Loch Kemp Storage - EIA Report

Appendix 3.5: Draft Borrow Pit Screening Assessment

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Borrow Pit Screening Assessment

Loch Kemp Storage

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Document approval

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Contents

1 Introduction

1.1 Background

Fichtner Consulting Engineers Limited (Fichtner) has prepared this Draft Borrow Pit Screening Assessment on behalf of Loch Kemp Storage Ltd (the Client). The assessment was conducted to describe the location and characteristics of potential borrow pits at the proposed Loch Kemp Storage Project (the Proposed Development) to facilitate the construction of key project structures.

This assessment will be updated following grant of consent from the Scottish Ministers under Section 36 of the Electricity Act (1989) and would form part of the Construction Environmental Management Plan (CEMP) for the Proposed Development. It is intended that the CEMP would be updated for approval by the planning authority (on behalf of the Scottish Ministers) prior to commencement of construction. This Draft Borrow Pit Screening Assessment has been developed to support the application for consent to demonstrate that appropriate management of borrow pit excavation and management at the Proposed Development has been considered.

The CEMP will include the measures to be employed to manage the risks associated with the excavation of rock mass from borrow pits, such as dust and groundwater. As such these are not contained within this Draft Borrow Pit Screening Report.

1.2 Objective

The objectives of this Draft Borrow Pit Screening Report are:

1. To provide an overview of potential borrow pits identified within the Proposed Development;
2. To reference the respective geological conditions at each potential borrow pit;
3. To provide estimates of potential rock mass extraction quantities; and
4. To outline how borrow pits would be managed at the Proposed Development.

2 Geological Setting

2.1 Superficial Geology

The superficial deposits of the entire site comprise of Quaternary soil cover, predominantly hummocky glacial deposits and peat as displayed in Figure 1. The superficial geological map for the site is attached to this report in Appendix A. The published mapping was confirmed by subsequent site surveys.

Superficial peat deposits have been mapped during peat probing investigation works on site, with a peat depth plan and detailed assessment provided within **Volume 4, Appendix 14.1: Peat Management Plan** (PMP) of the EIA Report. The probing provides comprehensive coverage of the site and locations of the infrastructure planned within the Proposed Development.

Figure 1: Dam Site 4 (View toward SE showing SW and NE), Quaternary Soil cover

2.2 Bedrock Geology

The bedrock geology of the Proposed Development is dominated by the felsic granitoids of the Devonian Foyers Intrusive Suite, which form part of the "Newer Granites" that intruded during lithospheric transtension about 418-404 Ma ago (Miles et al., 2016).

In the area the granitoids are hosted by the polydeformed Neoproterozoic clastic metasediments of the Loch Laggan formation of the Corrieyairack Subgroup and the Gairbeinn member of the Glenshirra Subgroup of the Grampian group (Haselok et al., 1982, Stephenson et al., 2013). Stratigraphically, the Corrieyairack Subgroup overlies the Glenshirra Subgroup (Stephenson et al., 2013), which would make the Loch Laggan (meta)psammites younger than the Gairbeinn (meta)psammites. The Gairbeinn sediments were deposited in a subaerial, fluvial or shallow marine

environment, whereas the Loch Laggan sediments reflect progressive deepening of a marine environment and turbidites. The two subgroups reach total thicknesses of 1,400 m (Loch Laggan) and approximately 700 m (Gairbeinn, Haselok et al., 1982), of which, in the field area, only some tens to hundreds of meters are represented. In the stratigraphic record, the two units are separated by Coire nan Laogh semipelite, which suggest a tectonic juxtaposition in the field area. This likely happened during a period of Ordovician tectono-metamorphism about 460-470 Ma ago. The field area is bordered to the NW by Loch Ness, which covers the Great Glen Fault, a long-lived tectonic lineament of great significance in the Caledonian orogeny. The strike-slip fault has experienced several phases of activation, with the oldest being sinistral displacements accumulated between 428 and 390 Ma ago (Stewart et al., 1999) and the most recent one a phase of dextral displacement during the Cenozoic in association with the opening of the North Atlantic (Underhill & Brodie, 1993, Le Breton et al., 2013). Examples of the aforementioned bedrock formations are displayed in Figure 2 and Figure 3.

The bedrock formations of with granitoid and psammite materials are expected to be suitable for use as engineering material. However, detailed geotechnical investigation (GI) should be conducted to confirm suitability to inform detailed development of the borrow pits.

Surface geological mapping (Scale 1:10,000) of the project area was conducted by Dr Florian Fusseis of Edinburgh University and identified the dominant geological formations (displayed in Appendix A). Additionally, and an extract of British Geological Survey (BGS) mapping (Scale 1:50,000) is displayed in Appendix A whilst a summary of bedrock formations at site is outlined in the Table 1.

Figure 2: Foyers intrusive suite granodiorite (FOY-_GD)

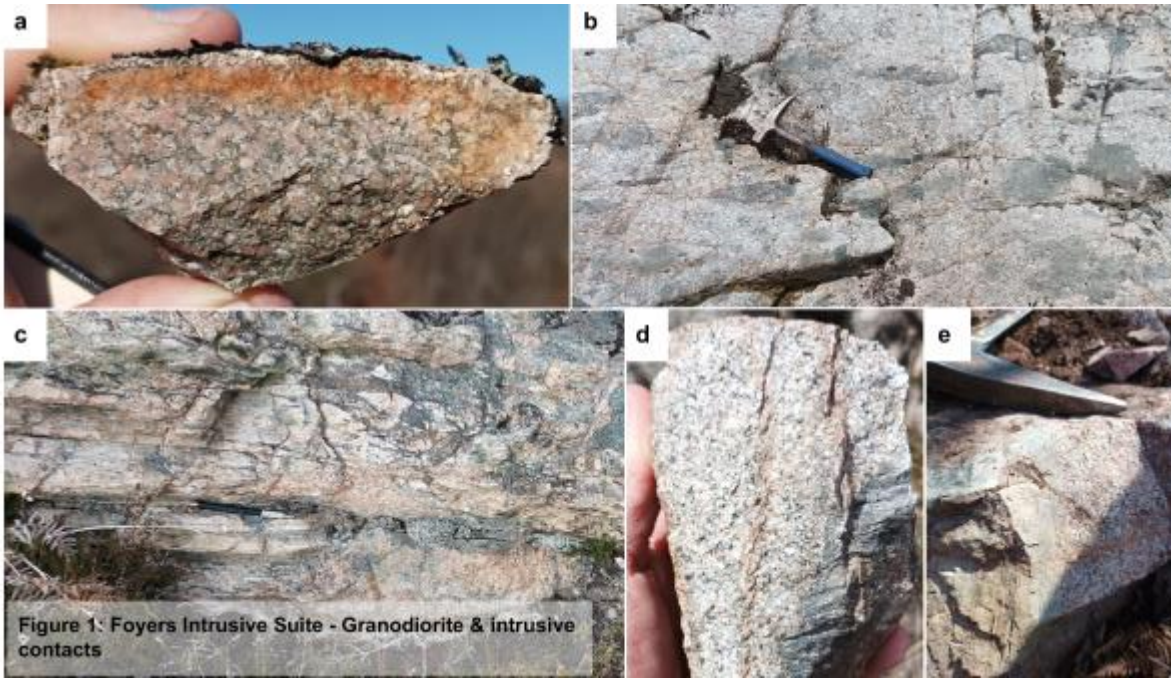


Figure 3: Gairbeinn (Pebbly) Psammite (GAIR-PSAP)

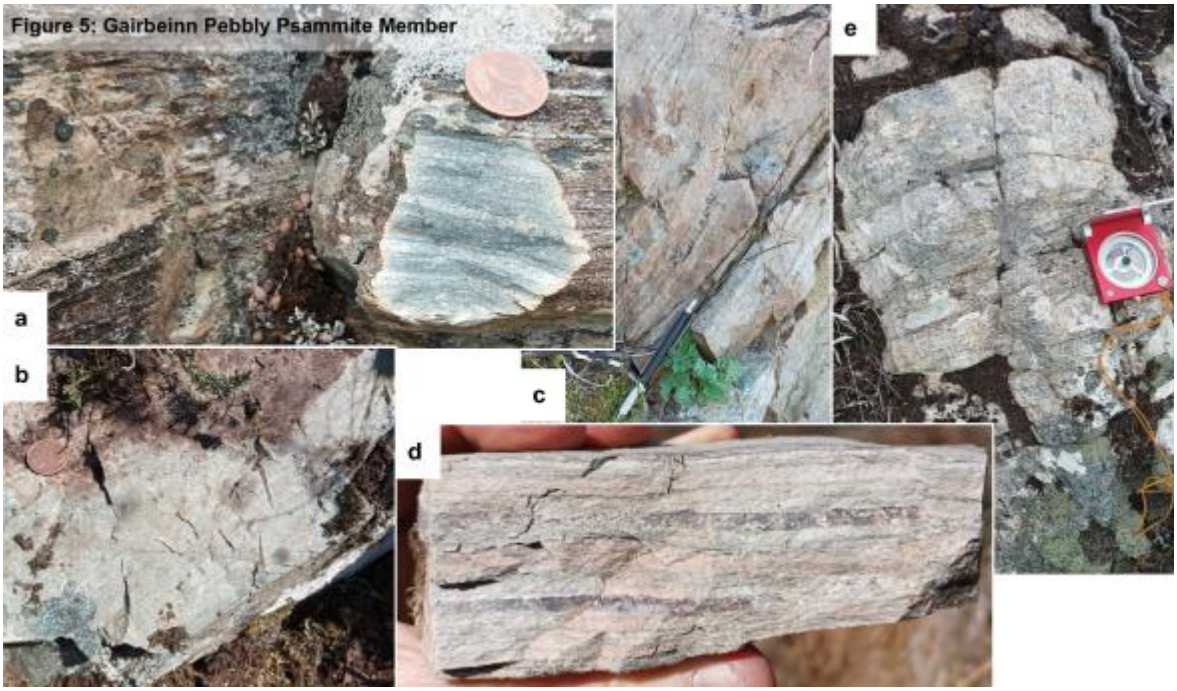


Table 1: Site Geological Formation

Rock Name	Geological Age	Numerical Age (Ma)	Group		Formation	Rock Type
Foyers Igneous Complex (FOY-GD)	Silurian	443.8-419.2	Caledonian Supersuite (CIGSS)		Argyll And Northern Highlands Granitic Suite (ANHGR)	Granodiorite
Gairbeinn Pebbly Psammite Member (GAIR-PSAP)	Neoproterozoic Era	541-1000	Grampian Group (GRAM)	Glenshirra Subgroup (GRGL)	Garva Bridge Psammite Formation (GABR)	Psammite, Pebbly
Loch Laggan Psammite Formation (LLGN-PSAMI)	Neoproterozoic Era	541-1000	Grampian Group (GRAM)		Corrieyairack Subgroup (GRCO)	Psammite, Micaceous

2.3 Structural Geology

Based on the available geological and surface mapping in conjunction with the prominent topographic steps (depressions) in the terrain, a number of geological structures (faults, shear zones) have been identified at the Proposed Development. The tentative placement of the faults can be seen on the geological map displayed in Appendix A.

