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Soil Management Plan for Stage 1

E&JW Glendinning Ltd.

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LINHAY-ATK-S1-GEN-E-RP-003

LINHAY HILL QUARRY EXTENSION

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Document history

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1. Introduction and Background

Project Background

1.1. Linhay Hill Quarry is a major limestone quarry located to the north-east of Ashburton and is the main site in the business of E&JW Glendinning Ltd. The quarry is immediately adjacent to the A38, which runs along the quarry's south-eastern boundary, and at this point is the boundary of the Dartmoor National Park Authority (DNPA). Due to the depletion of the reserves remaining in the quarry planning permission was sought for an extension so that the life of Linhay Hill Quarry, its products and the economic benefits and jobs it creates can be secured for the future. The quarry extension will enable continuation of the current business activity which employs circa 240 people and contributes significantly to the Devon and Dartmoor local economy. Planning permission was granted by the DNPA on 15 March 2021.

1.2. The proposed quarry extension area is into Alston Farm owned by Glendinning to the north east of the existing quarry and alongside the A38, which is underlain with limestone. Part of Alston Lane will have to be removed to allow the extension area to be quarried and a replacement, called Waye Lane is included in the approved proposals and has been constructed. The narrow part of Balland Lane has also been improved to mitigate for the small amount of extra traffic which may be diverted onto Waye Lane as a result of the closure of Alston Lane. In addition a replacement access to Alston Farm has been constructed and the previous routes of overhead electricity lines along Alston Lane have been diverted around the south and east of the planned quarry extension area.

1.3. Those pre-commencement works have been carried out in a Stage 0 and quarrying within the extension is planned to commence in Stage 1, which requires topsoil stripping and excavation of overburden to access the limestone rock to be quarried. The excavated overburden will initially be placed in landscape bunds shown on the drawings in Appendix C for Stage 1 identified as Stage 1a and Stage 1b Stage 1a is spilt into 1a west and 1a east and entails filling along the southern boundary of the Alston Farm fields parallel to the A38, i.e. across the south east end of fields identified as Fields C, F, J and L on the drawings. Stage 1b is filling in the field north east of Stage 1a and is also along the southern boundary of the Alston Farm fields parallel to the A38, i.e. across the south east end of the field identified as Field P on the drawings.

1.4. The subsequent Stage 2 entails filling of fields north of the Stage 1b area but adjoins the 1b landscape bund to form one landscape feature, i.e. across the north end of the field identified as Field N and across Fields M, R and S on the drawings. The envisaged Stage 2 is shown on the drainage drawings in Appendix D, and the future planned formation of the Stage 2 bund and changes planned in later stages have been included in the drainage design for Stage 1.

1.5. The overburden placement will be regulated under a Mining Waste Permit to comply with the Mining Waste Directive 2006/21/EC as covered by the Environmental Permitting (England and Wales) Regulations 2016 Schedule 20 Mining waste operations. That permit will be for the management of unpolluted soil / inert extractive waste by passive treatment, controlled by the conditions for the discharge set in the permit; for example, temporary settlement areas that become part of the site restoration when dry, and will include a water discharge activity for the rainfall dependent discharge. If an incident occurred to plant operating within the overburden placement areas causing a localised fuel or hydraulic oil leak, pollution mitigation would be by implementing the site's emergency response plan, such as the use of spill kits and subsequent appropriate disposal of the affected material.

1.6. The overburden placement to form the landscape bunds will be carried out in intensive campaigns during dry periods, expected to be between spring and autumn, commencing late spring 2025, with restoration of each filled area as per the planning approved Landscape and Ecological Mitigation and Enhancement Scheme as soon as possible after cessation of each campaign of overburden filling.

1.7. A Construction Environmental Management Plan (CEMP) is utilised for the construction works for the planned extension of Linhay Hill Quarry and this Soil Management plan will be part of the CEMP for Stage 1, i.e. within its Appendix B Management Plans.

Purpose of the Soil Management Plan

1.8. This Soil Management Plan (SMP) sets out the mitigation needed to manage the environmental effects associated with the handling and storage of topsoil required to progress the approved extension to Linhay Hill Quarry, Ashburton, operated by E&JW Glendinning Ltd., in accordance with Dartmoor National Park Authority planning permission reference 322/16 and DCC/3994/2017. The SMP has been prepared as required by the planning permission condition 25, which stipulates:

"25. Prior to the commencement of Stage 1 and Stage 2 respectively, details of the proposed soil and overburden stripping and the construction of the bunds in that stage shall be submitted to and approved in writing by the Mineral Planning Authority. The scheme shall include:
a) the arrangements for handling and storage of topsoil
b) proposed haulage routes
c) details of the drainage during the construction phase
d) details of the final drainage scheme
e) a timetable for construction, and
f) proposals for monitoring of noise and dust and reporting during construction of the bunds.
The bunds shall be constructed in accordance with the approved details."

1.9. This soil management plan covers Stage 1 of the planned quarry extension.

Planning Condition 25 requirements for the SMP

1.10. The following table details where the information required by planning condition 25 are included within this SMP.

Table 1-1 - Planning condition 25: location of required details within this SMP

Planning condition 25 requirements	Location within this SMP
Prior to the commencement of Stage 1 and Stage 2 respectively, details of the proposed soil and overburden stripping and the construction of the bunds in that stage shall be submitted to and approved in writing by the Mineral Planning Authority. The scheme shall include:	
a) the arrangements for handling and storage of topsoil	Section 2
b) proposed haulage routes	Section 3
c) details of drainage during construction	Section 4 and Appendix D
d) details of the final drainage scheme	Section 4 and Appendices C & D
e) a timetable for construction	Section 5
f) proposals for monitoring noise and dust and reporting during construction of the bunds.	Section 6

2. Handling and Storage of Soil

2.1. The key principles to be followed in the handling and storage of topsoil and overburden stripping and construction of the bunds are as follows:

- The main references for handling and storage of topsoil will be Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009) and the Institute of Quarrying's Good Practice Guide for Handling Soils in Mineral Workings (2021). This provides detailed guidance on the management of soils before and during overburden removal, in particular Sheets A and B. Copies of those sheets are provided in Appendix A.
- Planning for construction of the Stage 1 bunds has been undertaken with close reference to the Stage 1 Bunds Detailed Design Plan; the Tip Stability Report (Frederick Sherrell Ltd 2015) contained in Appendix 3E of the Linhay Hill Quarry extension Environmental Statement, and the geotechnical report under preparation for Condition 24 of the quarry extension planning permission.
- Sub-contractors working under this Soil Management Plan will adhere to this plan and a pre-start meeting will be held between E&JW Glendinning Ltd. and the sub-contractor(s) at least one week prior to commencement of works which could affect the soils at the site. The purpose of the meeting will be to ensure this plan is understood.

Pre-treatment of Existing Vegetation

2.2. The land will be kept vegetated as long as possible before it is necessary to move topsoil/subsoil.

2.3. But it is good practice to reduce the quantity of vegetation entering the storage stockpiles in order to minimise the formation of anaerobic conditions during storage.

2.4. Therefore in advance of soil stripping, the topsoil will be cleared of surface vegetation by a method suited to the vegetation type present.

2.5. Prior to commencement of work, the grass will be close mown or grazed down to a low level (< 100mm).

2.6. Hedgerows will be translocated or protected where necessary and as outlined in the following documents for the extension to Linhay Hill Quarry Extension as approved by the Mineral Planning Authority:

- Arboricultural Method Statement.
- Landscape and Ecological Mitigation and Enhancement Scheme.
- Operational Land Management Strategy.

General Site Soil Handling

2.7. The stripping and movement of topsoil and subsoil shall only be carried out when the full depth of soil to be stripped is in a suitably dry soil moisture condition, by using low ground pressure equipment and when weather conditions are dry in order to minimise structural damage and avoid soil physical degradation during the soil handling operations.

2.8. The soil suitability for stripping will be determined visually on excavation or via a soil wetness test which can be used on soils with more than 10% clay and less than 70% sand. If a 3cm ribbon of soil cannot be formed by rolling it out by hand or if the ribbon cracks, then the soil is not sufficiently dry to strip. The aim will be to not move soil if it fails that test or a moisture meter indicates the soil is too wet, or if it is raining or has just been raining, or there is standing water on the soil surface, or if heavy rain is forecast, or between October and March when its generally wetter.

Soil Stripping

2.9. Before any part of the site is excavated or traversed by heavy machinery (except for the purpose of stripping that part or stockpiling of topsoil on that part) or is used for the stationing of plant or machinery, stockpiling of subsoil or crossed by a haul road, the available topsoil shall be stripped from that part and stored for restoration purposes, with the excess beneficially disposed of off-site.

2.10. The aim is for the soil to be ‘dry’ when stripping is carried out i.e. avoiding conditions when the soils are wet / plastic during handling, so not after or during heavy rain. If the soil has to be stripped when those conditions persist which are not as ideal, then the soil may need to be stored in temporary windrows to dry out prior to placement in the designated longer term storage areas.

2.11. Soil stripping will be carried out following the guidance within the Institute of Quarrying’s Good Practice Guide for Handling Soils in Mineral Workings (2021), and in particular in particular the Part Two Sheet A – Soil Stripping with Excavators and Dump Trucks – Sequential Bed/Strip Practice, and Part Two Sheet B Building Storage Mounds with Excavators and Dump Trucks, and copies of those sheets are provided in Appendix A.

2.12. Generally a loose tip method, using dump trucks and hydraulic excavators, will be used to strip, transport and stockpile the soil. The loose-tipping method involves the use of a tracked hydraulic excavator, fitted with a flat edged grading bucket to strip the soil and load it into a dump truck. Alternatively, a tracked dozer may be used to strip the soils. The dump truck, running along a pre-designated route, then transports the soil to the designated stockpile location.

2.13. This operation will be monitored by the machine operator to ensure that the soil is recovered without the inclusion of other soils or other unacceptable material such as large stones (>100mm) or non-topsoil/subsoil materials.

Depth of Soil Strip and Stockpiling

2.14. The depth of strip and stockpiling is planned as follows:

- Expected nominal strip: 300mm ± 75mm.
- Topsoil stockpile heights: maximum 3m.
- Subsoil stockpile heights: maximum 5m.

2.15. The aim will be for the majority of the soils strip to be recovered without the inclusion of significant quantities of stoney material underlying the topsoil/subsoil i.e. overburden.

2.16. Based on the colour differences between the topsoil and subsoil and underling strata the soil strip will be reviewed by the machine operator/banksman or suitably qualified person on a continuous basis to ensure that the soil recovery is efficient without excess stones (target for topsoil is < 10% >20 mm).

Soil Stockpiling

2.17. Topsoil and subsoil shall be stored separately. There shall be no contamination of the two types of soil and they shall be separated by a suitable distance or barrier.

2.18. No soil storage store shall be constructed within 4 metres of a boundary hedge or within the root protection zone of trees. Soil stores shall be constructed with only the minimum amount of compaction necessary in order to ensure stability.

2.19. Topsoil or subsoils storage mounds will not exceed 3 metres and 5 metres in height respectively as measured from its base. Stores of topsoil and subsoil shall not be traversed by heavy vehicles or machinery except during construction or removal of these mounds.

Soil Re-spreading

2.20. When re-spreading the following approach will be applied:

- Soil re-spreading will ideally be carried out during the summer months and/or when the soils are suitably dry.
- During the handling of topsoil, stones larger than 100mm in size or other material capable of preventing or impeding land drainage operations shall be removed from the material and re-used where suitable elsewhere or shall be buried on site not less than 1.5 metres below the finished topsoil level.
- The surface on which the soil is to be spread will be inspected to ensure unacceptable material is not present and that the surface is in a state fit to receive the soil.
- The subgrade/subsoil surface will be graded in accordance with the design and landscape requirements to smooth flowing contours to achieve the desired formation levels and falls and the specified finished levels.
- The subgrade surface may require loosening at an angle to the line of drainage where possible, extended into the undisturbed soil on either side of the working area to provide a ‘key’ for the soil.
- Soils will generally be replaced with minimum vehicular movements to avoid re-compacting the loosened surface. Spreading will start at the furthest point from the exit to ensure that soils once deposited are not run on by earth moving machinery.
- Following the satisfactory replacement and treatment of the subsoil and overburden, topsoil shall be respread evenly to a minimum depth of 300mm. The topsoil shall then be prepared ready for landscaping.
- Where the topsoil is placed over non ‘rootable’ subgrade/subsoil, additional subsoil may need to be placed to an adequate depth to support the landscape scheme as indicated in the landscape designer’s drawings.

2.21. If topsoil has to be stored for more than 2 years then it may need to be sampled and tested as per BS 3882:2015 Specification for topsoil, Clause 5 and the parameters in Clause 4 for comparison to the baseline data pre stockpiling and to confirm the aftercare treatment approach.

Soil Aftercare

2.22. As soon as practicable following the construction of a topsoil or subsoil store or a temporary screening bund, they shall be grass seeded using a low maintenance grass seed mix. The grass sward established shall be managed throughout the period of soil storage or the life of the temporary screening bund.

2.23. The topsoil mounds and disturbed and restored areas shall be maintained and kept free of noxious weeds.

3. Haulage Routes

3.1. The haulage routes have been determined taking into account as much as possible the location of existing gateways, minimisation of distances, surface water runoff flow routes, reusing routes in subsequent stages, and position in relation to noise sensitive receptors.

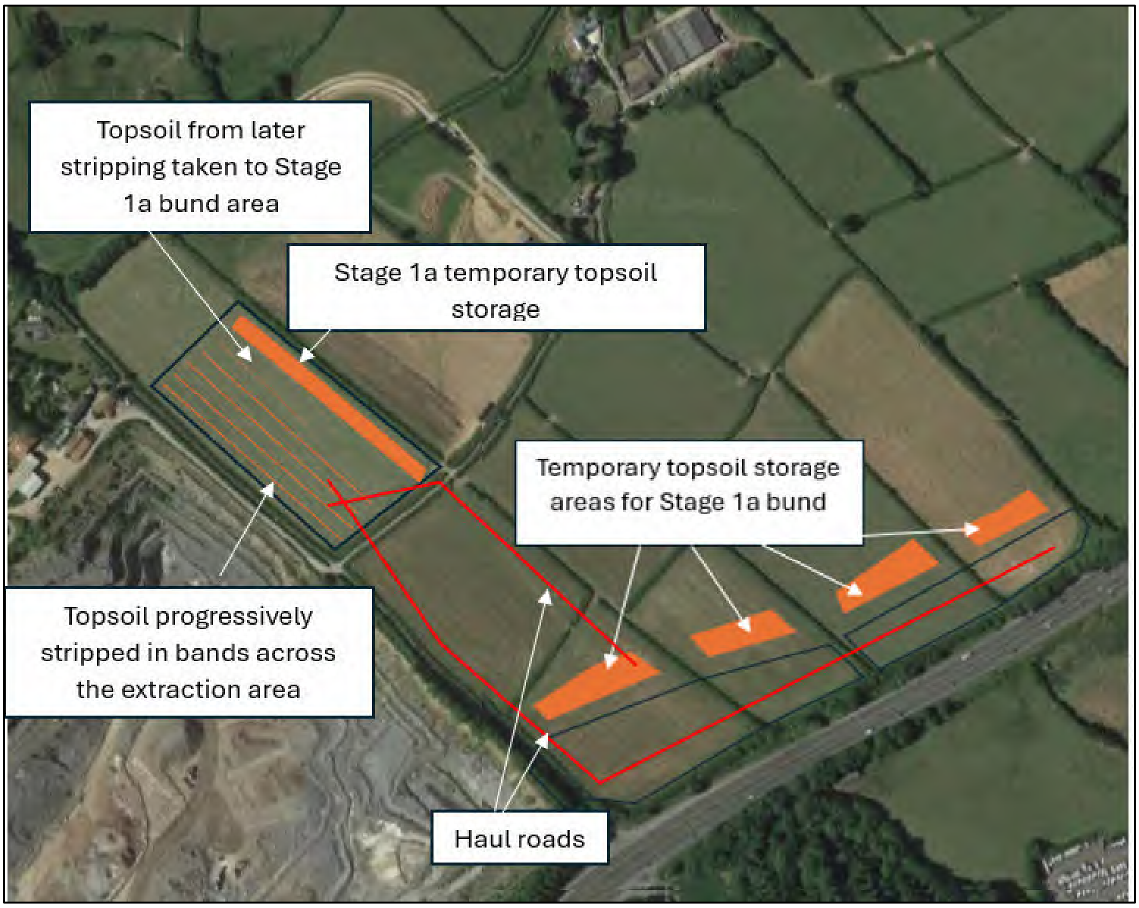
3.2. The routes of the haul roads for the transportation of overburden from the Stage 1a and Stage 1b extraction areas to the respective bund areas are as shown in Figures 3-1 and 3-2, and on the drawings in Appendices C and D.

Stage 1a

3.3. Stripping of topsoil will be undertaken progressively across the extraction area in strips parallel to the line of the southwest boundary. An initial temporary topsoil storage mound will be formed parallel to the northeast boundary.

3.4. Meanwhile the stripping of topsoil from the Stage 1a bund area will commence, starting at the northernmost end, with the topsoil being stored in four storage mounds, one in each field across which the Stage 1a bund is to be built. Topsoil will also be stripped from the haul road routes across the Stage 1b extraction area and stored in the westernmost field of the Stage 1a bund area. See Figure 3-1 below.

Figure 3-1 - Stage 1a Topsoil storage areas and haul roads



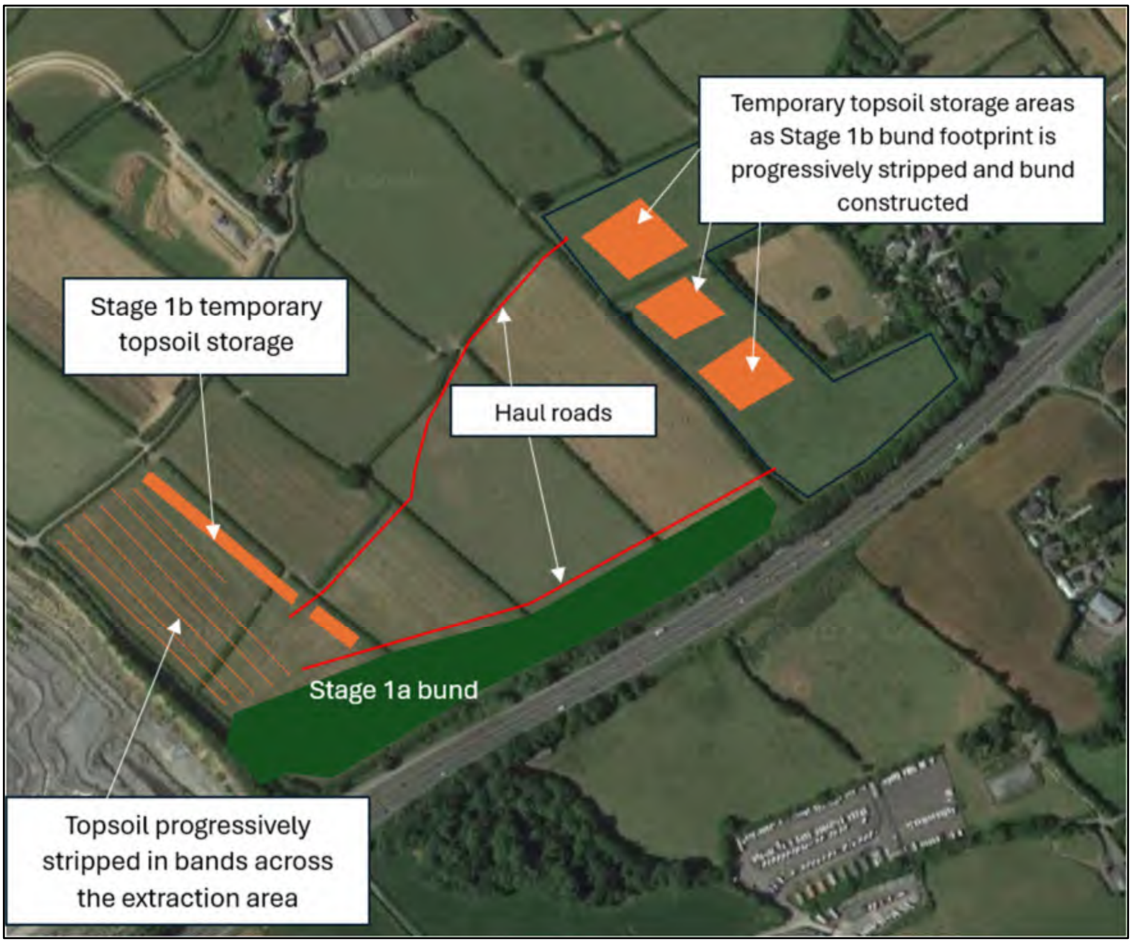
3.5. Overburden stripping from the Stage 1a extraction area will commence once topsoil from half the area has been stripped. Overburden will be transported to the Stage 1a bund area along the haul roads. Construction of the Stage 1a bund will commence with the Stage 1a east bund starting at the easternmost end and progressing westwards. The overburden will be placed in layers, each about 0.3-0.45m in height, and each layer will be rolled and compacted before placement of subsequent layers.

3.6. Coverage of the Stage 1a bund with topsoil will follow the sequential completion of each section of the bund utilising the topsoil from the respective bund area augmented as required by topsoil from the extraction area, preferably taken direct as it is stripped from the northern part to reduce double handling. Surplus topsoil from the temporary topsoil storage mound along the northern side of the extraction area will be sold off site. This will allow the remainder of the Stage 1a extraction area to be stripped of topsoil and then overburden.

Stage 1b

3.7. Stripping of topsoil will be undertaken progressively across the extraction area in strips parallel to the line of the southwest boundary. An initial temporary topsoil storage mound will be formed parallel to the northeast boundary. Meanwhile the stripping of topsoil from the Stage 1b bund area will commence with the topsoil being temporarily stored in storage mounds elsewhere within the footprint of the Stage 1b bund. Topsoil will also be stripped from the haul road routes across the intervening fields between the extraction and bund areas southernmost topsoil storage area in the Stage 1b bund area. See Figure 3-2 below.

Figure 3-1 - Stage 1b Topsoil storage areas and haul roads



3.8. Overburden stripping from the Stage 1b extraction area will commence once topsoil from half the area has been stripped. Overburden will be transported to the Stage 1b bund area along the haul roads. Construction of the Stage 1b bund will start at the southeasternmost end, and progress northwards within the larger field, and then progressing from east to west in the smaller field.

3.9. As with the Stage 1a bund the overburden will be placed in layers, each about 0.3-0.45m in height, and each layer will be rolled and compacted before placement of subsequent layers.

3.10. Coverage of the Stage 1b bund with topsoil will follow the sequential completion of each section of the bund utilising the topsoil from that section of the bund footprint augmented as required by topsoil from the extraction area, preferably taken direct as it is stripped from the northern part to reduce double handling. Surplus topsoil from the temporary topsoil storage mound along the northern side of the extraction area will be sold off site. This will allow the remainder of the Stage 1b extraction area to be stripped of topsoil and then overburden.

4. Drainage

Drainage Strategy

4.1. The drainage strategy for the landscape bunds is mostly as per the Proposed Extension of Linhay Hill Quarry Flood Risk Assessment, May 2016. That study details the catchment areas affected and changes in surface water runoff, and shows that the quarry extension will reduce the effective catchment of the Alston Farm fields and hence there is no requirement to attenuate surface water runoff and existing drainage flow routes will be maintained. However the construction works will cause bare soil surfaces to be created resulting in suspended solids in surface water runoff compared to that from the existing farm grassland, therefore surface water management is required to mitigate suspended solids in the runoff. That will be achieved by a combination of silt fencing and temporary settlement areas.

4.2. The fields where the landscape bunds are to be formed currently drain via infiltration or overland flow to lower elevation ground along the south east boundary of the Alston Farm fields C, F, J, L and P where the water finds its way to join the route of an un-named seasonal existing ordinary watercourse which is referred to herein as the Alston stream. The Alston stream flows along the east side of Field J and into a pipe near the south east corner of the field which discharges into a wide vegetated ditch parallel to the A38. Surface water runoff from fields C, F and J also flows directly into that ditch and the Alston stream passes under the A38 via a 300mm diameter pipe south east of Fields C and F.

4.3. Perimeter drainage will be formed to convey surface water runoff from the landscape bunds and natural catchment areas, with drainage on the inward and outward facing perimeter of the bunds, the inside area being Alston Farm or the quarry extension area where the surface water runoff catchment will change as the quarry extends. As surface water on the inward facing perimeter of the bunds can flood safely within Alston Farm or be managed via the quarry as it extends, a 1 in 30 year storm event return period has been used for the design of that drainage. A higher 1 in 100 year storm event return period plus 40% allowance for climate change has been used for the external perimeter drainage.

4.4. The external perimeter drainage will also be formed with a low permeability liner underneath to reduce the likelihood of localised point infiltration which can be a source of land instability risk due to the underlying buried karst limestone. If localised ponding occurred due to an exceedance event it would be contained within the site or outfall area because the boundary is mostly formed by hedgebanks or other manmade features.

4.5. Following formation of the external perimeter drainage to the landscape bunds that drainage will be protected by silt fencing to intercept the surface water runoff from the external slopes of the landscape bunds. Once those slopes are 3-5m high it is envisaged they will be topsoiled and seeded with the aim that the vegetation growth will help filter runoff from subsequent filling to form the external bund slopes at higher elevation.

4.6. Surface water runoff within the landscape bund filling area will be contained by the permanent bund formation and the use of temporary bunds to form temporary settlement areas, with silt fencing used where necessary to aid filtration of the surface water runoff prior to its discharge to the perimeter drainage. The temporary settlement areas will be moved as the working area of landscape bund construction moves.

4.7. The existing pipe for the Alston stream at the south east corner of Field J will be extended under the Stage 1A east bund to keep that seasonal stream flow separate from the surface water runoff from the landscape bund areas. It is envisaged the pipe size will remain as existing because an exceedance event would cause flooding upstream of the landscape bunds within Alston Farm rather than downstream closer to the A38. Once the Stage 1a landscape bund is restored and the surface water runoff and ditches effectively naturalised, then the Alston stream flow route can be altered to utilise the perimeter drainage around the Stage 1a east landscape bund. A small diversion upstream is required for formation of the Stage 2 landscape bunds, and for Stage 4 of the quarry extension the stream will need diversion to an alignment east of the Stage 4 quarry extension.

4.8. There will be a single point of discharge from the landscape bund's perimeter drainage to the wide vegetated ditch parallel to the A38, into which the Alston stream flows approximately 220m upstream of the perimeter drainage discharge point. A lining such as a pipe or concrete with cobbles embedded as riprap for erosion prevention and energy dissipation may be placed within that discharge channel dependent on the ground conditions encountered.

4.9. Infiltration occurs within the wide vegetated ditch parallel to the A38, however onward conveyance for water is via a 300mm diameter pipe which passes under the A38 approximately 150m north east of Alston Cross, and which discharges to an existing flow path through Mead Cross Unconfirmed Wildlife Site. The inlet to the 300mm diameter pipe is on National Highways land. Due to the wooded area along that ditch natural vegetation debris gathers at the grill to the inlet of the 300mm diameter pipe, which hinders inflow and hence requires occasional clearance which is carried out by the Alston Farm tenant or National Highways.

4.10. The surface water drainage will be constructed and maintained by E&JW Glendinning Ltd.

Final Drainage Scheme

4.11. For the landscape bunds restored situation i.e. with full vegetation cover, when surface water runoff will be effectively naturalised, perimeter drainage channels will convey the surface water runoff around the landscape bunds to join the flow route of the Alston stream.

4.12. Calculations for the drainage ditches and pipes are provided in Appendix B, with the layout of the landscape bunds to be formed from overburden and localised cut and fill required to from the drainage routes shown on the plans in Appendix C for Stage 1, i.e. drawings:

- LHQALS-ATK-S1-DR-C-2001 to 2004 ALSTON FARM STAGE 1 OVERBURDEN BUNDS PLAN 1 OF 4 to PLAN 4 OF 4.

