (CONSIDERED A WORST-CASE SCENARIO) INDICATIVE AREA OF STANDING WATER @1m DEPTH

EXPOSED QUARRY FLOOR/CLAY LINER

Phase 1

VEGETATED SWALES INTERCEPT SURFACE WATER RUNOFF AND CONVEY TO DRY DETENTION BASIN. UNLINED TO PROMOTE INFILTRATION

WATER PUMPED UPSLOPE TO VOID IF REQUIRED

DRY DETENTION BASIN TO PROVIDE APPROXIMATELY 1,773m³ ATTENUATION AT 1m DEPTH OF STORAGE + 0.3m FREEBOARD (SUITABILY SIZED TO ATTENUATE FOR 1 IN 100 YEAR (+CC) STORM EVENT) UNLINED TO PROMOTE INFILTRATION. WATER ULTIMATELY DRAINS TO VOID.

Phase 3

DRAINAGE CHANNEL TO INTERCEPT RUNOFF FROM OPERATIONAL LANDFILL AND DIRECT TO VOID AREA

ONGOING LANDFILLING

RESTORED/REVEGETATED

Phase 2

0 100 200
metres

DO NOT SCALE FROM THIS DRAWING

NOTES:

1. TO BE READ IN CONJUNCTION WITH FLOOD RISK ASSESSMENT (REF NT14834 APPENDIX 8.1)
2. LAYOUT IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.
3. RUNOFF CO-EFFICIENT APPLIED TO RESTORED AREAS.

KEY

- QUARRY BOUNDARY
- ACTIVE PHASE
- LANDFILL AREA
- RESTORED AREA
- TEMPORARY SURFACE WATER STORAGE
- FLOW DIRECTION
- PROPOSED DRAINAGE CHANNEL
- PROPOSED SWALE
- PROPOSED PIPED GRAVITY CONNECTION
- PROPOSED PUMPING ROUTE
- PROPOSED STORAGE LAGOON (LINED)
- PROPOSED DRY DETENTION BASIN (BASED ON VOLUME OF STORAGE REQUIRED POST RESTORATION)

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	AMENDMENT TO TEXT	02-02-23	DR	BG	NB
A	FIRST ISSUE	20/01/23	SJB	BG	NB

CLIENT: Lightwater Quarries

PROJECT: GEBDYKES QUARRY LANDFILL

DRAWING TITLE: PHASE 3 INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV
NT14834-010	B

DRG SIZE	SCALE	DATE
A2	1:2,500	03/09/2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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NOTES:

1. TO BE READ IN CONJUNCTION WITH FLOOD RISK ASSESSMENT (REF NT14834 APPENDIX 8.1)
2. LAYOUT IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.
3. RUNOFF CO-EFFICIENT APPLIED TO RESTORED AREAS.

KEY

- QUARRY BOUNDARY
- ACTIVE PHASE
- LANDFILL AREA
- RESTORED AREA
- TEMPORARY SURFACE WATER STORAGE
- FLOW DIRECTION
- PROPOSED DRAINAGE CHANNEL
- PROPOSED SWALE
- PROPOSED PIPED GRAVITY CONNECTION
- PROPOSED PUMPING ROUTE
- PROPOSED STORAGE LAGOON (LINED)
- PROPOSED DRY DETENTION BASIN (BASED ON VOLUME OF STORAGE REQUIRED POST RESTORATION)

Gybdykes

Phase 1
RESTORED/REVEGETATED

Phase 2

Phase 3
RESTORED/REVEGETATED

Phase 4
ONGOING LANDFILLING

DRAINAGE CHANNEL/GRAVEL TRENCH TO INTERCEPT RUNOFF FROM PHASE 1 AND CONVEY INTO LINED LAGOON (PIPED WHERE CROSSED BY ACCESS ROUTES)