A major thrust with a dipping towards E-NE has been identified to the immediate north of the Proposed Development, separating the Gairbeinn Formation from the Loch Laggan Psammite formation. Geological features parallel to the thrust may also be present in the vicinity. The location of the thrust can be identified in the field by topographical depressions.

The proposed location of the shoreline powerhouse building on Loch Ness is dominated by the proximity to the Great Glen Fault (strike-slip fault), in addition to corresponding parallel faults that may also be encountered in the vicinity. These parallel fault zones can be identified by prominent topographic steps in the terrain. The powerhouse site is located in the contact zone of the Moine Supergroup Psammite and the Foyers Igneous Complex Granodiorite while the bedrock is covered by sediments.

The bedrock units (granitoids) of FOY-GD (as detailed in Table 1) appear to be blocky with fewer discontinuities and dipping mostly NW as can be seen in Figure 4 and Figure 5.

Figure 4: Granitoid rock (FOY-GD), Blocky appearance, slight surface weathering, No evidence for faulting

Figure 5: Compact rock with pervasive jointing producing blocks of <1 m³ volume

3 Potential Borrow Pits

3.1 Assessment methodology

Appropriate siting of borrow pit locations is critical to ensure a sustainable supply of usable rock whilst minimising environmental impact. The most pertinent factors to determining borrow pit selection include:

- Geological setting - rock mass type and quality;
- Feasible rock mass extraction quantity;
- Proximity to the project site, accessibility and planned usage in structures;
- Proximity of rock mass to surface;
- Potential environmental impacts;
- Potential human impacts; and
- Legal regulations.

To inform rock mass type, quality and feasible extraction quantities, it is critical to conduct GI surveys at the proposed borrow pit locations to build upon available information from previous geological mapping.

A total of ten potential borrow pit areas were identified at the Proposed Development during concept design phase. The details of each potential borrow pit site and determination of their further inclusion within the Proposed Development are outlined in Sections 3.1.1 to 3.1.10 and summarised in Section 3.2.

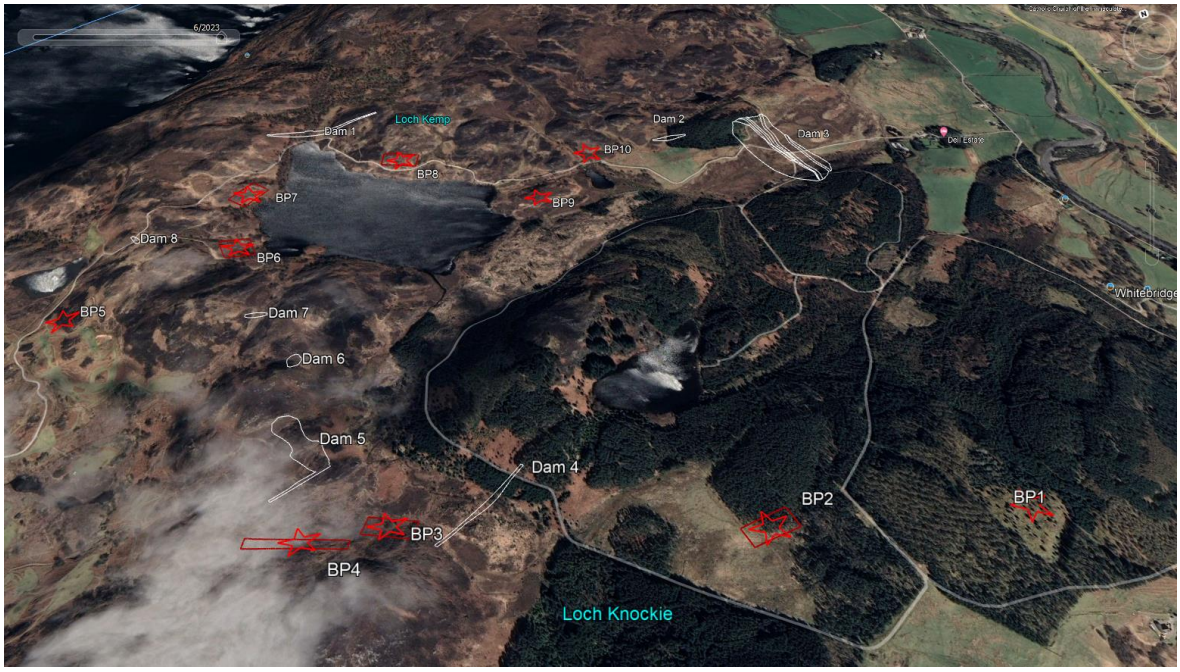
The present assessment of the selected borrow pits has been developed based on the available geological and surface mapping (as presented in Section 2) in conjunction with site visits and inputs of the Owner's Engineering (OE) team for the Proposed Development. It is estimated within **Volume 4, Appendix 3.4:Spoil Management Plan** of the EIA Report that c.30,000 m^3 of compacted rockfill is necessary at the early stages of construction to establish site access prior to excavation of the project structures and for concrete aggregates.

As such, it is estimated that c.25,000 m^3 of physically and mechanically suitable in-situ rock will be required from a combination of borrow pits at the Proposed Development and externally sourced material (assuming a rockfill bulking factor of 1.2 from in-situ rock to compacted re-used rockfill). Should the material gained from the excavation of the pressure tunnels and other project structures provide lower quality rockfill than anticipated during the concept design, the estimated total rockfill requirement from borrow pits should increase to meet the shortfall. This uncertainty will be alleviated by the results of subsequent geotechnical ground investigation surveys across the Proposed Development. Therefore, the borrow pit dimensions provided in this report are indicative and are subject to change following detailed design and geotechnical ground investigation surveys.

There have been no previous mining or quarrying works at the Proposed Development although, the landowner has conducted some small extraction from borrow pits for the construction of access tracks within the estate.

The proposed locations of the potential borrow pits suitable for use in the Proposed Development are displayed in Figure 6.

Figure 6 : Proposed borrow pits locations at the Proposed Development



3.1.1 Borrow Pit 1 (BP1)

The proposed location of BP1 is E: 247864, N: 814910, within a clearing of the forested area to the southeast of the Proposed Development. It is located approximately 80 m from the planned 8 m wide access track which provides access from the B862 public road. It is anticipated that BP1 would be critical in providing rockfill for initial site access track construction, and upgrading where existing tracks can be used, in order to facilitate construction access to other project structures.

The bedrock formation at BP1, as per geological mapping, is Granodiorite belonging to Foyers Igneous Complex (FOY-GD) and therefore a high quality of rockfill is anticipated. As per the mapped peat depth plan, it is anticipated to have a peat depth of around 0 - 0.5 m.

The physical characteristics of BP1 are summarised in Table 2.

Table 2: Physical characteristics of borrow pit BP1

Physical Characteristic	Value
Maximum site dimensions (L x W x D)	100 m x 50 m x 10 m
Platform elevation	264 m AOD
Maximum elevation	277 m AOD
Excavation volume	c.26,100 m³
Terrain conditions	The terrain is flat in NS and EW direction (<1%)
Extraction methodology	Ripping and blasting
Pit lithology	Peat thickness of approximately 0.5 m with a moderately weathered overburden rock of thickness of approximately 1 m. Bedrock at depth >1.5 m
Rock type	Mostly Granodiorite, Partly Psammite, Pebbly

Physical Characteristic	Value
Environmental considerations	Location within the Whitebridge Plantation would require forestry woodland removal which has been considered within **EIA Chapter 19 Forestry**. No watercourses have been identified within 200 m of the proposed borrow pit location.

Based on the available geological and topographical information at the location of BP1, a maximum potential excavation volume of c.26,100 m^3 is anticipated at BP1. Indicative sections and dimensions for excavation at BP1 are provided in Appendix C. Given the proximity of BP1 to the proposed Site access on the B862 south of Whitebridge, it is anticipated that material from BP1 could be used for the establishment of initial site access routes to reduce required import of materials from external sources and associated haulage impacts on the surrounding area.

Approximately 250 m southeast of BP1 is an existing lodge/private accommodation, highlighted in Figure 8. The impact of the Proposed Development has been considered at this receptor within the EIA, with particular respect to noise, dust and air quality.

Figure 7: Location of borrow pit BP 1 (looking north)

Figure 8: Location of borrow pit BP1 and proximity to residential receptor (within yellow circle).

3.1.2 Borrow Pit 2 (BP2)

The proposed location of BP2 is E: 247379, N: 815043, close to a forested area to the south of the Proposed Development. It is located approximately 200 m from the planned 8 m wide access track from BP1.

The bedrock formation at BP2, as per geological mapping, is Psammite, Pebbly belonging to Gairbeinn Pebbly Psammite Member (GAIR-PSAP). As per the mapped peat depth plan, it is anticipated to have a peat depth of around 0 – 0.5 m.

The physical characteristics of BP2 are summarised in Table 3.