4.13. Details of the final surface water drainage scheme for the Stage 1 and Stage 2 landscape bunds are shown on the drawings in Appendix D, i.e. drawings:

- LHQALS-ATK-S1-DR-C-1511 to 1516 STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 1 OF 6 to SHEET 6 OF 6.

4.14. The drawings show the drainage around the Stage 1 and Stage 2 bunds which will convey surface water runoff around the perimeter of the bunds to the existing outfall from the Alston Farm fields. The Alston stream flows seasonally to that outflow and its flow will be kept separate from the surface water runoff from the Stage 1 landscape bunds until they are fully restored with vegetation cover and the surface water runoff is effectively naturalised.

4.15. For Stage 2 the perimeter drainage around the Stage 1b landscape bund will be extended north on the west and east sides to intercept the surface water runoff from the Stage 2 landscape bund.

4.16. A small diversion of the Alston stream is required for formation of the Stage 2 landscape bund. The drawings also show the envisaged Stage 4 diversion of the Alston stream to an alignment east of the Stage 4 quarry extension. That diversion is shown to the east of an existing hedgebank which will remain, but alternatively could run along the west side, and if an exceedance event occurred from Stage 2 onwards there could be localised ponding along the stream managed within Alston Farm or some excess may be controlled to flow to the extended quarry.

4.17. During Stage 2 and subject to the findings of hydrogeological reviews on the effects of the extended quarry dewatering, a balancing pond could be installed south east of the Stage 2 landscape bund, south of Field S and north of Caton, and subject to a planning application. The aim of the balancing pond is as a receptor to receive pumped water from dewatering of the extended quarry to maintain groundwater levels and thereby mitigate potential effects due to dewatering of the extended quarry. However if installation of the balancing pond proceeded, then it should also be possible for surface water runoff from the east of the Stage 2 landscape bund to be diverted to the balancing pond to assist maintaining groundwater levels.

Drainage During Construction Phase

4.18. The drainage on the external outward facing perimeter of the bunds will be formed as a first task either prior to or in combination with the topsoil strip for the landscape bunds.

4.19. The drainage on the internal inward facing (i.e. to Alston Farm) perimeter of the bunds will be formed when required and dependent on internal haul route access within the bund area for filling and the progress of bund formation. Surface water run off from the Alston Farm fields will be intercepted by the internal perimeter drainage around the landscape bunds. Wherever possible the Alston Farm fields will be utilised with grass cover to intercept and filter surface water runoff from construction areas such as haul routes or topsoil storage, with overland flow to the internal perimeter drainage rather than installation of additional drainage ditches within the farm fields.

4.20. New ditches will be grass seeded as soon as possible after formation and when conditions are suitable for good germination.

4.21. Following formation of the external perimeter drainage to the landscape bunds that drainage will be protected by installation of silt fencing to intercept the surface water runoff from the external slopes of the landscape bunds.

4.22. Once those slopes are 3-5m high it is envisaged they will be topsoiled and grassed seeded with the aim that the vegetation growth will prevent erosion from the slopes and filter surface water runoff from subsequent filling to form the external bund slopes at higher elevation.

4.23. Surface water runoff within the landscape bund filling area will be contained by the permanent bund formation and the temporary bunds will also be used to form temporary settlement areas, with silt fencing also used where necessary to mitigate suspended solids in the surface water runoff prior to its discharge to the perimeter drainage. The temporary settlement areas will be moved as the working area of landscape bund construction moves.

4.24. The existing pipe for the Alston stream at the south east corner of Field J will be extended under the Stage 1a east bund to keep that seasonal stream flow separate from the surface water runoff from the landscape bund areas. A small diversion upstream is required for formation of the Stage 2 landscape bunds, and for Stage 4 of the quarry extension the stream will need diversion to an alignment east of the Stage 4 quarry extension. Land drainage consent will be applied for works to an ordinary watercourse.

Pollution, Water Quality and Emergency Control Measures

4.25. Surface water run-off during construction will be captured by the proposed perimeter drainage or its new components, and the main concern is the potential for suspended solids within surface water runoff from areas of overburden filling.

4.26. To mitigate that risk, suspended solids in surface water runoff will be managed by a combination of temporary settlement areas combined with silt fences.

4.27. For each period of filling the external bund area can be formed as the first task immediately downstream of the main operational area to be filled, to temporarily retain surface water runoff to enable some settlement of suspended solids. Silt fences will be installed between the bunds or operational area to be filled and the perimeter drainage.

4.28. It is envisaged that management approach will need to continue until each filled area draining to the perimeter drainage is reinstated with some vegetation cover and the surface water runoff is effectively natural.

4.29. Indicative temporary settlement areas are shown on the Drainage Plans in Appendix D and the effectiveness of suspended solids settlement compared to and in addition to silt fences will be assessed during filling in Year 1, with the approach adjusted if found necessary.

4.30. Construction plant and machinery will be maintained in a good condition to reduce the risk of leaks. If an incident occurred to plant operating in a construction works area causing a localised fuel or hydraulic oil leak, pollution mitigation would be by implementing the site's emergency response plan, such as the use of spill kits and subsequent appropriate disposal of the affected material.

4.31. There is not expected to be hazardous liquid storage within the planned quarry extension construction working areas. Should a spill or leak occur from operating plant, the response will include stopping the discharge or spill at source if possible (for example turn off or stem the fluid source) and to contain the spill to stop the substance entering the site drainage or contaminating the ground. The potential for ground contamination from a spill will be limited by the use of suitable materials such as sand bags, absorbent granules or pads, drip trays etc. Disposal of used spill kits or contaminated materials will be treated as hazardous waste and disposed of in the appropriate way. Each incident will be reported.

4.32. If an environmental incident occurs such as pollution to land or water, it will be recorded via the main contractor's incident reporting procedures (see the Construction Environmental Management Plan Section 8) and actioned promptly to mitigate the incident.

Construction Quality Assurance and Control

4.33. The main contractor will be responsible for implementing and where appropriate monitoring environmental mitigation measures during the construction works.

4.34. Monitoring of the drainage construction works will be by spot checks of the forecast weather and visual checks of the actual weather conditions and of potential sources of suspended solid loading to the surface water runoff from construction working areas if rainfall occurs during the works, with the following table detailing the construction quality assurance and control regime to be applied.

Table 4-1 - Surface Water Drainage Construction Quality Assurance

Task	Required Action	Frequency
Inspections	Pre-filling inspection to check drainage channels and silt fences, and other measures such as temporary bunds required to prevent uncontrolled surface water runoff discharge off-site.	Pre-overburden placement.
	Inspect surface water channels and connections for erosion, vegetation, or blockages.	Monthly for 12 months after each period of construction then as required.
	Inspect silt accumulation rates in temporary settlement areas and at silt fences and de-silt as necessary.	Weekly during construction.
	Visual check of turbidity of surface water discharge from temporary settlement areas and from silt fences.	Spot checks during rainfall storm events.
	Inspect outflow channel from perimeter drainage.	Monthly for 12 months after construction then annually and following heavy rainstorms of >1 in 2 year (e.g. more than 21, 34, 43, or 52mm in 2, 6, 12, or 24 hours respectively).
	Visual check for potential slope failure of the bunds which may affect drainage.	As above.
	Inspection to ensure that construction silt has been removed, construction is in accordance with the design and no visible defects.	Final inspection on cessation of filling each year.
Maintenance	Clean surface water channels or pipes.	As required following inspection.
	Inspect silt accumulation rates in temporary settlement areas and silt fences and establish suitable silt removal frequencies.	Monthly for 12 months after each period of construction then as required. Thereafter annually or as per the established suitable silt removal frequency.
	Grass cutting, weed and invasive plant control.	As required following inspection.
	Review maintenance schedule.	At end of 12 months after each construction period, and after five years.
Site Measurements	Check pipe sizes and invert levels accord with drainage design drawings (construction issue).	At setting out.
	Check invert levels of drainage channels accord with the drainage design drawings (construction issue).	At setting out.
	As built survey.	At end of construction.

Monitoring	Of surface water discharge quality from the site, if and as specified within water discharge activity permit (to be applied for with mining waste permit).	As specified within water discharge activity permit (to be applied for with mining waste permit).

Post Construction

4.35. At the end of 12 months after the final period of construction works, the inspection and maintenance tasks and frequency herein will be reviewed, updated and implemented.

5. Construction Programme

5.1. Overburden stripping and bund formation will be undertaken in campaigns of approximately four months duration. Commencement of the construction process will be determined by ground conditions and will not start until the ground is suitably dried out after the winter. In the event that ground conditions restrict the construction period, a further campaign may be undertaken in the following year.

5.2. The working hours for overburden stripping and bund construction shall be as follows:

Days	Hours
Mondays to Fridays	0800 to 1800
Saturdays	0800 to 1300
Sundays, Bank or Public Holidays	No working

5.3. The timetable for construction for the Stage 1a bund is as follows:

Month 1. Week 1. Topsoil stripping.

Weeks 2 to 4. Overburden stripping and bund construction.

Month 2 to 3. Continuation of overburden stripping and bund construction. Topsoil coverage of completed sections of the bund to follow progressively.

Month 4. Week 1. Continuation of overburden stripping and bund construction. Topsoil coverage of completed sections of the bund to follow progressively.

Weeks 2 and 3. Completion of topsoil coverage of bund and removal of surplus topsoil from temporary storage area within extraction area.

5.4. The timetable for construction for the Stage 1b bund is as follows:

Month 1. Week 1. Topsoil stripping.

Weeks 2 to 4. Overburden stripping and bund construction.

Month 2 to 3. Continuation of overburden stripping and bund construction. Topsoil coverage of completed sections of the bund to follow progressively.

Month 4. Weeks 1 and 2. Continuation of overburden stripping and bund construction. Topsoil coverage of completed sections of the bund to follow progressively.

Weeks 3 and 4. Completion of topsoil coverage of bund and removal of surplus topsoil from temporary storage area within extraction area.

6. Monitoring of Noise and Dust

6.1. The proposals for the monitoring of noise during construction of the bunds are set out in Chapter 9 of the Noise and Vibration Impact Review submitted in February 2024 to discharge condition 35 of the planning permission for the extension of Linhay Hill Quarry. In particular Paragraph 9.1 describes the noise monitoring locations, equipment, methodology and schedule.

6.2. The proposals for the monitoring of dust during construction of the bunds are set out in Operational Dust Management Plan which forms an appendix of the Construction Environmental Management Plan submitted to discharge condition 23 of the planning permission for the extension of Linhay Hill Quarry, and also discharge condition 36 of the planning permission for the extension of Linhay Hill Quarry.

6.3. The results of both noise and dust monitoring will be recorded, and copies of the records made available to the DNPA on request.

APPENDICES

Appendix A. Institute of Quarry – Good Practice Guide for Handling Soils in Mineral Workings

A.1. Part Two: Methodology – Sheet A – Soil Stripping with Excavators and Dump Trucks

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Methodology

- Sheet A -

Soil Stripping with Excavators and Dump Trucks
– Sequential Bed/Strip Practice

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- Blakemere Consultants Ltd & Celtic Energy Ltd

Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet A of the updated guidance is to provide a model method of best practice where excavators and dump trucks are to be used to strip soil using the sequential 'bed'/strip by strip practice.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types.

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974, and in the case of mineral extraction operations, The Quarries Regulations 1999 and its relevant statutory provisions; in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer's specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

In this soil handling option, back-acting excavators are used to lift the soil resources and load them into dump trucks for the direct transport to the area being restored or to storage until needed.

The stripping practice involves the sequential separation and removal of the individual layers of soil identified in the Soil Resource & Management Plan (SRMP). It takes the form of advancing vertical slices through the soil profile as successive strips across the soil being removed. Hence the practice is often referred to as the 'Strip' or 'Bed' method.

The upper layer (topsoil) in the strip being removed is lifted first within the safe and efficient operational reach of the excavator boom (which defines the width of each strip). For each subsequent soil layer, if it is to be recovered, the process is repeated until the basal layer (usually overburden or the economic mineral layer) is reached. When the soil resource/ profile sequence within the strip is completely removed, the process is repeated on the abutting area to be stripped of soil. The method can also be adopted where only a single soil horizon is to be recovered.

Normally the excavator operates only from on the soil surface with the dump trucks travelling on the exposed lower non-soil layer. This the preferred operating mode of the excavator as there is a better recovery of the particular soil layer on handling. In some circumstances, such as where, i) the topsoil/ surface layer has a particularly low baring capacity and is prone to compaction (such as peat or organic soils), ii) a thin soil layer lies directly on the mineral layer, or iii) access is limited from the bottom of steep gradients, the excavator will need to operate from the exposed 'basal' mineral/overburden layer or a raised access strip.

Similarly, the normal operation of the dump trucks is on the exposed non-soil basal/overburden layer. In cases where the soil horizon has i) a particularly low baring capacity or ii) where there needs to be enhanced protection of potential archaeological features, the dump trucks may have to operate upon the topsoil which may have to be surcharged.

Advantages & Disadvantages

The advantages of this machinery combination and handling practice are:

i) When the excavator operates only from on the soil surface, compaction is largely confined to the top-soil (which is ultimately more easily treated) and potentially reducing the risk of severe compaction of the subsurface soil layers where the soil is to be directly placed without storage

ii) It is easier to see and react to localised changes in soil types and variation in horizon depth

iii) It is suited to the stripping of thin and 'patterned' soil layers

iv) It offers the most flexibility in respect of short soil drying periods and likely wet weather as it is less susceptible to stoppages due to soil rewetting as a transpiring vegetation cover can be retained later into the stripping programme. It is particularly suited to northerly and western, and upland locations, and particularly when there are uncertain weather patterns.

The disadvantages are:

i) It requires skill and discipline in its deployment, and a high level of supervision, being suited to experienced operators

ii) Without care the bed system may result in a greater mixing of soil horizons

iii) Steep gradient/complex topographies may limit the safe and practical deployment of this machinery combination and handling practice.

Suitability

The excavator-dump truck combination with the bed/ strip handling practice methodology is considered as 'best practice' by Natural England and the Welsh Government for agricultural soils and preferred for all soils. In particular, it is the most suitable of any of the methods available where:

i) The soil is prone to compaction and where decompaction treatments cannot be relied upon to be effective (this incudes peat)

ii) The intended after use, environmental and ecosystem services are dependent on maintaining (as far as it is possible) the soil functional characteristics such as, porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This includes productive agricultural, horticultural and forestry land, but also some natural habitats, and where water storage/infiltration is of importance for risk of flooding. Where the soils are stored prior to replacement some remedial treatment may have to be relied upon.

ii) The bed/strip soil handling method is not suitable where an archaeological surface needs to be investigated as a whole. Subject to approval by the planning authority the method can be used with care where there is a 'watching brief' by an archaeologist, but may have to be abandoned for another approach where important artefacts are detected. However, trafficking may be restricted to the topsoil surface until the subsoil has been approved for removal and taken away.

iii) The placement of the stripped soils into stockpiles is likely to result in compression and compaction and may negate this particular benefit of the handling practice.

iv) As the benefit of the practice lies in the direct placement of the stripped soil it calls for the mineral extraction scheme to be organized to minimize the need for soils storage.

MODEL METHODOLOGY

A.1 Key operational points to minimise the risk of severe soil compaction and wet soil conditions are summarised in Boxes A.1 and A.2.

A.2 The timing of soil handling operations should only take place when the soils are in a 'dry and friable' condition (ie when it breaks and shatters when disturbed rather than smears and deforms) (see **Part One, Supplementary Note 4**). Prior to the start or recommencement of soil handling, they should be tested to confirm they are in suitably dry condition (see Box A.3).

Box A.1 - to minimise compaction:

- The dump trucks should normally only operate on the 'basal'/non-soil layer, and their wheels must not run on to the soil layer/s
- The excavator should normally operate on the topsoil layer
- The adoption of a bed/strip system avoids the need for the trucks to travel on the soil layers
- The machines are to only work when ground conditions enable their efficient operation
- Soils are to be in a 'dry' condition.

Box A.2 - to minimise soil wetness and re-wetting:

- The bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents The soil profile within the active strip should be stripped to the basal layer before rainfall occurs and before stripping is suspended
- Measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks
- The area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance
- The maintenance of a transpiting crop is important, and an appropriate cropping regime should be established for the year of soil stripping
- Before stripping, excess vegetation should be removed; in the case of grassland it should be cut or grazed short and arable crops should have been harvested.

A.3 Soil handling is not to take place during rain, sleet or snow and in these conditions should be prohibited due to unsafe machine operating conditions. Prior to commencing operations, a medium/long term weather forecast should be obtained which gives reasonable confidence of soil handling being completed without significant

Box A.3 - Test for Dry and Friable Soils

Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations on the soil handling area and at each soil horizon to the full depth of the profile to be recovered/replaced. The tests shall include visual examination of the soil and physical assessment of soil consistency.

i) Examination

- If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place**
- If the sample is moist (i.e. there is a slight dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place**
- If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place**

ii) Consistency

First Test

Attempt to mould soil sample into a ball by hand:

- Impossible because soil is too dry and hard or too loose and dry means soil handling can take place
- Impossible because the soil is too loose and wet means no soil handling to take place
- Possible - GO TO SECOND TEST

Second Test

Attempt to roll ball into a 3mm diameter thread by hand:

- Impossibe because soil crumbles or collapses means **soil handling can take place**
- Possible means **no soil handling to take place**

NB: It is impossible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

Box A.4 - Rainfall Criteria:

- In light drizzle soil handling many continue for up to four hours unless the soils are already at/near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that ground conditions are safe to do so.

interruptions from rainfall events. The soil based criteria set out in Box A.4 are to be used to determine whether soil handling should cease or be interrupted with the occurrence of rain.

A.4 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

A.5 The operation should follow the detailed stripping plan set out in the SRMP showing soil units to be stripped, haul routes and the phasing of vehicle movements. The different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. The haul routes and soil storage areas must be defined and should be stripped first in a similar manner. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

A.6 Within each soil unit the soil layers above the base/formation layer are to be stripped in sequential strips with the topsoil layer stripped first, followed by the subsoil layers; each layer stripped to its natural thickness without incorporating material from the lower layers. The next strip is not started until the current strip is completely stripped to the basal layer. The system involves the progressive stripping of the soil in strips (**Figure A.1**).

Box A.5

In doing so, compaction by the excavator is largely restricted to the upper layer of soil, which is more easily treated after the soil has been relaid. The degree of topsoil compaction will depend on the machine's ground pressure, its mode of operation and soil wetness. Smaller wide tracked excavators may cause less compaction.

Box A.6

For hard/stony soils toothed buckets are needed. Where the mixing of soil layers at their interface is to be minimized, a bucket with a 'blade' is preferable where the soil is 'soft' and free of large stones or stone free. Where there is a watching archaeological brief, the use of bladed buckets will normally be required.

Similarly the choice of bucket type, whether it is a standard 'digging'/bulking or wide ditchingtype will depend on the soil strength and stoniness.

A.7 Unless specified in the SRMP, the excavator is only to work on the topsoil layer and the dump trucks are only to travel on the basal/formation layer (Box A.5).

A.8 Stripping is to be undertaken by the excavator standing on the surface of the topsoil and digging the topsoil to its maximum depth, and it loading into dump trucks. The dump trucks draw alongside the exposed soil profile, standing and travelling only on the basal layer (**Figure A.2**). The type of bucket to be used largely depends on the nature of the soil (Box A.6).

A.9 The initial strip width and axis should be demarcated. The strip width is determined by the length of the excavator boom less the stand-off to safely operate; typically, about 3-4m (Box A7). Excavators with long booms ('long reach') can be used, but may be more restricted by gradient limitations, and require skilled and experienced operators.

A.10 Topsoil should be recovered to the full width of the strip without mixing with the underlying subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The full thickness of the topsoil horizon should be stripped progressively along the strip before the underlying subsoil horizon(s), if present, is to be started (**Figure A.2**).

A.11 The (upper) subsoil in the current strip is then to be stripped and monitored in the same manner. The final 25cm of the subsoil layer should be left as a step to protect the adjacent topsoil layer from local collapses. On completion, the process is to be repeated if there is a lower subsoil, and then any other lower layer to be recovered as a soil material (**Figure A.3**).

Box A.7 - Orientation of the Excavator

Usually the excavator is orientated and operates with its tracks at 90° to the axis of the bed being stripped as this is the most stable position.

Whilst the reach of the boom and hence the width of the bed/strip can be significantly increased and the excavator traffickiing over the soil surface decreased by orientating it with the tracks parallel to the soil being stripped, this may affect the stability of the excavator, particularly on a gradient or where soils have a low bearing capacity. Hence its safe deployment needs to be checked before its adoption.

A.12 On completion of the strip, the procedures are repeated sequentially for each subsequent strip until the soil to be stripped is completely removed.

A.13 Where the soils are to be directly replaced (without storage in mounds), the initial strip of the upper horizons will have to be stored temporarily to release the lowest layer and enable the sequential movement of materials. The stored initial soil material would normally be placed on the lower layer removed from the final strip at the end of the programme or on partially completed profiles if rain interrupted the operation.

A.14 Where the stripping operation is likely to be interrupted by rain, or there is likely to be over-night rain, remove any exposed subsoil down to the basal layer before suspending operations. Make provisions to protect base of current or next strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

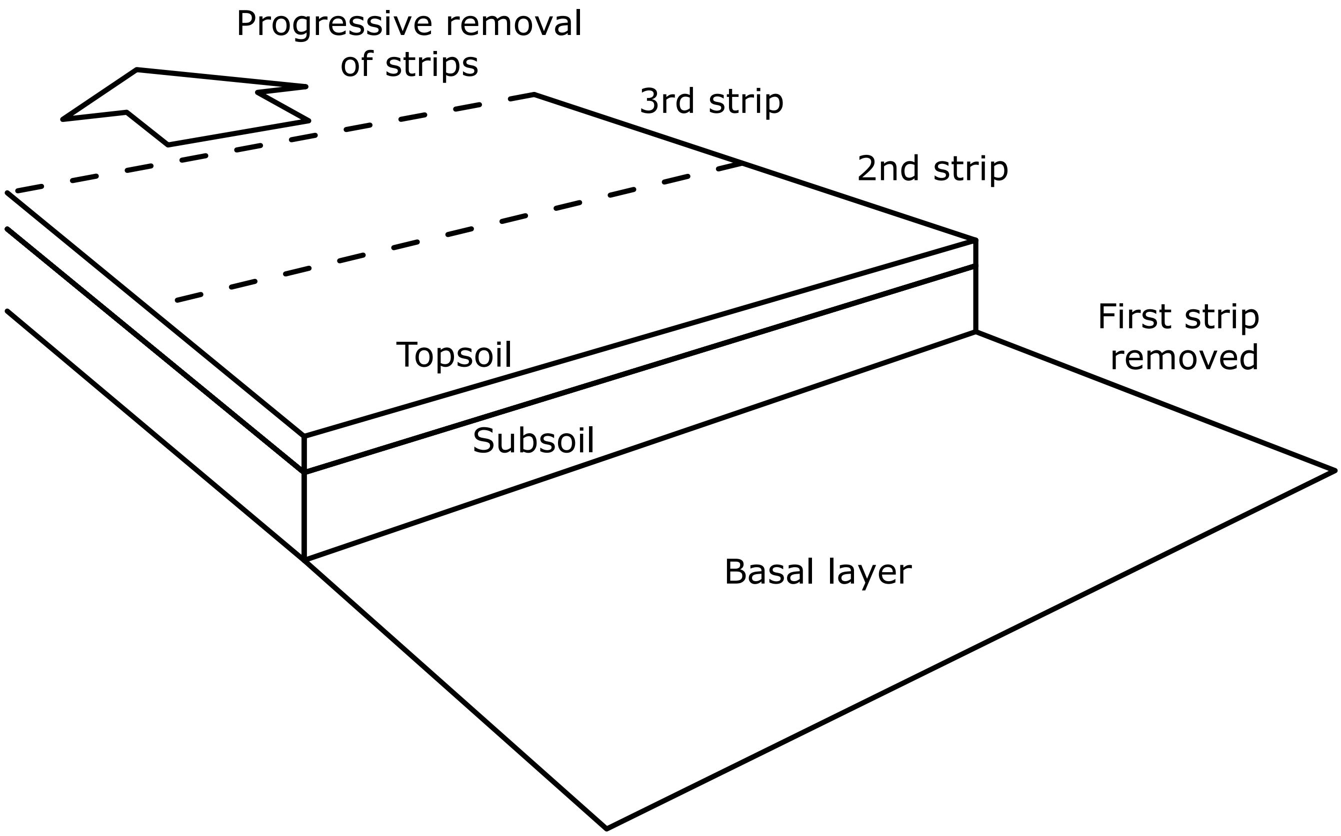

Figure A.1: Soil stripping with excavators and dump trucks: The bed system.

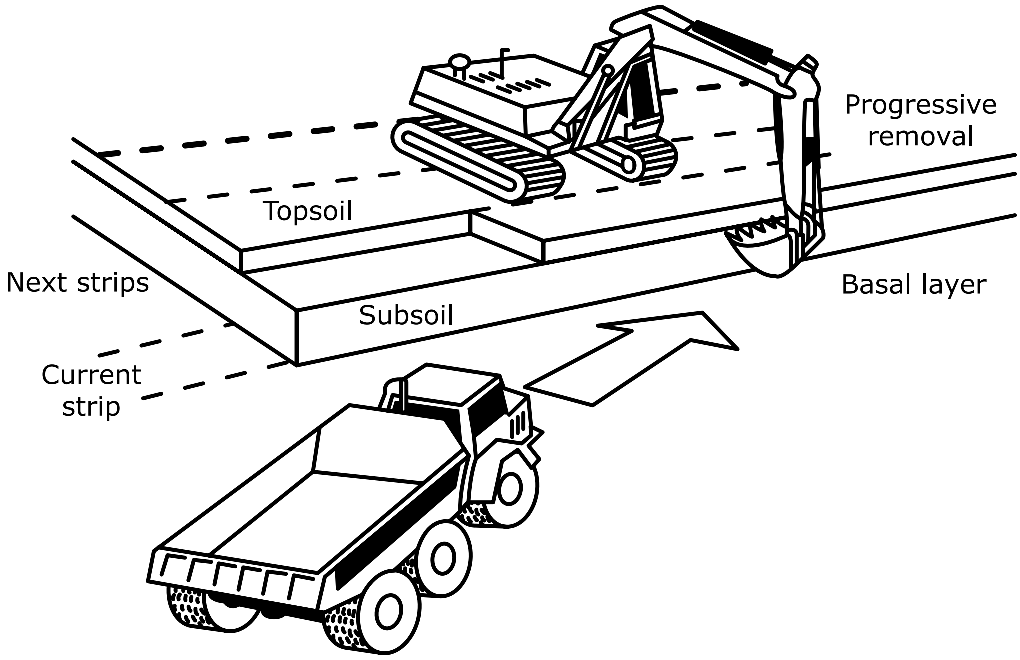

Figure A.2: Stripping with excavators and dump trucks: removal of topsoil from a strip.

