Upton House
Market Street
Charlbury
Oxfordshire, OX7 3PJ
United Kingdom
tel +44 (0)1608 810374
fax +44 (0)1608 810093
e-mail info@gwp.uk.com
www.gwp.uk.com

SHELLINGFORD QUARRY LANDFILL STABILITY RISK ASSESSMENT TO SUPPORT ENVIRONMENTAL PERMIT APPLICATION EPR/BP3095EU/V004

For

MULTI-AGG LIMITED

October 2025

GWP Consultants LLP
Registered No. OC326183
Registered Office: Upton House, Market Street, Charlbury, Oxfordshire, OX7 3PJ, UK

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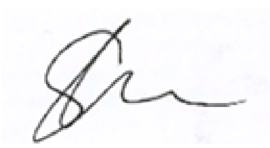

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1. INTRODUCTION

1.1 Report Context

Shellingford Quarry Landfill currently operates under Environmental Permitting Regulations (EPR) Permit EPR/BP3095EU which provides for the landfilling with imported inert waste of the quarry excavation in accordance with extant Planning Permissions STA/SHE/8554/12-CM (MW.0020.11) and STA/SHE/8554/11-CM (MW.0021.11).

Planning Permission P18/V2610/CM (MW.0104/18) was granted in September 2020 and provides for the extraction of sand and limestone from a western extension to Shellingford Quarry and restoration of the excavation to original ground levels using imported inert waste material and indigenous soils.

An EPR Permit application is being submitted to vary the existing EPR Permit EPR/BP3095EU to add a deposit for recovery activity to accommodate infilling within the adjacent western quarry excavation area with imported inert waste.

This report presents a Stability Risk Assessment (SRA) and has been prepared to support the EPR Permit application to vary the existing EPR Permit to accommodate infilling with imported inert waste associated with the adjacent western quarry excavation area.

1.2 Operator of the Proposed Installation

Multi-Agg Limited, The Upper Lime Kiln Works, Bytham Road, Ogbourne St. George, Marlborough, Wiltshire, SN8 1TD.

1.3 Agent who Completed this Report

GWP Consultants LLP, Upton House, Market Street, Charlbury, Oxfordshire, OX7 3PJ.

1.4 Outline of the Proposed Development

The EPR Permit application is to vary the existing EPR Permit EPR/BP3095EU to add a deposit for recovery activity to accommodate infilling within the adjacent western quarry excavation area with imported inert waste. The inert fill capacity associated with the deposit for recovery activity is *c.* 1.60Mm^3 which equates to a tonnage of *c.* 2.88Mt (using a conversion factor of 1.8t/m^3).

The additional deposit for recovery activity associated with the Permit variation will be limited to the western quarry excavation area that is adjacent to the inert landfilling area covered by the existing EPR Permit. This means the current Permit boundary will need to be extended to the west and south to allow for the additional deposit for recovery activity.

Details of the site setting and installation design are presented in the Environmental Setting and Site Design (ESSD) report prepared by GWP Consultants LLP (GWP) (GWP Report No. 250212) which accompanies the EPR Permit variation application (Appendix Hii of the EPR Permit variation application) and which should be read in conjunction with this report.

Drawing No. SHELLQMA2508-1 shows the site location.

Drawing No. SHELLQMA2508-2 shows the EPR Permit variation application area within the context of the existing EPR Permit area, highlighting where the deposit for recovery activity in the western extension area will take place.

Drawing No. SHELLQMA2508-3 is the site plan which shows the total extent of the varied EPR Permit area being applied for.

Drawing No. SHELLQMA2508-7 illustrates the phasing of the excavation and infilling of the western quarry extension, approved by P18/V2610/CM (MW.0104/18).

2. SITE SETTING

2.1 Physical Setting

The application site is located at Shellingford Quarry, Stanford Road, Stanford in the Vale, Faringdon, Oxfordshire, SN7 8HE (National Grid Reference SU 32700 93600).

Shellingford Quarry is located to the north of the White Horse Business Park between the villages of Shellingford *c.* 0.25km to the west and Stanford in the Vale *c.* 0.50km to the east. The town of Faringdon is located *c.* 3.0km to the west of the quarry

Original ground levels within the western quarry extension area range from *c.* 90mAOD in the north to *c.* 74mAOD in the south, north of the Holywell Brook (also known as the Hollywell Brook).