Table 3: Physical characteristics of borrow pit BP2

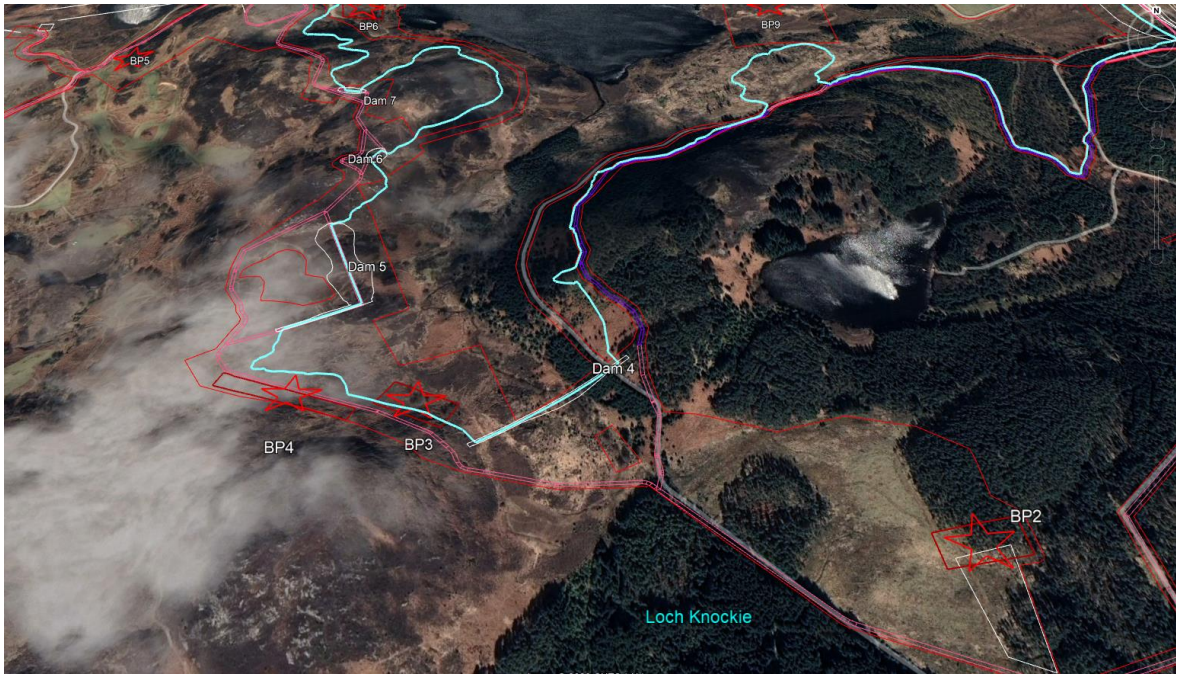
Physical Characteristics	Value
Maximum site dimensions (L x W x D)	100 m x 50 m x 10 m
Platform elevation	230 mAOD
Maximum elevation	240 mAOD
Excavation volume	c.36,700 m³
Terrain conditions	The terrain is comparatively flat in NS (2.5%) and of increasing gradient in the WE direction up to approximately 11%.
Extraction methodology	Ripping and blasting
Pit lithology	Peat thickness of approximately 0.5 – 1.0 m with a moderately weathered overburden rock of thickness of approximately 0.5 m. Bedrock at depth >1.5 m
Rock type	Psammite, Pebbly
Environmental considerations	BP2 is located on the edge of Whitebridge Plantation and has been located within an already open area of clearing to minimise impact on

Physical Characteristics	Value
	forestry woodland. No watercourses have been identified within 400 m of the proposed borrow pit location.

Based on the available geological and topographical information at the location of BP2, a maximum potential excavation volume of c.36,700 m^3 is anticipated at BP2. Indicative sections and dimensions for excavation at BP2 are provided in Appendix C.

Figure 9: Location of borrow pit BP2 (looking northeast)

Figure 10: Aerial showing proposed layout dimensions of borrow pits BP2, BP3 & BP4



3.1.3 Borrow Pit 3 (BP3)

The proposed location of BP3 is E: 246703, N: 815315 to the south of the Proposed Development, immediately north of a raised rock outcrop area. BP3 is immediately adjacent to the planned 8 m access track and resides within the planned upper reservoir inundation area.

The bedrock formation at BP3, as per geological mapping, is Granodiorite belonging to Foyers Igneous Complex (FOY-GD). As per the mapped peat depth plan, it is anticipated to have a peat depth of around 0 – 0.5 m. An additional 0.5 m of rock is assumed to be slightly to moderately weathered due to the rock outcrops in the vicinity and is considered as an overburden material.

The physical characteristics of BP3 are summarised in Table 4.

Table 4: Physical Characteristics of borrow pit BP3

Physical Characteristics	Value
Maximum site dimensions (L x W x D)	100 m x 50 m x 19 m
Platform elevation	191 mAOD
Maximum elevation	210 mAOD
Excavation volume	c.43,740 m³
Terrain conditions	Steep terrain with slope increasing N to S up to a maximum gradient of approximately 25% and moderately W to E at 1 – 2%.
Extraction methodology	Ripping and blasting
Pit lithology	Peat thickness of approximately 0 – 0.5 m and a moderately weathered overburden rock of thickness of around 0.5 m. Bedrock at depth >1.0 m

Physical Characteristics	Value
Rock type	Granodiorite
Environmental considerations	The nearest watercourse is approximately 120 m away from BP3 and is Allt Leachd Gowerie (a burn flowing into Loch Kemp through the proposed Dam 4 location). The location of BP3 would be within the 205 mAOD maximum inundation upper reservoir area of the Proposed Development. As such, this should be considered and managed within the reinstatement of BP3.

Based on the available geological and topographical information at the location of BP3, a maximum potential excavation volume of c. 43,740 m³ is anticipated at BP3. Indicative sections and dimensions for excavation at BP3 are provided in Appendix C.

Figure 11: Location of borrow pit BP3 (looking west)

3.1.4 Borrow Pit 4 (BP4)

The proposed location of BP4 is E: 246536, N: 815320, to the south of the Proposed Development and approximately 50m SW of BP3. Similar to BP3, the bedrock formation at borrow pit BP4, is Granodiorite belonging to Foyers Igneous Complex (FOY-GD). Surface geology indicates similar conditions to BP3 of a peat depth of around 0 – 0.5 m and an overburden of moderately weathered rock of 0.5 m thickness.

The physical characteristics of BP4 are summarised in Table 5.

Table 5: Physical characteristics of borrow pit BP4

Physical Characteristics	
Maximum site dimensions (L x W x D)	25 m x 200 m x 13m
Platform elevation	209 mAOD
Maximum elevation	222 mAOD
Excavation volume	c.26,000 m³

Physical Characteristics	
Terrain conditions	The terrain is steep with slope gradients increasing N to S to approximately 30%. Gradient W to E is significantly flatter at 1-2%.
Extraction methodology	Ripping and blasting
Pit lithology	Weathered soil (peat) with an overburden thickness of around 1-1.5 m. Bedrock at depth >1.5 m
Rock type	Granodiorite
Environmental considerations	The proposed borrow pit location is adjacent to proposed forestry regeneration areas as part of the Proposed Development's compensatory measures package as assessed within **EIA Chapter 19 Forestry.** No watercourses have been identified within 200 m of the proposed borrow pit location. Granodiorite

Based on the available geological and topographical information at the location of BP4, a maximum potential excavation volume of c.26,000 m^3 is anticipated at BP4. Indicative sections and dimensions for excavation at BP4 are provided in Appendix C.

3.1.5 Borrow Pit 5 (BP5)

The proposed location of BP5 is E: 246097, N: 816190, to the southwest of the Proposed Development and is approximately 20 m from the planned 8 m access track. The bedrock formation at BP5 is Granodiorite belonging to Foyers Igneous Complex (FOY-GD). As per the mapped peat depth plan it is anticipated to have a peat depth of around 0 - 0.5 m although this becomes deeper c.50 – 100 m to the north of BP5 between the Lochan a' Choin Uire waterbody.

As displayed in Figure 12, it is a predominantly flat terrain at BP5 however, to the west of BP5 is the steep slope descending to the shoreline of Loch Ness through Ness Woods Special Area of Conservation (SAC) designated site. As the flat terrain presents no sloped rock mass to cut into, the excavated area at BP5 would be significantly larger than at alternatives available within the Proposed Development. Furthermore, the steep slope to Loch Ness to the west means that any excavation works would be highly visible within the surrounding landscape and from the Great Glen Way walking route. Therefore, it is proposed to screen out BP5 due to landscape and visual reasons, proximity to environmental receptors and the availability of more suitable locations within the Proposed Development.

Figure 12: Location of borrow pit BP5 (looking east)

Figure 13: Aerial view showing proposed layout dimensions of borrow pits BP5, BP6 & BP7

3.1.6 Borrow Pit 6 (BP6)

The proposed location of BP6 is E: 246516, N: 816356, to the immediate west of the existing Loch Kemp reservoir and south of the proposed intake structure location for the Proposed Development. Additionally, BP6 resides within the proposed upper reservoir inundation area. The bedrock formation at BP6, is Psammite, Pebbly belonging to Gairbeinn Pebbly Psammite Member (GAIR-PSAP) with an anticipated surface peat depth is around 0 - 0.5 m.

The physical characteristics of BP6 are summarised in Table 6.

Table 6: Physical characteristics of borrow pit BP6

Physical Characteristics	Value
Maximum site dimensions (L x W x D)	75 m x 75 m x 20m
Platform elevation	180 mAOD
Maximum elevation	200 mAOD
Excavation volume	c.48,600 m³
Terrain conditions	The terrain is comparatively flat with slope of <1% in both NS and EW directions.
Extraction methodology	Ripping and blasting
Pit lithology	Peat of depth around 0-0.5 m with a moderately weathered overburden rock of thickness of approximately 0.5 m. Bedrock at depth >1.0 m
Rock type	Psammite, Pebbly
Environmental considerations	The location of BP6 would be within the 205 mAOD maximum inundation upper reservoir area of the Proposed Development. Due to BP6's proximity to the planned intake location, it is located c.25m from the existing Loch Kemp reservoir 177 mAOD level. As such, this should be considered and managed within any excavation and reinstatement of BP6.

Based on the available geological and topographical information at the location of BP6, a maximum potential excavation volume of c.48,000 m³ is anticipated at BP6. Indicative sections and dimensions for excavation at BP6 are provided in Appendix C.

Figure 14 Location of borrow pit BP6 (looking west)

3.1.7 Borrow Pit 7 (BP7)

The proposed location of BP7 is E: 246573, N: 816606, to the immediate west of the existing Loch Kemp reservoir and north of the proposed intake structure location for the Proposed Development. Similarly to BP3 and BP6, BP7 resides within the planned upper reservoir inundation area. The bedrock formation at borrow pit BP7 is again Psammite, Pebbly belonging to Gairbeinn Pebbly Psammite Member (GAIR-PSAP) with an anticipated surface peat depth is around 0 - 0.5 m.