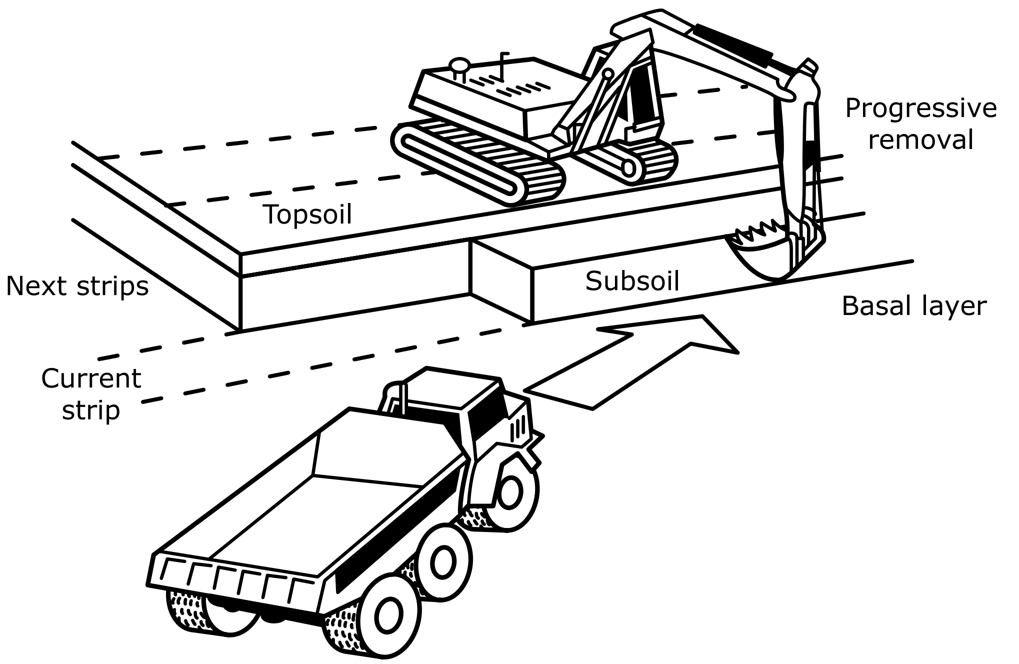

Figure A.3: Stripping with excavators and dump trucks: removal of subsoil from a strip.

A.2. Part Two: Model Methodology – Sheet B – Building Storage Mounds

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet B -

Building Soil Storage Mounds
with Excavators and Dump Trucks

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- Blakemere Consultants Ltd & Celtic Energy Ltd

Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet B of the guidance is to provide a model method of best practice where excavators and dump trucks are to be used to build soil storage mounds.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine perators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/ plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types.

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974 and in the case of mineral extraction operations, The Quarries Regulations 1999 and its relevant statutory provisions; in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer's specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

This soil handling method uses back-acting excavators to build the storage mound in combination with dump trucks to transport the soil. Either the excavator sits on the basal layer and casts the tipped soil into a mound or it sits on the tipped soil and pulls it into a mound. The latter is preferred as it is easier to form the mound. In many cases low ground pressure bulldozers are used to grade and trim the finished mound.

Top- and subsoil(s) are to be stored in separate mounds or in clearly defined parts of mounds, in some circumstances where the topsoil can be easily recovered it may be laid over the subsoil.

The space available for storage in mineral workings is often limited and this determines the ‘height’ of mounds. For topsoil the preference is for 1 to 3m height in order to minimize the impact of storage on biological processes, whereas for subsoils where the biological activity is lower, subject to safe operations, mounds are often raised to heights of 3 to 5m depending on the resilience of the soils to compaction (see Part One & Supplementary Note 3).

In this soil handling option, the mounds are either built as one ‘tier’ or ‘multi-tier’ high. In the single tier only the excavator and if used the bulldozer traffic the tipped soil surface and usually the final surface. Whilst, in the multi-tier mounds it is also trafficked by loaded dump trucks.

Advantages & Disadvantages
Storage vs Direct Placement:
The advantages of storage are:
i) It gives flexibility in the operation of the mineral site
ii) Flexibility (i.e. weather and ground conditions) for when it is reused.

The disadvantages are:
i) There is an high risk of compaction of the soil material by stacking in the mound which later cannot be effectively treated
ii) There may be significant degradation of biological functions with long-term storage.

Single vs Multi-tier Mounds:
The advantage of multi-tier mounds is that they take less space.The disadvantages are:
i) With multi-tier mounds there is high risk of severe compaction of the soil material layers by repeated trafficking by laden dump trucks in the building of multi-tier mounds which later cannot be effectively treated
ii) There may be a longer delay in recovery of the soil’s biological functions on replacement.

Suitability
Soil storage is less suitable where:
i) The subsoil(s) are significantly less resilient to compaction (such as silts and sandy clay loams) and when decompaction treatments cannot be relied upon to be effective because of a risk of soil wetness or operational limitations (such as the unavailability of effective decompaction tools) (see **Part One and Supplementary Notes 3 & 4**)
ii) The intended after use, environmental and ecosystem services are dependent on maintaining functional characteristics such as soil porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This usually includes the most productive agricultural, horticultural and forestry land, many types of natural habitats, and where water storage/infiltration is of importance for the risk of flooding
iii) The bed/strip practice using excavators is used (Sheet A) as the compaction caused can negate its benefit
iv) Multi-tier mounds are used, particularly where the intended after use, and the environment and ecosystem services are dependent on maintaining functional characteristics such as soil porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This usually includes the most productive agricultural and forestry land, many types of natural habitats, and where water storage/infiltration is of importance for the risk of flooding.

MODEL METHODOLOGY

B.1 Key operational points to minimize the risk of severe soil compaction and soil wetness are summarised in Boxes B.1 and B.2.

Box B.1 - To minimize compaction:

- strip in advance the soil to basal layer along haul routes and the operational footprint of the storage mound
- dump trucks are only to stand and travel on the basal layer (unless raising the next level in multi-tier mounds)
- the machines are to only work when ground or soil surface conditions enable their efficient operation
- single-tier mounds should be prioritised over multi-tier mounds as it avoids the need for trafficking on the soil being stored
- raise the soil using only the excavator and maximise the mound height before trucks allowed to access upper surface
- in the raising of multi-tier mounds, trafficking is to be confined to the upper surface of the lower tier. This layer will require decompaction on excavation of the mound.

B.2 The timing of the building of the soil storage mounds will be governed by the weather and soil conditions governing stripping (see **Sheets A, E, F, I**). Unless the soils are required to be kept in a wet state (eg peat), the mounds should be sited on dry ground, not in hollows and should not disrupt local surface drainage (Box B.3). Where necessary mounds should be protected from run-off/ponding by a cut-off ditch which is linked to appropriate water discharge facilities. Where the storage mound is in a hollow due to the removal of surface soils, measures should be undertaken to ensure that water is not able to pond within the storage area.

B.3 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

Box B.2 - To minimize the wetting of soils:

- soil mounds to be built in dry/draining/drained locations and protect from run-off from adjacent areas
- raise the soil mound to maximum height progressively along the axis of the mound, and shape the mound as it is being built to shed water and seal exposed surfaces whenever stripping is suspended
- measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.

Box B.3

Where soils such as peat need to be kept in a wet condition this may require storage in (bunded) cells where receiving rainfall cannot drain.

B.4 The operation should follow the detailed stripping/storage plan set out in the SRMP showing soil units to be stripped, haul routes and the phasing of vehicle movements. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. The haul routes and soil storage areas must be defined and should be stripped first in a similar manner. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

B.5 Adopting the practices outlined in **Sheet A**, where relevant, remove topsoil and subsoil to basal layer from the haul routes, footprint of the storage mound and any other operating area in advance. The soils should be stored in their respective mounds.

B.6 The dump trucks must only travel within the haul route and operational areas. Typically the trucks should enter the storage area, reverse and tip the soil load starting at the furthest point of the mound from the point of access. The back- acting excavator pulls up the soil into a mound of the required dimensions (Box B.4). The excavator operates by standing on the mound (**Figure B.1**) or the stripped basal layer. The excavator bucket can be used to shape and firm the sides as the mound is progressively formed to promote the shedding of rain.

B.7 The process is repeated with the tipping of soil against the forming mound, and without the dump truck wheels traversing onto previously tipped material. The operation continues progressively along the main axis of the mound.

Box B.4 - Choice of Bucket Type

For hard /stony soils toothed buckets are needed. Where the mixing of soil layers at their interface is to be minimized, a bucket with a 'blade' is preferable where the soil is 'soft' and free of large stones or stone free. Where there is a watching archaeological brief, the use of bladed buckets will normally be required.

Similarly, the choice of bucket type, whether it is a standard 'digging'/bulking or wide ditching type will depend on the soil strength and stoniness.

B.8 Without the trucks rising onto the soil mound, the maximum possible height and width of the mound is related to the boom reach of the excavator (typically about 3-4m). Excavators with long booms ('long reach') can be used, but may be more restricted by gradient limitations, and require skilled and experienced operators.

B.9 To raise the mound higher, as a multi-tier mound, the trucks will have to travel on the upper surface of the mounded soils (first tier). In this case the mound should be raised to its maximum height (**Figure B.2**). A ramp will have to be provided for the trucks to rise onto the surface of the first tier, which should be capable of trafficking safely and without difficulty. The next tier would be formed repeating the process described above.

B.10 If further tiers are required, the process would be repeated. Any exposed edges/surfaces should be shaped using the excavator bucket on the onset of rain during the day, this should include any exposed incomplete surfaces. All surfaces should be shaped to shed water at the end of the day. The final outer surface should be progressively shaped using the excavator bucket or low ground pressure bulldozer to promote the shedding of rain.

B.11 Work should stop in wet conditions (Box B.5) with measures undertaken to shed water from the soil surfaces and to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layers and operating areas.

Box B.5 - Rainfall Criteria

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/ near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.

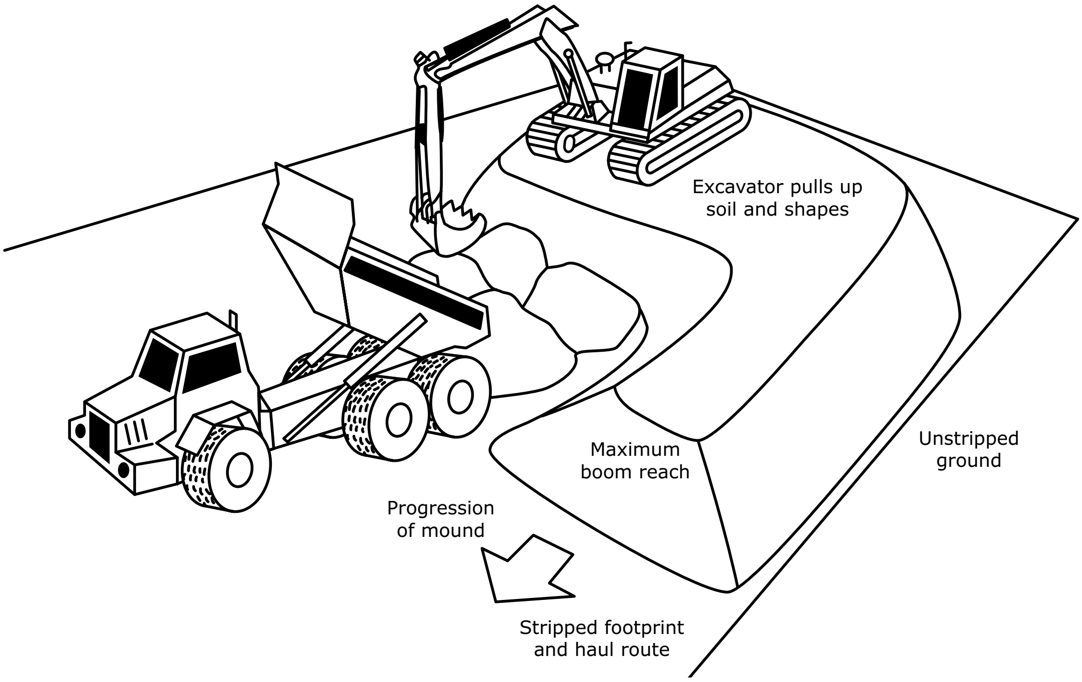

Figure B.1: Soil storage mound construction with excavators and dump trucks: Single tier mound.

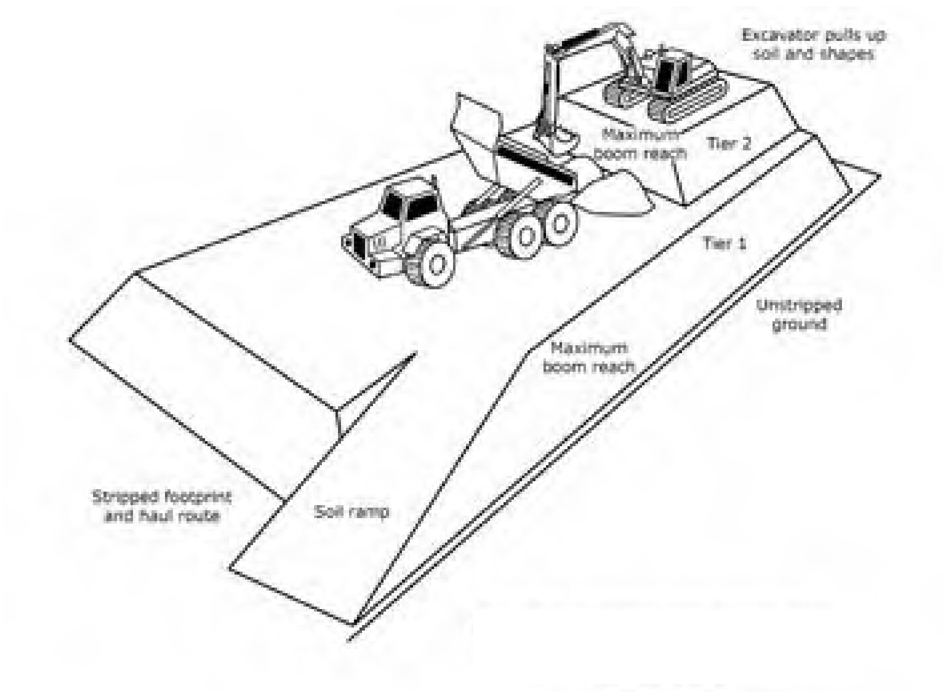

Figure B.2: Soil storage mound construction with excavators and dump trucks: Multi-tier mound.

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet D -

Soil Replacement with Excavators and Dump Trucks
- Sequential Bed/Strip Practice

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Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet D of the guidance is to provide a model method of best practice where excavators and dump trucks are to be used to replace soil using the sequential 'bed'/strip by strip practice.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/ plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974 and in the case of mineral extraction operations The Quarries Regulations 1999 and its relevant statutory provisions; in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer's specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

In this soil handling option, back-acting excavators are used to replace the soil resources tipped from dump trucks at the area being restored.

The replacement practice involves the sequential building up of the individual layers of soil identified in the Soil Resource & Management Plan (SRMP) as vertical slices through the soil profile and advancing as successive strips. Hence, the practice is often referred to as the 'Strip' or 'Bed' method.

The lower layer (subsoil) is placed first within the safe and efficient operational reach of the excavator boom which defines the width of each strip. For each subsequent soil layer, the process is repeated until the top layer (usually topsoil) is placed. When the soil resource/profile sequence within the strip is completely replaced, the process is repeated on the next strip to be replaced with soil and until the whole receiving area is completed. The following guidance can also be adopted where only a single soil horizon is to be replaced.

Unlike the stripping and storage practices, the replacement of soils is usually in concert with other work to remediate soil conditions such as compaction (**Sheets N & O**) and removal of stones/non-soil debris (**Sheets L & M**) to facilitate the intended after use, soil functions, and environmental and ecosystem service provisions. These actions have their own practices which need to be integrated into this model methodology of soil handling. The need for these will have been specified in the SRMP and/or in soil replacement conditions attached to the planning consent, or as determined by the soil specialist during the soil stripping/storage/replacement operations.

Advantages & Disadvantages
The advantages of this machinery combination and handling practice are:
i) Provided the soils are not put into storage mounds, it is the most likely to result in soil profiles with the least compacted soils, which may not require remedial treatment or only minimal of action, as trafficking on the relayed soils is avoided
ii) It can be easier to create localised changes in soil types and variation in horizon depth
iii) It is suited both to the replacement of deep and uniform soils (including peat) as well as thin and 'patterned' soil layers
iv) It is more flexible and quicker in responding to stoppages and restarts due to wet weather
v) There is a greater certainty that a transpiring vegetation cover can be established during the soil replacement programme

The disadvantages are:
i) That it requires greater supervision, skill and discipline in its deployment, and is best suited to experienced operators
ii) Without good control and regular monitoring of soil layer depths, use of profile boards or machine fitted GPS it can be harder to gauge the rate of use of soil resource
iii) There is a risk of some soil 'loss' and mixing of soil horizons at the exposed edges of multi-layered soils as the profile is built up
iv) The bed system involving sequential remedial works may take longer to complete than other practices and machinery options
v) Steep gradient/complex topographies may limit the safe and practical deployment of this handling practice

Suitability
The excavator-dump truck combination with the bed/strip handling practice methodology is considered 'best practice' by Natural England and the Welsh Government for agricultural soils and preferable for all soils. In particular, it is the most suitable of any of the methods available where:
i) The soil is prone to compaction and where decompaction treatments cannot be relied upon to be effective
ii) The intended after use, environmental and ecosystem services are dependent on soils maintaining their functional characteristics such as, porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This includes productive agricultural, horticultural and forestry land, many types of natural habitats, and where water storage/infiltration is of importance for the risk of flooding. Where the soils are stored prior

to replacement some remedial treatment may have to be relied upon

iii) As the bed/strip method offers the most flexibility in respect of short soil drying periods and likely wet weather, and can be less prone to delays and stoppages, it is particularly suited the wetter geographical locations

iv) The full benefit of the practice for soils lies in their direct placement, this requires the mineral extraction scheme to be organized to minimize the need for soils storage.

MODEL METHODOLOGY

Basic Soil Replacement Operation

D.1 The following is the basic model methodology using excavators and dump trucks and the bed/strip practice. It is presented here, firstly without any remedial interventions to give clarity of the methodology. Further on the methodology is repeated to demonstrate how the interventions can be integrated in to the soil replacement process.

D.2 Key operational points to minimise the risk of severe soil compaction and soil wetness are summarised in Boxes D.1 and D.2.

D.3 The timing of soil handling operations in England and Wales is set out in **Part One, Supplementary Note 4**. For directly placed soils this will use the in situ soil wetness protocol for soil stripping operations to determine the timing for soil replacement (Box D.3). For soil that has been stored, the relaying operation should be governed by the weather (rainfall) criteria set out in Box D.4. Here, the operation will generally need to be completed no later than the end of September unless the establishment of a satisfactory vegetation cover can be assured.

D.4 Soil handling is not to take place during rain, sleet or snow and in these conditions should be prohibited if unsafe for machine operations. Prior to commencing operations, a medium/long term weather forecast should be obtained which gives reasonable confidence of soil handling being completed without significant interruptions from rainfall events. The soil based criteria set out in Box D.4 are to be used to determine whether soil handling should cease or be interrupted with the occurrence of rain.

D.5 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable their efficient operation. The work should only be carried out when the basal layer supports the machinery without ruts or is capable of repair/maintenance. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

D.6 The operation should follow the detailed SRMP replacement plan showing the soil units to be replaced, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers,

Box D.1 - To minimise compaction:

- The dump trucks should only operate on the ‘basal’/non-soil layer and not run on the replaced soil layer(s)
- The excavator must only operate on the basal layer
- The machines are to only work when ground conditions enable their efficient operation
- If compaction has been caused, then measures are required to treat it (see **Sheets N & O**).

Box D.2 - To minimise soil wetness and re-wetting:

- The bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active strip should be completed including the topsoil layer before rainfall occurs and before replacement is suspended
- Measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks
- The area to be restored is to be protected from in-flow of water, ponding etc. Wet sites must be drained in advance. Before the operation starts the basal layer should be to level and clean.

Box D.3 - Test for Dry and Friable Soils

Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations on the soil handling area and at each soil horizon to the full depth of the profile to be recovered/replaced. The tests shall include visual examination of the soil and physical assessment of soil consistency.

i) Examination

- If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place**
- If the sample is moist (i.e. there is a slight dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place**
- If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place**

ii) Consistency
First Test
Attempt to mould soil sample into a ball by hand:

- Impossible because soil is too dry and hard or too loose and dry means soil handling can take place
- Impossible because the soil is too loose and wet means no soil handling to take place
- Possible - GO TO SECOND TEST

Second Test
Attempt to roll ball into a 3mm diameter thread by hand:

- Impossibe because soil crumbles or collapses means **soil handling can take place**
- Possible means **no soil handling to take place**

NB: It is impossible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

Box D.4 - Rainfall Criteria:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.

and thickness and conveyed to the operational supervisor/operator. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. Detailed daily records should be kept of operations undertaken and site and soil conditions.

D.7 The excavator and dump trucks are only to stand, work and travel on the basal/formation layer.

D.8 The soil layers above the base/formation layer are to be replaced in sequential strips with the sub-soil layer(s) replaced first, followed by the topsoil layer, each layer being replaced to the specified thickness. The next strip is not to be started until the profile in the current strip is completed. This is often referred to as the 'bed' or 'strip' system which involves the progressive sequential laying of the soil in strips across the area to be restored (**Figure D.1**).

D.9 The initial strip width and axis is to be demarcated. The strip width is determined by excavator boom length less the stand-off to operate; typically, about 3-4m (Box D.5). Excavators with long booms ('long reach') can be used, but may be more restricted by gradient limitations, and require skilled and experienced operators.

D.10 The preferred type of bucket to place the soils is usually a digging/bulking bucket with an attached blade or a wide ditching bucket, but a toothed bucket can be used.

D.11 Profile boards should be used to control soil horizon thickness in each strip and overall levels achieved verified using soil pits. Allowances (i.e. a bulking factor) should be made for any settlement that may take place of the replaced loose soil.

Box D.5 - Orientation of the Excavator

Usually, the excavator is orientated and operates with its tracks at 90° to the axis of the bed being stripped as this is the most stable position. Whilst the reach of the boom and hence the width of the bed/strip can be significantly increased by orientating it with the tracks parallel to edge of the soil being spread, this may affect the stability of the excavator, particularly on a gradient or where the basal layer has a low baring capacity. Hence, its safe deployment needs to be checked before its adoption.

D.12 The dump trucks reverse up to edge of the current strip and tip the lowest layer (subsoil) soil, without the wheels riding onto the strip (**Figure D.1**). The dump truck should not drive away until all the soil is deposited within the strip without spillage over the basal layer; this may require assistance from the excavator to 'dig away' some of the tipped soil (**Figure D.2**). The excavator is to spread the tipped soil to full thickness by digging, and using the pushing and pulling action of bucket.

D.13 Each load of soil should be spread following tipping before another is tipped. Should the spread soil comprise of large blocks (>300mm), normally these should be broken down by using the excavator bucket into smaller pieces before the next load is spread. The process is repeated until the strip is completely covered with the required depth of the soil layer (**Figure D.3**).

D.14 On completion of the lowest (subsoil) layer, repeat the process spreading the next layer (subsoil/topsoil) (**Figure D.4**). Tip the soil by reversing to the outer edge of strip/soil previously laid, but without the truck wheels riding onto the already placed layer (see Box D.6 for deep soil profiles). The soil is to be spread by the excavator to full thickness by digging, and using the pushing and pulling action of bucket described above. Repeat the process progressively along the strip. Profile boards should be used to control the soil thickness in the strip and overall levels.

D.15 Where the profile is made up of further soil layers (subsoil/topsoil) the above process should be repeated on completion of the strip.

BOX D.6 - Soil Profiles Greater Than 1m Thickness

When the replaced soil profiles reach about 1m in height from the basal layer it may not be possible to discharge the load from smaller dump trucks directly onto the previously placed lower layers because of the height of the dump truck body. The preferred solution is to tip the soil against the partially completed profile as heaps without the dump trucks rising onto or reversing into the placed material. The soil material is then lifted by the excavator onto the profile. It is considered preferable to accept some limited soil losses rather than to contaminate the topsoil with overburden. The loss of top-soil is minimised if the basal/ formation layer is kept to level and clean.

D.16 On completion of topsoil layer, the processes outlined above should be repeated for the next strips until the area to be restored is completed. Before the operation starts the basal layer should be to level and cleared of any residual soil.

D.17 At the end of each day the current strip must be completed if rain is forecast. If during a day it is evident that a full strip cannot be completed, then complete the part of a strip that has been started.

D.18 At the end of each day, or during the day if interrupted by rain, make provisions to protect base of restored strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

Method with Integration of Remedial Actions

D.19 Usually there should be less of a need for remedial treatment during the replacement operation with this machinery combination and handling practice (unless the soils were compacted during stripping or storage). Where compaction occurs, treatment will need to be integrated into the replacement process as will the need for the removal of stones or non-soil debris. Both decompaction and the removal of materials are covered in **Sheets L to O**. Where required, the early installation of under drainage can either be integrated sequentially during the replacement of the soils or later during the aftercare period.

D.20 The placement of the stripped soils in storage is likely to result in compaction and negate this particular benefit of the handling practice. Box D.7 sets out some of the remedial options/combinations to facilitate decompaction, and where necessary, the removal of stones and non-soil debris for a final profile comprising a basal layer, subsoil and topsoil layers. Except for Option 3, these actions need to be undertaken sequentially as each soil strip is placed.

D.21 The following is the model methodology integrating the remedial interventions within the bed/strip handling practice.

D.22 The key operational points to minimise the risk of severe soil compaction and soil wetness are summarised in the above Boxes 1 and 2.

D.23 Prior to commencing operations a weather forecast should be obtained which gives reasonable confidence of soil replacement proceeding without interruptions from rainfall events (Box D.4).

D.24 If significant rainfall occurs during operations, the replacement must be suspended, and where the soil profile has been started it should be replaced to topsoil level. Replacement should not restart unless the weather forecast is expected to be dry for at least a full day and the soils are in a dry condition (Box D.3).

D.25 The operation should follow the detailed replacement plan in the SRMP showing the soil units to be replaced, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers, and thickness and conveyed to the operational supervisor/operator. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. Detailed daily records should be kept of operations undertaken and site and soil conditions (including the removal of stones and other non-soil debris that needs to be removed), and the results of the effectiveness of the work undertaken, and any need for additional remedial treatments.

Box D.7 - Integration of Decompaction & Stone/Debris Removal

Option 1: is where the basal layer needs to be treated but is left until the subsoil is placed when both are decompacted together, followed by the decompaction of the topsoil and subsoil layers together (and basal layer) using tines that are long enough. This option is not suited to digging where the soil horizons would be mixed.

Option 2: is where each layer is treated separately by either tines or digging.

Option 3: is where the basal layer is treated or left untreated, followed by the placement of the subsoil and topsoil layers, which are to be decompacted by the use of tines. In the case of deep horizons this option can be limited by the capability of the machinery, the tines or bucket used. This option is not suited to digging where the soil horizons would be mixed.

D.26 The excavator and dump trucks are only to stand, work and travel on the basal/formation layer. Only where the remedial work involves the use of a bulldozer does machinery have to traffic the soil surface being treated, as the excavators work from the basal layer.

D.27 The soil layers above the base/formation layer are to be replaced in sequential strips with the subsoil layer(s) replaced first, followed by the topsoil layer; each layer being replaced to the specified thickness. The next strip is not to be started until the profile in the current strip is completed. This is often referred to as the 'bed' or 'strip' system which involves the progressive sequential laying of the soil in strips across the area to be restored (**Figure D.1**).

D.28 The initial strip width and axis is to be demarcated. Strip width is determined by excavator boom length less the stand-off to operate; typically, about 3-4m (see Box D.5).

D.29 The preferred type of bucket to place the soils is usually a digging/bulking bucket with an attached blade or a wide ditching bucket. However, where a bucket is being used to decompact soils, it should be a 'digging' type and have teeth or a stone-rake type with multiple tines is to be used.

D.30 Where there is a requirement to treat compaction and/or remove stones/damaging materials in the basal layer, these need to be carried out along the demarcated strip prior to the first layer of soils being laid.

D.31 Decompaction of the basal layer can by digging with the excavator bucket or by bulldozer drawn tines (**Sheets N & O**). Stone removal may require prior ripping/digging to release them from the basal material, followed by the excavator using a stone-rake bucket (the stone to be loaded on a dump truck and removed (**Sheet L**).

D.32 Profile boards should be used to control soil horizon thickness in each strip and overall levels achieved verified using soil pits to verify. Allowances (i.e. a bulking factor) should be made for any settlement that may take place of the replaced loose soil.

D.33 On completion, the loaded dump trucks reverse up to edge of the current strip and tip the lowest layer subsoil without the wheels riding onto the strip (**Figure D.1**). The dump truck should not drive away until all the soil is deposited within the strip without spillage over the basal layer; this may require assistance from the excavator to 'dig away' some of the tipped soil (**Figure D.2**). The excavator is to spread the tipped soil to full thickness by digging, and using the pushing and pulling action of bucket.

