March 2025

Glen Earrach Pumped Storage Hydro

Environmental Impact Assessment Report

Volume 5: Appendices
Appendix 15.1: Material Management Appraisal (MMA)

Glen Earrach Energy Ltd

Glen Earrach AECOM

Quality information

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1. Introduction

1.1.1 This Materials Management Appraisal (MMA) report has been undertaken to detail the strategy for the management of the materials excavated, and how they can be re-used during the construction of the Proposed Development. This report also demonstrates that little material would require to be imported for construction of the main components of the scheme and there would be no substantial waste material disposed of off-site. This MMA should be read in conjunction with **Chapter 15 Geology and Ground Conditions (Volume 2: Main Report)** and **Appendix 15.2 Outline Peat Management Plan (Volume 5: Appendices)**.

1.1.2 The MMA outlines the volumes of material that are anticipated to be associated with various components of the Proposed Development. The general philosophy behind the project's material management strategy is that the main component, the Headpond, would be created by undertaking a large balanced cut (excavation) and fill (placement of material) exercise using material generated from a Borrow Pit Search Area (BP) Search Area within the Headpond location and from above and below ground excavation activities.

1.1.3 This MMA has been produced before any intrusive Ground Investigation (GI) works have been completed. It is therefore anticipated that this appraisal would be updated once more data is available following future site-specific GI campaigns.

1.1.4 The management of peat has been excluded from this appraisal as it is covered separately in **Appendix 15.2 Outline Peat Management Plan (Volume 5: Appendices)**.

1.1.5 The following sections show the processes that have been used to calculate the volumes of material anticipated to be required to support construction of the Proposed Development.

1.1.6 Two options are proposed for the Proposed Development - Option A and Option B (see **Figure 2.4: Below Ground Infrastructure (Sheet 1 Option A, Sheet 2 Option B) (Volume 3: Figures)**, which largely vary only in the alignment / orientation of the below ground infrastructure. In alignment with **Section 2.5.3 Upper Control Works** of **Chapter 2: Project and Site Description (Volume 2: Main Report)** the assessment focuses on the above ground infrastructure of Option B - the worst-case scenario due to increased material volumes for this option compared to Option A.

2. Sources of Information

2.1.1 A number of sources of information have been used to undertake this appraisal, as detailed below:

- ICE Earthworks A guide 2nd Edition (2015)[1];
- Autodesk Civil 3D (C3D);
- Site visits; and
- Peat Probing - details of peat probing can be found within Appendix 15.2: Outline Peat Management Plan (Volume 5: Appendices).

3. Appraisal

3.1 Introduction

3.1.1 The volume of material that would be generated from the construction of the Proposed Development has been calculated from the AutoCAD Civil 3D (C3D) model and from engineering estimates. In both cases,

[1] Earthworks: a guide (2015)

the volumes calculated have been bulked or compacted to reflect the actual volumes that would be generated / used during construction.

3.1.2 **Table 1. Bulking and Compaction Factors for Rocks and Soils** details the bulking and compaction factors that have been assumed for this MMA.

Table 1. Bulking and Compaction Factors for Rocks and Soils

Component	Bulking	Compaction
Conglomerate (Sandstone)	1.33	0.86
Sandstone	1.60	0.72
Psammite	1.70	0.68
Peat	1.35	0.85

3.1.3 The bulking factors are based on the standard values detailed in ICE Earthworks: A Guide 2nd Edition, 2015 and engineering judgement.

3.1.4 To estimate the compaction factors, a net bulking of 15% has been used, as recommended in ICE Earthworks: A Guide 2nd Edition, 2015.

3.1.5 Note that all totals within this appraisal have been rounded to the nearest 10,000 m, m^2 or m^3.

3.2 Material Generated

Sections

3.2.1 The material generated through excavation activities is split into the following sections, as detailed below:

- Headpond;
- Waterways;
- Dry Tunnels;
- Caverns; and
- Above Ground Excavations.

3.2.2 All the volumes have been determined either via C3D take-offs or through calculation and all below ground excavations works are anticipated to be undertaken using the conventional drill and blast technique.