Table 7: Physical characteristics of borrow pit BP7

Physical Characteristics	
Maximum site dimensions (L x W x D)	50 m x 100 m x 25 m
Platform elevation	180 mAOD
Maximum elevation	205 mAOD
Excavation volume	c.65,270 m³
Terrain conditions	The terrain is comparatively flat with slope of <1% in both NS and EW directions.
Extraction methodology	Ripping and blasting
Pit lithology	Peat of depth around 0-0.5 m with a moderately weathered overburden rock of thickness of approximately 0.5 m. Bedrock at depth >1.0 m
Rock type	Psammite, Pebbly
Environmental considerations	The location of BP7 would be within the 205 mAOD maximum inundation upper reservoir area of the Proposed Development. Due to BP7's proximity to the planned intake location, it is located c.25m from the existing Loch Kemp reservoir 177 mAOD level. As such, this should be considered and managed within any excavation and reinstatement of BP7.

Based on the available geological and topographical information at the location of BP7, a maximum potential excavation volume of c.65,270 m³ is anticipated at BP7. Indicative sections and dimensions for excavation at BP7 are provided in Appendix C.

Figure 15: Location of borrow pit BP7 (looking west and east respectively)

3.1.8 Borrow Pit 8 (BP8)

The proposed location of BP8 is E: 247008, N: 816654, to the north of the Proposed Development. Similarly to BP3, BP6 and BP7, BP8 resides within the upper reservoir inundation area. The bedrock formation at BP8 is Granodiorite belonging to Foyers Igneous Complex (FOY-GD) with an anticipated surface peat depth is around 0 - 0.5 m.

Table 8: Physical Characteristics of borrow pit BP8

Physical Characteristics	
Maximum site dimensions (L x W x D)	50 m x 100 m x 15 m
Platform elevation	186 mAOD
Maximum elevation	201 mAOD
Excavation volume	c.34,060 m³
Terrain conditions	The terrain is comparatively flat. Slope increases slightly south to north and west to east by <2%.
Extraction methodology	Ripping and blasting
Pit lithology	Peat of depth around 0 - 0.5 m with a moderately weathered overburden rock of thickness of approximately 0.5 m. Bedrock at depth >1.0 m
Rock type	Granodiorite
Environmental considerations	The location of BP8 would be within the 205 mAOD maximum inundation upper reservoir area of the Proposed Development. As such, this should be considered and managed within the reinstatement of BP8.

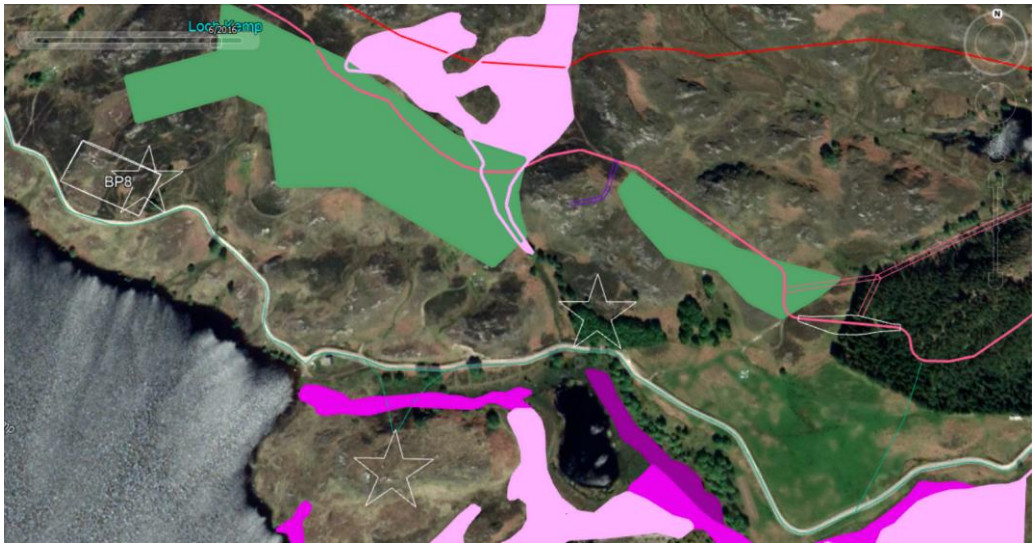
Based on the available geological and topographical information at the location of BP8, a maximum potential excavation volume of c.34,060 m³ is anticipated at BP8. Indicative sections and dimensions for excavation at BP8 are provided in Appendix C..

3.1.9 Borrow Pit 9 (BP9)

The proposed location of BP9 is E: 247537, N: 816512, to the northeast of the Proposed Development in a small, forested area adjacent to an existing estate access track. The bedrock formation at BP9 is Granodiorite belonging to Foyers Igneous Complex (FOY-GD) with an anticipated surface peat depth is around 0 - 0.5 m. However, site visits indicate that the material at BP9 is representative of glacial till deposits of an unknown depth which do not provide suitable physical and mechanical strength for use in project structures at the Proposed Development. Furthermore, mapped bog areas were identified on site in close proximity to the proposed BP9 location (pink areas shown in Figure 17) whilst it would also be located in close proximity to forestry regeneration areas (green areas shown in Figure 17).Therefore, it is planned to screen out BP9 due to its unsuitability for rockfill provision, environmental constraints and the availability of more suitable locations within the Proposed Development.

Figure 16: Location of borrow pit BP9 (looking east)

Figure 17: Plan view showing proposed layout dimensions of BP8 and locations of BP9 & BP10



3.1.10 Borrow Pit 10 (BP10)

The proposed location of BP10 is E: 247333, N: 816346, to the northeast of the Proposed Development, adjacent to an existing estate fishing lodge. The bedrock formation at BP10 is Granodiorite belonging to Foyers Igneous Complex (FOY-GD). BP10 is shown in peat mapping as being in close proximity to deep peat areas (peat depth >3m) whilst areas of peat depth of 1 – 2 m are abundant in this area east of the existing Loch Kemp reservoir. In addition, site visits have also indicated significant peat areas in the vicinity of BP10. Therefore, it is planned to screen out BP10 due potentially significant peat removal requirements and the availability of more suitable locations within the Proposed Development.

Figure 18: Location of borrow pit BP10

3.2 Summary of Potential Borrow Pits

Typical cross sections and layouts for the borrow pits deemed suitable for use in the Proposed Development are provided in Appendix C. The excavations demoted in the cross sections assume a minimum of 1 m to 1.5 m of overburden thickness and the slope of cutting of > 80° in rock that is 'slightly weathered' to 'un-weathered'. The summarised maximum volumes of rockfill that can be extracted from the borrow pits suitable for use in the Proposed Development are given in Table 9.

Table 9 : Volume of rockfill extractible from suitable potential borrow pits

Borrow Pit Location	Platform width m	Platform length m	Platform elevation mAOD	Top of excavation mAOD	Max. height m	Volume of solid rock m^3
BP1	50	100	264	274	10	26,100
BP2	50	100	230	240	10	36,700
BP3	50	100	191	210	20	43,740
BP4	25	200	209	222	15	26,000
BP5	-	-	-	-	-	-
BP6	75	75	180	200	20	48,600
BP7	50	100	180	205	25	65,270
BP8	50	100	186	201	15	34,060
BP9	-	-	-	-	-	-
BP10	-	-	-	-	-	-
Total Volume (m^3)						**280,470**

As displayed in Table 9, seven suitable borrow pit locations (subject to detailed ground investigations) have been identified which have the potential to provide sufficient structurally suitable rock to facilitate the construction of the Proposed Development. Meanwhile, three borrow pits have been screened out due to a combination of environmental factors listed in section 3.1.

Of the seven suitable borrow pits identified, four would be located within the proposed inundation area of the upper reservoir which would minimise further environmental, landscape and visual impacts as a result of the Proposed Development.

It is expected that all borrow pits would be restored in line with the requirements of the CEMP, PMP, industry best practice and with the advice of the ECoW. This would include in relation to reseeding and the use of turves, where present.

4 Summary and Conclusions

This Draft Borrow Pit Screening Assessment has been produced to support the application for consent for the Proposed Development under Section 36 of the Electricity Act (1989). This will be reviewed prior to commencement of construction works once the detailed site investigation, detailed design works have taken place and the Principal Contractor has been appointed. The execution of borrow pit excavation works and management, as a result of the Proposed Development, would be the responsibility of the Principal Contractor.

The screening of the potential borrow pit locations has been completed based on the available surface geological maps, the peat probing, recent site visits and site inspections. The estimated borrow pit extraction dimensions (length, width and depth) are based on desktop study and provide an indicative quantification of quality, accessibility and quantity of extractible material.