D.34 Each load of soil should be spread following tipping before another is tipped. Should the spread soil comprise of large blocks (>300mm), normally these should be broken down by using the excavator bucket to break the blocks into smaller pieces before the next load is spread. The process is repeated from left to right until the strip is completely covered with the required depth of the soil layer (**Figure D.3**).

D.35 Where there is a requirement to treat compaction and/or remove stones/damaging materials in the subsoil layer, these need to be carried out along the demarcated strip prior to the next overlying layer of soils being laid. Decompaction can by digging with the excavator bucket or by bulldozer drawn tines (**Sheets N & O**). Stone removal may require prior ripping/digging to release them from the soil (particularly if it is wet), followed by the excavator using a stone-rake bucket (to be loaded on a dump truck and removed (**Sheet L**).

D.36 On completion of the lowest (subsoil) layer, repeat the process spreading the next layer (topsoil or upper subsoil) (**Figure D.4**). Where the profile is made up of further soil layers (subsoil/topsoil) the process outlined above should be repeated on completion of the strip. Tip the soil by reversing to the outer edge of strip/soil previously laid, but without the truck wheels riding onto the already placed layer (see Box D.6). The topsoil is to be spread by the excavator to full thickness by digging, and using the pushing and pulling action of bucket described above. Repeat the process progressively along the strip. Profile boards should be used and soil pits to verify soil thickness and overall levels in each strip.

D.37 Where there is a requirement to treat compaction in the topsoil layer within each strip as it is completed (see Box D.8), this can by digging with the excavator bucket or by bulldozer drawn tines (**Sheets N & O**). If required, stone removal may require prior ripping/digging to release them from the soil clods, followed by the excavator using a stone-rake bucket (the stone to be loaded on a dump truck and removed) (**Sheet L**).

D.38 On completion of the topsoil layer the processes outlined above should be repeated for the next strips until the whole area to be restored is completed. Before the operation starts the basal layer should be to level and clean.
D.39 At the end of each day the current strip must be completed if rain is forecast. If during a day it is evident that a full strip cannot be completed, then complete the part of a strip that has been started.

Box D.8

It is important that the decompaction and any stone/debris is removed from the topsoil layer as each strip is completed. Leaving it until the entire area is soiled will mean that the equipment, and in particular where the dump trucks collecting stones, have to traffic the soil surface resulting in compaction of the topsoil and the underlying subsoil.

Decompaction might be undertaken from the topsoil surface once the placing of the soils is completed (see **Sheet O**). However, this only advisable where it is certain that it will be effective and no other earth-moving machinery is to traffic the replaced soil and that soil wetness and weather conditions are suitable (see **Part One, Supplementary Notes 3 & 4**).

D.40 At the end of each day, or during the day if interrupted by rain, make provisions to protect base of restored strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

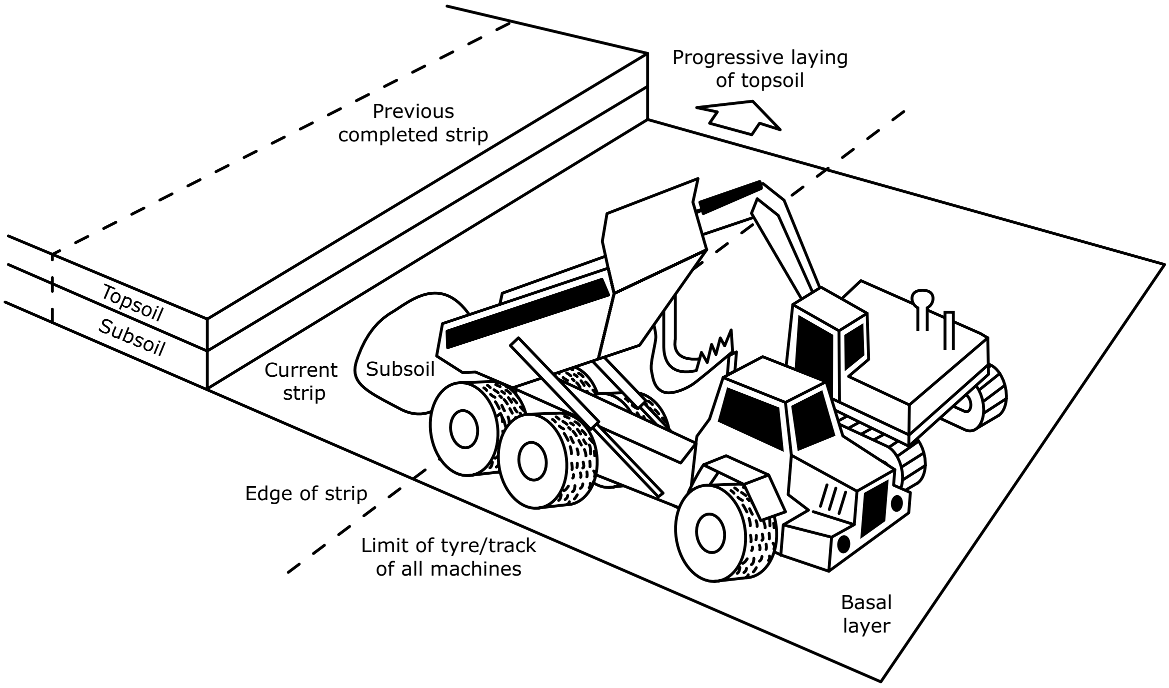

Figure D.1: Soil replacement with excavators and dump trucks: Subsoil layer.

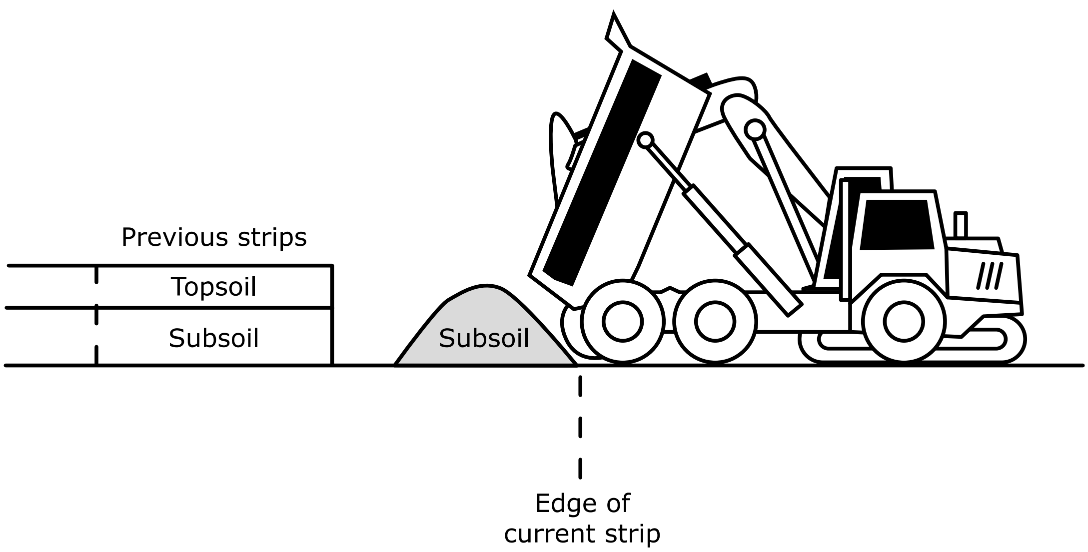

Figure D.2a: Soil replacement with excavators - dump trucks: Subsoil layer.

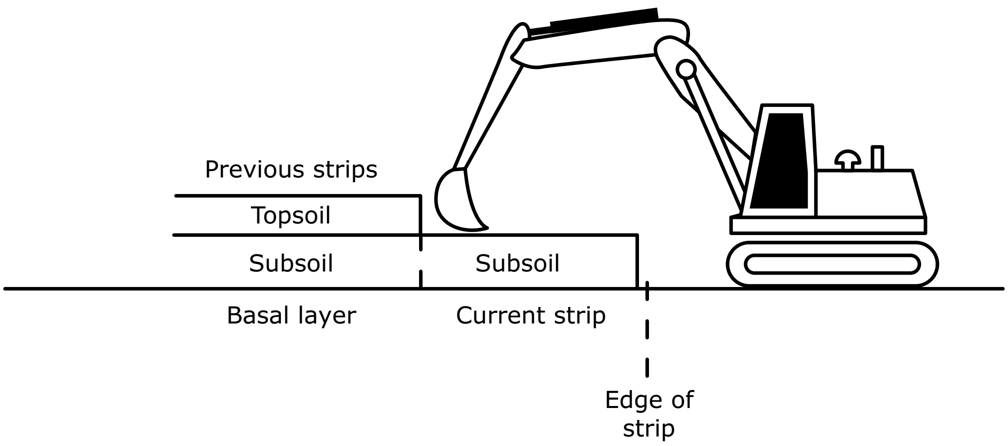

Figure D.2b: Soil replacement with excavators - dump trucks: Subsoil layer.

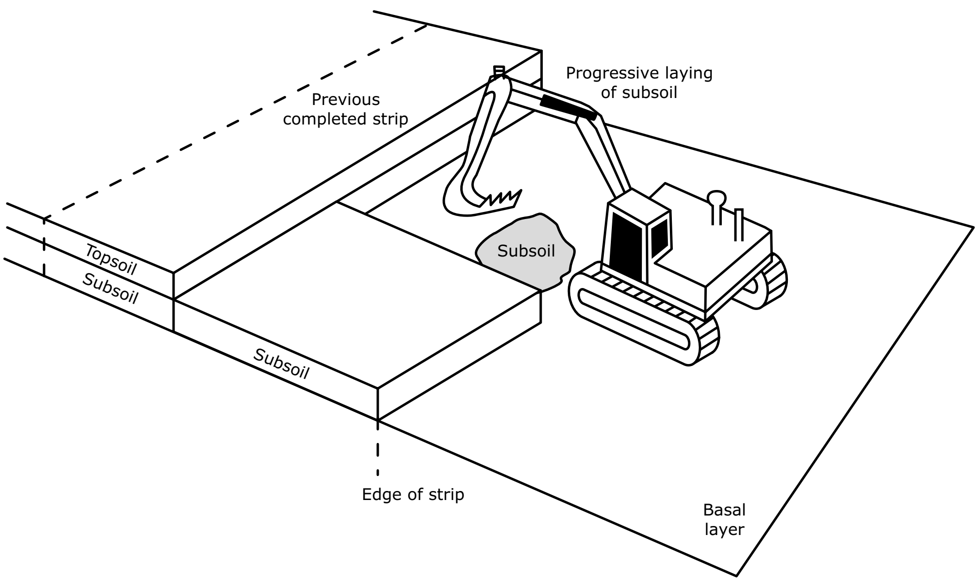

Figure D.3: Soil replacement with excavators and dump trucks: Subsoil progressively laid.

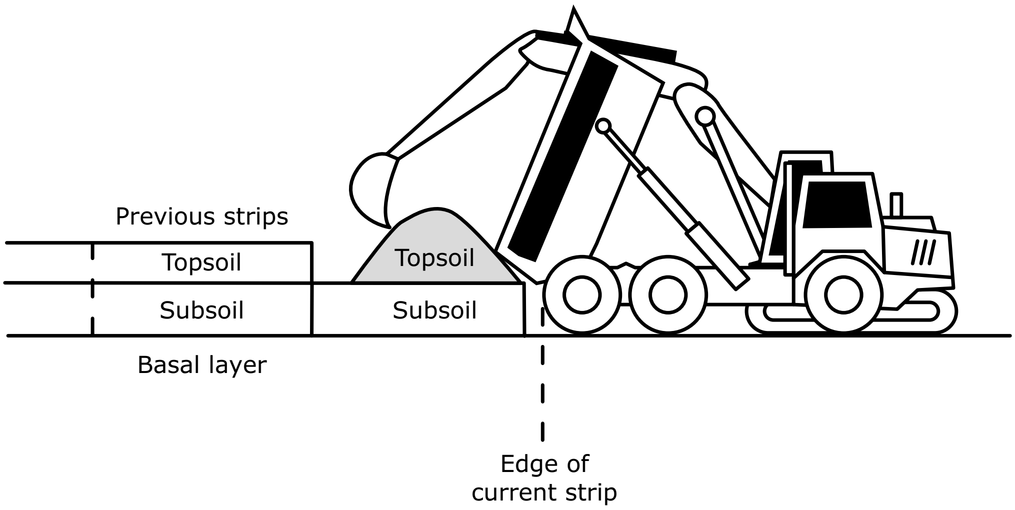

Figure D.4a: Soil replacement with excavators - dump trucks: Topsoil layer.

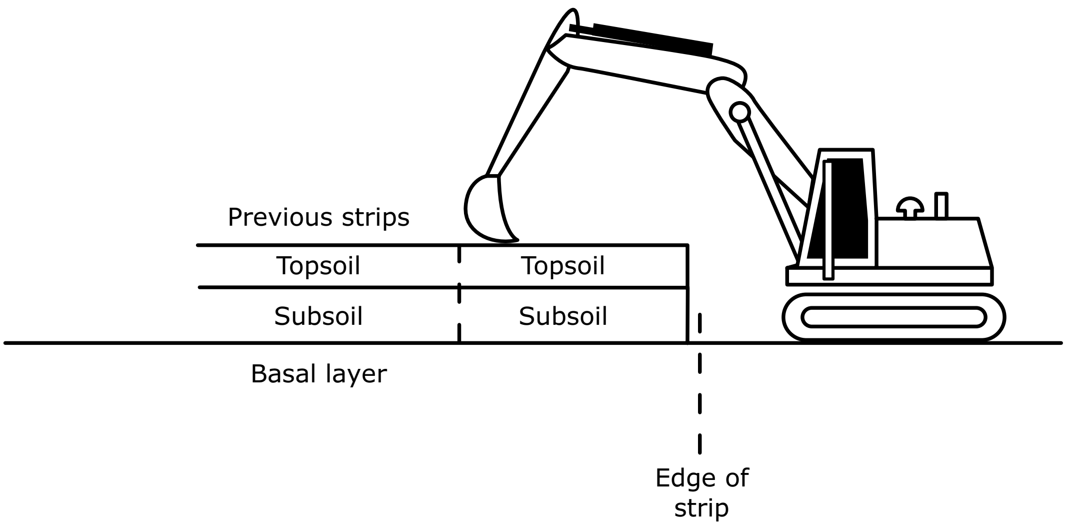

Figure D.4b: Soil replacement with excavators - dump trucks: Topsoil layer.

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet E -

Soil Stripping with Excavators and Dump Trucks
- Windrow Practice

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Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet E of the guidance is to provide a model method of best practice where excavators and dump trucks are to be used to strip soil using the windrow practice.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/ plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types.

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974 and in the case of mineral extraction operations, The Quarries Regulations 1999 and its relevant statutory provisions; in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer's specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

In this soil handling option, back-acting excavators are used to lift the soil resources gathered in 'windrows' and load them into dump trucks for the direct transport to an area being restored or to storage until needed.

The windrow stripping practice, sometimes referred to as the 'peninsular' method, involves the sequential separation and removal of the individual layers of soil identified in the Soil Resource & Management Plan (SRMP). The area to be stripped is divided into spaced parallel strips (windrows) where the soil between them is pulled from each side onto the strip acting as temporary repositories. The safe and efficient operational reach of the excavator boom defines the width between the windrows. The topsoil on the retreating surcharged windrows is then loaded systematically into the dump trucks by the excavator retreating towards the loading point on the haul route. On completing the removal of the topsoil, the exposed subsoil layer(s) is then recovered by the same procedure. The practice of stripping all the top-soil layer before starting the lower soil layers should be avoided as it increases the risk of rainfall events causing longer stoppages. The following guidance can also be adopted where only a single surface soil horizon is to be stripped.

Advantages & Disadvantages

The advantages of this machinery combination and handling practice are that:

i) It is a relatively simple operation to undertake and can be quicker than the bed/strip practice

ii) It can result a lower risk of severe compaction than the soil layer by layer practice, provided the soil is in a dry condition

iii) If the soil horizons are stripped sequentially for each windrow, it offers flexibility in respect of short soil drying periods and likely wet weather as it is less susceptible to stoppages due to soil rewetting as a transpiring vegetation cover can be retained later into the stripping programme. Hence, it can be suited to northern and western, and upland locations, and particularly when there are uncertain weather patterns.

The disadvantages are:

i) Its beneficial effect is dependent on all the soil horizons being stripped as windrows, which may make it a slower more involved operation than the soil layer by layer practice

ii) It requires skill and discipline, and a high level of supervision in its deployment, being suited to experienced operators

iii) Whilst it can result in less soil compaction than other methods, it is likely some will be caused by the excavator moving on the soil during the formation of and operation of the windrows, and hence, there may be reliance on subsequent remedial treatment

iv) Steep gradient/complex topographies may limit the safe and practical deployment of this machinery combination and handling practice.

Suitability

As the methodology involves the excavator operating on each layer of soils to form the successive windrows, there is a risk that compaction can occur and the likely reliance on remedial treatment with this practice. Hence, it is considered to be a less suitable practice than the bed/strip practice for minimizing the risk of soil compaction. The full benefit of the practice lies in the direct placement of the stripped soil and therefore requires the mineral extraction scheme to be organized to provide for this and minimize the need for soils storage.

Whilst it is not considered to be the 'best practice', the windrow practice may be acceptable in circumstances such as where there is a medium to high soil resilience to compaction (see **Table 7**, **Part One**) or the best available where:

i) The soil profile in each designated windrow is stripped sequentially to the basal layer before progressing to the next

ii) The dump trucks do not run on the in situ and the windrowed soils

iii) It is used to recover a single surface soil layer

iv) The intended after use, and environmental and ecosystem services are less dependent on maintaining their full functional characteristics such as porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This may include the less productive agricultural and forestry land, many types of natural habitats, and where water storage/ infiltration is of lesser importance for the risk of flooding. Where the soils are stored prior to replacement, effective remedial treatment may have to be relied upon

v) It is not suitable for soils with a low bearing capacity such as peat or organic soils, or soils having a high water table

vi) It is often considered to be the most suitable of the soil stripping practices available for important archaeological sites (see Box E.1).

Box E.1

Stripping soils in windrows with an excavator is often the preferred practice when archaeological investigations and recording (as opposed to trial pit/trench sampling and 'watching briefs') are required as part of a planning consent. However, there may be a need for a deviation from normal good practice for soils with the excavator and dump trucks trafficking over the topsoil layer used as the haul route, and in some cases the surcharging of the topsoil for further protection of the archaeological feature. In these cases compaction of the topsoil will result and remedial treatment will have to be relied upon.

MODEL METHODOLOGY

E.1 Key operational points to minimize the risk of severe soil compaction and soil wetness are summarised in Boxes E.2 and E.3.

Box E.2 - To minimize compaction:

- The dump trucks should normally only operate on the 'basal'/non-soil layer, and their wheels must not run on to the soil layer(s)
- The excavator only operates on the windrow with the dump trucks only travelling on the basal layer
- The machines are to only work when ground conditions enable their efficient operation
- The topsoil to be surcharged on the windrow as a thick layer as possible whilst maintaining the safe operation
- The soil layers are to be in 'dry' condition.

Box E.3 - To minimize the wetness of the soil and re-wetting of the soil:

- The progressive windrow system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active windrowed strip should be removed to the basal layer before rainfall occurs and before stripping is suspended
- Measures are required to protect the exposed face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks
- The area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance
- The maintenance of a transpiring crop is important, and an appropriate cropping regime should be established for the year of soil stripping
- Before stripping, excess vegetation should be removed; in the case of grassland it should be cut or grazed short and arable crops should have been harvested.

E.2 The timing of soil handling operations should only take place when the soils are in a 'dry and friable' condition (ie when it breaks and shatters when disturbed rather than smears and deforms) (see **Part One, Supplementary Note 4**). Prior to the start or recommencement of soil handling they should be tested to confirm they are in suitably dry condition (see Box E.4).

E.3 Soil handling is not to take place during rain, sleet or snow and in these conditions should be prohibited due to unsafe machine operating conditions. Prior to commencing operations, a medium/long term weather forecast should be obtained which gives reasonable confidence of soil handling being completed without significant interruptions from rainfall events. The soil based criteria set out in Box E.5 are to be used to determine whether soil handling should cease or be interrupted with the occurrence of rain.

E.4 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

E.5 The operation should follow the detailed stripping plan set out in the SRMP showing soil units to be stripped, haul routes and the phasing of vehicle movements. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. The haul routes and soil storage areas must be defined and should be stripped first in a similar manner. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

E.6 Within each soil unit the soil layers above the base/formation layer are to be stripped in sequential strips with the topsoil layer stripped first, followed by the subsoil layers; each layer stripped to its natural thickness without incorporating material from the lower layers. To protect the subsoil from becoming wet during changes in the weather, the next windrowed topsoil strip should not be started

Box E.4 - Test for Dry and Friable Soils

Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations on the soil handling area and at each soil horizon to the full depth of the profile to be recovered/replaced. The tests shall include visual examination of the soil and physical assessment of soil consistency.

i) Examination

- If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place**
- If the sample is moist (i.e. there is a slight dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place**
- If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place**

ii) Consistency
First Test
Attempt to mould soil sample into a ball by hand:

- Impossible because soil is too dry and hard or too loose and dry means soil handling can take place
- Impossible because the soil is too loose and wet means no soil handling to take place
- Possible - GO TO SECOND TEST

Second Test
Attempt to roll ball into a 3mm diameter thread by hand:

- Impossibe because soil crumbles or collapses means **soil handling can take place**
- Possible means **no soil handling to take place**

NB: It is impossible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

until the subsoil under lying the strip is completely stripped to the basal layer (**Figure E.1**). Stripping is to be undertaken by the excavator standing within the windrow strip and loading the surcharged soil layer into dump trucks.

Box E.5 - Rainfall Criteria:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/ near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.

Box E.6 - Choice of Bucket Type

For hard /stony soils toothed buckets are needed. Where the mixing of soil layers at their interface is to be minimized, a bucket with a 'blade' is preferable where the soil is 'soft' and free of large stones or particularly stony stone free.

Similarly, the choice of bucket type, whether it is a standard 'digging'/bulking or wide ditching type will depend on the soil strength and stoniness.

Bladed buckets will be required for soil stripping involving archaeological investigation. Where there is a watching archaeological brief, the use of bladed buckets will normally be required.

E.7 The type of bucket to be used largely depends on the nature of the soil (Box E.6).

E.8 Demarcate the windrow topsoil strips to be surcharged; the width of the soil strip to be recovered between the windrows is determined by the effective and safe excavator boom radius from the edge of each windrow; typically, about 3-4m (Box E7). Excavators with long booms ('long reach') can be used, but may be more restricted by gradient limitations, and require skilled and experienced operators.

Box E.7 - Orientation of the Excavator

Usually, the excavator is orientated and operates with its tracks at 90^{o} to the axis of the bed being stripped as this is the most stable position.

Whilst the reach of the boom and hence the width of the bed/strip can be significantly increased and the excavator trafficking over the soil surface decreased by orientating it with the tracks parallel to edge of the soil being stripped, this may affect the stability of the excavator, particularly on a gradient or where soils have a low baring capacity. Hence, its safe deployment needs to be checked before its adoption.

E.9 The excavator is only to stand and work on the soil layers when stripping soils, otherwise it is to travel only on the basal/formation layer. The dump trucks are only to operate on the basal/formation layer. The exception is where it is stipulated that they are to traffic the topsoil for the protection of underlying archaeological features (see above Box E.1).

E.10 The top-soil layer is to be pulled up in the thickest layer possible onto the surcharged strip (**Figures E.1 & E.2**). It should be recovered to the full width of the segment being stripped without mixing with the underlying subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The full thickness of the topsoil horizon should be stripped progressively before the underlying subsoil horizon(s), if present, is to be started. On completion of the topsoil windrow and its removal, the above procedures are repeated sequentially for each underlying soil horizon until the area is completely stripped of soil to the basal layer (**Figures E.3 & E.4**).

E.11 Where the soils are to be directly placed without storage in mounds, the initial strip of the upper horizons will have to be stored temporarily to

release the lowest layer and enable the sequential movement of materials.
The stored initial soil material would be placed on the lower layer removed from the final strip at the end of the programme or on partially completed profiles if rain were forecast.

E.12 When the stripping operation is likely to be interrupted by rain or there is likely to be overnight rain remove any exposed subsoil down to the basal layer before suspending operations. Make provisions to protect base of current or next strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

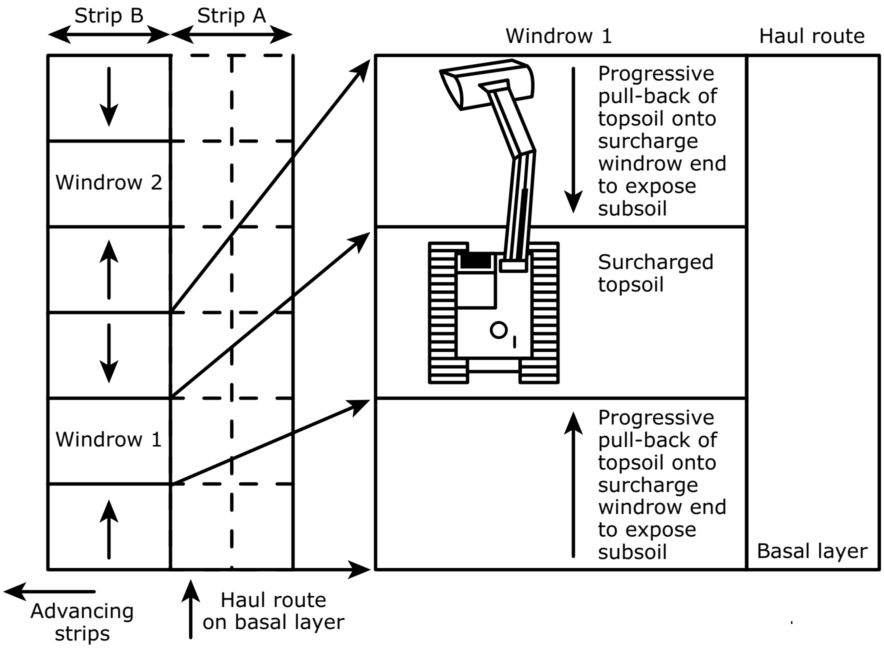

Figure E.1: Surcharging of windrow with topsoil.

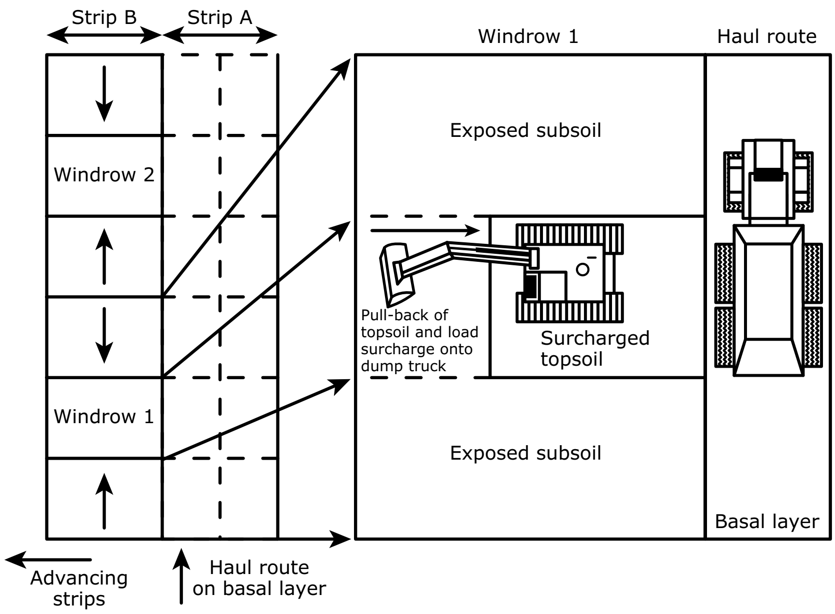

Figure E.2: Retreat of topsoil, surcharged windrow and loading of dump trucks.