Headpond

3.2.3 The excavation works within the Headpond would primarily be at the Upper Control Works (UCW), with additional material requirements fulfilled using a BP Search Area within the Headpond location.

3.2.4 As set out in **Appendix 15.2 Outline Peat Management Plan (Volume 5: Appendices)** and **Chapter 15: Geology and Soils (Volume 2: Main Report)**, peat is present across the Proposed Development Site, including the Headpond site. Accordingly, the peat will be excavated across the footprint of the Embankments, the UCW and Headpond BP Search Area before any excavation of material is undertaken.

3.2.5 The excavated peat volumes have therefore been removed from the total volume of excavated material, as shown in **Table 2. Headpond Excavation - UCW and Table 3. Headpond Excavation - BP Search Area**.

3.2.6 Peat volumes, management, handling and storage is detailed in **Appendix 15.2 Outline Peat Management Plan (Volume 5: Appendices)**.

Table 2. Headpond Excavation - UCW

Item	Raw Volume Excavated (m³)	Likely Geology	Bulking Factor	Bulked Volume Excavated (m³)
UCW Excavation	2,362,492	Psammite	1.70	4,016,236
UCW Peat Excavation	54,321	Peat	1.35	- 73,333
		Total Usable Volume of Excavation		3,942,903

Table 3. Headpond Excavation - BP Search Area

Item	Raw Volume Excavated (m³)	Likely Geology	Bulking Factor	Bulked Volume Excavated (m³)
Headpond BP Search Area	1,304,589	Psammite	1.70	2,217,801
Headpond BP Search Area Peat Excavation	92,924	Peat	1.35	- 125,447
		Total Usable Volume of Excavation		2,092,354

Waterways

3.2.7 **Table 4. Below Ground Excavation - Waterways** details the waterway excavation volumes. As the Proposed Development consists of two waterways, all sections of both waterways are considered.

Table 4. Below Ground Excavation - Waterways

Item	Internal Diameter (m)	Length (m)	Raw Volume Excavated (m³)	Likely Geology	Bulking Factor	Bulked Volume Excavated (m³)
Low Pressure Tunnel 1 (LPT1)	9.0	514	42,000	Psammite	1.70	71,401
LPT2	9.0	442	36,117	Psammite	1.70	61,399
Vertical Pressure Shaft 1 (VPS1)	7.6	460	27,978	Psammite	1.70	47,562
VPS2	7.6	460	27,978	Psammite	1.70	47,562
High Pressure Tunnel 1 (HPT1)	6.9	64	3,298	Psammite	1.70	5,606
HPT1 manifolds 1, 2 & 3	4	150	3,186	Psammite	1.70	5,415
HPT2	6.9	64	3,298	Psammite	1.70	5,606
HPT2 manifolds 1, 2 & 3	4	150	3,186	Psammite	1.70	5,415
LPT3 manifolds 1, 2 & 3	4	160	3,398	Psammite	1.70	5,777
LPT4 manifolds 1, 2 & 3	4	160	3,398	Psammite	1.70	5,777
LPT5	6.9	124	6,390	Psammite	1.70	10,863
LPT6	6.9	124	6,390	Psammite	1.70	10,863
LPT7	9.0	2,752	224,874	Sandstone	1.60	359,798
LPT8	9.0	2,733	223,321	Sandstone	1.60	357,314
			Total Volume of Excavated Material (m³)			**1,000,000**

Assumptions:

The dimensions stated above are based on an initial design and are approximate values based on a reasonable maximum component size. Excavated areas of tunnels allows for additional excavation for lining and overbreak, as follows:

- *Drill and blast lining (waterways) = 500 – 700 mm.*

- *Drill and blast overbreak (waterways) = 100 – 150 mm.*

3.2.8 As shown in **Table 4. Below Ground Excavation - Waterways**, the total volume of excavated material is ~ 1,000,000 m³. Excavated material from the tailrace tunnels is less preferred for use in the construction of the Headpond Embankments.