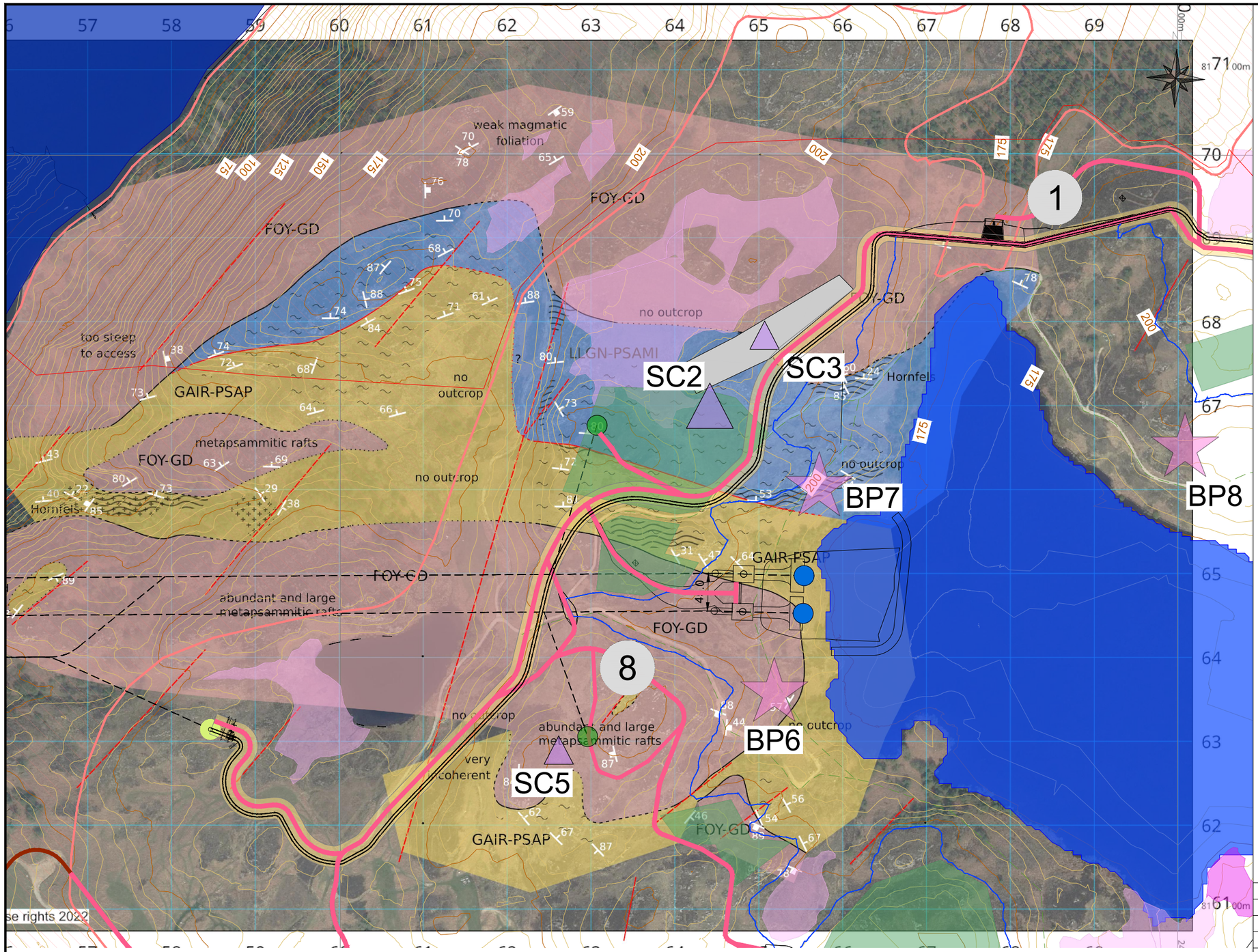
Seven suitable borrow pit locations (subject to detailed ground investigations) have been identified which have the potential to provide sufficient structurally suitable rock to facilitate the construction of the Proposed Development, four of which reside within the proposed upper reservoir inundation area. Meanwhile, three borrow pits have been screened out due to a combination of environmental factors.

It is expected that with the additional information from detailed ground-investigation works, the exact dimensions, locations and quantities of extraction of borrow pits can be confirmed.

This assessment provides the framework required for a finalised Borrow Pit Screening Assessment and informs the investigation works required for the next phases of the Proposed Development. This is to confirm that sufficient volumes of suitable rock material can be sourced on site, allowing for the fact that detailed ground investigation may identify unsuitable aggregate in some of the potential borrow pit locations.

It is expected that all borrow pits would be restored in line with the requirements of the CEMP, PMP, industry best practice and with the advice of the ECoW. This would include in relation to reseeding and the use of turves, where present.

A Geological Mapping



LEGEND

- Dominant foliation (S0/S1, dip direction/dip)
- Joints (dip direction/dip)
- Gneissic
- Contact metamorphic/hornfels
- Melt impregnation
- Loose boulders in colour of lithology
- Foyers Igneous Suite Granodiorite (FOY-GD)
- Loch Lagan Psammite Formation (LLGN-PSAMI)
- Gairbeinn Pebbly Psammite Member (GAIR-PSAP)
- Moine Supergroup Psammite (M-PSMY)
- Lithological contacts (observed, inferred, suspected)
- Tectonic contact (observed, inferred, suspected)
- (Tectonic) lineament mapped on aerial photograph

Coordinate system:	British National Grid
Projection:	Transverse Mercator
Datum:	OSGB36

0 50 100 150 200 250 m

SCALE A3 1:5'000

REV.	DETAILS OF REVISION	DRAWN	CHKD	APR	DATE
0	First Issue	D.He	Y.Lama	T.Clegg	27.07.2023

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Loch Kemp Storage
A STATERA COMPANY

Pre-FEED

Loch Kemp Pumped Storage

	Name	Date
Designed	Y.Lama	27.07.2023
Checked	T. Clegg	27.07.2023
Modified	D. He	27.07.2023
Status		31.07.2023

Annex 1
Borrow Pit
Overview with Geological Map

Project No.	Scale in Paper Size A3	Drawing No.	Rev.
FIS0000261	1:5.000	LKCV_FIC_BP_ZZ_TV_O_000842	0

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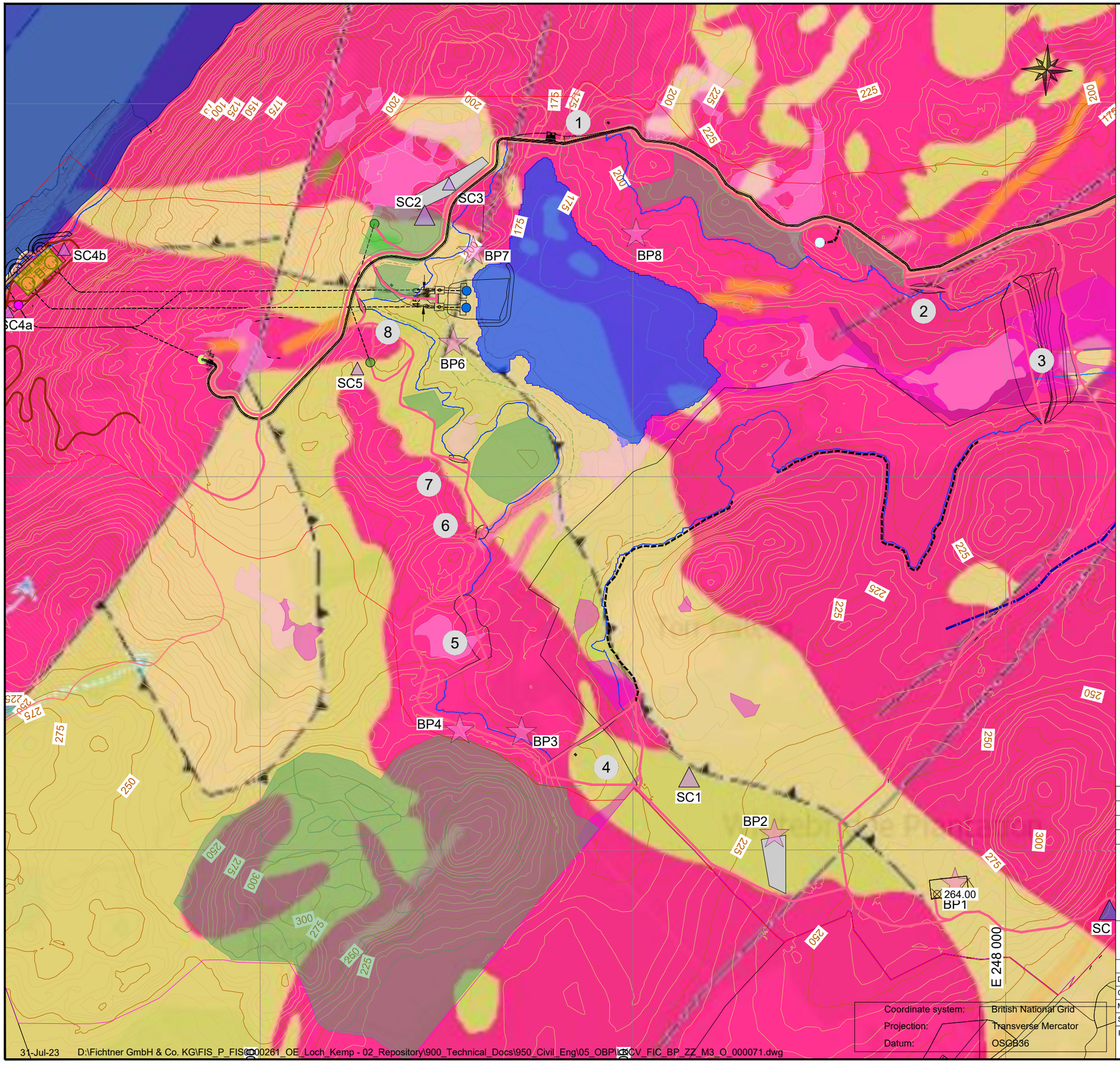

Bedrock geology 1:50,000 scale

- NORTH BRITAIN SILURO-DEVONIAN CALC-ALKALINE DYKE SUITE - MELAMICRODIORITE
- ACHNACONERAN STRIPED FORMATION - PSAMMITE AND SEMIPELITE
- FOYERS IGNEOUS COMPLEX - MICRODIORITE
- FOYERS IGNEOUS COMPLEX - DIORITE
- FOYERS IGNEOUS COMPLEX - QUARTZ-MONZODIORITE
- FOYERS IGNEOUS COMPLEX - DIORITE, HORNBLENDE
- FOYERS IGNEOUS COMPLEX - MONZOGRANITE
- LOCH LAGGAN PSAMMITE FORMATION - PSAMMITE
- GLEN MORISTON VEIN COMPLEX - PEGMATITE AND LEUCOGRANITE
- FOYERS FORMATION - SANDSTONE
- MEALFUARVONIE SANDSTONE MEMBER - SANDSTONE, PEBBLY (GRAVELLY)
- FARIGAIG FORMATION - BRECCIA AND CONGLOMERATE
- NORTH BRITAIN SILURO-DEVONIAN CALC-ALKALINE DYKE SUITE - FELSITE, PORPHYRITIC
- LOCH LAGGAN PSAMMITE FORMATION - PSAMMITE, MIGMATITIC
- FOYERS FORMATION - FELDSPATHIC-ARENITE
- FOYERS IGNEOUS COMPLEX - GRANITE
- FOYERS IGNEOUS COMPLEX - GRANODIORITE
- GLEN DOE PSAMMITE FORMATION - PSAMMITE, MICACEOUS
- FOYERS FORMATION - CONGLOMERATE
- MEALFUARVONIE SANDSTONE MEMBER - CONGLOMERATE
- FOYERS IGNEOUS COMPLEX - QUARTZ-MICRODIORITE
- NORTH BRITAIN SILURO-DEVONIAN CALC-ALKALINE DYKE SUITE - PEGMATITE
- GAIRBEINN PEBBLY PSAMMITE MEMBER - PSAMMITE, PEBBLY
- GAIRBEINN PEBBLY PSAMMITE MEMBER - QUARTZITE
- NORTH BRITAIN SILURO-DEVONIAN CALC-ALKALINE DYKE SUITE - FELSITE
- APPINITE SUITE - MELADIORITE, HORNBLENDE
- UNNAMED IGNEOUS INTRUSION, PRE-CALEDONIAN - AMPHIBOLITE AND HORNBLENDE SCHIST