UNCONTAMINATED WATER PUMPED FROM LAGOON TO DISPERSE WITHIN QUARRY

PROPOSED LAGOON TO PROVIDE MINIMUM 5,620m³ STORAGE ATTENUATION (FOOT PRINT BASED ON MAXIMUM VOLUME REQUIRED FOR 1 IN 100 YEAR (+CC) STORM DURING ALL PHASES

WATER WITHIN LAGOON TESTED FOR CONTAMINANTS BEFORE DISCHARGE

DRAINAGE CHANNEL/GRAVEL TRENCH TO INTERCEPT RUNOFF FROM PHASE 1 AND 4 AND CONVEY TO LAGOON (PIPED WHERE CROSSED BY ACCESS TRACKS)

VEGETATED SWALES INTERCEPT SURFACE WATER RUNOFF AND CONVEY TO DRY DETENTION BASIN. UNLINED TO PROMOTE INFILTRATION

WATER PUMPED UPSLOPE TO VOID IF REQUIRED

DRY DETENTION BASIN TO PROVIDE APPROXIMATELY 1,367m³ ATTENUATION AT 1m DEPTH OF STORAGE + 0.3m FREEBOARD (SUITABILY SIZED TO ATTENUATE FOR 1 IN 100 YEAR (+CC) STORM EVENT) UNLINED TO PROMOTE INFILTRATION. WATER ULTIMATELY DRAINS TO VOID.

EXPOSED QUARRY FLOOR

APPROXIMATELY 618m³ OF TEMPORARY STORAGE IN UNLINED AREA OF VOID @1m DEPTH

DRAINAGE CHANNEL TO INTERCEPT RUNOFF FROM OPERATIONAL LANDFILL AND DIRECT TO VOID AREA

SWALE OR SEPARATE PERIMETER DRAIN TO PROVIDE OVERFLOW ROUTE TO QUARRY VOID

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	AMENDMENT TO TEXT	02-02-23	DR	BG	NB
A	FIRST ISSUE	20/01/23	SJB	BG	NB

CLIENT: Lightwater Quarries

PROJECT: Gebdykes Quarry Landfill

DRAWING TITLE: PHASE 4 INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV
NT14834-011	B