3.2.9 As such, the total volume of usable material for the construction of the Headpond Embankments is ~ 280,000 m³. The ~ 720,000 m³ of material excavated from the tailrace tunnels would not be used for the construction of the Embankments and is instead earmarked for re-use elsewhere across the Proposed Development Site, as discussed in **Section 3.4 Excess Material Re-Use**.

Dry Tunnels

3.2.10 **Table 5. Below Ground Excavation – Dry tunnels** details the dry tunnel excavation volumes.

Table 5. Below Ground Excavation – Dry tunnels

Item	Finished Dimensions (m)	Length (m)	Raw Volume Excavated (m³)	Likely Geology	Bulking Factor	Bulked Volume Excavated (m³)
Main Access Tunnel	8.0 x 8.0 (D – Shaped Tunnel)	3,158	238,612	Psammite	1.70	405,641
Cable Tunnel 1	6.0 x 6.0 (D – Shaped Tunnel)	3,180	147,163	Psammite	1.70	250,176
Cable Tunnel 2	6.0 x 6.0 (D – Shaped Tunnel)	3,579	165,627	Psammite	1.70	281,566
Gate Shaft Tunnel	6.0 x 6.0 (D – Shaped Tunnel)	1,107	51,229	Psammite	1.70	87,090
Ventilation Shaft	6.0	546	23,483	Psammite	1.70	39,920
				Total Volume of Useable Material (m³)		**1,060,000**

Assumptions:

The dimensions stated above are based on an initial design and are approximate values based on a reasonable maximum component size. Excavated areas of tunnels allows for 600mm additional diameter for lining and overbreak, as follows:

- *Drill and blast lining (dry tunnels) = 500 mm.*
- *Drill and blast overbreak (dry tunnels) = 100 mm.*

Caverns

3.2.11 **Table 6. Below Ground Excavation – Caverns** details the excavation volume associated with the Caverns.

Table 6. Below Ground Excavation – Caverns

Item	Dimensions (m) [L x W x H]	Raw Volume Excavated (m³)	Likely Geology	Bulking Factor	Bulked Volume Excavated (m³)
Power Cavern	267 x 30 x 54	482,048	Psammite	1.70	819,482
Transformer Cavern	260 x 25 x 21	162,702	Psammite	1.70	276,593
Busbar Gallery (x10)	62 x 8 x 8	6,400	Psammite	1.70	10,880
Gate Cavern	128 x 10 x 17	29,981	Psammite	1.70	50,968
			Total Volume of Useable Material (m³)		**1,160,000**

Assumptions:

The dimensions stated above are based on an initial design and are approximate values based on a reasonable maximum component size. Excavated areas of tunnels allows for 1 m additional diameter for lining and overbreak, as follows:

- *Drill and blast lining (caverns) = 500mm.*

- *Drill and blast overbreak (caverns) = 500mm.*

Above Ground Excavations

3.2.12 In addition to the below ground excavations, there would be above ground excavations that need to be accounted for in the material appraisal. **Table 7. Above Ground Excavations** details the above ground excavation volumes in further detail.

Table 7. Above Ground Excavations

Item	Raw Volume Excavated (m³)	Likely Geology	Bulking Factor	Bulked Volume Excavated (m³)
Tunnel Portal 1 (Access)	12,600	Psammite	1.70	21,420
Tunnel Portal 2 (Cable 1 and 2)	47,000	Psammite	1.70	79,900
Tunnel Portal 3 (Gate Shaft Tunnel)	38,300	Psammite	1.70	65,110
Lower Control Works (LCW)	149,969	Sandstone	1.60	239,950
		Total Volume of Excavated Material (m³)		**410,000**

3.2.13 As shown in **Table 7. Above Ground Excavations**, the total volume of excavated material is ~ 410,000 m³. However, due to the location of excavation in comparison to the main site, the excavated material from the LCW is not considered to be usable for the construction of the Headpond Embankments. In order to reuse this material, the excavated rock would need to be transported ~ 16 km on the public road network to the Proposed Development Site. Accordingly, to reduce traffic and transportation impacts generated by the Proposed Development, it is not considered that this material is usable. As such, the total volume of usable material for the construction of the Headpond Embankments is ~ 170,000 m³.