Linear features 1:50,000 scale

- Axis_of_large_scale_glacial_flute
- Axis_of_large_scale_glacial_gouge
- Backfeature_terrace
- Esker_Crestline
- Fault_Thrust_Inf_Triangle_on_hangingwall_side
- Glacial_meltwater_channel_Centre_Undiff
- Ice_marg_Glacial_meltwater_channel_Right
- Landslide_lower_or_side_limit
- Limit_Granite_vein
- Limit_Pegmatite
- Marked_concave_break_of_slope

0 100 200 300 400 500 m

SCALE A3 1:10'000

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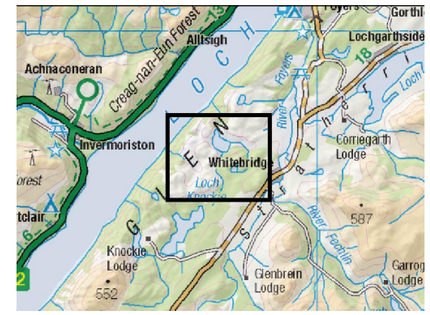
Annex 2
Borrow Pit
Overview with Britisch Geological Society

Project No.	Scale in Paper Size A3	Drawing No.	Rev.
FIS0000261	1:10.000	LKCV_FIC_BP_ZZ_TV_O_000843	0

Peat Depth (m)

- 0
- 0 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- > 3



Coordinate system:	British National Grid
Projection:	Transverse Mercator
Datum:	OSGB36

0 100 200 300 400 500 m

SCALE A3 1:10'000

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REV.	DETAILS OF REVISION	DRAWN	CHKD	APR	DATE
0	First Issue	D.He / Y.Lama	T.Clegg		27.07.2023

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Loch Kemp Pumped Storage

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Modified	D. He	27.07.2023
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Annex 3
Borrow Pit
Overview with Peat Probe Data

Project No.	Scale in Paper Size A3	Drawing No.	Rev.
FIS0000261	1:10.000	LKCV_FIC_BP_ZZ_TV_O_000844	0

28-Jul-23 D:\Fichtner GmbH & Co. KG\FIS_P_FIS0000261_OE_Loch_Kemp - 02_Repository\900_Technical_Docs\950_Civil_Eng\05_OBP\LKCV_FIC_BP_ZZ_M3_O_000071.dwg

B Preliminary Material Balance

Loch Kemp - Preliminary Material Balance

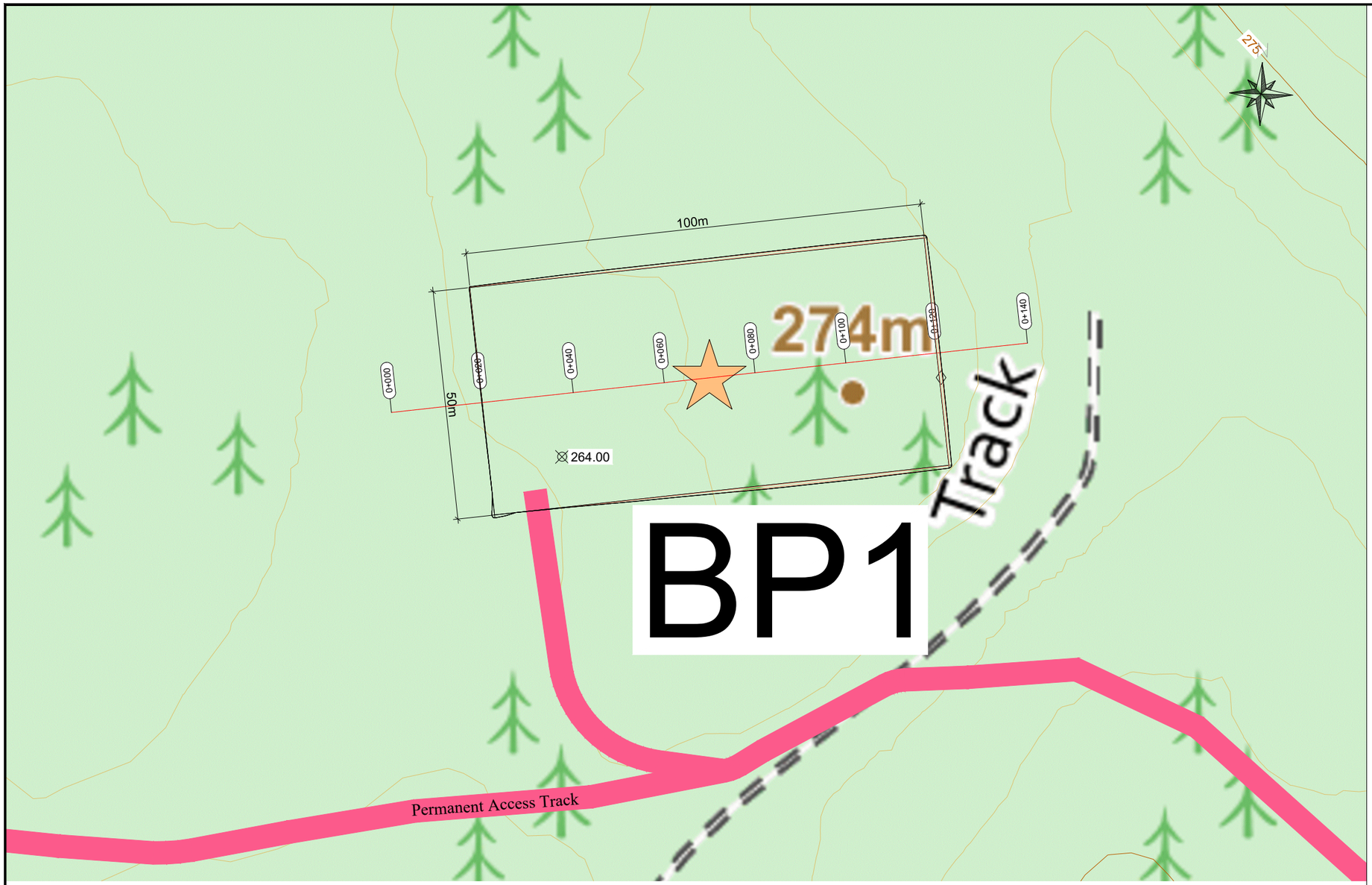
Description	*Spoil Generation Factor*	*Usable Rockfill Factor*	*Solid Volume (Excavation) (m³)*	*Spoil Material Generated (m³)*	*Compacted Rockfill Generated (m³)*	*Design Volume (m³)*	*Concrete Required incl. Shotcrete (m³)*
Loch Kemp - Upper Reservoir							
Dam 1							
Option 1 - Rockfill Dam							
- Tip/Overburden Excavation if required for Dam Seat (Rockfill Dam) (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	19,400	14,550	11,640		
- Material to be used in Rockfill Dam				120,200		240,400	
Option 2 - RCC Dam							
- Tip/Overburden Excavation if required for Dam Seat (RCC Dam) (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	10,000	7,500	6,000		
- Material to be used in RCC Dam						61,350	1,740
Dam 2							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	1,400	1,050	840		
- Material to be used in Rockfill Dam						3,000	966
- Material to be used in RCC Dam							
Dam 3							
- Peat (Assumed Depth 2m average)	100%*1.5		57,000	85,500			
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	28,500	21,375	17,100		
- Material to be used in Rockfill Dam						378,700	2,142
Dam 4							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	2,320	1,740	1,392		
- Material to be used in RCC Dam						17,300	260
Dam 5							
- CFRD							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	8,820	6,615	5,292		
- Material to be used in Rockfill Dam						59,900	1,743
- RCC Dam							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	1,190	893	714		
- Material to be used in RCC Dam						7,800	
Dam 6							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	990	743	594		
- Material to be used in Rockfill Dam						4,300	378
Dam 7							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	720	540	432		
- Material to be used in Rockfill Dam						1,900	378
Dam 8							
- Tip/Overburden Excavation if required for Dam Seat (Assumed Rock Surface estimated 2m average)	50%*1.5	50%*1.2	730	548	438		
- Material to be used in Rockfill Dam						800	420
Waterway							
Intake + Gate Shaft							
Surface Excavation	50%*1.5	50%*1.2	267,200	200,400	160,320		
Underground Excavation	1/3*1.5	2/3*1.2	22,400	11,200	17,920		
Access Road	50%*1.5	50%*1.2	30	23	18	15,400	
Concrete							16,800
Shotcrete							10,600
Surge Shaft							
Excavation							
Concrete							
Headrace Tunnel / Shaft							
Pressure Shaft	1/3*1.5	2/3*1.2	9,600	4,800	7,680		2,400
Concrete Lined Tunnel	1/3*1.5	2/3*1.2	97,100	48,550	77,680		26,300
Steel Lined Tunnel	1/3*1.5	2/3*1.2	28,400	14,200	22,720		11,500
Bifurcation Tunnel	1/3*1.5	2/3*1.2	2,600	1,300	2,080		1,100
Shotcrete							10,900
Powerhouse Area							
Powerhouse (underground)							
Excavation Shaft	50%*1.5	50%*1.2	95,500	71,625	57,300		
Excavation Access Gallery (between both Shafts)	50%*1.5	50%*1.2	450	338	270		