DRG SIZE	SCALE	DATE
A2	1:2,500	03/09/2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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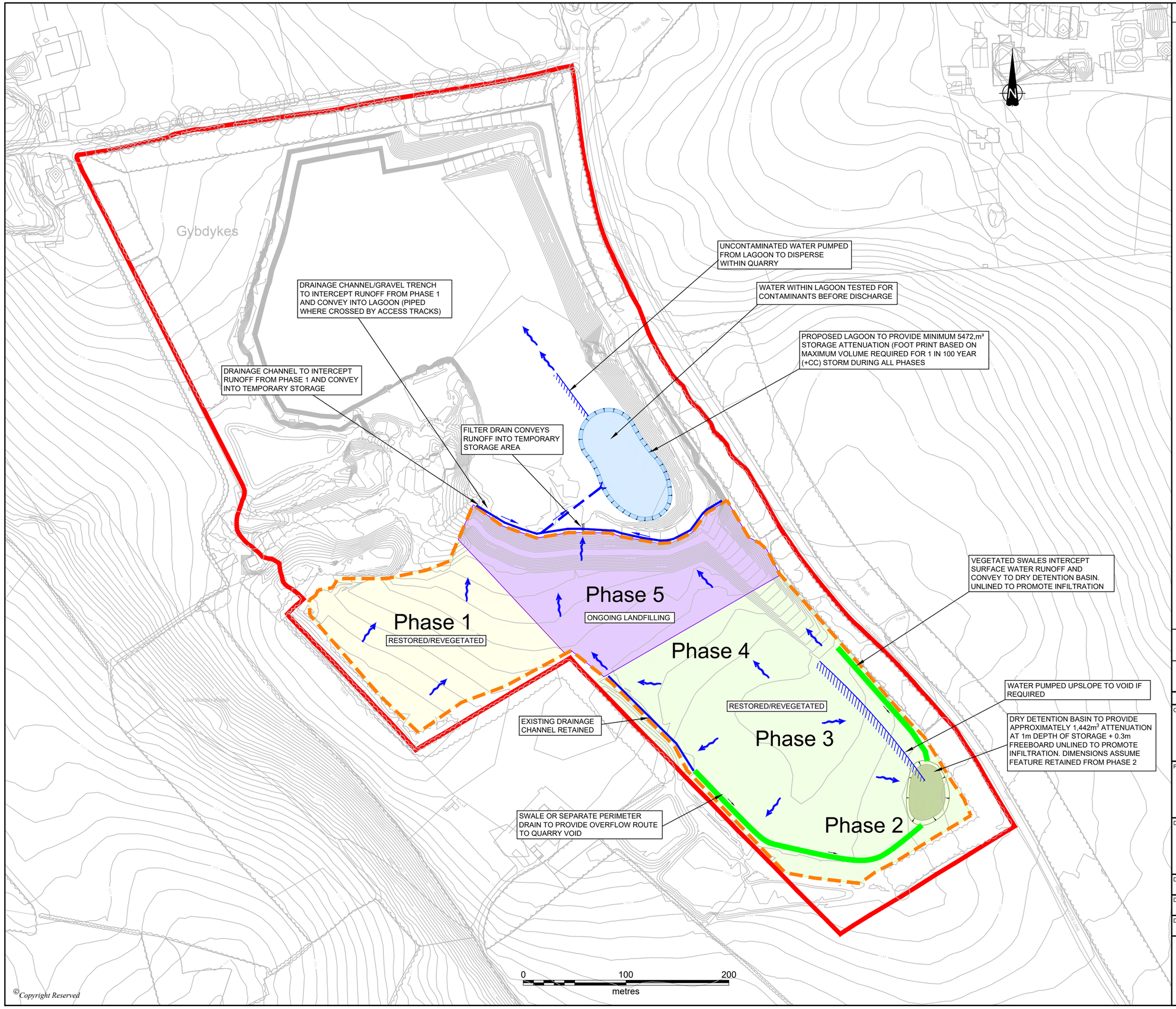
N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834-011-B SURFACE WATER MANAGEMENT PLAN [PHASE 4].DWG



DO NOT SCALE FROM THIS DRAWING

NOTES:

1. TO BE READ IN CONJUNCTION WITH FLOOD RISK ASSESSMENT (REF NT14834 APPENDIX 8.1)
2. LAYOUT IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.
3. RUNOFF CO-EFFICIENT APPLIED TO RESTORED AREAS.

KEY

- QUARRY BOUNDARY
- ACTIVE PHASE
- LANDFILL AREA
- RESTORED AREA
- TEMPORARY SURFACE WATER STORAGE
- FLOW DIRECTION
- PROPOSED DRAINAGE CHANNEL
- PROPOSED SWALE
- PROPOSED PIPED GRAVITY CONNECTION
- PROPOSED PUMPING ROUTE
- PROPOSED STORAGE LAGOON (LINED)
- PROPOSED DRY DETENTION BASIN (BASED ON VOLUME OF STORAGE REQUIRED POST RESTORATION)

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	AMENDMENT TO TEXT	02-02-23	DR	BG	NB
A	FIRST ISSUE	20/01/23	SJB	BG	NB

CLIENT: Lightwater Quarries

PROJECT: Gebdykes Quarry Landfill

DRAWING TITLE: PHASE 5 INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV
NT14834-012	B

DRG SIZE	SCALE	DATE
A2	1:2,500	03/09/2021

DRAWN BY	CHECKED BY	APPROVED BY
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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834-012-B SURFACE WATER MANAGEMENT PLAN [PHASE 5].DWG

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1. TO BE READ IN CONJUNCTION WITH FLOOD RISK ASSESSMENT (REF NT14834 APPENDIX 8.1)
2. LAYOUT IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.
3. RUNOFF CO-EFFICIENT APPLIED TO RESTORED AREAS.