3.2.14 The ~ 240,000 m³ of material excavated from the LCW will be transported off site as either waste material or a commercial product. The movement of this material is expected to be undertaken using Loch Ness and the Caledonian Canal via barge. This approach and the final destination for the material will be confirmed post-consent.

Total Material Generated

3.2.15 **Table 8. Total Excavated Volume (Bulked)** summarises the total volume of material that would be excavated during construction and the relevant usable and unusable volumes for the construction of the Headpond.

Table 8. Total Excavated Volume (Bulked)

Excavation Area	Excavated Volume (Psammite) (m³)	Excavated Volume (Sandstone) (m³)	Excavated Volume (Bulked) (m³)
Headpond	6,040,000	-	6,040,000
Waterways	280,000	720,000*	1,000,000
Dry Tunnels	1,060,000	-	1,060,000
Caverns	1,160,000	-	1,160,000
Above Ground	170,000	240,000**	410,000
		Total Volume of Excavated Material	**9,670,000**
	Total Volume of Excavated Material Usable in Headpond Construction		**8,710,000**

Notes

** As noted in Section 3.2.8 the sandstone is considered less preferrable for use in the dams and is therefore deducted from the Total Volume of Excavated Material Usable in Headpond Construction*

*** As noted in Section 3.2.6.3 the excavated material at the LCW will be disposed of off-site using waterborne transport to reduce impacts on the public roads. Therefore, volume is deducted from the Total Volume of Excavated Material Usable in Headpond Construction*

3.3 Reuse of Excavated Material

Introduction

3.3.1 The main component that will utilise the material excavated during construction is the Headpond Embankments. **Table 9. Headpond Embankments** details the volume required for the construction of the Embankments. Note, the volume represents the compacted volume of material. Therefore, the required volume to construct the Embankments is based on the bulked volume.

Table 9. Headpond Embankments

Item	Compacted Volume (m^3)	Material Used for Construction	Compaction Factor	Bulked Volume (m^3)
Main Dam	3,692,880	Psammite	0.68	5,459,040
Saddle Dam 1	266,720	Psammite	0.68	394,282
Saddle Dam 2	162,911	Psammite	0.68	240,825
Spillway	98	Psammite	0.68	144
Secondary Bund	2,355	Psammite	0.68	3,481
		Total Bulked Volume (m^3)		**6,100,000**

3.3.2 The design of the Headpond Embankments has been supported by a cut / fill exercise to balance the two with an aim to limit material wastage. The process to construct the Embankments is set out into the following three phases:

- Phase 1 – UCW excavation;
- Phase 2 – Headpond BP Search Area excavation; and
- Phase 3 – Above / Below Ground excavation.

3.3.3 The majority of the material to be used in the Embankments will come from Phase 1 and Phase 2 and be supplemented by the Phase 3 excavation activities. This methodology has been implemented according to the construction programme and location of excavations across the Proposed Development.

3.3.4 Guidance from the ICE Earthworks, A guide 2nd Edition states that wastage of material from processing (as dust and particulates), transportation (as dust), and runoff (as suspended solids) should be estimated at 2%.

3.3.5 The estimates for the amount of material suitable for reuse is based on engineering judgement and considers the geological uncertainty present in the assessment.

Phase 1 – UCW Excavation

3.3.6 **Table 10. Headpond UCW Excavation – Material Reuse** provides a breakdown of the cut / full exercise undertaken for the Embankments using the excavated material from the UCW within the footprint of the Headpond.

Table 10. Headpond UCW Excavation – Material Reuse

UCW Excavated Material (m³)	Wastage / Loss @ 2% (m³)	Usable Volume (m³)	Percentage of Reuse (%)	Material to be used in Embankments (m³)	Surplus Unusable (m³)	Volume of Embankments (m³)	Deficit of Material for the Embankments (m³)
3,942,903	78,858	3,864,045	85	3,284,438	579,607	6,100,000	**- 2,815,562**

Assumptions:

- *The UCW Excavated Material considers the removal of any peatlands across the extent of the UCW, within the Headpond site.*
- *All volumes are bulked.*

3.3.7 As demonstrated in **Table 10. Headpond UCW Excavation – Material Reuse**, there is a deficit of material required to build the Headpond Embankments from the UCW excavation alone. To make up this shortfall, the material excavation from the Headpond BP Search Area would be utilised.