The quarry is excavated in Upper Jurassic strata belonging to the Corallian Group and comprising principally the Highworth Grit Member (sand) and underlying Highworth Limestone Member (limestone) of the Kingston Formation.

Access to the site is currently from the A417 (Faringdon Road) and will remain unchanged.

2.2 Geological Setting

The geological setting of the site has been determined based on a review of published information, site investigation information and observations made in the existing quarry excavation.

The general geological setting of the site is shown on Drawing No. SHELLQMA2508-9.

Strata represented in the existing quarry and the western quarry extension area belong to the Stanford Formation and the underlying Kingston Formation which form part of the Corallian Group (Upper Jurassic).

More specifically, the strata comprise:

- Calne Member (Stanford Formation) – rubbly oolitic and clayey limestones (0.0m to *c*. 1.5m thick locally); overlying
- Highworth Grit Member (Kingston Formation) – fine and medium grained sands, rippled and cross bedded with thin limestone bands and clay lenses, increasingly silty to the base (*c*. 2.0m to *c*. 11m thick locally); overlying
- Highworth Clay Member (Kingston Formation) – grey sandy and silty clay, often thin or absent (0.0m to *c*. 3m thick locally); overlying
- Highworth Limestone Member (Kingston Formation) – oolitic and bioclastic limestones with thin sandy clay bands, becoming a sandy limestone to the base (*c*. 2.5m to *c*. 10m thick locally); overlying
- Lower Calcareous Grit Formation (Corallian Group) – silty and clayey fine to medium sands (*c*. 5.5m to *c*. 10m thick locally – not worked); overlying
- Oxford Clay Formation (Ancholme Group) – clay (greater than 30m thick – not worked).

The strata within and near the site generally dip to the south and southeast at variable gradients of between *c.* 1v : 40h (vertical : horizontal) and *c.* 1v : 100h. However, variations in strata dip and dip direction occur as a result of lateral variations in strata character and thickness.

Consistent with the requirements of the extant Planning Permissions the quarry is not currently, and will not be, excavated below the base of the Highworth Limestone Member *i.e.* no excavation into the underlying Lower Calcareous Grit Formation.

3. CONCEPTUAL STABILITY SITE MODEL

Details of the components of the conceptual stability site model for the deposit for recovery activity within the western extension area are presented in the following sub-sections and are summarised in Table 1.

3.1 Basal Sub-Grade Model

The basal sub-grade of the imported inert waste associated with the deposit for recovery activity in the western excavation area will comprise the lower part of the Highworth Limestone Member/top of the Lower Calcareous Grit Formation which will form the floor of the mineral excavation.

3.2 Side Slopes Sub-Grade Model

The side slopes sub-grade of the western extension area comprises the perimeter slopes of the mineral excavation formed generally in the Kingston Formation and the overlying Stanford Formation strata.

3.3 Basal Artificial Geological Barrier Model

A basal artificial geological barrier (AGB) will be constructed on a phased basis across the floor of the western excavation area, as has been constructed within the currently permitted existing inert landfill area. The artificial geological barrier constructed within the western excavation area will comprise a compacted layer of indigenous quarry waste (processing fines, excess clays and overburden material) and/or suitable selected imported inert waste material and will have a minimum thickness of 1m and a permeability no greater than 1×10^{-7}m/s.

The basal AGB will be constructed in accordance with the approved original Construction Quality Assurance (CQA) Plan (PGW&A Report reference SQL/CQA Plan/1) and the Addendum CQA Plan (GWP Report No. 190508) approved by the Environment Agency (EA).

3.4 Side Slopes Artificial Geological Barrier Model

A side slopes AGB will be formed on a phased basis within the western excavation area using suitable indigenous quarry material (overburden material and processing fines) and/or suitable selected imported inert waste, as has been constructed within the currently permitted existing inert landfill area.

The suitable material will be compacted in layers and brought up in lifts up to *c.* 5m high against the side slopes sub-grade formed in the Kingston Formation and the overlying Stanford Formation as the general placement of waste progresses.