KEY

- QUARRY BOUNDARY
- RESTORED AREA
- PROPOSED DRAINAGE CHANNEL
- PROPOSED SWALE
- PROPOSED PIPED GRAVITY CONNECTION
- PROPOSED STORAGE LAGOON (LINED)
- PROPOSED DRY DETENTION BASIN (BASED ON VOLUME OF STORAGE REQUIRED POST RESTORATION)

Quarry Access Restored by 2039

DRAINAGE CHANNEL TO INTERCEPT RUNOFF FROM PHASE 1, 4 AND 5 AND CONVEY INTO LINED LAGOON

PROPOSED LAGOON TO PROVIDE MINIMUM 2,864m³ STORAGE ATTENUATION FOR 1 IN 100 YEAR (+CC) STORM. LAGOON SHAPE CHANGED FROM PREVIOUS PHASES TO SUIT PROPOSED RESTORED LANDSCAPE

WATER WITHIN LINED LAGOON TESTED FOR CONTAMINANTS BEFORE DISCHARGE

VEGETATED SWALES INTERCEPT SURFACE WATER RUNOFF AND CONVEY TO DRY DETENTION BASIN. UNLINED TO PROMOTE INFILTRATION

DRY DETENTION BASIN TO PROVIDE APPROXIMATELY 1,564m³ ATTENUATION AT 1m DEPTH OF STORAGE + 0.3m FREEBOARD UNLINED TO PROMOTE INFILTRATION. DIMENSIONS ASSUME FEATURE RETAINED FROM PHASE 2

EXISTING DRAINAGE CHANNEL RETAINED

Landfill Phase 1 Restored by 2027

Landfill Phase 5 Restored by 2044

Landfill Phase 4 Restored by 2040

Landfill Phase 3 Restored by 2036

Landfill Phase 2 Restored by 2031

0 100 200 metres

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
A	FIRST ISSUE	02-02-23	DR	LG	NB

CLIENT: Lightwater Quarries

PROJECT: GEBDYKES QUARRY LANDFILL

DRAWING TITLE: RESTORATION INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV	SUIT. CODE
NT14834-013	A	

DRG SIZE	SCALE	DATE
A2	1:2,500	24-01-23

DRAWN BY	CHECKED BY	APPROVED BY
DR	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834-013-A SURFACE WATER MANAGEMENT PLAN- RESTORATION.DWG

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Legend

- Site Boundary
- Groundwater Monitoring Boreholes,Groundwater Elevation (m AOD)
- Groundwater Contours August 2020 (m AOD)
- Groundwater Flow Direction

REVISION	DETAILS	DATE	DRN	CHKD	APPD

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill Permit Applciation

DRAWING TITLE

Groundwater Contour Plot August 2020

DRG No.		REV
NT14621-Figure 2		A
DRG SIZE A3	SCALE 1:3,500	DATE March 2021
DRAWN TR	CHECKED BY AS	APPROVED BY AS

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N:\NT\NT14621 - GEBDYKES QUARRY WML\03 - DESIGN\QGIS\NT14621_GEBDYKES_HYDRO_JANUARY_REPORT.QGZ

DO NOT SCALE FROM THIS DRAWING

Legend

- Site Boundary
- Other Land Under the Applicant's Control
- Groundwater Monitoring Boreholes,Groundwater Elevation (m AOD)
- Groundwater Contours January 2021 (m AOD)
- Groundwater Flow Direction

REVISION	DETAILS	DATE	DRN	CHKD	APPD

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill Permit Applciation

DRAWING TITLE

Groundwater Contour Plot January 2021

DRG No. NT14621-Figure 3		REV A
DRG SIZE A3	SCALE 1:3,500	DATE March 2021
DRAWN TR	CHECKED BY AS	APPROVED BY AS

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N:\NT\NT14621 - GEBDYKES QUARRY WML\03 - DESIGN\QGIS\NT14621_GEBDYKES_HYDRO_JANUARY_REPORT.QGZ