Phase 2 – BP Search Area Excavation

3.3.8 Table 11. Headpond BP Search Area Excavation – Material Reuse provides a breakdown of how the material excavated from the BP Search Area would be utilised.

Table 11. Headpond BP Search Area Excavation – Material Reuse

Total BP Search Area Excavated Material (m³)	Wastage / Loss @ 2% (m³)	Bulked Volume (m³)	Percentage of Reuse (%)	Material to be used in Embankments (m³)	Surplus Unusable (m³)	Volume of Embankments (m³)	Deficit of Material for the Embankments (m³)
2,092,354	41,847	2,050,507	90	1,845,456	205,051	2,815,562	**- 970,106**

Assumptions:

- *The Headpond BP Search Area Excavated Material excludes the removal of any peatlands across the extent of the Headpond BP Search Area.*
- *All volumes are bulked.*
- *Recovery rates are higher for the BP as it would operate as a dedicated borrow area as opposed to the LCW excavation.*

3.3.9 As demonstrated in **Table 11. Headpond BP Search Area Excavation – Material Reuse**, there is a deficit of material required to build the Headpond Embankments from the UCW excavation and the Headpond BP Search Area excavation. To make up this shortfall, the material from the above / below ground excavations would be utilised.

Phase 3 – Above / Below Ground Excavation

3.3.10 **Table 12. Above / Below Ground Excavation – Material Reuse** provides a breakdown of how the material excavated from the above / below ground excavation would be utilised.

Table 12. Above / Below Ground Excavation – Material Reuse

Total Above / Below Ground Excavated Material (m³)	Wastage / Loss @ 2% (m³)	Bulked Volume (m³)	Percentage of Reuse (%)	Material to be used in Embankments (m³)	Surplus Unusable (m³)	Volume of Embankments (m³)	Deficit of Material for the Embankments (m³)
2,672,938	53,459	2,619,479	37.5	982,305	1,637,174	970,106	**12,199**

Assumption:

- *All volumes are bulked.*
- *Total Above / Below Ground Excavation Material (m³) includes waterways (less LPT7 and LPT8), dry tunnels, caverns and above ground excavation (less LCW).*

3.3.11 **Table 12. Above / Below Ground Excavation – Material Reuse** shows that there would be sufficient material from the excavation of the UCW, Headpond BP Search Area and 37.5% of the above / below ground excavation to construct the Headpond Embankments, with an excess of ~12,000 m³. In total, there is sufficient material to construct the Headpond Embankments using the BP Search Area, UCW and the below ground excavations. **Table 13. Headpond Embankment Construction Breakdown** shows the overall material breakdown for the construction of the dams.

Table 13. Headpond Embankment Construction Breakdown

Excavation Source	Total Volume used for Embankment Construction (m³)	Percentage of use in Embankments (%)
UCW	3,284,438	54
Headpond BP Search Area	1,845,456	30
Above / Below Ground Excavations	982,305	16

Excess Material

3.3.12 The total volume of excess material following excavation of all works and construction of the Headpond Embankments is shown in **Table 14. Total Excess Material**.

Table 14. Total Excess Material

Phase 1 Material Surplus (m³)	Phase 2 Material Surplus (m³)	Phase 3 Material Surplus (m³)	Total Material Surplus (m³)
579,607	205,051	1,649,373	**2,430,000**

Note:

– The ~12,000 m³ excess noted in Paragraph 3.3.11 is included in the Phase 3 Material Surplus i.e. *Phase 3 Material Surplus = Surplus Unusable + Deficit of Material for the Embankments* from per Table 12. Above / Below Ground Excavation – Material Reuse.