Following the completion of each side slopes AGB lift, imported inert waste material will be graded against the compacted material in order to provide buttress support and to establish a stable platform for the placement and compaction of the next side slopes AGB lift. Excavated perimeter slopes in the Kingston Formation and the overlying Stanford Formation will have a maximum height *c.* 15m and the maximum unsupported height of the side slopes AGB will be *c.* 2m. The side slopes AGB will have a minimum thickness of 1m and a permeability no greater than 1×10^{-7}m/s.

The side slope AGB will be constructed in accordance with the approved original CQA Plan (PGW&A Report reference SQL/CQA Plan/1) and the Addendum CQA Plan (GWP Report No. 190508) approved by the EA.

3.5 Waste Mass Model

The site will receive inert waste as part of the deposit for recovery activity within the western extension area.

The waste associated with the deposit for recovery activity in the western excavation area will be placed in layers *c.* 1m thick in lifts *c.* 5m thick. The maximum total thickness of waste will be *c.* 15m. Active advancing slopes in waste material will be formed no steeper than 1v : 2h. Temporary inter-phase slopes in waste material will be formed no steeper than 1v : 3h. An intermediate bench with a minimum width of 10m will be maintained between lifts. The final restoration surface of the waste mass will be formed at gradients shallower than *c.* 1v : 25h.

No daily cover material will be placed.

3.6 Capping System Model

No engineered low permeability capping system will be placed (see Section 2.2.4 of the ESSD report (GWP Report No. 250212) which accompanies the EPR Permit variation application (Appendix Hii)). The waste will be capped in a progressive manner with restoration soils following deposit for recovery.

Restoration infilling will be to a final restoration platform level of between *c.* 74mAOD to *c.* 90mAOD in accordance with the approved restoration scheme for Shellingford Quarry included as part of Planning Permission P18/V2610/CM (MW.0104/18) (see Drawing No. 2459-5-2 DR-0001 presented in Appendix 1).

4. STABILITY RISK ASSESSMENT

4.1 Risk Screening

A risk screening of the geotechnical issues relating to the stability and integrity of the components of the deposit for recovery development within the western extension area is presented in Table 1.

4.2 Modelling Approach and Software

Assessment of the geotechnical stability and integrity of the deposit for recovery development within the western extension area has principally involved the completion of a series of 2D limit equilibrium slope stability analyses. This modelling and analytical approach is considered appropriate given the simplicity of the geotechnical setting of the development.

Industry standard computer software (SLIDE – supplied by Rocscience Inc.) has been used to complete the slope stability analyses.

4.3 Geotechnical Parameters Selected for Analyses

Geotechnical parameters selected for analysis purposes are presented in Table 2 below. Note the parameters are deemed to be conservative:

Table 2 – Geotechnical parameters selected for analyses

Material Type	Drained Shear Strength [c′ (kPA)]	Angle of Shearing Resistance (°)	Bulk Density (Mg/m^3)
Artificial Geological Barrier (AGB)	4	23	1.8
Waste Mass	4	23	1.8

4.4 Selection of Appropriate Factor of Safety

A benchmark minimum Factor of Safety (FoS) value of 1.30 has been adopted for the purpose of assessing the stability of the deposit for recovery development within the western extension area. It is considered that this benchmark value is appropriate given that:

- the geotechnical setting of the site is simple and is adequately defined;
- the geotechnical input parameters selected for analysis are known or have been conservatively estimated with reasonable confidence;
- the geotechnical stability and safety risks associated with the deposit for recovery development within the western extension area at the site are considered to be very low.

4.5 Stability Analyses

4.5.1 Basal Sub-Grade

No specific stability analyses have been deemed necessary. Relevant geotechnical issues are discussed below in Section 4.6.1.

4.5.2 Side Slopes Sub-Grade

No specific stability analyses have been deemed necessary. Relevant geotechnical issues are discussed below in Section 4.6.2.

4.5.3 Basal Artificial Geological Barrier

See Appendix 2 and Section 4.6.3 below.

4.5.4 Side Slopes Artificial Geological Barrier

See Appendix 3 and Section 4.6.4 below.

4.5.5 Waste Mass

See Appendix 4 and Section 4.6.5 below.

4.5.6 Capping

No specific stability analyses have been deemed necessary. Relevant geotechnical issues are discussed below in Section 4.6.6.