Estimated Remaining Limestone Reserves to 117m A.O.D

1. c.291,000 m³
2. c.210,000 m³
3. c.307,500 m³
4. c.323,000 m³ or c.37,500 m³ (if just a pass is excavated)
5. c.75,500 m³

Limestone Extraction between 27th Mar 20 & 30th Mar 21 c.126,300 cu.m

Blasted Rock 490m³

Blasted Rock 7,578m³

Topsoil Heap 7,619m³

Topsoil Bund 754m³

Limestone Extraction between 27th Mar 20 & 30th Mar 21 c.36,300 cu.m

Overburden Heap 11,884m³

Topsoil Heap 12,145m³

Additional Topsoil Added c.8,596m³

Blasted Rock 1,858m³

Topsoil 11,558m³

Blasted Rock 626m³

Limestone Extraction between 27th Mar 20 & 30th Mar 21 c.39,300 cu.m

BH E-423746.20 N-482280.62 Collar Level - 118.67m AOD Ground Level - 117.84m AOD

High water slab level 117.63m AOD

Co Const, CP & ED Bdy

1.14m RH

1.14m FW

Gybdykes Farm

Gybdykes

LIMEKILN LANE

Dales View

Low Burton Wood

Track

Def

Pump

Path (um)

FW

WB

BM

Tree Planting 2020

Hedge

The Belt

HALFPENNY HOUSE LANE

B 6268

135.6m

140.3m

142.6m

137.5m

134.5m

131.7m

126.9m

Legend:

- Land Under Control of Applicant
- Planning Permission Area
- Limestone Reserve Areas

Top of Banking	Overhead Cable	LP	Lamp Post	BH	Borehole / Trial Pit
Bottom of Banking	60.0 1m Contour Intervals	TP	Telegraph Pole	133.92	Spot Level
Kerb - Top	OS Backcloth	EP	Electric Pole		Trees
Kerb - Channel	Building/Structure	ST	Stop Tap		Survey Control Station
Fence - Post & Wire	Verge Line	GV	Gas Valve		
Fence - Secure	Foliage Line	WL	Water Level		
Gate	Top of Rock Face	IL	Invert Level		
Track / Footpath	MH Manhole	CL	Cover Level		
Wall	IC Inspection Cover	EL	Eave Level		
Edge of Waterline	BT British Telecom Cover	RL	Ridge Level		
Hedgeline	G Gully				

REVISIONS

	Date	Description	By
//	//	//	//

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e-mail - linearsurveys@gmail.com

Client: **LIGHTWATER QUARRIES LTD**

Job Title: GEBDYKES QUARRY

Project Title:

Scale	Date	Drawn by	Surveyed By
1:2000@A1	MAR 2021	SW/PR	SW/PR

Dwg. title: Quarry update and stockpile survey - 30th March 2021 with reserve estimates

DWG No. LQ/GDQ/MAR21-02

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Office Tower
Almaty
Kazakhstan
050040
Tel: +7(727) 334 1310

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DRAWINGS

DO NOT SCALE FROM THIS DRAWING

KEY

- Application boundary
- Surrounding agricultural land
- Existing woodland, hedgerows and trees
- Agricultural grassland
- Magnesian limestone grassland
- Native hedgerow with hedgerow trees
- Woodland planting
- Scrub planting
- Drainage channels
- Swales
- Detention basins (based on volume of storage required post restoration)

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill

DRAWING TITLE

Figure 3.6
Restoration

DRG No.	REV
NT14834/Figure 3.6	-

DRG SIZE	SCALE	DATE
A2	1:2,500	17/11/2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834 FIGURE 3.6 RESTORATION.DWG

DO NOT SCALE FROM THIS DRAWING

KEY

- Application boundary
- Extent of inert landfill
- Active landfill phase
- Direction of working
- Access track
- Existing quarry
- Surrounding agricultural land
- Existing woodland, hedgerows and trees
- Agricultural grassland
- Magnesian limestone grassland