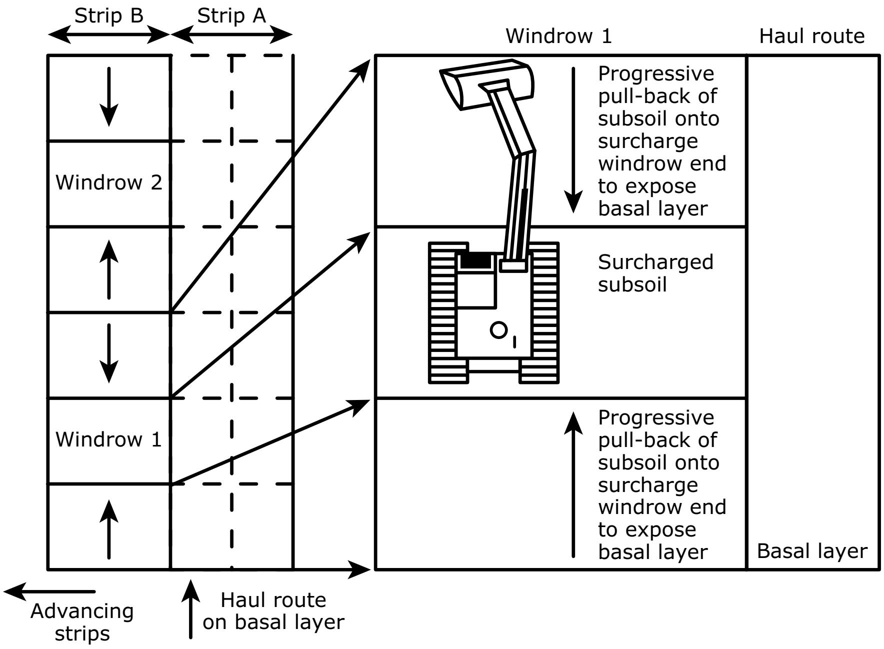

Figure E.3: Surcharging of windrow with subsoil.

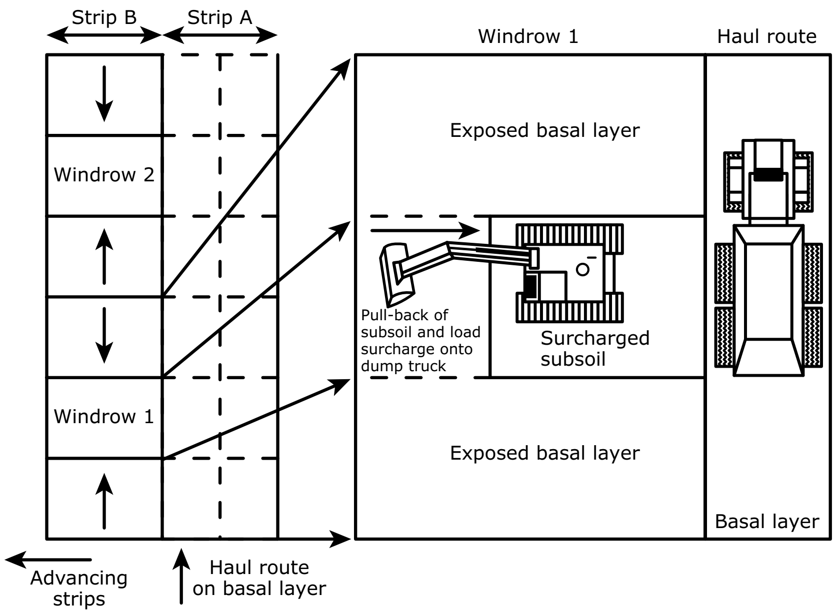

Figure E.4: Retreat of subsoil surcharged windrow and loading of dump trucks.

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet G -

Building Soil Storage Mounds
with Bulldozers and Dump Trucks

Author: Dr R N Humphries CBiol CSci FRSB FBSSS FIQ
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Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet G of the guidance is to provide a model method of best practice where bulldozers and dump trucks are used to build soil storage mounds.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/ plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types.

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974 and in the case of mineral extraction operations, The Quarries Regulations 1999 and its relevant statutory provisions; in particular, those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer’s specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

This soil handling method uses low ground pressure bulldozers to build the storage mound in combination with dump trucks to transport the soil. Top- and subsoil(s) are to be stored in separate mounds or in clearly defined parts of mounds, in some circumstances where the topsoil can be easily recovered it may be laid over the subsoil.

The space available for storage in mineral workings is often limited and this determines the ‘height’ of mounds. For topsoil, the preference is for 1 to 3m height in order to minimize the impact of storage on biological processes, whereas for subsoils where the biological activity is lower, subject to safe operations, mounds are often raised to heights of 3 to 5m depending on the resilience of the soils to compaction (see **Part One & Supplementary Note 3**).

In this soil handling option, the mounds are either built as one ‘tier’ or ‘multi-tier’ high. In the single tier only the bulldozer traffic the soil surface and usually the final surface. In the multi-tier, the mound is also trafficked by loaded dump trucks.

Advantages & Disadvantages
Storage vs Direct Placement:
The advantages of storage are:
i) It gives flexibility in the operation of the mineral site
ii) Flexibility (i.e., weather and ground conditions) when it is reused.

The disadvantages are:
i) There is a high risk of compaction of the soil material by stacking in the mound which later cannot be effectively treated
ii) There may be significant degradation of biological functions with long-term storage.

Single vs Multi-tier Mounds:
The advantage of multi-tier mounds is that they take less space. The disadvantages are:
i) With multi-tier mounds there is high risk of severe compaction of the soil material layers by repeated trafficking by laden dump trucks in the building of multi-tier mounds which later cannot be effectively treated
ii) There may be a longer delay in recovery of the soil’s biological functions on replacement.

Suitability
Soil storage is less suitable where:
i) The subsoil(s) are significantly less resilient to compaction (such as silts and sandy clay loams) and when decompaction treatments cannot be relied upon to be effective because of a risk of soil wetness operational limitations (such as the unavailability of effective decompaction tools) (see **Part One and Supplementary Notes 3 & 4**)
ii) The intended after use, and environmental and ecosystem services are dependent on maintaining functional characteristics such as soil porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This usually includes the most productive agricultural, horticultural and forestry land, many types of natural habitats, and where water storage/infiltration is of importance for the risk of flooding
iii) The bed/strip practice using excavators is used (**Sheet A**) as the compaction caused can negate its benefit
iv) Multi-tier mounds are used, particularly where the intended after use, and the environment and ecosystem services are dependent on maintaining functional characteristics such as soil porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This usually includes the most productive agricultural and forestry land, many types of natural habitats, and where water storage/infiltration is not of importance for the risk of flooding.

MODEL METHODOLOGY

G.1 Key operational points to minimize the risk of severe soil compaction and soil wetness are summarised in Boxes G.1 and G.2.

Box G.1 - To minimize compaction:

- Strip in advance the soil to basal layer along haul routes and the operational footprint of the storage mound
- The soils are to be pushed by the bulldozer to form the mound in as thick layers as possible whilst maintaining their efficient operation
- The machines are to only work when ground or soil surface conditions enable their efficient operation
- The dump trucks should only operate on the 'basal'/non-soil layer, and their wheels must not in any circumstances run on to the tipped soil
- In the raising of multi-tier mounds, trafficking is to be confined to the upper surface of the lower tier. This layer will require decompaction on excavation of the mound.

Box G.2 - To minimise the wetting of soils:

- Site soil mounds in dry locations and protect from run-off from adjacent areas. Drain if a wet location
- Raise the soil mound to maximum height progressively along the axis of the mound and shape the mound as it is being built to shed water and whenever stripping is suspended
- Measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.

G.2 The timing of the building of the soil storage mounds will be governed by the weather and soil conditions governing stripping (see **Sheets A, E, F, I**). The mounds should be sited on dry ground and not in hollows and should not disrupt local surface drainage (Box G.3). Where necessary mounds should be protected from run-off/ponding by a cut-off ditch which is linked to appropriate water discharge facilities.Where the storage mound is in a hollow due to the removal of surface soils, measures should be undertaken to ensure that water is not able to pond within the storage area.

G.3 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

Box G.3

Where soils such as peat need to be kept in a wet condition this may require storage in bunded cells where receiving rainfall cannot drain. Here, the use of bulldozers is not appropriate for handling peat, and excavators and dump trucks are to be used (**Sheets A – D**).

G.4 The operation should follow the detailed stripping/storage plan set out in the SRMP showing soil units to be stripped, haul routes and the phasing of vehicle movements. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. The haul routes and soil storage areas must be defined and should be stripped first in a similar manner. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

G.5 Adopting the practices outlined in **Sheets A**, F or I, where relevant, remove topsoil and subsoil to basal layer from the haul routes, footprint of the storage mound and any other operating area in advance. The soils should be stored in their respective mounds.

G.6 The dump trucks must only travel within the haul route and operational areas. The trucks should enter the storage area, reverse and tip the soil load starting at the furthest point of the mound from the point of access.

G.7 The low ground pressure bulldozer pushes the soil into a mound of the required dimensions (**Figure G.1**). The bulldozer is used to shape the sides as the mound is progressively formed to promote the shedding of rain, particularly at the end of each day, but also on the onset of rain during the day. This should include any exposed incomplete surfaces.

G.8 The process is repeated with the tipping of soil against the forming mound, and without the dump truck wheels traversing onto previously tipped material. The operation continues progressively along the main axis of the mound. Without the trucks rising onto the soil mound, the typical height of a mound raised by bulldozer is in the order of 4-6m.

G.9 Work should stop in wet conditions (Box G.4) with measures undertaken to shed water from the soil surfaces and to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layers and operating areas.

Box G.4 - Rainfall Criteria:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.

G.10 To raise the mound higher, the trucks will have to travel on the upper surface of the mounded soils, or long reach excavators used to cast-up the soil. In this case the mound should be raised to its maximum height (**Figure G.2**). A ramp will have to be provided for the trucks to rise onto the surface of the first tier, which should be capable of trafficking without difficulty. The next tier would be formed repeating the process described above. If further tiers are required, the process would be repeated again.

G.11 Any exposed edges/surfaces should be shaped using the bulldozer blade on the onset of rain during the day. All surfaces should be shaped to shed water at the end of the day. The final outer surface should be progressively shaped using the bulldozer blade to promote the shedding of rain.

G.12 Work should stop in wet conditions (Box G.4) with measures undertaken to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layers and operating areas.

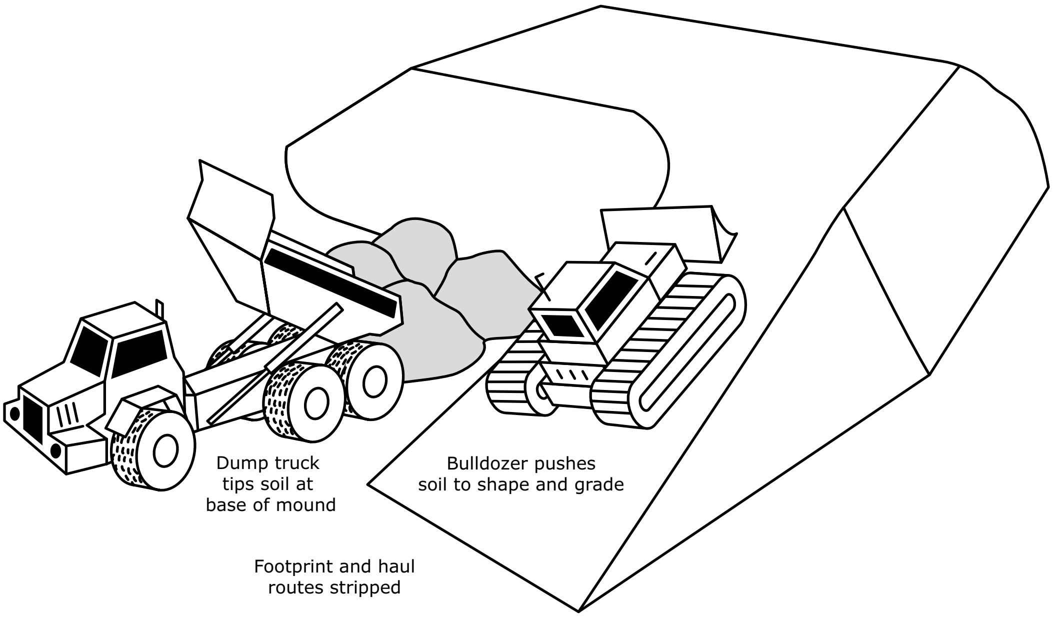

Figure G.1: Soil storage mound construction with bulldozer and dump trucks: Single tier mound.

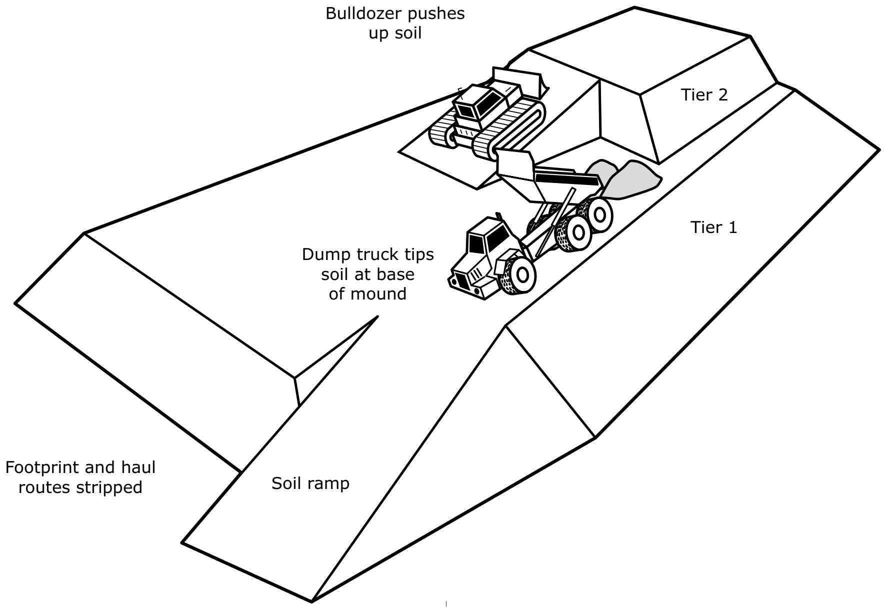

Figure G.2: Soil storage mound construction with bulldozers and dump trucks: Multi-tier mound..

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet I -

Soil Stripping with Bulldozers and Dump Trucks
- Modified Layer by Layer Practice

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Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet I of the guidance is to provide a model method of best practice where bulldozers and dump trucks are to be used to strip soil using a modified soil layer by layer practice.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
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Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

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The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer's specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

In the past soil layers have been stripped in their entirety one by one. Firstly the topsoil, then the subsoil layers by layer until the basal layer is exposed. The method deployed across the entire area is now discredited because of the likely severe compaction caused by the trafficking of the machines over much of the exposed soil surfaces. However, by restricting the extent of the ongoing process to blocks or wide bands of soil, to enable the dump trucks to travel on the basal layer, there may be instances where this 'modified' layer by layer approach can be deployed.

In this practice, only the bulldozer works on the exposed soil layers to form soil bunds along the exposed edge for loading by an excavator (usually) standing on the mound. This approach was described and illustrated in MAFF Sheet 13 https://webarchive.nationalarchives.gov.uk/20090318025435/http://www.defra.gov.uk/farm/environment/land-use/soilguid/sheet13.pdf.

It is also similar to the bulldozer practice described in **Sheet F**, but without the formation of windrows and the need for the excavator to traffic the surcharged soil to recover and load it into the dump trucks. In this respect it is easier to operate than the windrow practice and likely to cause less compaction.

The following modified guidance can also be adopted where only a single soil horizon is to be stripped.

Advantages & Disadvantages
The advantages of the modified handling practice are:
i) It is very simple to administer requiring little supervision and skill
ii) It can be quicker than both the excavator combination with the bed/strip and windrow practices
iii) It offers flexibility in respect of short soil drying periods and likely wet weather as it is l ess susceptible to stoppages due to soil rewetting as a transpiring vegetation cover can be retained later into the stripping programme. It is particularly suited to northerly and western, and upland locations, and particularly when there are uncertain weather patterns.

The disadvantages of the modified handling practice are:
i) There is risk of compaction of the top- and subsoil layers by the repeated trafficking of the bulldozer, even if a low ground pressure machine is used, as it pushes soil to the windrows. Hence, subsequent remedial treatments are likely to be relied upon
ii) It is slow react to localised changes in soil types and variation in horizon depth, and can result in the mixing of soil horizons
iii) It is not suited to the stripping of thin and 'patterned' soil layers, and cleanly exposing the top-sub-soil interface.

Suitability
Neither the unmodified or modified practice are suitable for sites requiring archaeological investigations and reporting, or for 'watching briefs' during soil stripping.

The layer by layer handling practice, without modification, is not advisable for the conservation of soil resources and functioning. Whilst the modified method is not considered 'best practice', it may be acceptable in circumstances where:
i) The subsoil(s) have a high resilience to further compaction (see **Part One**) and when decompaction treatments can be more relied upon to be effective because of a low risk of soil wetness (low rainfall areas/prolonged dry conditions) or operational limitations (such as the availability of effective decompaction tools)
ii) The intended after use, and environmental and ecosystem services are less dependent on maintaining functional characteristics such as soil porosity and hence drainage and aeration, plant available water capacity, and low resistance to plant root growth. This may include low productivity agricultural and forestry land, some types of natural

habitats, and where water storage/infiltration is of lesser importance for the risk of flooding. Where the soils are stored prior to replacement, effective remedial treatment may have to be relied upon

iii) The soils are placed into storage stockpiles.

MODEL METHODOLOGY

I.1 Key operational points to minimise the risk of severe soil compaction and soil wetness with the modified layer by layer practice are summarised in Boxes I.1 and I.2.

Box I.1 - To minimise compaction:

- The dump trucks should normally only operate on the basal layer, and their wheels must not in any circumstances run on to the soil layer(s)
- The adoption of the strip by strip system minimises the need for the trucks to travel on the soil layers
- The machines are to only work when ground conditions enable their efficient operation
- The soils are to be stripped by the bulldozer in as thick layer as possible whilst maintaining their efficient operation
- The bulldozer should make the minimal number of passes over the soil as possible
- The soil layers are to be in ‘dry’ condition.

Box I.2 - To minimize the wetness of the soil and re-wetting of the soil:

- The modified strip by strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active strip should be stripped to the basal layer before rainfall occurs and before stripping is suspended.
- Measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks
- The area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance
- The maintenance of a transpiring crop is important, and an appropriate cropping regime should be established for the year of soil stripping
- Before stripping, excess vegetation should be removed; in the case of grassland it should be cut or grazed short and arable crops should have been harvested.

I.2 The timing of soil handling operations should only take place when the soils are in a ‘dry and friable’ condition (ie when it breaks and shatters when disturbed rather than smears and deforms) (see **Part One, Supplementary Note 4**). Prior to the start or recommencement of soil handling, they should be tested to confirm they are in suitably dry condition (see Box I.3).

I.3 Soil handling (by any machinery combination and handling practice) is not to take place during rain, sleet or snow and in these conditions should be prohibited due to unsafe machine operating conditions. Prior to commencing operations a medium/long term weather forecast should be obtained which gives reasonable confidence of soil handling being completed without significant interruptions from rainfall events. The soil based criteria set out in BOX I.4 are to be used to determine whether soil handling should cease or be interrupted with the occurrence of rain.
The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

I.5 The operation should follow the detailed stripping plan set out in the SRMP showing soil units to be stripped, haul routes and the phasing of vehicle movements. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. The haul routes and soil storage areas must be defined and should be stripped first in a similar manner. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

I.6 Demarcate an initial width of the ‘strip’ of soils to be recovered as the modified layer by layer practice.

Box I.3 - Test for Dry and Friable Soils

Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations on the soil handling area and at each soil horizon to the full depth of the profile to be recovered/ replaced. The tests shall include visual examination of the soil and physical assessment of soil consistency.

i) Examination
- If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place**
- If the sample is moist (i.e. there is a slight dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place**
- If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place**

ii) Consistency
First Test
Attempt to mould soil sample into a ball by hand:
- Impossible because soil is too dry and hard or too loose and dry means soil handling can take place
- Impossible because the soil is too loose and wet means no soil handling to take place
- Possible - GO TO SECOND TEST

Second Test
Attempt to roll ball into a 3mm diameter thread by hand:
- Impossibe because soil crumbles or collapses means **soil handling can take place**
- Possible means **no soil handling to take place**

NB: It is impossible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

Box I.4 – Rainfall Criteria:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/ near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately.

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.

Box I.5

Whilst there can be a lower of a risk of compaction when using wide tracked ('low ground pressure' (LGP)) bulldozers, in some circumstances they may require to traffic the soil surface more than standard machines to achieve the same work rate, and therefore the advantage of their use may be less than anticipated. However, the risk of severe compaction and reliance on remedial treatments may be less with the use of LGP machines.

This is the effective push distance of the bulldozer to bund the soil at the edge of the strip (Box I.5).
I.7 Within each soil unit the soil layers above the base/formation layer are to be stripped layer by layer in the retreating strips/blocks until all the soil is removed (**Figure I.1**).

I.8 The bulldozer is only to stand and work on the soil layer when stripping soils and the excavator on the resulting soil mound, otherwise they are to travel only on the basal/formation layer. The dump trucks are to operate only on the basal layer (**Figure I.2**).

I.9 The topsoil is to be pushed towards the retreating edge and heaped for the excavator to load onto the dump trucks (**Figure I.2**). The topsoil should be recovered to the full width of the segment without mixing with subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The procedure is repeated until all of the topsoil has been removed.

I.10 The above procedure is then repeated for the sub-soil until all the soil layer has been recovered, and then any subsequent lower layer to be recovered until the basal layer is fully exposed (**Figure I.3**).

I.11 Where the soils are to be directly replaced without storage in mounds, the initial strip of the upper horizons will have to be stored temporarily to release the lowest layer and enable the sequential movement of materials. The stored initial soil material would be placed on the lower layer removed from the final strip at the end of the programme or on partially completed profiles if rain was forecast.

I.12 Where the stripping operation is likely to be interrupted by rain or there is likely to be overnight rain, the soil layer is to be ‘sealed’ by the bulldozer tracking and ‘blading’ the exposed surface. Make provisions to protect base of current or next strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

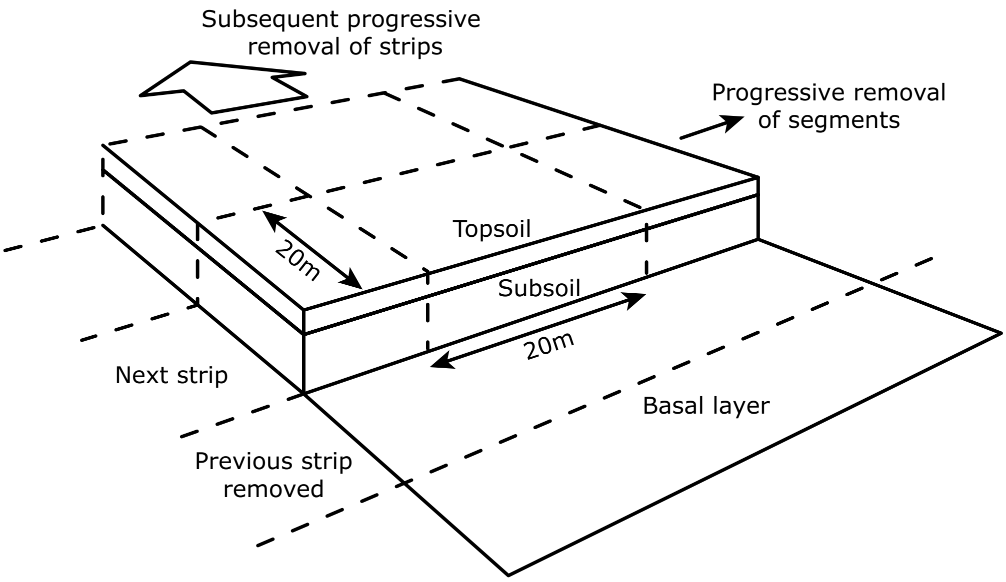

Figure I.1: Soil stripping with bulldozers and dump trucks using modified layer by layer practice.

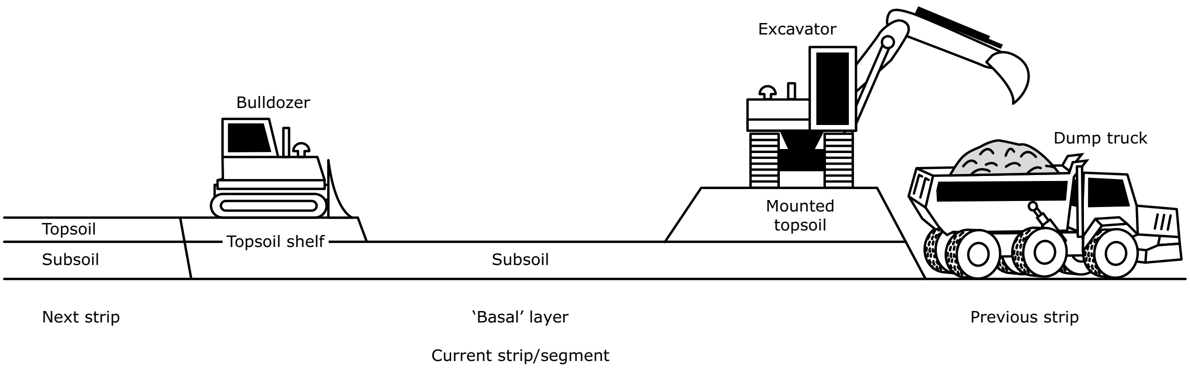

Figure I.2: Soil stripping with bulldozers and dump trucks using modified layer by layer method: Topsoil.

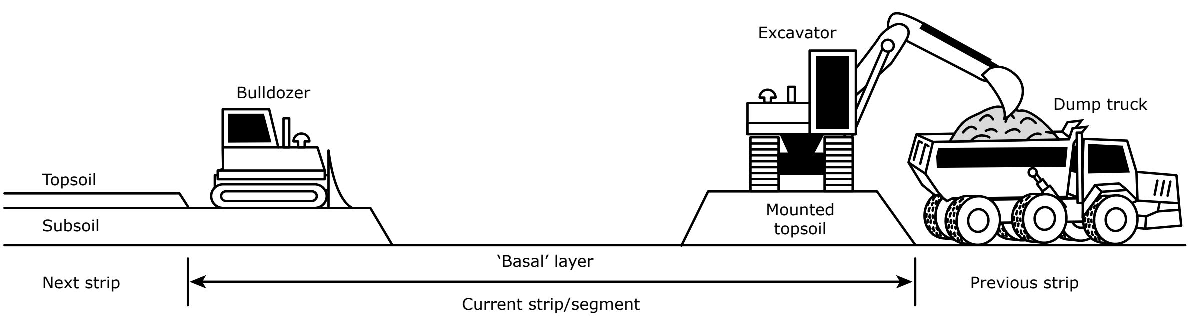

Figure I.3: Soil stripping with bulldozers and dump trucksn using modified layer by layer method: Subsoil.

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet N -

Soil Decompaction by Excavator Bucket

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- Blakemere Consultants Ltd & Celtic Energy Ltd

Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Preface

The purpose of Sheet N of the guidance is to provide a model method of best practice where excavators are to be used to decompact replaced soils and the basal layer by digging with a bucket.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/ plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types.

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974 and in the case of mineral extraction operations, The Quarries Regulations 1999 and its relevant statutory provisions; in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer's specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

The purpose of this Guidance Sheet is to provide a model method for best practice where an excavator is used to decompact soils and basal/formation layers. Excavators are most likely to be used for this purpose where soils are replaced by excavator (Sheet D), however the methodology can be deployed in combination with the machinery and practices presented in Sheets H, J and K.