4.6 Stability Analyses Results

The following sub-sections summarise the results of the stability analyses performed and discuss relevant geotechnical issues associated with the various deposit for recovery components. Reference should be made as appropriate to the relevant Appendices for full details of the analyses performed and the associated results.

4.6.1 Basal Sub-Grade

- Basal Sub-Grade Stability

  Based on evidence from geotechnical site inspection, site investigation borehole logs and published information relating to the lithological character of the strata sequence it is considered that no compressible material or cavities will be present beneath the western extension area. Accordingly, it is considered that the stability and integrity of the basal sub-grade will not be compromised by compressibility or the presence of cavities.

- Basal Heave

  The basal sub-grade of the western excavation area will comprise the lower part of the Highworth Limestone Member/top of the Lower Calcareous Grit Formation which will form the floor of the mineral excavation.

  Groundwater is present in the Highworth Limestone Member and the underlying Lower Calcareous Grit Formation (Corallian Group), and the existing quarry is dewatered to allow mineral excavation, AGB construction and restoration infilling to be undertaken in dry conditions. The quarry, including the western quarry excavation area, will continue to be operated in the same manner.

  There will be no groundwater pressures acting which have the potential to promote basal heave. Accordingly, it is considered that the stability and integrity of the basal sub-grade will not be compromised by basal heave.

4.6.2 Side Slopes Sub-Grade

- Compressibility

  Based on evidence from geotechnical site inspection, site investigation borehole logs and published information relating to the lithological character of the strata sequence, it is considered that no compressible material or cavities will be present in the excavated perimeter slopes.

  Accordingly, it is considered that the stability and integrity of the excavated perimeter side slopes sub-grade will not be compromised by compressibility or the presence of cavities.

- Slope Stability

  Excavated perimeter slopes in the Kingston Formation and the overlying Stanford Formation will generally be formed at overall design gradients of *c.* 1v : 0.5h (vertical : horizontal) in limestone and *c.* 1v : 1h in sand. The maximum height of the excavated perimeter slopes will be *c.* 15m.

  Based on the findings of geotechnical inspections undertaken by GWP, it is considered that the excavated slopes will remain adequately stable at the design gradients. Any minor face dressing or re-grading of the side slopes sub-grade will be undertaken on a phased basis in advance of the construction of the side slopes AGB.

  In accordance with the requirements of the Quarries Regulations 1999, the quarry operator is responsible for ensuring that the excavated faces are designed, constructed, operated and maintained so as to ensure that instability or movement which is likely to give rise to a risk to the health and safety of any person is avoided. Accordingly, it is considered that the stability and integrity of the side slopes sub-grade will not be compromised by slope instability.

4.6.3 ***Basal Artificial Geological Barrier*** (see Appendix 2)

- Basal Sub-Grade Stability

  Based on evidence from geotechnical site inspection, site investigation borehole logs and published information relating to the lithological character of the strata sequence it is considered that no compressible material or cavities will be present beneath the western extension area. Accordingly, it is considered that the stability and integrity of the basal AGB will not be compromised by compressibility or the presence of cavities in the basal sub-grade.

- Basal Heave

  The basal sub-grade of the western excavation area will comprise the lower part of the Highworth Limestone Member/top of the Lower Calcareous Grit Formation which will form the floor of the mineral excavation.

  Groundwater is present in the Highworth Limestone Member and the underlying Lower Calcareous Grit Formation (Corallian Group) and the existing quarry is dewatered to allow mineral excavation, AGB construction and restoration infilling to be undertaken in dry conditions. The quarry, including the western quarry excavation area, will continue to be operated in the same manner.

  There will be no groundwater pressures acting which have the potential to promote basal heave. Accordingly, it is considered that the stability and integrity of the basal sub-grade will not be compromised by basal heave.

  Following the cessation of excavation dewatering, the surcharge weight provided by the placed landfill material will negate the potential for any basal heave to occur associated with groundwater level rebound.

- Slope Instability involving Side Slope and Basal Artificial Geological Barriers

  Using the input parameters detailed in Appendix 2, a satisfactory minimum FoS value of 1.34 is indicated by the analysis results for a circular slope failure involving the side slope and basal AGBs. Accordingly, it is considered that the stability and integrity of the basal AGB will not be compromised by slope instability involving the side slope AGB.