3.3.13 The total excess material volume has been calculated based on the total surplus material and any excess material as shown in **Table 10. Headpond UCW Excavation – Material Reuse**, **Table 11. Headpond BP Search Area Excavation – Material Reuse** and **Table 12. Above / Below Ground Excavation – Material Reuse**.

3.3.14 **Table 14. Total Excess Material** shows that the total excess of material is ~ 2,400,000 m³. However, the following factors must be considered to estimate the realistic total excess material.

- As noted in **Waterways**, the excavated material from the tailrace tunnels is considered to be unsuitable for use in the construction of the Headpond Embankments and has been discounted from **Table 14. Total Excess Material**. However, as the material is excavated it must be considered as part of the overall excess material and subsequent balance. As such, ~ 720,000 m³ must be added to the total material surplus as set out in **Table 14. Total Excess Material.**
- The BP Search Area is viewed as a source of material that would only be excavated for the construction of the Headpond Embankments. As such the BP Search Area would be excavated as required, just in time for construction of the Headpond Embankments. Therefore, the ~ 200,000 m³ of excess material set out in **Table 14. Total Excess Material** must be excluded from the total excess material.

3.3.15 **Table 15. Corrected Total Excess Material** shows the corrected total excess of material following the deductions identified above.

Table 15. Corrected Total Excess Material

UCW Excavation Surplus (m^3)	BP Search Area Excavation Surplus (m^3)	Below Ground Excavation Surplus (m^3)	Material Not suitable for use in Embankment Construction (m^3)	Total Excess Material (m^3)
579,607	0	1,649,373	717,112	**2,950,000**

3.4 Excess Material Re-Use

Introduction

3.4.1 As shown in **Table 15. Corrected Total Excess Material**, there is an estimated material surplus of ~ 2,950,000 m^3. The appraisal generally focuses on the cut/fill balance for the construction of the Headpond Embankments; however, excavated material would be utilised elsewhere to construct other aspects of the Proposed Development and for reinstatement purposes, post construction.

3.4.2 The additional material uses are detailed below and summarised in **Table 16. Site Wide Material Use (Additional)**.

Reinstatement of Temporary Workers Accommodation

3.4.3 To establish the Temporary Workers Accommodation for the Proposed Development, a substantial cut/fill exercise will be undertaken. As the accommodation would be established during the enabling phase of the project, the material excavated would be used to construct the permanent access tracks to the Headpond site. Post construction, the area of disturbance would be reinstated with excess excavated material.

3.4.4 The total volume of displaced material is estimated using C3D and detailed accordingly in **Table 16. Site Wide Material Use (Additional)**.

On-site concrete batching

3.4.5 To reduce impacts on the local traffic network, on-site concrete batching is proposed across the Proposed Development Site, using locally won material for the batching operations. The material required would be won through on-site excavation works and would be graded using on-site facilities. Note, cement and additives required for the specified concrete mix would be imported to the Proposed Development Site as required. Water would be abstracted from sources across the Proposed Development Site, subject to agreement with SEPA.

Switchyard, Permanent Compound Hardstands and Access Track Construction

3.4.6 Similar to the implementation of on-site concrete batching, to reduce impacts on the local traffic network, permanent hardstands would be established using material won on site. This includes the GIS Switchyard hardstands and access tracks and the Temporary Construction Compound hardstands across the Proposed Development Site. The material would be graded as required and laid according to the relevant construction methodology.

3.4.7 The access tracks to the Headpond will likely be constructed at the start of the Construction phase of the project, utilising material won during the Enabling and Pre-Construction phases. The material excavated from the primary tunnel will be stockpiled temporarily in construction compounds during the Enabling and Pre-Construction phase and utilised to construct the access tracks to the Headpond.

Road resurfacing

3.4.8 During construction, the existing construction access tracks will be extensively used by heavy goods vehicles (HGV) and construction traffic. To maintain safe access, the track will be re-surfaced annually, as detailed in **Table 16. Site Wide Material Use (Additional)**.