Advantages & Disadvantages
The advantages of the methodology are:
i) It is an efficient means of decompaction
ii) The equipment is standardized and readily available
iii) It is flexible with the quick interchange with a stone-rake for the need remove stones or level/cultivate a final surface
iv) It is suited to single shallow soil layer.

The disadvantages are:
i) The deployment adds another level of complexity needed in the soil replacement and skill and discipline in the decompaction procedures
ii) The methodology is significantly slower than the alternative of ripping (**Sheet S**)
iii) The effective decompaction is dependent on the soils being in a sufficiently ‘dry’ condition
iv) There is a risk of mixing of soil horizons.

Suitability
This practice is the most suitable for a wide range of and uses, soil functions, and environmental and ecosystem services where decompaction is required. It can be deployed on steep and complex landforms. Like with the use of tines (**Sheet O**), to be effective the soil must be dry enough to shatter. The SRMP will have specified the need and particular requirements, within the soil replacement procedures, site conditions land and use aims.

Many former mineral workings have been backfilled with inert waste. Remedial treatments of the infill, by digging or ripping, may not be advisable where these are not to be part of the replaced soil profile and this should be covered in the SRMP. The treatment of former silt lagoons needs careful consideration and consultation with a geotechnical specialist where there is a possibility of breaking through the dewatered and stabilised upper material into the saturated underlying lower material.

MODEL METHODOLOGY

The Decompaction Operation
N.1 Key operational points to minimize the risk of severe soil compaction and soil wetness are summarised in Boxes N.1 and N.2.

Box N.1 - To minimize compaction:

- Wherever possible the excavator is to operate on the basal layer
- The excavator is only to work when ground conditions enable efficient operation
- The operation should only be carried out when the soils are in a ‘dry’ condition.

Box N.2

- The soil profile within the active strip should be completed to the topsoil layer before rainfall occurs and before replacement is suspended
- Measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.

N.2 The timing of soil handling operations should only take place when the soils are in a ‘dry and friable’ condition (i.e. when it breaks and shatters when disturbed rather than smears and deforms) (see **Part One, Supplementary Note 3**). Prior to the start or recommencement of soil handling they should be tested to confirm they are in suitably dry condition (see Box N.3).

N.3 Soil handling is not to take place during rain, sleet or snow and in these conditions should be prohibited due to unsafe machine operating conditions. Prior to commencing operations, a medium/long term weather forecast should be obtained which gives reasonable confidence of soil handling being completed without significant interruptions from rainfall events. The soil based

Box N.3 - Test for Dry and Friable Soils

Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations on the soil handling area and at each soil horizon to the full depth of the profile to be recovered/ replaced. The tests shall include visual examination of the soil and physical assessment of soil consistency.

i) Examination

- If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place**
- If the sample is moist (i.e. there is a slight dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place**
- If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place**

ii) Consistency
First Test
Attempt to mould soil sample into a ball by hand:

- Impossible because soil is too dry and hard or too loose and dry means soil handling can take place
- Impossible because the soil is too loose and wet means no soil handling to take place
- Possible - GO TO SECOND TEST

Second Test
Attempt to roll ball into a 3mm diameter thread by hand:

- Impossibe because soil crumbles or collapses means **soil handling can take place**
- Possible means **no soil handling to take place**

NB: It is impossible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

criteria set out in BOX N.4 are to be used to determine whether soil handling should cease or be interrupted with the occurrence of rain.

N.3 Soil handling is not to take place during rain, sleet or snow and in these conditions should be prohibited due to unsafe machine operating conditions. Prior to commencing operations, a medium/long term weather forecast should be obtained which gives reasonable confidence of soil handling being completed without significant interruptions from rainfall events. The soil based criteria set out in Box N.4 are to be used to determine whether soil handling should cease or be interrupted with the occurrence of rain.

Box N.4 - Rainfall Criteria:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/ near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may restart, provided that the ground is free from ponding and ground conditions are safe to do so.

N.4 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

N.5 The operation should follow the detailed replacement plan set out in the SRMP showing soil units to be stripped, haul routes and the phasing of vehicle movements. Different soil units to be kept separate are to be marked out and information to distinguish types and layers, and ranges of thickness needs to be conveyed to the operational supervisor/operator. The haul routes and soil storage areas must be defined and should be stripped first in a similar manner. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

N.6 The digging radius is determined by excavator boom length less the stand-off to operate; typically, about 3-4m. Excavators with long booms (‘long reach’) can be used, but may be more restricted by gradient limitations, and require skilled and experienced operators. The excavator bucket is to be maximum capacity of 2.5m^3 and 1.0 m to 1.5m wide cutting edge (blade) with armoured teeth at about 150 mm spacing, 150 mm long and 50mm in section.

N.7 The excavator should stand on and work from the basal/formation layer wherever possible.

N.8 Where the soil layer to be decompacted as a single layer and is less than about 0.5m thick the following procedure is to be adopted. The area to be treated is decompacted as a series of sequential ‘trenches’ to the depth required (**Figure N.1**).

N.9 Each trench is to be the effective working length of the excavator boom (nominally 3-4m). The trench is started by inserting the bucket ‘blade’ downwards into the soil to the depth required and keeping this vertical attitude pulled towards the excavator (**Figure N.1**). When the bucket is almost filled it is lifted and the soil tipped into the ‘trench’ created. The bucket’s tines have a ripping action and the pushing of the soil into the bucket has a shattering effect if the soil is dry enough, otherwise it will compress the soil material with no resulting beneficial effect. If the replaced soil in the trench is cloddy, it can be ‘chopped’ using the bucket’s blade. The process is repeated until the trench has been decompacted, then another trench is treated until the whole area to be treated is completed. It is essential each successive bucket ‘dig’ overlaps with the former both to the back and sides of the trenches. Finally, the bucket cutting edge can be used to lightly grade the finished surface.

N.10 Where the soil layer is deeper than the capability of the bucket (about 0.5m), a ‘double-digging’ approach is needed. The process is similar to above, but the upper material in the trench is to be cast aside over the adjacent untreated strip (‘double digging’). The exposed lower layer is then treated as above and on completion the cast aside upper material is replaced with any necessary cultivation/levelling with the bucket taking place. This method is relatively slow.

N.11 The alternative for deep profiles than 0.5m to be decompacted by the excavator method is to place the soil layer in several successive sub-layers each up to 0.5m in thickness, and to sequentially decompact each replaced layer as described above. The process is repeated until the full soil horizon is replaced to the required thickness and has been completely ‘dug over’. This method is also slow.

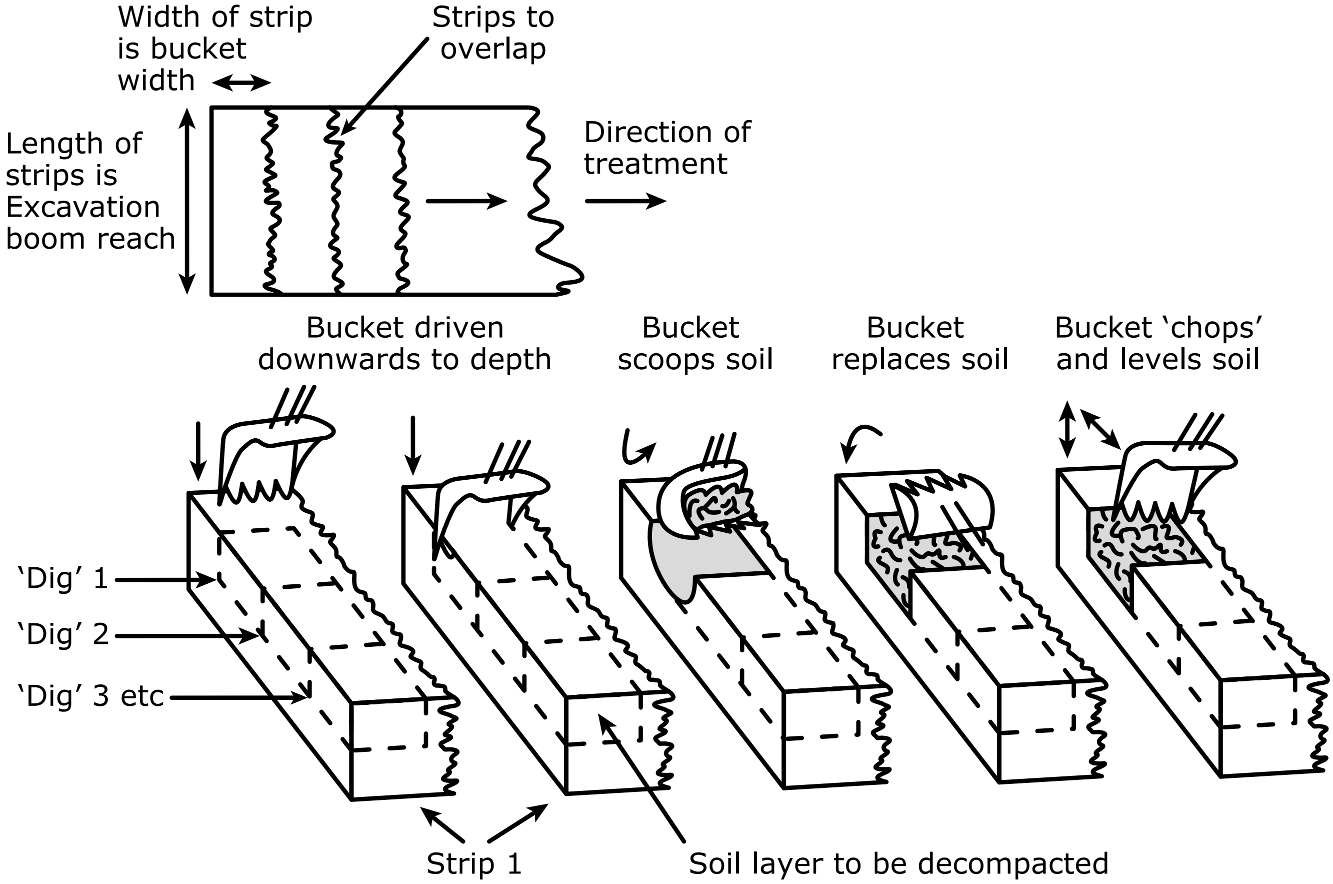


Figure N.1 Decompaction by excavator bucket..

Appendix B. Calculations for Drainage Ditches and Pipes

Client	E&JW Glendinning Ltd.													
Project	Linhay Hill Quarry		Proposed quarry extension landscape bund formation - calculations for drainage channels & field pipe connections											
Revision	R2													
Input														
Output of interest														
Parameter		Unit	Justification	Ditch AC 1.0	Ditch 1.1	Ditch 1.2	Ditch 3.0	Ditch 3.1	Ditch 3.2	Ditch 4.1	Ditch 4.2	Ditch 3.3	Ditch 3.6	Ditch 3.7
Catchment drainage route				East	West	West	West	East	East	West	West	South east	West	East
Outfall				Kester Brook	Quarry	Quarry	Quarry	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Quarry	Kester Brook
Installation stage				Stage 1	Stage 1 & then 1 & 2	Stage 2	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1
Summation of catchments areas														
To Ditch AC 1.0				72										
To Ditch 1.1		m2			6315									
To Ditch 1.2		m2			7864	7864								
To Ditch 3.1		m2						4152	4152			4152		
To Ditch 3.2		m2							2392			2392		
To Ditch 3.6		m2											1098	
To Ditch 3.7		m2											D	6244
To Ditch 4.1		m2								1555	1555	1555		
To Ditch 4.2		m2									1434	1434		
To Ditch 3.3		m2										560		
To SW flow route 7.1, Stage 2		m2												
To Ditc h 7.2, Stage 2		m2												
To Ditch 7.3, Stage 2		m2												
SW flow route 5.1, Stage 1 only		m2												
To Ditch 5.2 at Stage 1b		m2												
To Ditch 5.2 at Stage 2		m2												
To Ditch 5.3 at Stage 2		m2												
SW flow route 6.1, Stage 1 only		m2												
SW flow route 6.2		m2												
SW flow route 8.1		m2												
To Ditch 5.5		m2												
To Ditch 5.6														
To Ditch 3.4		m2												
To Pipe 9.1 / Ditch 9.2		m2												
To Ditch 9.3		m2												
To Ditch 10.1		m2												
Total Catchment area	Acatchtot	ha		0.0072	1.418	0.786	0.017	0.415	0.654	0.156	0.299	1.009	0.110	0.624
Return period & justification		yr		1 in 100, perimeter drainage	1 in 30, exceedance flow to quarry	1 in 30, exceedance flow to quarry	1 in 30, exceedance flow to quarry	1 in 30, exceedance flow north of bunds	1 in 30, exceedance flow north of bunds	1 in 30, exceedance flow north of bunds	1 in 30, exceedance flow north of bunds	1 in 30, exceedance flow north of bunds	1 in 30, exceedance flow to quarry	1 in 100, perimeter drainage
Design storm duration		hr	As per FRA2016, except for AC 1.0	1	3	3	3	3	1	3	3	3	3	3
Total rain		mm	FEH22 no seasonal adjustment	41.50	50.40	50.40	50.40	50.40	25.60	50.40	50.40	50.40	50.40	60.60
Climate change allowance				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%
Rainfall intensity	i	mm/hr	Calc	41.5	16.8	16.8	16.8	16.8	25.6	16.8	16.8	16.8	16.8	28.3
Coefficient of runoff	C		FRA 2016, C=0.343 for Existing runoff rate for Kestor Brook catchment, for landscape bunds C=0.52, or an intermediate value for combination of catchments	0.52	0.343	0.343	0.520	0.520	0.520	0.520	0.520	0.520	0.520	0.520
Flow from catchment	Qcatch	m3/s	Calc Qcatch=CiAcatchtot/360	0.00043	0.023	0.013	0.0004	0.010	0.024	0.004	0.007	0.024	0.003	0.026
Hydraulic Design of Ditches using Manning's equation (ref. DMRB CD 532 Vegetated drainage systems for highway runoff)														
Length		m	Drawings, design	7.7	116.0	129.9	24.4	133.4	128.4	101.0	119.7	35.7	29.8	145.9
Existing ground level or invert upstream		mOD	Existing ground level from topo	118.05	138.23	141.80	121.10	121.10	118.00	122.70	120.20	117.30	119.10	119.10
Existing ground level or invert downstream		mOD	Existing ground level from topo	118.00	133.40	138.20	119.60	118.00	117.30	120.20	117.30	115.30	118.70	114.60
Gradient	S	m/m	Average for channel	0.0065	0.0416	0.0277	0.0615	0.0232	0.0055	0.0248	0.0242	0.0560	0.0134	0.0308
Manning's roughness coefficient	n		CD532 V0.10 Cl 3.29 n=0.05 for new ditch then maintainance	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manning's roughness coefficient	n		New grassed channel, maintained											
Trapezoidal channel														
Base width	B	m	Design	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Side slopes 1:b (V:H)	b		Design	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Channel depth	y	m	Design	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Width of channel	W	m	Calc	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Area of channel	Achan	m2	Calc	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Wetted perimeter	P	m	Calc	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hydraulic radius	R	m	Calc	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Full channel flow rate	Qchan	m3/s	Calc	0.04	0.10	0.08	0.12	0.07	0.04	0.07	0.07	0.11	0.05	0.08
Qchan > Qcatch			Qchan > Qcatch, ditch dimensions OK	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Free board	f	m	So depth >0.35m, or approx 1/4 to 1/6 depth	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Channel depth with freeboard	yf	m	Design	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Width of channel with freeboard	Wf	m	Calc	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pipe Hydraulics Using Colebrook-White equation in simplified usage mode														
Pipe ID														
Length		m	From drawings											
Invert upstream		mOD	Design											
Level downstream		mOD	Design											
Gradient		m/m	Calc											
Slope 1V:	H		Calc											
Diameter		mm	Design											
Pipe Roughness		mm	As per Sewage Sector Guidance Appendix C for surface water sewer											
Discharge	Qpipe	l/s	Calc											
		m3/s	Calc											
Velocity		m/s	Calc											
Qpipe > QcatchCC			Qpipe > QcatchCC, pipe dimensions OK											

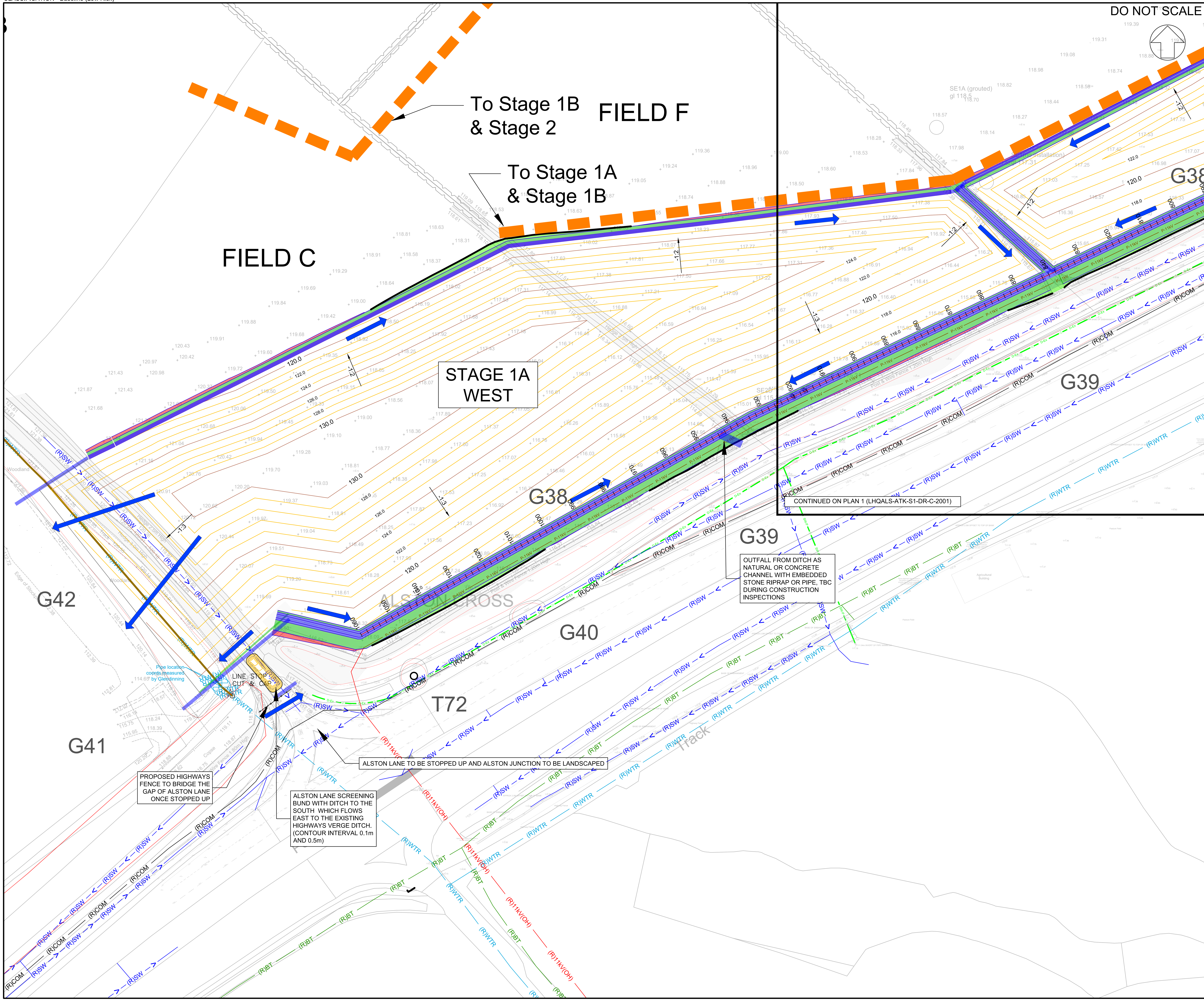
Client E&JW Glendinning Ltd.
Project Linhay Hill Quarry
Revision R2
Input
Output of interest

Proposed quarry extension landscape bund formation - calculations for drainage channels & field pipe connections

Parameter		Unit	Justification	Ditch 7.2	Ditch 7.3	Ditch 5.2	Ditch 5.3	Pipe 5.4	Ditch 5.5	Ditch 5.6	Ditch 3.4	Ditch 3.5	Pipe 9.1, Ditch 9.2	Ditch 9.3, Pipe 9.4	Ditch 10.1
Catchment drainage route				South east	South west	South west	South	South west	South west	South west	South west	South	South east	South east	South east
Outfall				Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook	Kester Brook
Installation stage				Stage 2	Stage 2	Stage 1B	Stage 1B	Stage 1B	Stage 1A	Stage 1A	Stage 1A	Stage 1A	Stage 2	Stage 2 to Stage 4	Stage 2
Summation of catchments areas															
To Ditch AC 1.0															
To Ditch 1.1		m2													
To Ditch 1.2		m2													
To Ditch 3.1		m2										4152			
To Ditch 3.2		m2										2392			
To Ditch 3.6		m2													
To Ditch 3.7		m2										6244			
To Ditch 4.1		m2													
To Ditch 4.2		m2													
To Ditch 3.3		m2													
To SW flow route 7.1, Stage 2		m2		10094	10094	10094	10094	10094	10094	10094	10094	10094			
To Ditc h 7.2, Stage 2		m2		2257	2257	2257	2257	2257	2257	2257	2257	2257			
To Ditch 7.3, Stage 2		m2			10728	10728	10728	10728	10728	10728	10728	10728			
SW flow route 5.1, Stage 1 only		m2				3944	3944	3944	3944	3944	3944	3944			
To Ditch 5.2 at Stage 1b		m2				5067	5067	5067	5067	5067	5067	5067			
To Ditch 5.2 at Stage 2		m2				3436	3436	3436	3436	3436	3436	3436			
To Ditch 5.3 at Stage 2		m2					15662	15662	15662	15662	15662	15662			
SW flow route 6.1, Stage 1 only		m2						1771	1771	1771	1771	1771			
SW flow route 6.2		m2						11298	11298	11298	11298	11298			
SW flow route 8.1		m2						7286	7286	7286	7286	7286			
To Ditch 5.5		m2							2414	2414	2414	2414			
To Ditch 5.6										2930	2930	2930			
To Ditch 3.4		m2									3426	3426			
To Pipe 9.1 / Ditch 9.2		m2							116777	116777	116777	116777	116777	116777	
To Ditch 9.3		m2							2412	2412	2412	2412		2416	
To Ditch 10.1		m2													35277
Total Catchment area	Acatchtot	ha		1.235	2.308	3.553	5.119	7.154	19.315	19.608	19.950	21.229	11.678	11.919	3.528
Return period & justification		yr		1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 100, perimeter drainage	1 in 30, exceedance flow north of bunds or to quarry	1 in 30, exceedance flow north of bunds or to quarry	1 in 30, exceedance flow north of bunds or to quarry
Design storm duration		hr	As per FRA2016, except for AC 1.0	3	3	3	3	3	3	3	3	3	3	3	3
Total rain		mm	FEH22 no seasonal adjustment	60.60	60.60	60.60	60.60	60.60	60.60	60.60	60.60	60.60	50.40	50.40	50.40
Climate change allowance				40%	40%	40%	40%	140%	40%	40%	40%	40%	0%	0%	0%
Rainfall intensity	i	mm/hr	Calc	28.3	28.3	28.3	28.3	48.5	28.3	28.3	28.3	28.3	16.8	16.8	16.8
Coefficient of runoff	C		FRA 2016, C=0.343 for Existing runoff rate for Kestor Brook catchment, for landscape bunds C=0.52, or an intermediate value for combination of catchments	0.520	0.520	0.520	0.520	0.520	0.411	0.412	0.414	0.414	0.343	0.343	0.343
Flow from catchment	Qcatch	m3/s	Calc Qcatch=CiAcatchtot/360	0.050	0.094	0.145	0.209	0.501	0.623	0.635	0.649	0.691	0.187	0.191	0.056
Hydraulic Design of Ditches using Manning's equation (ref. DMRB CD 532 Vegetated drainage systems for highway runoff)															
Length		m	Drawings, design	85.5	147.3	120.8	446.7		104.8	117.2	104.8	6.7	152.7	309.7	344.9
Existing ground level or invert upstream		mOD	Existing ground level from topo	136.65	132.65	132.20	131.95		122.45	117.55	117.55	113.95	139.45	134.65	131.90
Existing ground level or invert downstream		mOD	Existing ground level from topo	132.65	132.20	131.95	123.15		117.55	114.70	113.95	113.80	134.65	122.85	118.10
Gradient	S	m/m	Average for channel	0.0468	0.0031	0.0021	0.0197		0.0468	0.0243	0.0344	0.0224	0.0314	0.0381	0.0400
Manning's roughness coefficient	n		CD532 V0.10 Cl 3.29 n=0.05 for new ditch then maintainance	0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manning's roughness coefficient	n		New grassed channel, maintained												
Trapezoidal channel															
Base width	B	m	Design	0.30	0.60	0.60	0.60		0.60	0.60	0.90	0.90	0.30	0.30	0.30
Side slopes 1:b (V:H)	b		Design	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Channel depth	y	m	Design	0.20	0.30	0.45	0.45		0.45	0.50	0.55	0.55	0.35	0.35	0.20
Width of channel	W	m	Calc	0.70	1.20	1.50	1.50		1.50	1.60	2.00	2.00	1.00	1.00	0.70
Area of channel	Achan	m2	Calc	0.10	0.27	0.47	0.47		0.47	0.55	0.80	0.80	0.23	0.23	0.10
Wetted perimeter	P	m	Calc	0.87	1.45	1.87	1.87		1.87	2.01	2.46	2.46	1.29	1.29	0.87
Hydraulic radius	R	m	Calc	0.12	0.19	0.25	0.25		0.25	0.27	0.32	0.32	0.18	0.18	0.12
Full channel flow rate	Qchan	m3/s	Calc	0.10	0.10	0.17	0.53		0.82	0.72	1.40	1.13	0.25	0.28	0.09
Qchan > Qcatch			Qchan > Qcatch, ditch dimensions OK	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES
Free board	f	m	So depth >0.35m, or approx 1/4 to 1/6 depth	0.15	0.15	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.15
Channel depth with freeboard	yf	m	Design	0.35	0.45	0.55	0.55		0.55	0.60	0.65	0.65	0.45	0.45	0.35
Width of channel with freeboard	Wf	m	Calc	1.00	1.50	1.70	1.70		1.70	1.80	2.20	2.20	1.20	1.20	1.00
Pipe Hydraulics Using Colebrook-White equation in simplified usage mode															
Pipe ID								Pipe 5.4					Pipe 9.1	Pipe 9.4	
Length		m	From drawings					12.00					13.75	12.30	
Invert upstream		mOD	Design					123.15					139.65	122.85	
Level downstream		mOD	Design					122.45					139.45	122.45	
Gradient		m/m	Calc					0.06					0.01	0.03	
Slope 1V:	H		Calc					17.14					68.75	30.75	
Diameter		mm	Design					450					375	300	
Pipe Roughness		mm	As per Sewage Sector Guidance Appendix C for surface water sewer					0.6					0.6	0.6	
Discharge	Qpipe	l/s	Calc					783.8					241.5	201.1	
		m3/s	Calc					0.784					0.241	0.201	
Velocity		m/s	Calc					4.928					2.187	2.844	
Qpipe > QcatchCC			Qpipe > QcatchCC, pipe dimensions OK					YES					YES	YES	

Appendix C. Overburden Plan Drawings

CLASSIFICATION - Baseline (Low Risk)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

N/A

MAINTENANCE/CLEANING

N/A

DECOMMISSIONING/DEMOLITION

N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.