- Slope Instability involving Waste Mass and Basal Artificial Geological Barrier

  Using the input parameters detailed in Appendix 2, a satisfactory minimum FoS value of 1.34 is indicated by the analysis results for circular slope failure involving the waste mass and the basal AGB. Accordingly, it is considered that the stability and integrity of the basal AGB will not be compromised by slope instability involving the waste mass.

4.6.4 ***Side Slopes Artificial Geological Barrier*** (see Appendix 3)

- Side Slopes Sub-Grade Stability

  Based on evidence from geotechnical site inspection, site investigation borehole logs and published information relating to the lithological character of the strata sequence it is considered that no compressible material or cavities will be present in the excavated perimeter slopes. Accordingly, it is considered that the stability and integrity of the side slopes AGB will not be compromised by compressibility or the presence of cavities associated with the excavated perimeter side slopes sub-grade.

  Excavated perimeter slopes in the Kingston Formation and the overlying Stanford Formation will generally be formed at overall design gradients of *c.* 1v : 0.5h (vertical : horizontal) in limestone and *c.* 1v : 1h in sand. The maximum height of the excavated perimeter slopes will be *c.* 15m.

  Based on the findings of geotechnical inspections undertaken by GWP Consultants LLP (GWP), it is considered that the excavated slopes will remain adequately stable at the design gradients. Any minor face dressing or re-grading of the side slopes sub-grade will be undertaken on a phased basis in advance of the construction of the side slopes AGB.

  In accordance with the requirements of the Quarries Regulations 1999, the quarry operator is responsible for ensuring that the excavated faces are designed, constructed, operated and maintained so as to ensure that instability or movement which is likely to give rise to a risk to the health and safety of any person is avoided. Accordingly, it is considered that the stability and integrity of the side slopes AGB will not be compromised by slope instability associated with the excavated perimeter side slopes sub-grade.

- Side Slopes Artificial Geological Barrier Slope Stability

  Using the input parameters detailed in Appendix 3, a satisfactory minimum FoS value of 1.34 is indicated by the analysis results for circular slope failure involving the side slopes AGB. Accordingly, it is considered that the stability and integrity of the side slopes AGB will not be compromised by slope instability.

4.6.5 ***Waste Mass*** (see Appendix 4)

Using the input parameters detailed in Appendix 4, a satisfactory minimum FoS value of 1.34 is indicated by the analysis results for circular slope failure involving the waste mass. Accordingly, it is considered that the stability and integrity of the waste mass within the western extension area will not be compromised by slope instability.

4.6.6 ***Capping***

- Slope Stability

  The final restoration surface of the inert fill material placed within the western extension area under the deposit for recovery activity will be formed at gradients shallower than *c.* 1v : 25h in accordance with the approved restoration scheme for Shellingford Quarry included as part of Planning Permission P18/V2610/CM (MW.0104/18) (see Drawing No. 2459-5-2 DR-0001 presented in Appendix 1).

  Given the shallow restoration gradients, it is considered that the stability of the final restoration surface will not be compromised by slope instability.

- Deformation Due to Landfill Settlement

  No engineered low permeability capping system will be placed and therefore the potential for the integrity of such a system to be compromised by settlement of the waste mass does not exist.

  Given:

  - the character of the inert waste which will be placed in the western extension area under the deposit for recovery activity (mainly clayey soil and stone);
  - that site operational procedures, consistent with principles of best practice, will be employed to ensure that the waste is placed in layers *c.* 1m thick and is adequately compacted

  it is considered that the potential for inert waste settlement will be low (less than *c.* 2% of waste thickness). Re-grading of the restored surface will be undertaken if inert waste settlement results in the formation of localised shallow depressions. Whilst it is considered that such depressions would not adversely affect waste mass stability, they may cause localised ponding and therefore affect the afteruse of the site.

5. MONITORING

5.1 Basal Sub-Grade

The basal sub-grade will be inspected prior to the construction of the basal AGB, in order to ensure that no compressible or unsuitable material is present, and that no ponded surface water is present.

5.2 Side Slopes Sub-Grade

The side slopes sub-grade will be inspected prior to the construction of the side slopes AGB in order to ensure that no compressible or unsuitable material is present and that the sub-grade slopes exhibit adequate stability.