Excavation Tailrace Outlet	50%*1.5	50%*1.2	26,300	19,725	15,780		
Concrete							76,600
Shotcrete							3,600
Main Access Tunnel							
Excavation	1/3*1.5	2/3*1.2	25,500	12,750	20,400		
Shotcrete							2,300
Access Tunnel to Cable Shaft; Cable Shaft; Top Building Excavation							
Excavation	1/3*1.5	2/3*1.2	8,000	4,000	6,400		
Shotcrete							900
Concrete							240
Access Track							
Access Track within SAC							
Excavation incl. Powerhouse Surface Excavation	50%*1.5	50%*1.2	270,160	202,620	162,096		
Backfill						3,923	
Access Track outside SAC (excl. Dam Crest Road)							
Excavation	50%*1.5	50%*1.2	160,000	120,000	96,000		
Backfill						53,296	
Total material balance:			**1,124,910**	**838,033**	**679,466**	**607,669**	**171,267**

Balance	***Spoil Compaction Factor***	***Usable Rockfill Factor***	***Solid Volume (Excavation) (m^3)***	***Spoil Material Generated (m^3)***	***Compacted Rockfill Generated (m^3)***	***Design Volume (m^3)***	***Concrete Required incl. Shotcrete (m^3)***
Uncompacted Spoil Volume				838,033			
Compacted Spoil Volume (incl. surplus structural rockfill)	**1.3**			673,621			
Additional fill areas volume							
Dam 3 Downstream Backfill						400,100	
Reservoir fill SW of Dam 3						424,100	
Dam 5 downstream fill up to elevation 201.5 m AOD (planted dam tail)						*195,600*	
Valley fill to north of Proposed Development						*146,800*	
North of Dam 2, fill up to elevation 205 m AOD						*215,100*	
Reduced excavation at Kemp inlet						*133,000*	
Total additional fill area available						**824,200**	
Surplus potential backfill volume in additional fill areas						**150,579**	
Surplus potential backfill volume as percentage of total excavation (%)						22.35%	

Estimated outstanding spoil material (m^3)						**0**	
Percentage of total excavated material anticipated to be reused within Proposed Development (%)						**100.00%**	

C Borrow Pit Dimensions

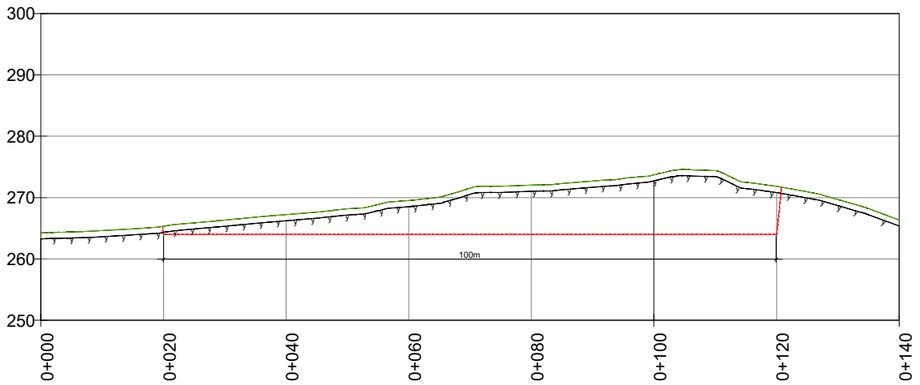


NOTE:

- Assumed Overburden Depth: 1m
- Excavation Slope h:v=1:10
- Rock Excavation Volume:

  BP1: 26,100 m³

Cross Section of BP1



0	First Issue	D.He	Y.Lama	T.Clegg	27.07.2023
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A STATERA COMPANY

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Loch Kemp Pumped Storage

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Designed	Y.Lama	27.07.2023
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Modified	D. He	27.07.2023
Status		07.07.2023

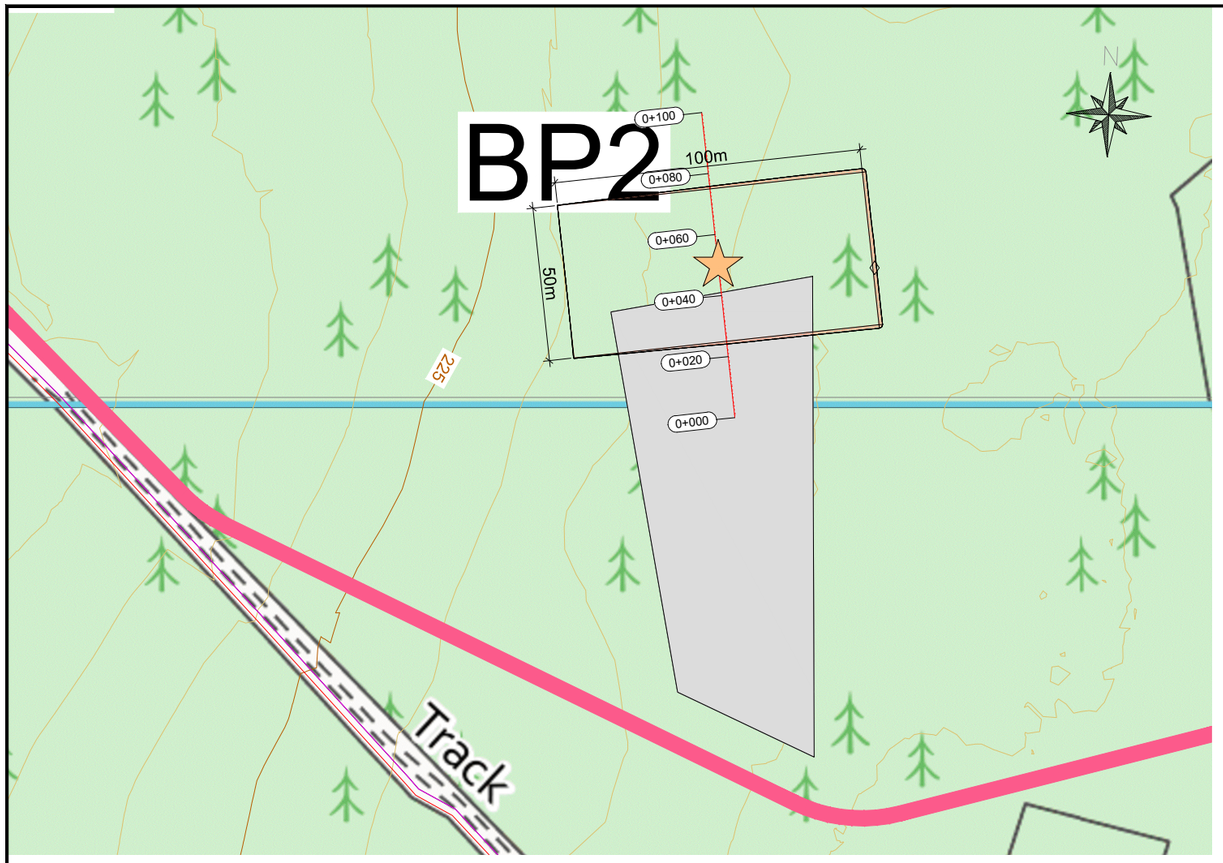
Annex 6
Borrow Pit 1
Plan View and Cross Section

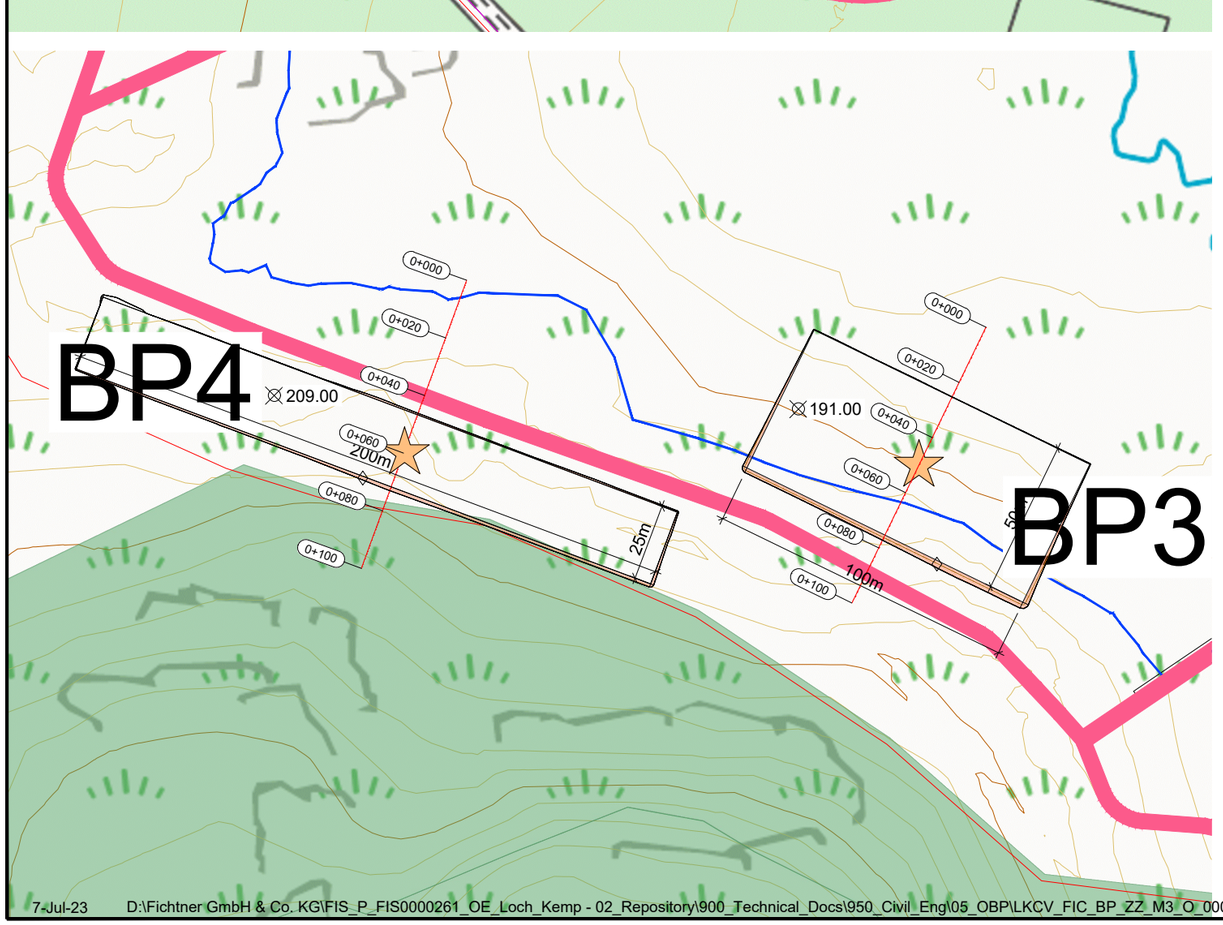
Project No.	Scale in Paper Size A3	Drawing No.	Rev.
FIS0000261	1:1.000	LKCV_FIC_BP_ZZ_TV_O_000845	0