PROPOSED DITCH ROUTE

PROPOSED VERGE

PROPOSED CUT

PROPOSED FILL

PROPOSED HEDGEBANK

EXISTING HEDGEBANK (FROM TOPO SURVEY)

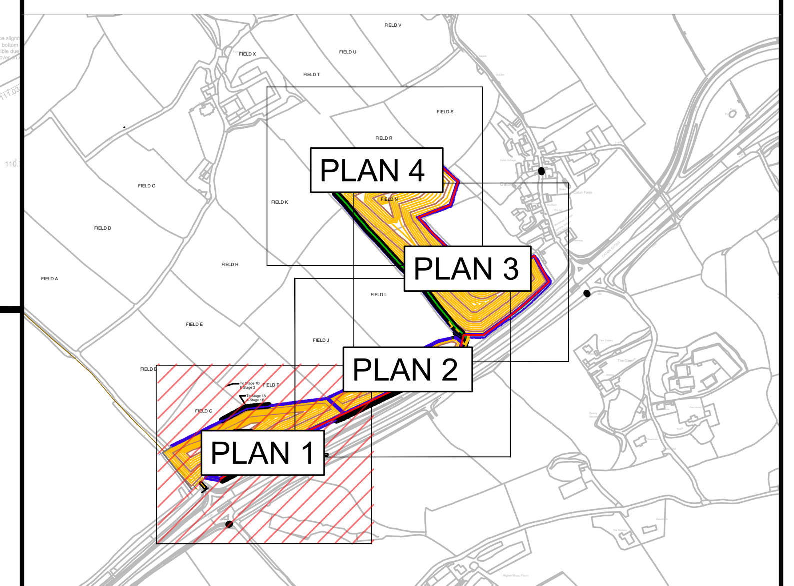
EXISTING HEDGEBANK (INDICATIVE FROM AERIAL)

PROPOSED HAUL ROAD

CONTOURS (1m AND 5m INTERVALS)

TREE ROOT PROTECTION (RED = TREE ROOT / BLACK = CANOPY EXTENTS)

SURFACE WATER INDICATIVE FLOW PATH



Rev.	Date	Description	By	Chk'd	App'd
P02	05/06/24	ISSUED FOR INFORMATION	JDP	TSM	ATF
P01	08/04/24	ISSUED FOR INFORMATION	JDP	PAC	ATF

Drawing Status: FOR INFORMATION

Suitability: S2

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: ALSTON FARM STAGE 1 OVERBURDEN BUNDS PLAN 1 OF 4

Scale	Designed	Drawn	Checked	Authorised
1:500	JDP	JDP	PAC	KR
Original Size	Date	Date	Date	Date
A1	JAN 2024	JAN 2024	31/01/2024	31/01/2024

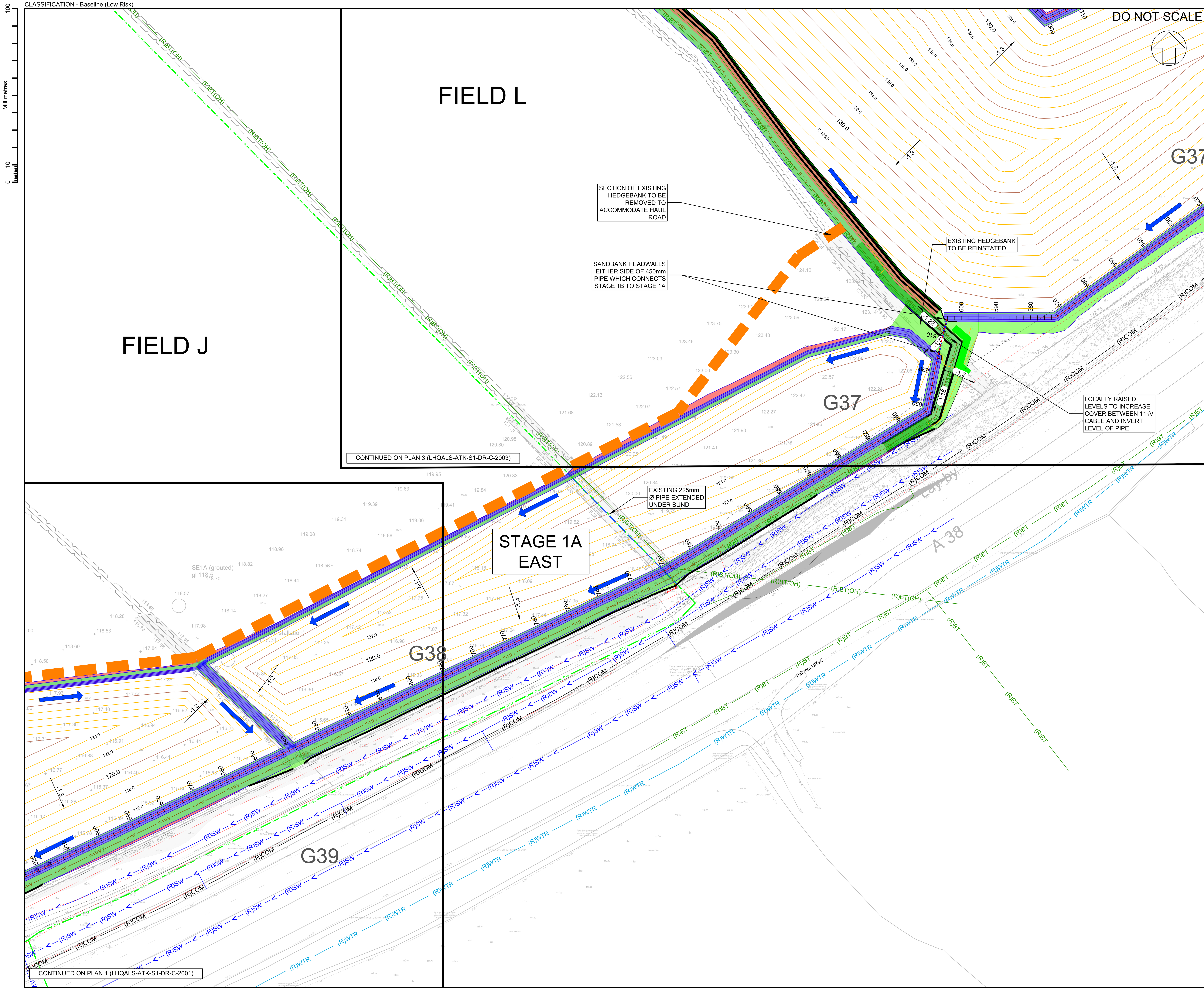
Drawing Number: LHQALS-ATK-S1-DR-C-2001

Revision: P02

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)

CLASSIFICATION - Baseline (Low Risk)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

N/A

MAINTENANCE/CLEANING

N/A

DECOMMISSIONING/DEMOLITION

N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.

- PROPOSED DITCH ROUTE
- PROPOSED VERGE
- PROPOSED CUT
- PROPOSED FILL
- PROPOSED HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (INDICATIVE FROM AERIAL)
- PROPOSED HAUL ROAD
- CONTOURS (1m AND 5m INTERVALS)
- TREE ROOT PROTECTION (RED = TREE ROOT / BLACK = CANOPY EXTENTS)
- SURFACE WATER INDICATIVE FLOW PATH

Rev.	Date	Description	By	Chk'd	App'd
P02	05/06/24	ISSUED FOR INFORMATION	JDP	TSM	ATF
P01	08/04/24	ISSUED FOR INFORMATION	JDP	PAC	ATF

Drawing Status: FOR INFORMATION
Suitability: S2

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: ALSTON FARM STAGE 1 OVERBURDEN BUNDS PLAN 2 OF 4

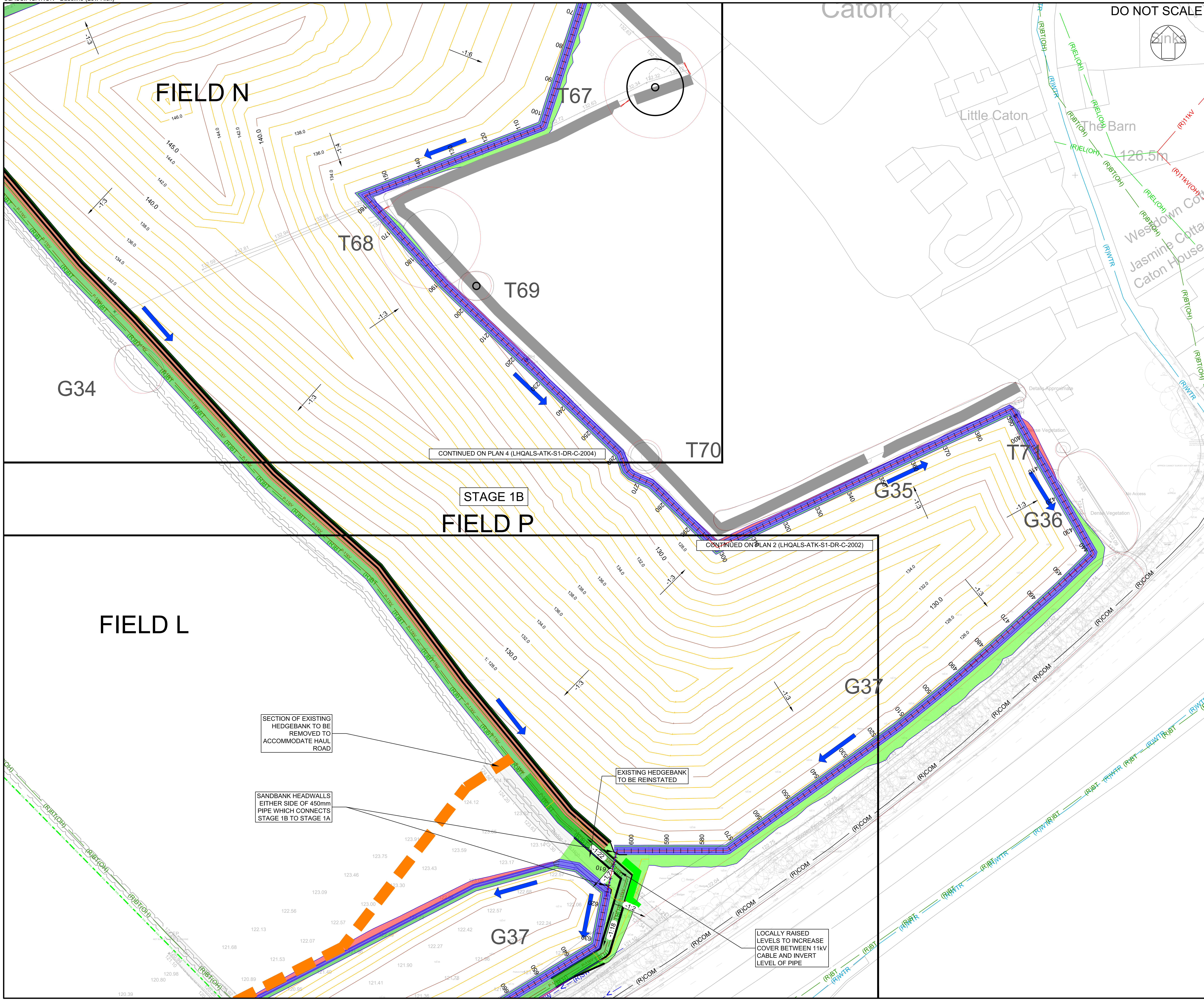
Scale	Designed	Drawn	Checked	Authorised
1:500	JDP	JDP	PAC	KR
Original Size	Date	Date	Date	Date
A1	JAN 2024	JAN 2024	31/01/2024	31/01/2024

Drawing Number: LHQALS-ATK-S1-DR-C-2002
Revision: P02

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)

CLASSIFICATION - Baseline (Low Risk)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION
N/A

MAINTENANCE/CLEANING
N/A

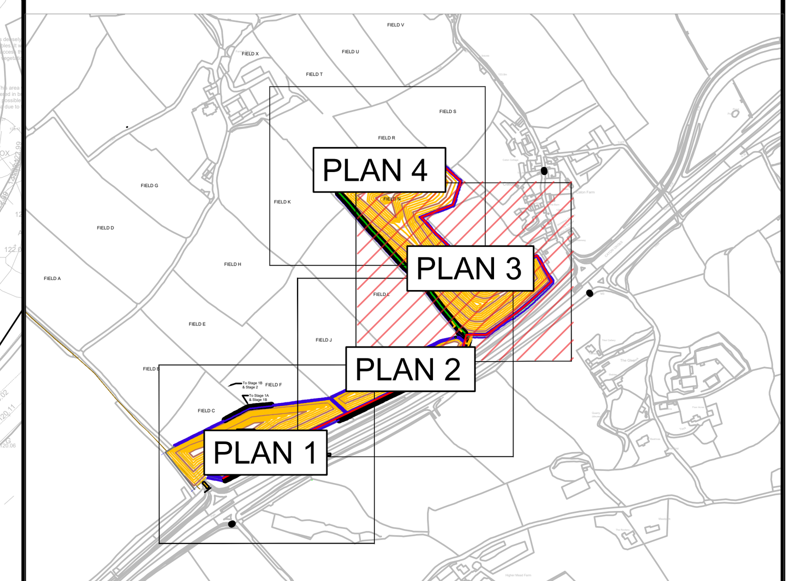
DECOMMISSIONING/DEMOLITION
N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.

- PROPOSED DITCH ROUTE
- PROPOSED VERGE
- PROPOSED CUT
- PROPOSED FILL
- PROPOSED HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (INDICATIVE FROM AERIAL)
- PROPOSED HAUL ROAD
- CONTOURS (1m AND 5m INTERVALS)
- TREE ROOT PROTECTION (RED = TREE ROOT / BLACK = CANOPY EXTENTS)
- SURFACE WATER INDICATIVE FLOW PATH



Rev.	Date	Description	By	Chk'd	App'd
P02	05/06/24	ISSUED FOR INFORMATION	JDP	TSM	ATF
P01	08/04/24	ISSUED FOR INFORMATION	JDP	PAC	ATF

Drawing Status: FOR INFORMATION
Suitability: S2

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: ALSTON FARM STAGE 1 OVERBURDEN BUNDS PLAN 3 OF 4

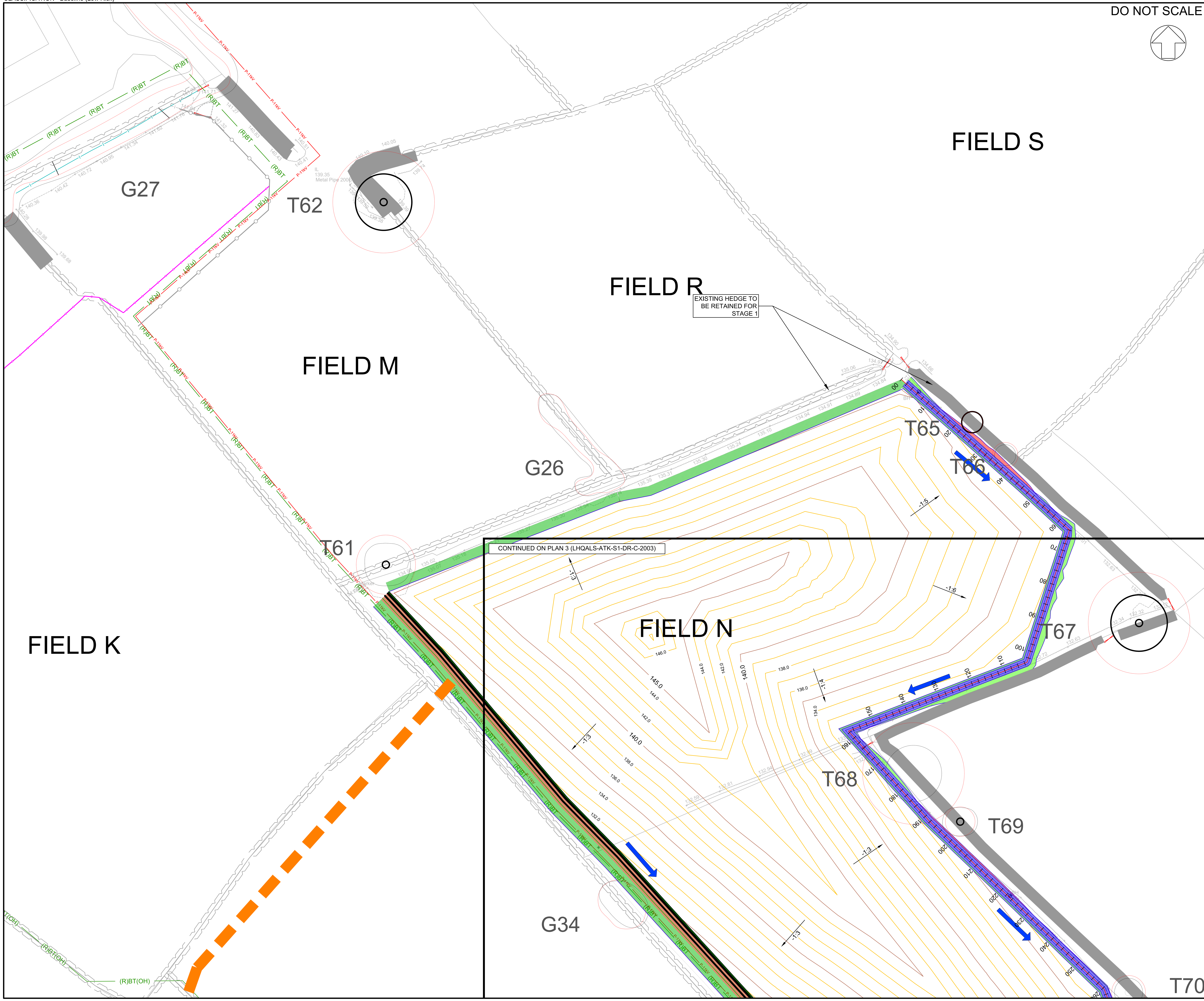
Scale	Designed	Drawn	Checked	Authorised
1:500	JDP	JDP	PAC	KR
Original Size	Date	Date	Date	Date
A1	JAN 2024	JAN 2024	31/01/2024	31/01/2024

Drawing Number: LHQALS-ATK-S1-DR-C-2003
Revision: P02

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)

Millimetres 0 10 100



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION
N/A

MAINTENANCE/CLEANING
N/A

DECOMMISSIONING/DEMOLITION
N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.

- PROPOSED DITCH ROUTE
- PROPOSED VERGE
- PROPOSED CUT
- PROPOSED FILL
- PROPOSED HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (INDICATIVE FROM AERIAL)
- PROPOSED HAUL ROAD
- CONTOURS (1m AND 5m INTERVALS)
- TREE ROOT PROTECTION (RED = TREE ROOT / BLACK = CANOPY EXTENTS)
- SURFACE WATER INDICATIVE FLOW PATH

PLAN 4 · PLAN 3 · PLAN 2 · PLAN 1

Rev.	Date	Description	By	Chk'd	App'd
P02	05/06/24	ISSUED FOR INFORMATION	JDP	TSM	ATF
P01	08/04/24	ISSUED FOR INFORMATION	JDP	PAC	ATF

Drawing Status: FOR INFORMATION
Suitability: S2

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: ALSTON FARM STAGE 1 OVERBURDEN BUNDS PLAN 4 OF 4

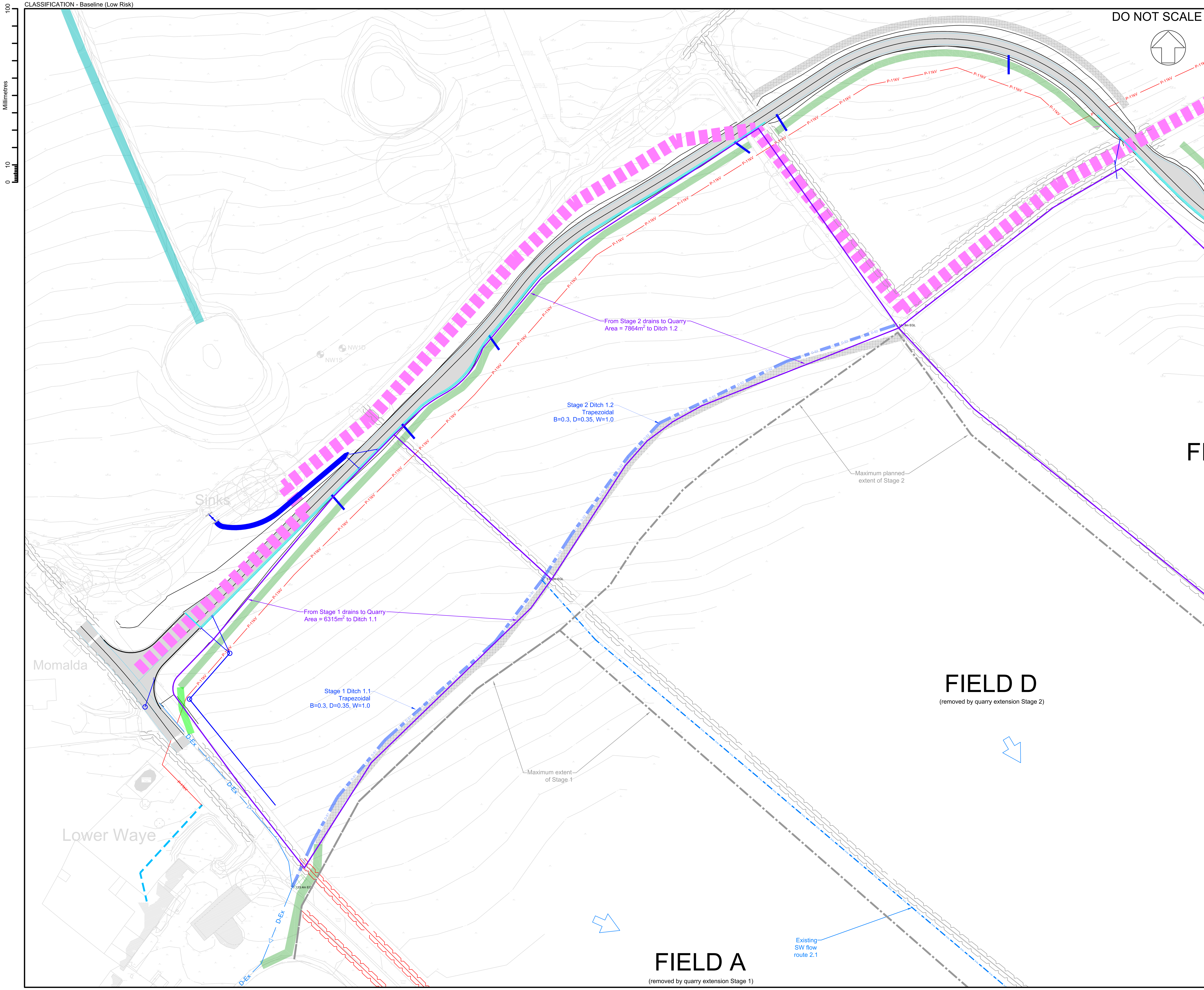
Scale	Designed	Drawn	Checked	Authorised
1:500	JDP	JDP	PAC	KR
Original Size	Date	Date	Date	Date
A1	JAN 2024	JAN 2024	31/01/2024	31/01/2024

Drawing Number: LHQALS-ATK-S1-DR-C-2004
Revision: P02

Internal Project Number: 5196443

Appendix D. Drainage Plan Drawings

DO NOT SCALE



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

N/A

MAINTENANCE/CLEANING

N/A

DECOMMISSIONING/DEMOLITION

N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.
3. REFER ALSO TO DRAWINGS LHQALS-ATK-S1-DR-C-2001 TO 2004 FOR STAGE 1 BUND DESIGN DETAILS AND LEMES FOR DETAILS OF HEDGEBANK MANAGEMENT .
4. DRAINAGE AS LABELLED, B = BASE, D = DEPTH, W = WIDTH, Ø = DIAMETER, EGL = EXISTING GROUND LEVEL, PGL = PROPOSED GROUND LEVEL

KEY

- Stage 1 / Stage 2 — PROPOSED TRANSLOCATED HEDGEBANK
- PROPOSED NEW HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (FROM OS MAP OR AERIAL) RED = TO BE TRANSLOCATED STAGE 1 OR FOR BU
- Stage 1 / Stage 2 — PROPOSED FOOTPATH
- PROPOSED HAUL ROAD
- CONTOURS (2m AND 10m INTERVALS) UNLESS STATED OTHERWISE
- STAGE 1 SURFACE WATER CATCHMENT AREA FOR DRAINAGE DESIGN. STAGE 2 AS DASHED.
- GENERAL SURFACE WATER FLOW DIRECTION
- INTERIM STAGE OF LANDSCAPE BUND
- TEMPORARY BUND
- INDICATIVE TEMPORARY SETTLEMENT AREA
- SILT FENCING

Rev.	Date	Description	By	Chk'd	App'd
P01		ISSUED FOR INFORMATION			

Drawing Status: FOR INFORMATION — Suitability: S1

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

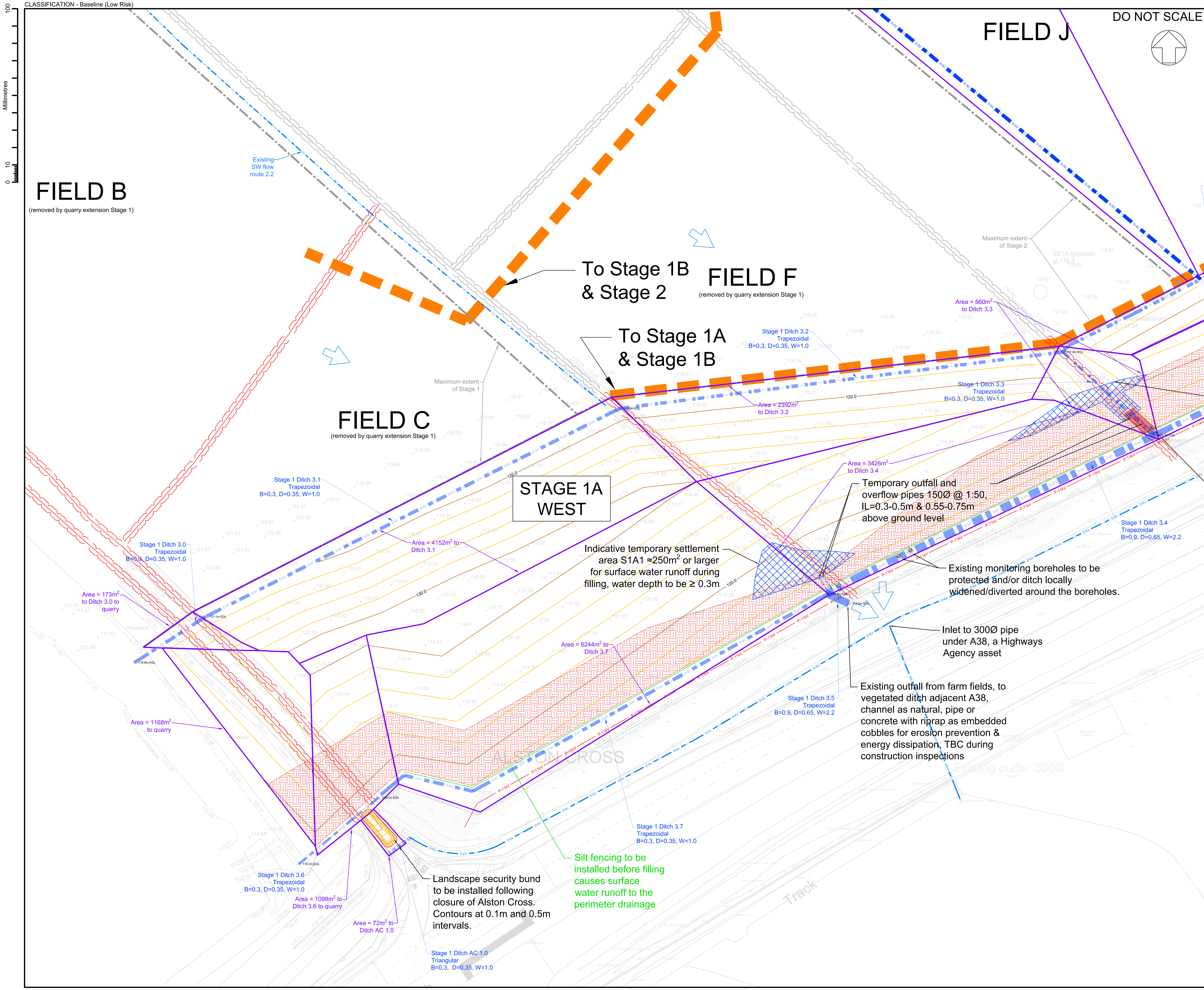
Drawing Title: STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 1 OF 6