Gybdykes

Phase 1

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill

DRAWING TITLE

Figure 3.1
Phase 1

DRG No.	REV
NT14834-002	-

DRG SIZE	SCALE	DATE
A2	1:2,500	November 2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834 FIGURE 3.1 PHASE 1 PLAN.DWG

DO NOT SCALE FROM THIS DRAWING

KEY

- Application boundary
- Extent of inert landfill
- Active landfill phase
- Direction of working
- Access track
- Existing quarry
- Surrounding agricultural land
- Existing woodland, hedgerows and trees
- Agricultural grassland
- Magnesian limestone grassland
- Scrub planting
- Drainage channels
- Swales
- Dry detention basins (based on volume of storage required post restoration)

Gybdykes

Phase 2

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CH'KD	APP'D

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill

DRAWING TITLE

Figure 3.2
Phase 2 Plan

DRG No.	REV
NT14834-003	-

DRG SIZE	SCALE	DATE
A2	1:2,500	November 2021

DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834 FIGURE 3.2 PHASE 2 PLAN.DWG

DO NOT SCALE FROM THIS DRAWING

KEY

- Application boundary
- Extent of inert landfill
- Active landfill phase
- Direction of working
- Access track
- Existing quarry
- Surrounding agricultural land
- Existing woodland, hedgerows and trees
- Agricultural grassland
- Magnesian limestone grassland
- Scrub planting
- Drainage channels
- Swales
- Dry detention basins (based on volume of storage required post restoration)

Gybdykes

Phase 3

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CH'KD	APP'D

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill

DRAWING TITLE

Figure 3.3
Phase 3 Plan

DRG No.		REV
NT14834-004		-
DRG SIZE	SCALE	DATE
A2	1:2,500	17/11/2021
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AB	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834 FIGURE 3.3 PHASE 3 PLAN.DWG

DO NOT SCALE FROM THIS DRAWING

KEY

- Application boundary
- Extent of inert landfill
- Active landfill phase
- Direction of working
- Access track
- Existing quarry
- Surrounding agricultural land
- Existing woodland, hedgerows and trees
- Agricultural grassland
- Magnesian limestone grassland
- Scrub planting
- Drainage channels
- Swales
- Dry detention basins (based on volume of storage required post restoration)

Gybdykes

Phase 4

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CH'KD	APP'D

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill

DRAWING TITLE

Figure 3.4
Phase 4 Plan

DRG No.		REV
NT14834-005		-
DRG SIZE	SCALE	DATE
A2	1:2,500	17/11/2021
DRAWN BY	CHECKED BY	APPROVED BY
AB	LG	NB

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N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834 FIGURE 3.4 PHASE 4 PLAN.DWG

DO NOT SCALE FROM THIS DRAWING

KEY

- Application boundary
- Extent of inert landfill
- Active landfill phase
- Direction of working
- Access track
- Existing quarry
- Surrounding agricultural land
- Existing woodland, hedgerows and trees
- Agricultural grassland
- Magnesian limestone grassland
- Scrub planting
- Drainage channels
- Swales
- Dry detention basins (based on volume of storage required post restoration)