3.4.9 At the end of the construction programme, the existing Balnain Main Access track, would require local resurfacing to return it to the pre-construction condition. It is assumed that the road surface would be resurfaced and this is reflected in **Table 16. Site Wide Material Use (Additional)**.

Excess Material Reuse Summary

3.4.10 **Table 17. Adjusted Excess Material Balance** summarises the proposed material re-use measures for the Proposed Development, as set out in **Section 3.4.1 – 3.4.5**. The volumes area a high-level estimate based on project experience and C3D outputs and are subject to refinement as the design evolves.

Table 16. Site Wide Material Use (Additional)

Item	Compacted Volume of Rock (m³)	Geology	Compaction Factor	Bulked Volume (m³)
Landscaping Workers Accommodation Area	85,000	Psammite	0.68	125,000
On-site Concrete Batching	1,200,000	Psammite	0.68	1,764,706
Aggregate for Compound Hardstandings, backfill etc.	200,000	Psammite	0.68	294,118
Road Surfacing during Construction	400,000	Psammite	0.72	555,556
Road Resurfacing (End of Construction)	80,000	Psammite	0.72	111,111
			Total	**2,850,000**

3.4.11 **Table 17. Adjusted Excess Material Balance** shows that after the additional reuse measures are factored into this appraisal, a total of 100,000 m³ of excess material will remain from the excavation works across the Proposed Development Site.

Table 17. Adjusted Excess Material Balance

Excess Material (m³)	Site Wide Material Use (Additional) (m³)	Balance (m³)
2,950,000	2,850,000	100,000

3.5 Excess Material Management

Introduction

3.5.1 Despite the excess material detailed in **Table 17. Adjusted Excess Material Balance**, it is assumed that the excess material would be negligible at construction, with limited import of fill material. This is due to a number of factors discussed below.

Geological Uncertainty

3.5.2 As the project develops, post consent, intrusive GI would be undertaken to gain improved understanding of the underlying geology. This would allow for certainty in the estimations detailed above and give confidence to the practicality of reusing excavated material for construction of the Headpond Embankments.

3.5.3 For instance, a conservative assumption has been made that the excavated material from the tailrace tunnels is not suitable for use in the construction of the Embankments. This is as a result of uncertainty around the depth of faults and relative strength of material along the alignment of the tailrace tunnels.

Should intrusive GI provide certainty to the depth, quality and suitability of the rock as fill material in the Headpond Embankments, the material balance could be reviewed accordingly.

Level of Detail / Optimisation

3.5.4 The appraisal and subsequent material balance is based on a planning stage design, as represented in **Figures 2.3 Above Ground Infrastructure and 2.4 Below Ground Infrastructure (Volume 3 Figures)**. As the design of the Proposed Development progresses, there may be suitable optimisations and design refinements that would optimise the overall material balance.

3.5.5 Additionally, as the project develops further, general assumptions and estimates would be refined. For instance, the volume of concrete batched on site would be formalised as the detail design is undertaken and the overall balance of material would be adjusted accordingly.

3.5.6 Overall, it is assumed that the excess material would be negligible at the end of construction, with excess excavated material being reused across the Proposed Development Site.

4. Conclusion

4.1.1 This material appraisal has been undertaken to demonstrate how the main component of the Proposed Development – the Headpond – would be constructed using material won on site. It is estimated that 9,670,000 m³ of material would be excavated during construction, assuming that the entire BP Search Area is quarried. This material would primarily be used to construct the Headpond Embankments, with an excess excavated material of around 100,000 m³.

4.1.2 Although this appraisal shows an excess volume, it is anticipated that there would be a negligible excess volume of material at the end of the construction phase as the level of detail is developed as the design progresses, optimisations are put in place by the design contractors and further geological understanding is gained.

4.1.3 Approximately 2% (LCW excavation) of all material excavated across the Proposed Development Site will be exported off-site, however, this will be done by barge using Loch Ness and the Caledonian Canal. The final destination and use of this material will be confirmed with THC and SEPA post consent.

4.1.4 Outside of the LCW excavation, it is not anticipated that any excess material would have to be left on-site at the end of the construction phase.

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