Scale	Designed	Drawn	Checked	Authorised
1:500	TSM	TSM	PC	ATF
Original Size	Date	Date	Date	Date
A1	MAY 2024	MAY 2024	22/05/2024	23/05/2024

Drawing Number: LHQALS-ATK-S1-DR-G-1511 — Revision: P01

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

N/A

MAINTENANCE/CLEANING

N/A

DECOMMISSIONING/DEMOLITION

N/A

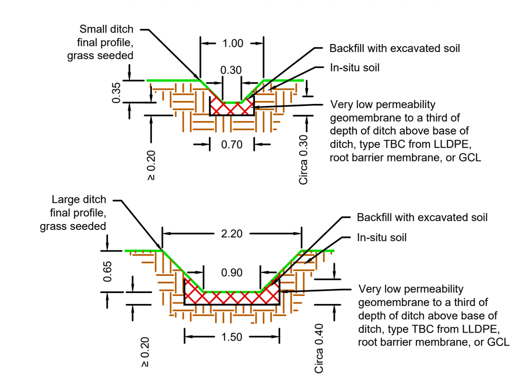
It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.
3. REFER ALSO TO DRAWINGS LHQALS-ATK-S1-DR-C-2001 TO 2004 FOR STAGE 1 BUND DESIGN DETAILS.
4. DRAINAGE AS LABELLED, B = BASE, D = DEPTH, W = WIDTH, Ø = DIAMETER

KEY

- PROPOSED TRANSLOCATED HEDGEBANK
- PROPOSED NEW HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (FROM OS MAP OR AERIAL) RED = TO BE TRANSLOCATED STAGE 1 OR FOR BU
- PROPOSED FOOTPATH
- PROPOSED HAUL ROAD
- CONTOURS (2m AND 10m INTERVALS) UNLESS STATED OTHERWISE
- STAGE 1 SURFACE WATER CATCHMENT AREA FOR DRAINAGE DESIGN. STAGE 2 AS DASHED.
- GENERAL SURFACE WATER FLOW DIRECTION
- INTERIM STAGE OF LANDSCAPE BUND
- TEMPORARY BUND
- INDICATIVE TEMPORARY SETTLEMENT AREA
- SILT FENCING



Rev.	Date	Description	By	Chk'd	App'd
P01		ISSUED FOR INFORMATION			

Drawing Status: FOR INFORMATION

Suitability: S1

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 2 OF 6

Scale	Designed	Drawn	Checked	Authorised
1:500	TSM	TSM	PC	ATF

Original Size	Date	Date	Date	Date
A1	MAY 2024	MAY 2024	22/05/2024	23/05/2024

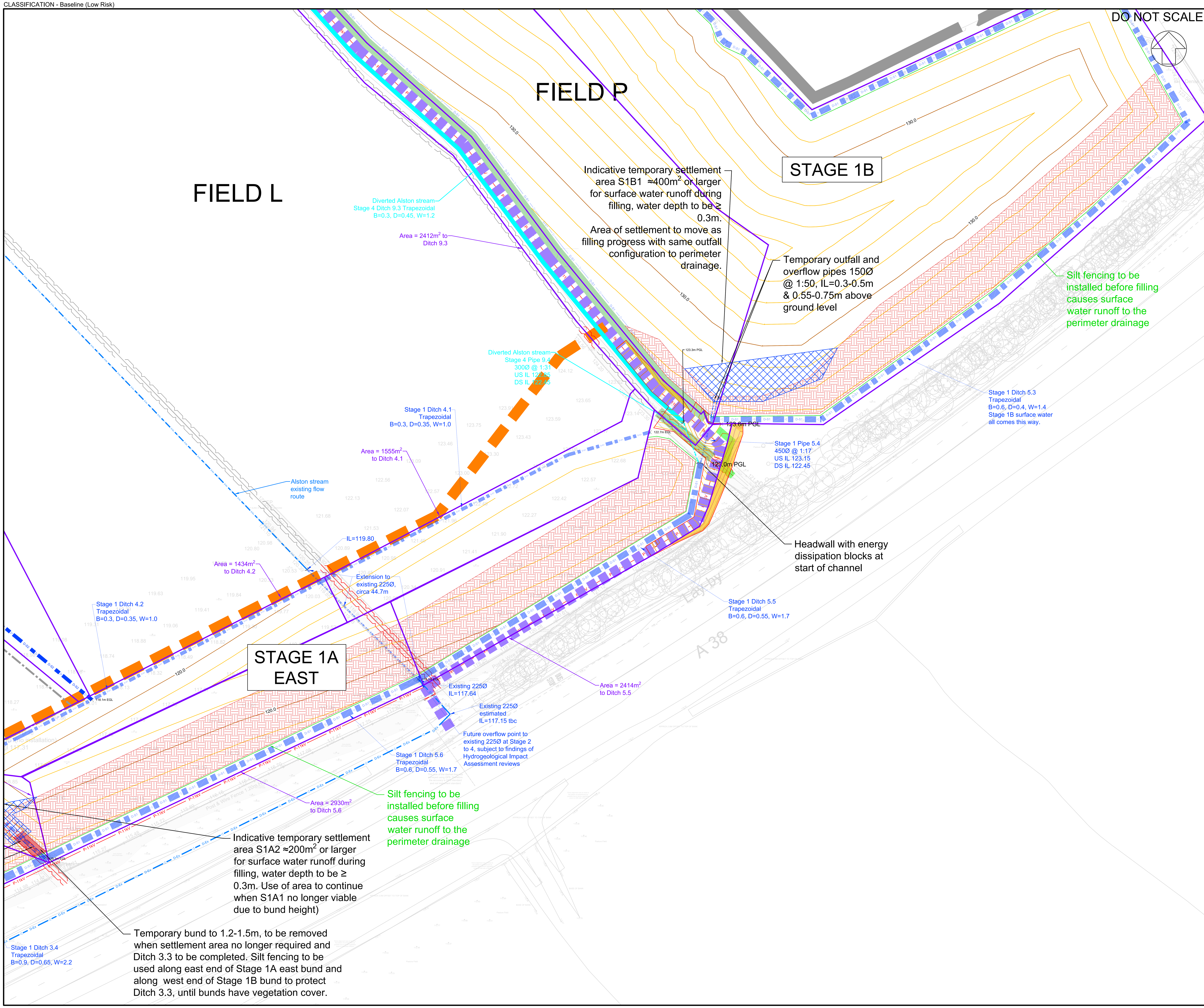
Drawing Number: LHQALS-ATK-S1-DR-G-1512

Revision: P01

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)

CLASSIFICATION - Baseline (Low Risk)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION
N/A

MAINTENANCE/CLEANING
N/A

DECOMMISSIONING/DEMOLITION
N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.
3. REFER ALSO TO DRAWINGS LHQALS-ATK-S1-DR-C-2001 TO 2004 FOR STAGE 1 DESIGN DETAILS.
4. DRAINAGE AS LABELLED, B = BASE, D = DEPTH, W = WIDTH, Ø = DIAMETER

KEY

- PROPOSED TRANSLOCATED HEDGEBANK
- PROPOSED NEW HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (FROM OS MAP OR AERIAL) RED = TO BE TRANSLOCATED STAGE 1 OR FOR BU
- PROPOSED FOOTPATH
- PROPOSED HAUL ROAD
- CONTOURS (2m AND 10m INTERVALS) UNLESS STATED OTHERWISE
- STAGE 1 SURFACE WATER CATCHMENT AREA FOR DRAINAGE DESIGN. STAGE 2 AS DASHED.
- GENERAL SURFACE WATER FLOW DIRECTION
- INTERIM STAGE OF LANDSCAPE BUND
- TEMPORARY BUND
- INDICATIVE TEMPORARY SETTLEMENT AREA
- SILT FENCING

INDICATIVE DETAIL FOR BASAL LINING OF EXTERNAL PERIMETER DITCHES:
AC 1.0, 3.4, 3.5, 3.6, 2.7, 5.2, 5.3, 5.4, 5.5, 7.2, 7.3

Rev.	Date	Description	By	Chk'd	App'd
P01		ISSUED FOR INFORMATION			

Drawing Status: FOR INFORMATION
Suitability: S1

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 3 OF 6

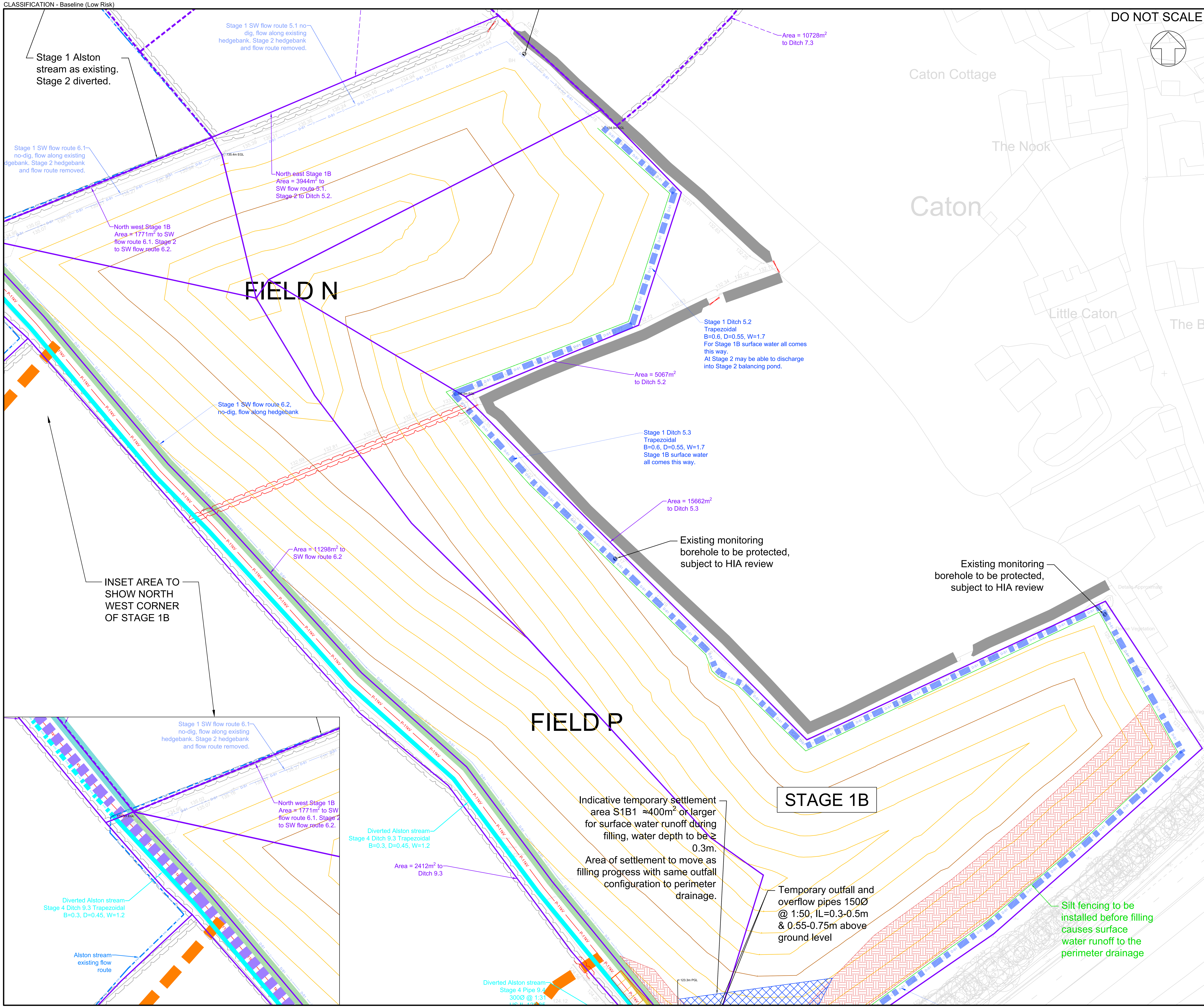
Scale	Designed	Drawn	Checked	Authorised
1:500	TSM	TSM	PC	ATF
Original Size: A1	Date: MAY 2024	Date: MAY 2024	Date: 22/05/2024	Date: 23/05/2024

Drawing Number: LHQALS-ATK-S1-DR-G-1513
Revision: P01

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)

DO NOT SCALE



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

N/A

MAINTENANCE/CLEANING

N/A

DECOMMISSIONING/DEMOLITION

N/A

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

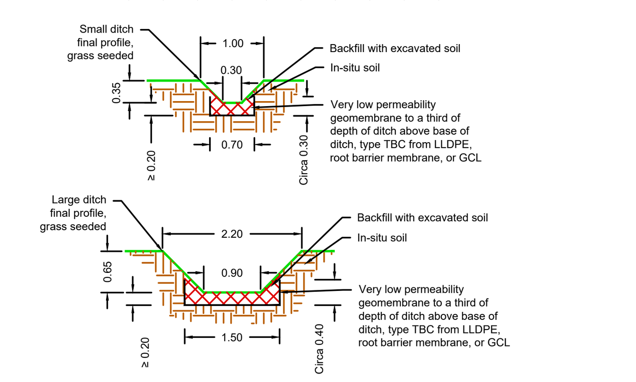
NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.
3. REFER ALSO TO DRAWINGS LHQALS-ATK-S1-DR-C-2001 TO 2004 FOR STAGE 1 DESIGN DETAILS.
4. DRAINAGE AS LABELLED, B = BASE, D = DEPTH, W = WIDTH, Ø = DIAMETER

KEY

- PROPOSED TRANSLOCATED HEDGEBANK (Stage 1 / Stage 2)
- PROPOSED NEW HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (FROM OS MAP OR AERIAL) RED = TO BE TRANSLOCATED STAGE 1 OR FOR BU
- PROPOSED FOOTPATH (Stage 1 / Stage 2)
- PROPOSED HAUL ROAD
- CONTOURS (2m AND 10m INTERVALS) UNLESS STATED OTHERWISE
- STAGE 1 SURFACE WATER CATCHMENT AREA FOR DRAINAGE DESIGN. STAGE 2 AS DASHED.
- GENERAL SURFACE WATER FLOW DIRECTION
- INTERIM STAGE OF LANDSCAPE BUND
- TEMPORARY BUND
- INDICATIVE TEMPORARY SETTLEMENT AREA
- SILT FENCING

INDICATIVE DETAIL FOR BASAL LINING OF EXTERNAL PERIMETER DITCHES: AC 1.0, 3.4, 3.5, 3.6, 2.7, 5.2, 5.3, 5.4, 5.5, 7.2, 7.3



Rev.	Date	Description	By	Chk'd	App'd
P01		ISSUED FOR INFORMATION			

Drawing Status: FOR INFORMATION | Suitability: S1

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

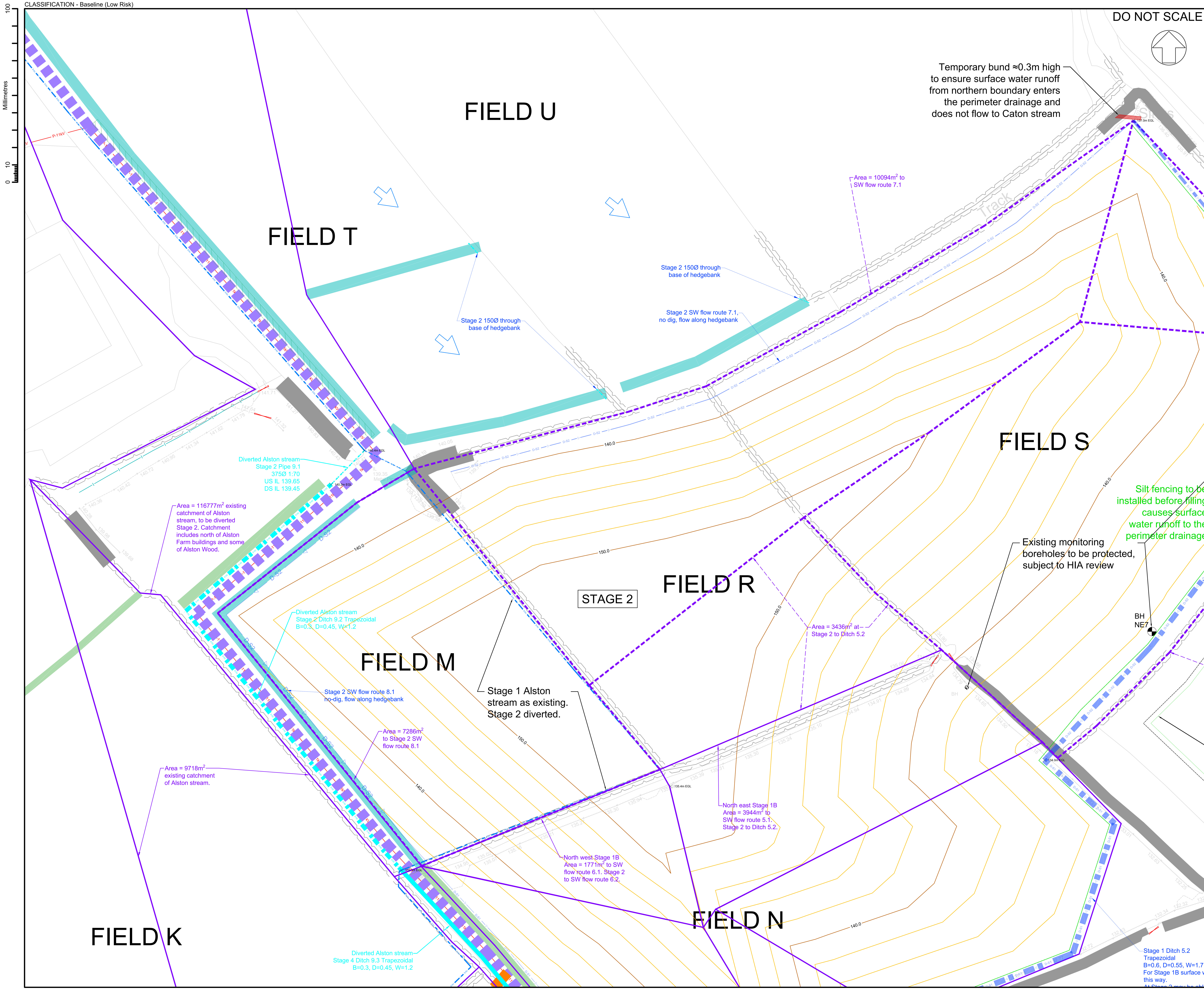
Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 4 OF 6

Scale	Designed	Drawn	Checked	Authorised
1:500	TSM	TSM	PC	ATF
Original Size	Date	Date	Date	Date
A1	MAY 2024	MAY 2024	22/05/2024	23/05/2024

Drawing Number: LHQALS-ATK-S1-DR-G-1514 | Revision: P01

Internal Project Number: 5196443



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

N/A

MAINTENANCE/CLEANING

N/A

DECOMMISSIONING/DEMOLITION

N/A

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NOTES:

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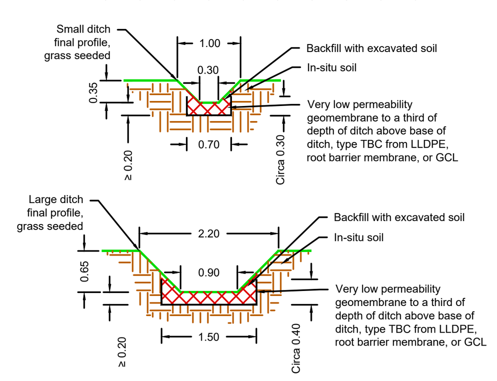
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE.
3. REFER ALSO TO DRAWINGS LHQALS-ATK-S1-DR-C-2001 TO 2004 FOR STAGE 1 BUND DESIGN DETAILS.
4. DRAINAGE AS LABELLED, B = BASE, D = DEPTH, W = WIDTH, Ø = DIAMETER

KEY

- Stage 1 / Stage 2 — PROPOSED TRANSLOCATED HEDGEBANK
- PROPOSED NEW HEDGEBANK
- EXISTING HEDGEBANK (FROM TOPO SURVEY)
- EXISTING HEDGEBANK (FROM OS MAP OR AERIAL) RED = TO BE TRANSLOCATED STAGE 1 OR FOR BU
- Stage 1 / Stage 3 — PROPOSED FOOTPATH
- PROPOSED HAUL ROAD
- CONTOURS (2m AND 10m INTERVALS) UNLESS STATED OTHERWISE
- STAGE 1 SURFACE WATER CATCHMENT AREA FOR DRAINAGE DESIGN. STAGE 2 AS DASHED.
- GENERAL SURFACE WATER FLOW DIRECTION
- INTERIM STAGE OF LANDSCAPE BUND
- TEMPORARY BUND
- INDICATIVE TEMPORARY SETTLEMENT AREA
- SILT FENCING

INDICATIVE DETAIL FOR BASAL LINING OF EXTERNAL PERIMETER DITCHES:
AC 1.0, 3.4, 3.5, 3.6, 2.7, 5.2, 5.3, 5.4, 5.5, 7.2, 7.3



Rev.	Date	Description	By	Chk'd	App'd
P01		ISSUED FOR INFORMATION			

Drawing Status: FOR INFORMATION
Suitability: S1

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

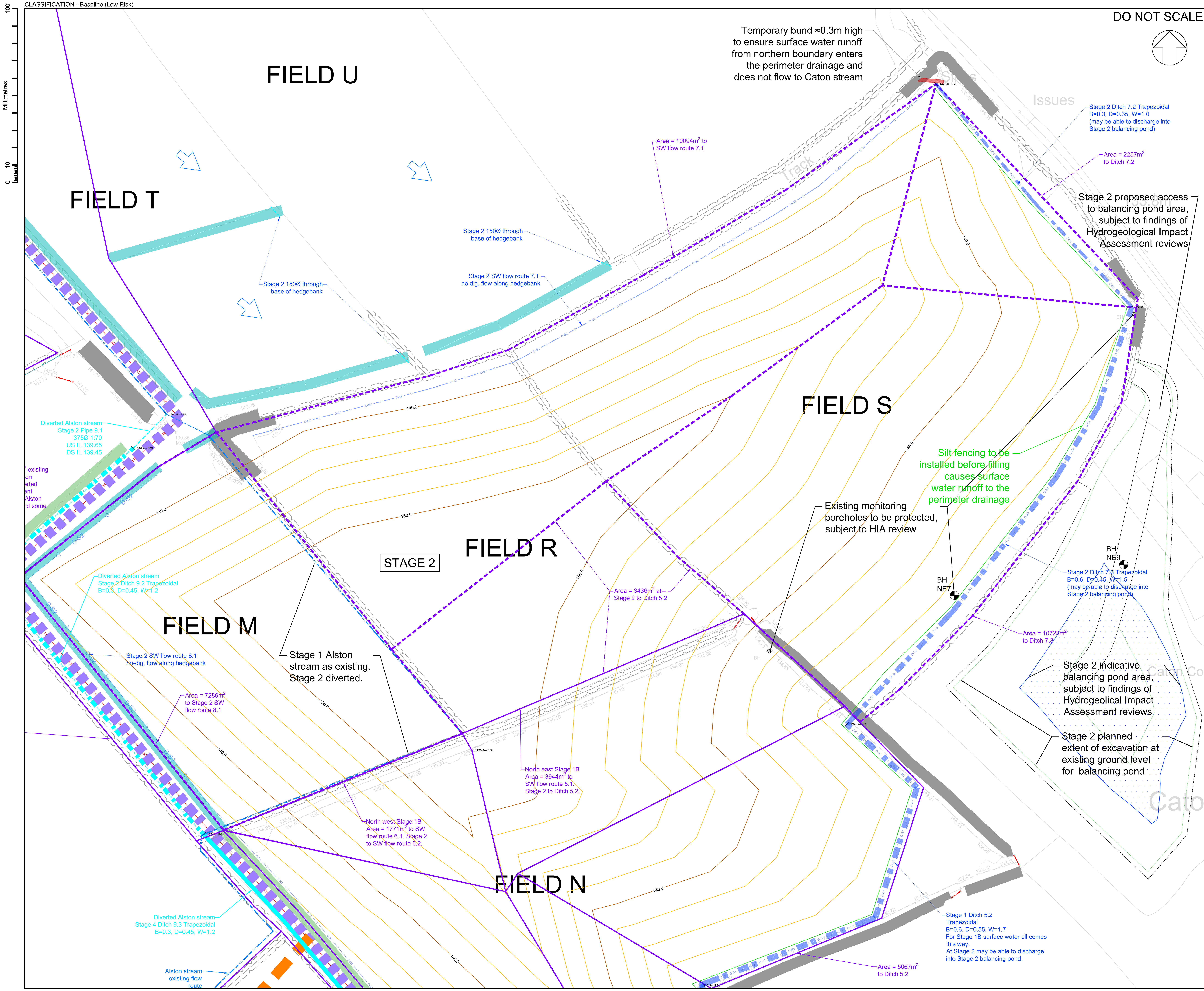
Drawing Title: STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 5 OF 6

Scale	Designed	Drawn	Checked	Authorised
1:500	TSM	TSM	PC	ATF
Original Size	Date	Date	Date	Date
A1	MAY 2024	MAY 2024	22/05/2024	23/05/2024

Drawing Number: LHQALS-ATK-S1-DR-G-1515
Revision: P01

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION
N/A
MAINTENANCE/CLEANING
N/A
DECOMMISSIONING/DEMOLITION
N/A

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NOTES:

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4. DRAINAGE AS LABELLED, B = BASE, D = DEPTH, W = WIDTH, Ø = DIAMETER

KEY

- PROPOSED TRANSLOCATED HEDGEBANK (Stage 1 / Stage 2)
- PROPOSED NEW HEDGEBANK
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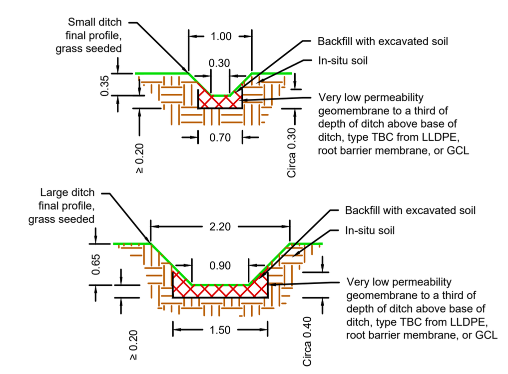
- PROPOSED HAUL ROAD
- CONTOURS (2m AND 10m INTERVALS) UNLESS STATED OTHERWISE
- STAGE 1 SURFACE WATER CATCHMENT AREA FOR DRAINAGE DESIGN. STAGE 2 AS DASHED.
- GENERAL SURFACE WATER FLOW DIRECTION
- INTERIM STAGE OF LANDSCAPE BUND
- TEMPORARY BUND
- INDICATIVE TEMPORARY SETTLEMENT AREA
- SILT FENCING

INDICATIVE DETAIL FOR BASAL LINING OF EXTERNAL PERIMETER DITCHES: AC 1.0, 3.4, 3.5, 3.6, 2.7, 5.2, 5.3, 5.4, 5.5, 7.2, 7.3



Rev.	Date	Description	By	Chk'd	App'd
P01		ISSUED FOR INFORMATION			

Drawing Status: FOR INFORMATION — Suitability: S1

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Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: LINHAY HILL QUARRY PROPOSED EXTENSION

Drawing Title: STAGE 1 AND STAGE 2 DRAINAGE PLAN CONSTRUCTION PHASE & FINAL SCHEME SHEET 6 OF 6

Scale	Designed	Drawn	Checked	Authorised
1:500	TSM	TSM	PC	ATF
Original Size	Date	Date	Date	Date
A1	MAY 2024	MAY 2024	22/05/2024	23/05/2024

Drawing Number	Revision
LHQALS-ATK-S1-DR-G-1516	P01

Internal Project Number: 5196443

CLASSIFICATION - Baseline (Low Risk)

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