Gybdykes

Phase 5

0 100 200
metres

REVISION	DETAILS	DATE	DRAWN	CH'KD	APP'D

CLIENT

Lightwater Quarries

PROJECT

Gebdykes Quarry Landfill

DRAWING TITLE

Figure 3.5
Phase 5 Plan

DRG No.	REV
NT14834-006	-

DRG SIZE	SCALE	DATE
A2	1:2,500	November 2021

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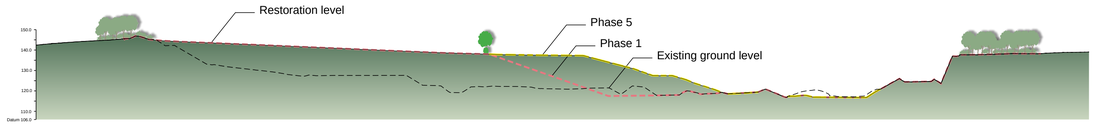
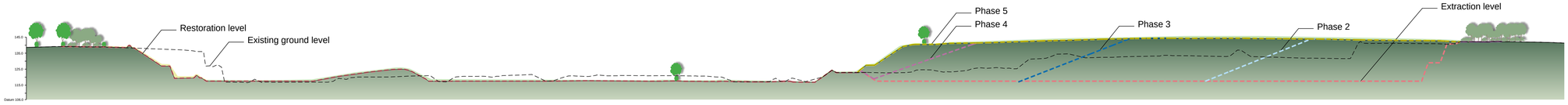
N:\NT\NT14834 - GEBDYKES QUARRY LANDFILL EIA\03 - DESIGN\AUTOCAD\NT14834 FIGURE 3.5 PHASE 5 PLAN.DWG

DO NOT SCALE FROM THIS DRAWING

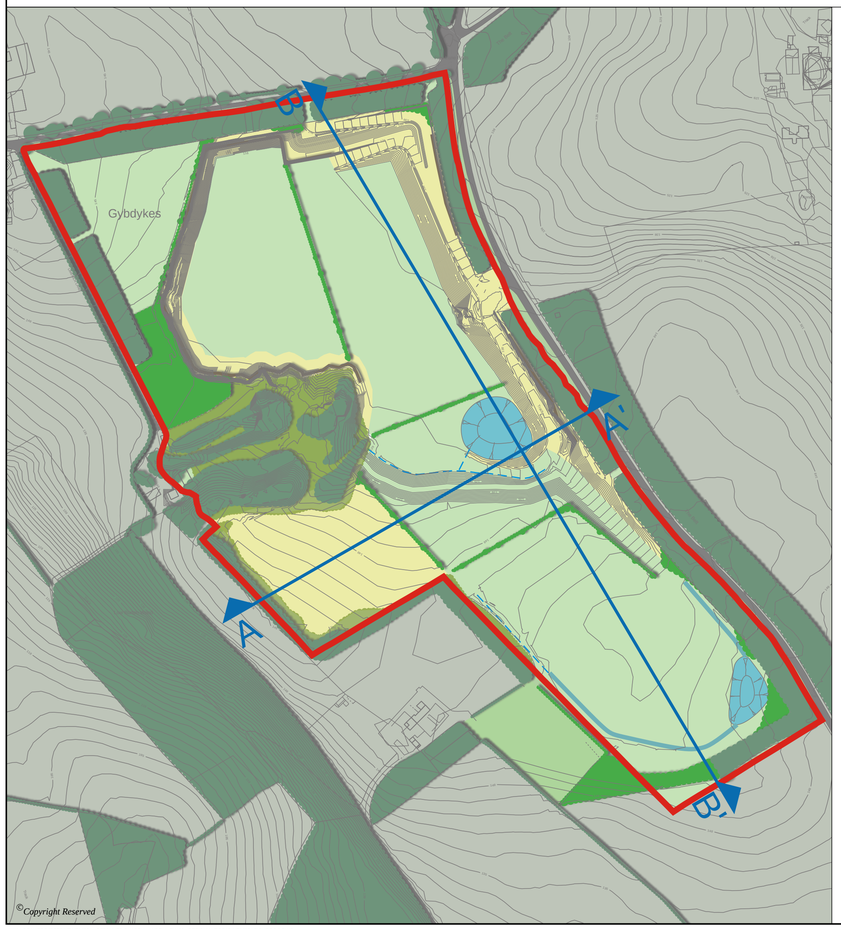
Section A - A'



Section B - B'



0 100 200
metres



REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT: Lightwater Quarries

PROJECT: GEBDYKES QUARRY LANDFILL

DRAWING TITLE: FIGURE 3.7
CROSS-SECTION

ORG No.		REV
NT14834/ 014		-
DRG SIZE: A1	SCALE: 1:1500	DATE: 02/12/2021
DRAWN BY: TL	CHECKED BY: LG	APPROVED BY: NB

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