5.3 Basal Artificial Geological Barrier

CQA procedures, consistent with the approved original CQA Plan (PGW&A Report reference SQL/CQA Plan/1) and the Addendum CQA Plan (GWP Report No. 190508) approved by the EA, and involving construction supervision and testing, will be adopted in order to ensure that the basal AGB meets required specifications.

5.4 Side Slopes Artificial Geological Barrier

CQA procedures, consistent with the approved original CQA Plan (PGW&A Report reference SQL/CQA Plan/1) and the Addendum CQA Plan (GWP Report No. 190508) approved by the EA, and involving construction supervision and testing, will be adopted in order to ensure that the side slopes AGB meets required specifications.

5.5 Waste Mass

Placement of the waste will be routinely monitored in order to ensure that the waste is placed in layers *c.* 1m thick and is adequately compacted and that waste slopes are formed at appropriate gradients and remain stable.

5.6 Capping

A topographic survey of the restored surface will be undertaken at intervals in accordance with the requirements of the EPR Permit in order to monitor inert waste settlement within the western extension area.

6. SUMMARY AND CONCLUSIONS

This report presents a Stability Risk Assessment and has been prepared to support an EPR Permit application to vary the existing EPR Permit EPR/BP3095EU to accommodate the infilling with imported inert waste under a deposit for recovery activity within an adjacent western quarry excavation area.

It is considered that the geotechnical setting of the site is adequately defined and that the geotechnical stability and safety risks associated with the development are very low.

The geotechnical stability and integrity of the components of the deposit for recovery activity within the western extension area have been assessed and it is considered that adequate FoS values will be obtained during site development and following completion.

GWP CONSULTANTS
OCTOBER 2025

Table 1 – Stability risk screening of deposit for recovery components

Component	Geotechnical issue	Classification of geotechnical issue	Justification		
			Is stability/integrity of component at significant risk?	Principal reason(s)	Supporting analyses
Basal sub-grade	Compressibility of sub-grade	Simple	No	No compressible material in basal sub-grade	See Section 4.6.1
	Cavities in sub-grade	Simple	No	No cavities in basal sub-grade	See Section 4.6.1
	Basal heave	Simple	No	No groundwater pressures acting to promote basal heave	See Section 4.6.1
Side slopes sub-grade	Compressibility of sub-grade	Simple	No	No compressible material in side slopes sub-grade	See Section 4.6.2
	Cavities in sub-grade	Simple	No	No cavities in side slopes sub-grade	See Section 4.6.2
	Slope stability	Simple	No	Adequate stability of side slopes sub-grade	See Section 4.6.2
Basal artificial geological barrier	Compressibility of sub-grade	Simple	No	No compressible material in basal sub-grade	See Section 4.6.3
	Cavities in sub-grade	Simple	No	No cavities in basal sub-grade	See Section 4.6.3
	Basal heave	Simple	No	No groundwater pressures acting to promote basal heave	See Section 4.6.3
	Stability of sides slopes artificial geological barrier or waste mass and basal artificial geological barrier	Simple	No	Shallow gradient drained slopes in adequately strong side slopes artificial geological barrier and waste mass material	See Section 4.6.3
Side slopes artificial geological barrier	Compressibility and slope stability of side slopes sub-grade	Simple	No	No compressible material in side slopes sub-grade and adequate stability of side slopes sub-grade	See Section 4.6.4
	Cavities in sub-grade	Simple	No	No cavities in side slopes sub-grade	See Section 4.6.4
	Slope stability	Simple	No	Shallow gradient slopes in adequately strong side slopes artificial geological barrier material	See Section 4.6.4
Waste mass	Stability of waste mass	Simple	No	Shallow gradient slopes in adequately strong waste mass material	See Section 4.6.5
Capping system	Slope stability	Simple	No	Shallow gradient restored surface	See Section 4.6.6
	Deformation due to waste settlement	Simple	No	No engineered capping system – limited inert waste settlement	See Section 4.6.6

APPENDIX 1

Drawing No. 2459-5-2 DR-0001

APPENDIX 2

Stability analyses – basal artificial geological barrier

APPENDIX 3

Stability analyses – side slopes artificial geological barrier

APPENDIX 4

Stability analyses – waste mass