Coordinate system:	British National Grid
Projection:	Transverse Mercator
Datum:	OSGB36

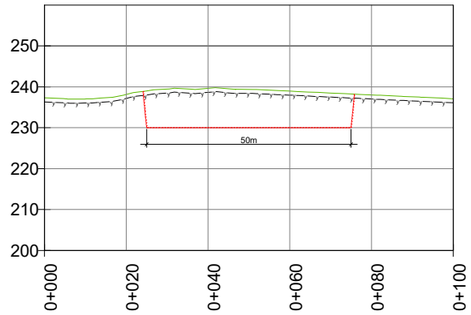
0 10 20 30 40 50 m

SCALE A3 1:1'000

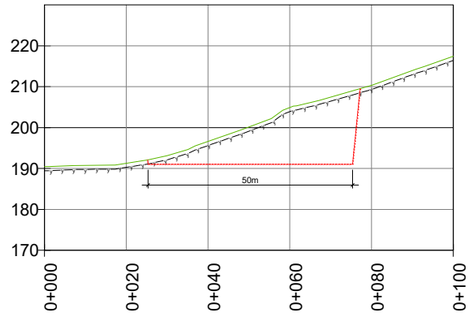




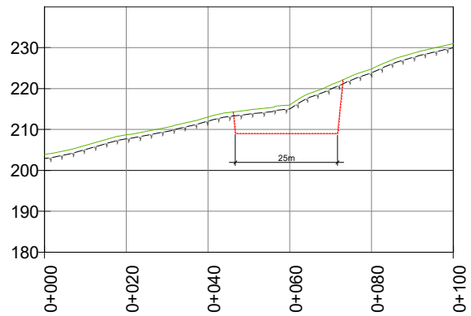
Cross Section of BP2



Cross Section of BP3



Cross Section of BP4



NOTE:

- Assumed Overburden Depth: 1m
- Excavation Slope h:v=1:10
- Rock Excavation Volume:
  - BP2: 36,700 m³
  - BP3: 43,740 m³
  - BP4: 26,000 m³

Coordinate system:	British National Grid
Projection:	Transverse Mercator
Datum:	OSGB36

0 15 30 45 60 75 m
SCALE A3 1:1'500

0 20 40 60 80 100 m
SCALE A3 1:2'000

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Annex 4
Borrow Pit 2,3,4
Plan View and Cross Sections

Project No.	Scale in Paper Size A3	Drawing No.	Rev.
FIS0000261	1:1.500/1:2.000	LKCV_FIC_BP_ZZ_PV_O_000840	0

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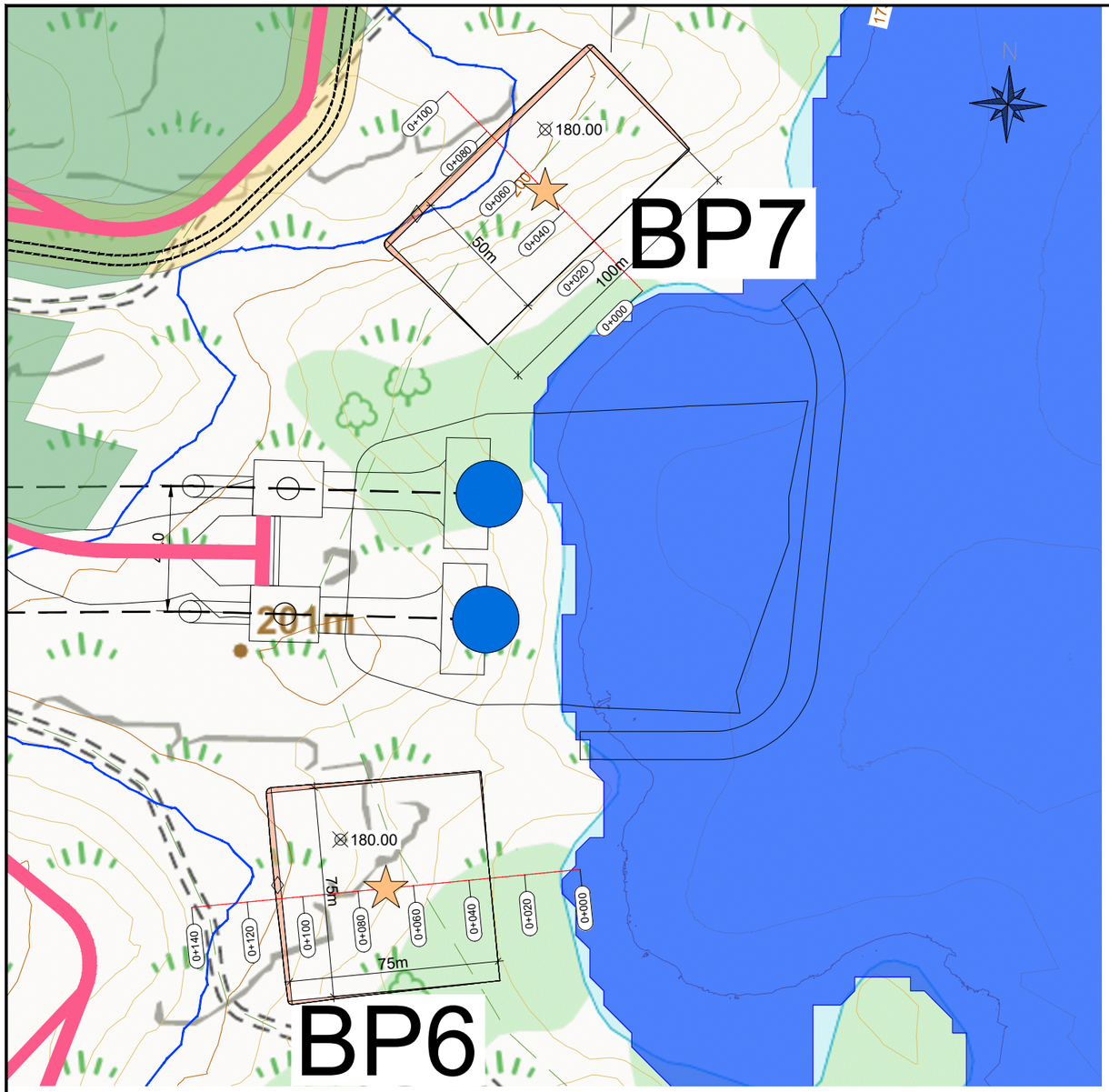
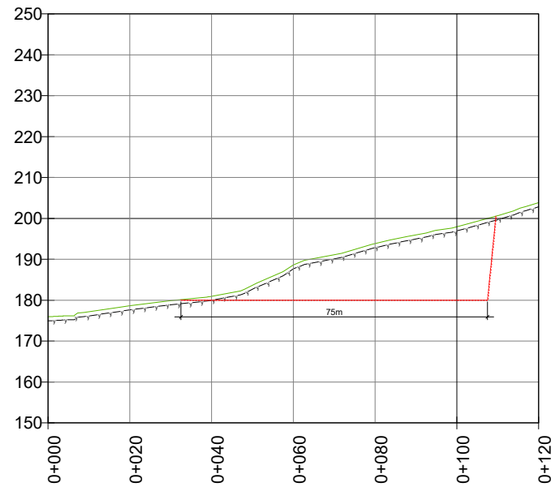
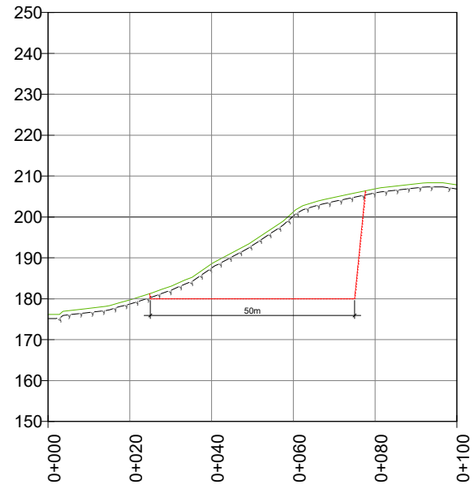


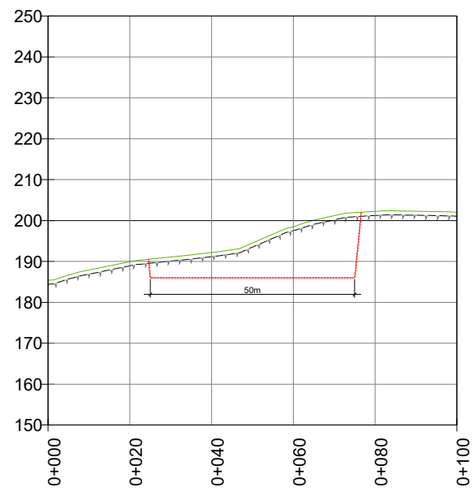
Cross Section of BP6



Cross Section of BP7



Cross Section of BP8



NOTE:

- Assumed Overburden Depth: 1m
- Excavation Slope h:v=1:10
- Rock Excavation Volume:

BP6: 48,600 m³

BP7: 65,270 m³

BP8: 34,060 m³

Coordinate system:	British National Grid
Projection:	Transverse Mercator
Datum:	OSGB36

0 15 30 45 60 75 m

SCALE A3 1:1'500

0 20 40 60 80 100 m

SCALE A3 1:2'000

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Annex 5
Borrow Pit 6,7,8
Plan View and Cross Sections

Project No.	Scale in Paper Size A3	Drawing No.	Rev.
FIS0000261	1:1.500/1:2.000	LKCV_FIC_BP_ZZ_PV_O_000841	0

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